Prepared for

Akerman LLP and Tramontina U.S. Cookware, Inc.

SITE INVESTIGATION WORK PLAN ADDENDUM

Mirro Co PLT 2 (Former)
2009 Mirro Drive
Manitowoc, Wisconsin
WDNR BRRTS # 02-36-588656

Prepared by

Geosyntec consultants

309 North Water Street, Suite 350
Milwaukee, Wisconsin 53202
Project Number CHW8334

September 26, 2023

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b

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INTRODUCTION

This Site Investigation Work Plan Addendum ("Work Plan Addendum") was prepared by Geosyntec Consultants, Inc. ("Geosyntec") on behalf of Akerman LLP ("Akerman") and their client Tramontina U.S. Cookware, Inc. ("Tramontina") for the former Mirro Company Plant 2 site located at 2009 Mirro Drive, Manitowoc, Wisconsin ("Site").

This Work Plan Addendum was prepared according to the "Scoping and Work Plan Submittal" requirements of the Wisconsin Department of Natural Resources ("WDNR") February 25, 2022 "Reported Contamination at Mirro Co Plt 2 (Former)" letter to Tramontina with the objective to investigate the reported per- and polyfluoroalkyl substances (PFAS) detected in groundwater at the Site. This Work Plan Addendum builds on the prior Site Investigation Work Plan (SIWP) and Site Investigation Report (SIR) completed by Geosyntec (Geosyntec, 2022A and Geosyntec, 2022B).

This Work Plan Addendum was prepared in general accordance with Wisconsin Administrative Code NR 716.09. The NR 712.09 submittal certification is provided in **Appendix 1**.

This Work Plan includes the following sections:

- Section 1: Introduction;
- Section 2: Background Information;
- Section 3: Soil Investigation;
- Section 4: Groundwater Investigation;
- Section 5: Reporting and Schedule; and
- Section 6: References.

BACKGROUND INFORMATION

This section provides salient background information including the Site's location, description, and history; a summary of previous investigation activities; and the Site's physiographical and geological setting.

1.1 Site Location

The Site property is identified by the address of 2009 Mirro Drive, Manitowoc, Wisconsin and only includes Plants 2 and 5. The Site property is located in the northwest ¼ of the southeast ¼ of Section 9, Township 19 North, Range 24 East, and at Wisconsin Transverse Mercator ("WTM") coordinates 709752, 408,900 on WDNR's Redevelopment and Remediation ("RR") Sites Map. The Site location is depicted in **Figure 1**.

1.2 Site Description

The Site property consists of an approximately 575,000 square-foot industrial building located on an approximately 80-acre parcel (Tax ID 05280940101000) which is currently owned by Skana Aluminum Company ("Skana"). The industrial building is divided into two distinct plants, Plant 2 and Plant 5. The Site property is zoned I-2, Heavy Industrial.

Skana owns three adjacent parcels (Tax IDs 05280910301100, 05280910201100, and 00910901300200). Two parcels are located to the north of the Site property and comprise approximately 50 acres which are leased for agricultural use. Skana also owns a 1.12-acre parcel of wooded land east of the Site property.

The Site vicinity generally consists of residential, agricultural, commercial, and industrial land use. The Site is directly bordered to the north by agricultural land, the east by commercial and residential properties and the Woodland Dunes Nature Center, the south by the Wisconsin Central Railroad and commercial properties, and the west by residential multi-tenant properties and Roncalli High School. Surrounding properties are depicted in **Figure 2**.

Multiple WDNR Bureau for Remediation and Redevelopment Tracking System ("BRRTs") sites are located in the general Site vicinity as depicted on the WDNR RR Sites Map included in **Appendix 2**. Seven closed WDNR BRRTs Environmental Repair Program ("ERP") sites are located on the Site. Of the seven closed sites, six have Continuing Obligations associated with residual soil and groundwater impacts from petroleum, chlorinated solvent, polychlorinated biphenyls, and metals. Directly to the

east of the Site property at the location of Plant 1, is a closed ERP site with Continuing Obligations for residual groundwater chlorinated solvent impacts.

1.3 Site History

Aluminum Goods and Manufacturing Company owned and operated Plant 1 and the Site property (Plant 2 and Plant 5) from 1956 until 2003. During this time, the facility was used for the manufacturing of cookware products. In 1956, Aluminum Goods and Manufacturing changed the company name to Mirro, and in 1983 Mirro became a division of Newell Operating Company ("Newell") (WDNR, 2022).

Koenig and Vits, Inc. ("Koenig and Vits") acquired the Site property and Plant 1 from Mirro in 2003 and manufactured aluminum products at the facility until 2009. Great Lakes Energy Technologies, LLC acquired Plant 1 from Koenig and Vits in 2004 and leased the Plant 1 property to Orion Energy Systems which has used Plant 1 to manufacture lighting systems since 2004. (BL Companies, 2019). In 2005, Koenig and Vits leased portions of Plant 5 (5-B, 5-D, and 5-E) to Tramontina (WDNR, 2005).

Tramontina operated in portions Plant 5 and manufactured aluminum cookware products from 2006 until 2019. Tramontina did not conduct any manufacturing operations in Plant 1, Plant 2, Plant 5-C, or Plant 5-F. Skana purchased Plant 2 and Plant 5 from Koenig and Vits in 2010 and continued leasing Plants 5-B, 5-D, and 5-E to Tramontina until 2019. Skana is the current owner of Plant 2 and Plant 5.

The Site layout is depicted in **Figure 3**.

Previous Environmental Activities Summary

Non-PFAS Environmental Investigations:

Previous environmental assessment activities associated with the Site have resulted in seven case closures with Continuing Obligations. The ERP site closure dates and Continuing Obligations are listed below (WDNR, 2012).

Closure Date	BRRTS #	Continuing Obligation
1/20/2012	02-36-544601	Cap Maintenance
1/20/2012	02-36-550138	Cap Maintenance
1/20/2012	02-36-555268	Groundwater Use Restriction
1/31/2003	02-36-220607	Cap Maintenance Plan
4/23/2002	03-36-280532	None
1/27/2003	03-36-170638	Deed Notice Residual Contamination
1/13/1999	02-36-000497	Conditional Closure Groundwater Use Restriction

In 2010, Skana enrolled in the WDNR Voluntary Party Liability Exemption ("VPLE") process and requested a Certificate of Completion for the Site property. The WDNR determined that Skana's environmental investigation and restoration (to the extent practicable) of the Site met the requirements under s. 292.15(s), Wis. Stats., and issued the Certificate of Completion on March 15, 2012.

PFAS Environmental Investigations:

On October 26, 2021, Skana notified the WDNR of hazardous substances found in soil and groundwater samples collected at the Site by Skana's consultant, TRC Companies, Inc. ("TRC"). The investigation consisted of collecting soil samples from 20 boring locations and three surface locations and collecting groundwater samples from 17 temporary groundwater monitoring wells.

PFAS compounds were detected in 28 of the 29 soil samples; however, none of the concentrations exceeded the NR 720 Non-Industrial or Industrial Direct Contact Residual Contaminant Levels ("RCLs") developed by the WDNR.

PFAS compounds were detected in all groundwater samples, but only perfluorooctanoic acid ("PFOA") was detected at concentrations that exceeded the Wisconsin Department of Health Services ("WDHS") recommended NR 140 Enforcement Standard ("ES") of 20 nanograms per liter (ng/L) in samples collected from 15 of the 17 temporary wells and exceeded the United States Environmental Protection Agency's ("USEPA") Health Advisory Limit ("HAL") of 70 ng/L in samples collected from 12 of the 17 wells (Godfrey and Kahn, 2021).

In December 2021 and January 2022, Skana's consultant, AECOM, conducted an additional soil and groundwater investigation. The investigation consisted of collecting soil from nine soil borings and groundwater samples from the co-located temporary groundwater monitoring wells for analysis of PFAS. PFOA was detected in eight of nine soil samples, but concentrations did not exceed the WDNR NR 720 RCLs. PFAS concentrations were detected in all groundwater samples, but PFOA was the only PFAS that exceeded the WDHS recommended NR140 ES and USEPA HAL in samples collected from each temporary well (AECOM, 2022).

The groundwater analytical results prompted the WDNR to collect samples from potable water wells in the vicinity of the Site. The WDNR identified seven wells, and four of the seven were sampled for PFAS in December 2021 by the WDNR's consultant, AECOM. Analytical results did not exceed the WDHS recommended drinking water criteria for PFOA (20 ng/L [note, the Wisconsin Natural Resources Board amended the PFOA standard to 70 ng/L in February 2022]) or the WDNR

proposed ES and USEPA HAL for PFOA (70 ng/L), but concentrations of another PFAS, perfluorooctanesulfonamide ("PFOSA"), did exceed the WDHS recommended standard of 20 ng/L in samples from two wells.

The previous TRC and AECOM PFAS Site investigation results are depicted in **Figure 4**.

On April 7, 2022, Newell's consultant, Ramboll US Consulting, Inc, ("Ramboll"), submitted an Immediate Action Work Plan to the WDNR for review and approval, which included collecting and analyzing samples from seven potable wells. Five of the seven planned potable wells were sampled, and Ramboll submitted the results from the sampling event to the WDNR on September 30 and October 17, 2022. There were no PFAS compounds detected at concentrations greater than the recommended criteria for selected PFAS listed in WDHS recommended groundwater standards (Ramboll, 2022).

Geosyntec prepared and submitted a Site Investigation Work Plan on May 26, 2022, and performed the Site Investigation in September 2022 to confirm and supplement the existing PFAS soil and groundwater data (Geosyntec, 2022A and Geosyntec, 2022B). The site investigation (SI) included collecting and analyzing samples from five soil borings and installing and sampling permanent monitoring wells at the five soil boring locations. PFAS compounds were detected in four of the five soil samples; however, none of the concentrations exceeded the NR 720 Non-Industrial or Industrial Direct Contact RCLs developed by the WDNR. PFAS compounds were detected in groundwater samples collected from each groundwater monitoring well. PFOA was detected at concentrations greater than the WDHS recommended ES of 20 ng/L in each of the groundwater samples. Two compounds, perfluorooctanesulfonic acid (PFOS) and perfluorononanoic acid (PFNA), were detected in groundwater samples at two monitoring wells at concentrations greater than their respective WDHS recommended PALs (Geosyntec, 2022B).

The Geosyntec groundwater SI results are depicted in **Figure 5.**

1.4 Physiographical and Geological Setting

1.4.1 Topography and Drainage

The Site property is generally flat with little topographic relief and an elevation of approximately 610 feet mean sea level ("MSL") (Terracon, 2005).

The topographic gradient is generally towards the south-southeast and surface water appears to drain to a small lake located to the east of the building as depicted in **Figures 2 and 3**. Lake Michigan is located approximately 3,300 feet to the southeast.

1.4.2 Geology and Hydrogeology

Based on the December 2021 and January 2022 soil boring data, Site soils generally consist of 6 to 10 feet of soil fill (gravel, sand, silt, clay) overlying native material (silt, clay, and sand) to a depth of at least 15 feet below ground surface ("ft bgs"), the maximum depth of the soil borings. In unimproved areas, native material generally consisted of 2 feet of topsoil overlying silt with clay and sand. A thin black peat layer was observed in two locations in the east-central portion of the Site at approximately 9 ft bgs (AECOM, 2022).

According to well construction reports accessed from the WDNR Well Construction Information System, the depth to bedrock in the area is approximately 100 ft bgs.

During the January 2022 Site investigation, depth to water was measured in temporary monitoring wells at depths ranging from approximately 2.4 to 8.4 ft bgs (AECOM, 2022).

Based on Site topography and local drainage features, it is estimated that shallow groundwater flow is to the south-southeast.

During the Geosyntec 2022 SI, Site soils were consistent with the December 2021 and January 2022 soil boring data. There was additional thin black peat observed in the central portion of the Site at approximately 8.5 to 13 ft bgs. Groundwater elevations from September 2022 SI ranged from 1.5 to 8.5 ft bgs. Measurements indicated shallow groundwater at lower elevations immediately adjacent to the Plant and higher elevations at the property boundaries to the north and south (Geosyntec, 2022B).

SOIL INVESTIGATION

PFAS were not detected at concentrations exceeding industrial standards established by the WDNR in any of the soil samples collected during previous investigations. Therefore, no additional soil investigation has been proposed in this Work Plan.

GROUNDWATER INVESTIGATION

This section provides the objectives, scope, and procedures for the focused PFAS groundwater investigation.

1.5 Objective

The objectives of this investigation are to assess the extent of PFAS impacts to groundwater off Site and assess potential off-site migration.

1.6 Scope

The scope of the groundwater investigation will consist of the following:

- Advance five (5) soil borings to approximately 15 feet bgs using either direct push or hollow stem auger ("HSA") drilling. Groundwater well locations were chosen based the need to assess off Site migration. The proposed well located near the northwest property boundary is to delineate groundwater migrating to the west and assist with the extent of any migration towards the northwest in combination with the northern proposed well location. The wells located in the north and east were chosen to delineate off Site migration north and east of the Site, and the two south west well locations were chosen to delineate migration to the southwest.
- Describe the lithology at each boring location based on the soil borings.
- Install permanent groundwater monitoring wells at the seven boring locations using HSA drilling.
- Collect and analyze one groundwater sample from each well (five total) for the 33 PFAS compounds on the WDNR PFAS List dated January 1, 2021.

The planned groundwater monitoring well locations are depicted in **Figure 6**.

The final groundwater monitoring well locations may be modified based on observed field conditions.

1.7 Procedures

This section provides additional detail on the procedures to be used by Geosyntec in the accomplishment of field activities. Standard operating procedures ("SOPs") for field activities are included in **Appendix 3**. The SOPs include the following:

- Drilling activities at sites for assessment of PFAS;
- Sampling and analysis of PFAS; and
- Groundwater sampling of monitoring wells and analysis of PFAS.

1.7.1 Access Agreements

Access agreements and/ or permits will be required to complete the off Site delineation activities. Access agreements or permits will likely be required from the City of Manitowoc and Manitowoc County.

1.7.2 Underground Utility Locates

Underground utilities will be located before proceeding with subsurface exploration activities. Diggers Hotline and a private utility location contractor will be notified and retained to identify utilities on the Site Property near the proposed monitoring well locations.

1.7.3 Soil Boring Drilling

Groundwater monitoring wells will be installed using an HSA drill rig. Soil samples will be collected continuously with a 2-foot split-spoon sampler or a direct push sample barrel. If a direct push sample barrel is used, the well will be installed using HSA technology at the same location as the direct push boring.

Each soil sample will be classified in accordance with the Unified Soil Classification System (“USCS”) and the groundwater level observed during drilling will be recorded.

A soil boring log (WDNR Form 4400-122) will be completed for each soil boring.

1.7.4 Monitoring Well Installation and Development

Groundwater monitoring wells will be installed in the HSA soil borings in accordance with Wisconsin Administrative Code Chapter NR 141. It is anticipated the water table monitoring wells will be screened from approximately 5 to 15 ft bgs. Completed screen intervals will be based on field observation during drilling. The wells will be constructed of two-inch nominal diameter Schedule 40 polyvinyl chloride (“PVC”) riser and 10-foot long (water table monitoring wells) Schedule 40 PVC, 0.010-inch machine slotted well screen. The wells will be completed with a 3-foot stick-up cover or a flush-mount steel, bolt-down cover (depending on location). A Well Construction Form (WDNR Form 4400-113A) will be completed for each groundwater monitoring well.

The groundwater monitoring wells will be developed in accordance with Wisconsin Administrative Code Chapter NR 141. Development will include multiple cycles of purging and surging. A portable water quality meter will be used to record the pH, conductivity, dissolved oxygen ("DO"), oxidation reduction potential ("ORP"), turbidity, and temperature of the purged water. A Monitoring Well Development Form (WDNR Form 4400-113B) will be completed for each groundwater monitoring well.

Equipment and materials used to construct the monitoring wells will be PFAS-free.

1.7.5 Groundwater Sampling

Before sampling, the groundwater monitoring wells will be opened and the depth to water will be measured with an electronic water level indicator.

Groundwater samples will be collected using low-flow purging and sampling methods in accordance with NR 140 and the WDNR "Groundwater Sampling Field Manual" (WDNR, 1996).

During low flow purging, field parameters (pH, temperature, conductivity, DO, turbidity, and ORP) will be monitored using a portable water quality meter until the parameters stabilize.

Collected groundwater samples will be immediately placed in laboratory supplied containers and placed in a cooler with ice for submittal to the laboratory.

Equipment and materials used to collect the samples will be PFAS-free.

1.7.6 Laboratory Analysis

The groundwater samples will be submitted in accordance with Wisconsin Administrative Code Chapter NR 219 under standard chain-of-custody ("COC") protocols to a laboratory certified by the WDNR for PFAS analyses. The samples will be analyzed for the WDNR's 33 PFAS compound list.

1.7.7 Surveying

The location and elevation of the groundwater monitoring wells will be surveyed. Surveying will include northing and easting coordinates (State Plane Coordinates) and ground surface and groundwater monitoring well top of casing elevations [National Geodetic Vertical Datum of 1929 ("NGVD 29")].

1.7.8 Investigation-Derived Waste Management

Soil boring cuttings and groundwater monitoring well development water and sampling purge water will be contained in 55-gallon drums. The drums will be labeled, and it is anticipated that the drums will be staged on Site property pending disposal.

1.7.9 Quality Assurance/Quality Control

Sampling and analysis quality assurance and quality control ("QA/QC") procedures will be conducted in general accordance with NR 716.13(6) and include the following:

- One duplicate sample for every 10 primary samples.
- One matrix spike and matrix spike duplicate will be collected, if required by the laboratory.
- One equipment blank using PFAS-free water for every 10 primary samples.
- Checking and calibration of field instruments in accordance with manufacturer's instructions.
- One laboratory provided temperature blank per cooler.

The quality of the laboratory analytical data will be evaluated by reviewing the chain-of-custody forms, holding times, analytical detection limits, results of field QA/QC sample analyses, and laboratory QA/QC results (method blanks, surrogates, and laboratory control samples).

1.7.10 Data Evaluation

The groundwater investigation data will be evaluated with respect to the investigation objectives. This evaluation will include groundwater flow, potential contaminant migration pathways, and the distribution of groundwater concentrations relative to the WDHS recommended NR 140 ESs.

Previously collected groundwater and potable water assessment data will also be integrated with newly collected data to evaluate the Site investigation objectives.

REPORTING AND SCHEDULE

The Site investigation results will be submitted to the WDNR and property owner in accordance with NR 716.14 within 10 business days of receiving the sample results. The Site investigation findings and conclusions will be documented in a Site Investigation Report ("SIR") prepared in accordance with NR 716.15.

It is anticipated that Site investigation field activities will be conducted in the fourth quarter of 2023. The SIR will be submitted to WDNR within 60 days after receipt of the groundwater sampling event laboratory results.

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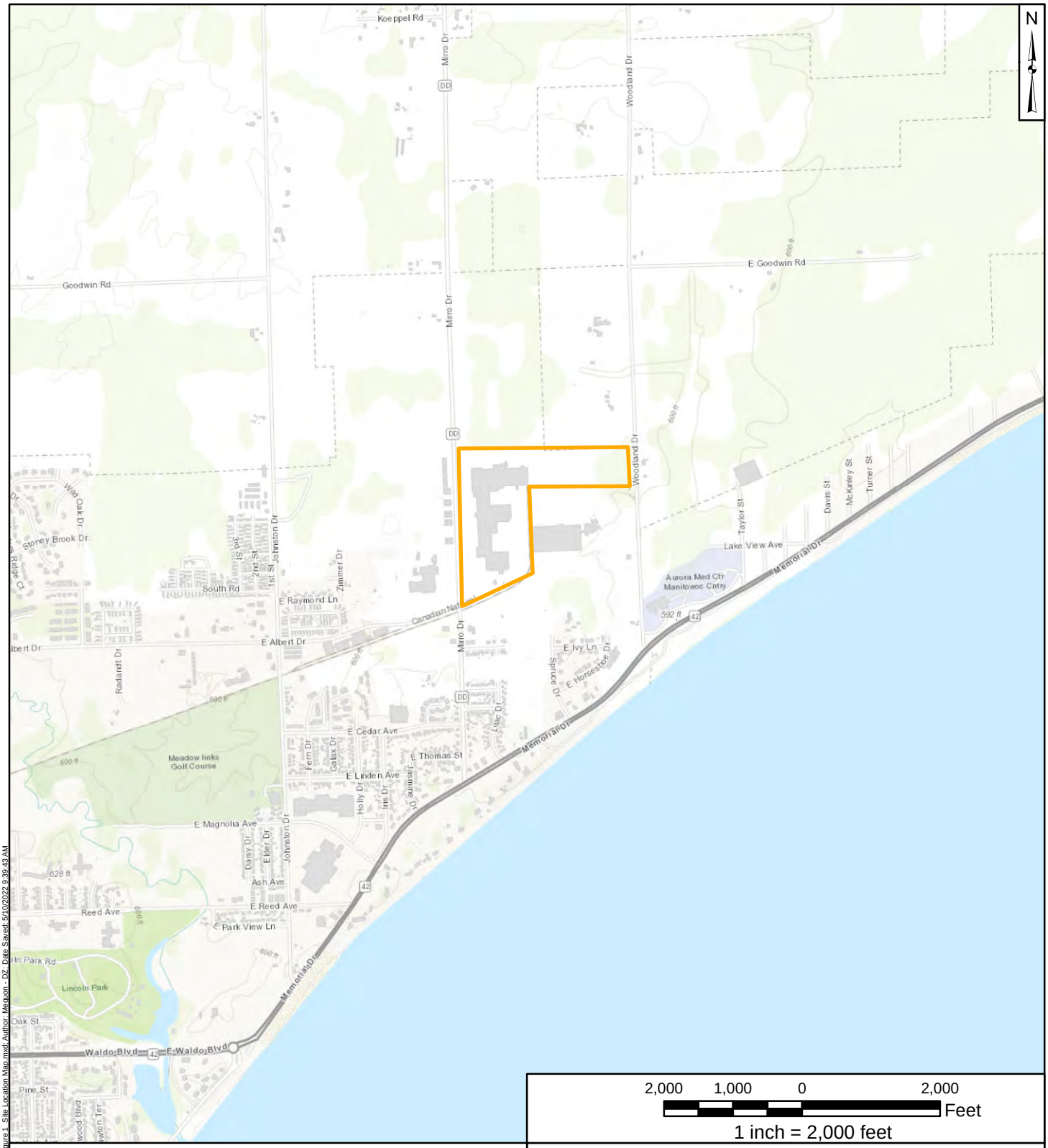

2,000 1,000 0 2,000 Feet

1 inch = 2,000 feet

Site Location Map

Mirro Co Plt 2 (Former)
BRRTS # 02-36-588656
2009 Mirro Drive
Manitowoc, Wisconsin

Legend

Approximate Site Location

Notes
Topographic Map Courtesy of ESRI

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Figure 1

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Legend

- Approximate Tax Parcel Boundary
- Wisconsin Central Railroad
- Approximate Property Boundary

Notes:
Basemap Courtesey of ESRI

Site Vicinity Map

Mirro Co Plt 2 (Former)
BRRTS # 02-36-588656
2009 Mirro Drive
Manitowoc, Wisconsin

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Figure **2**

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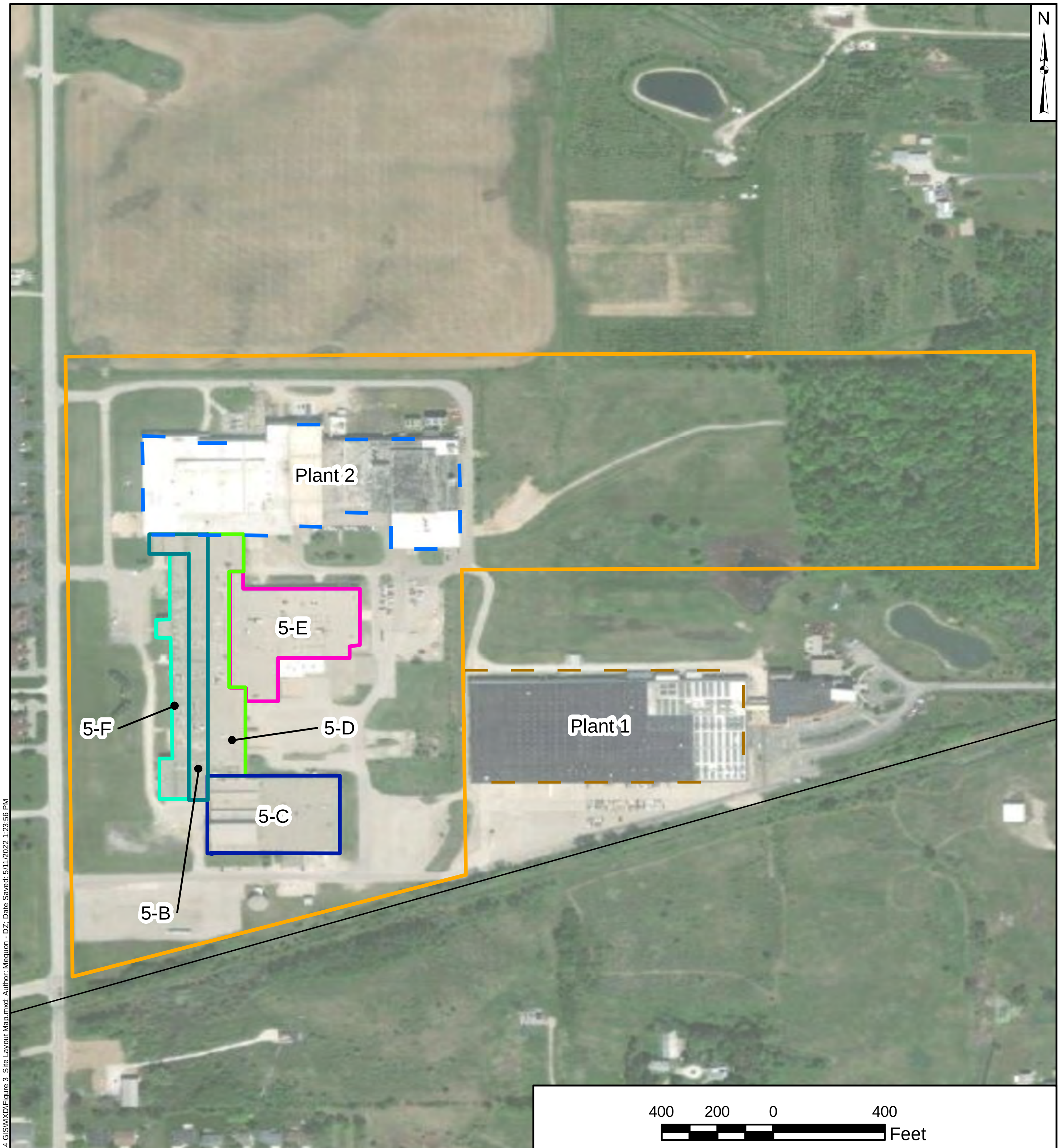

Legend

Plant 5

- Approximate Property Boundary
- Wisconsin Central Railroad
- Plant 1
- Plant 2
- 5-B
- 5-C
- 5-D
- 5-E
- 5-F

Notes:
Basemap Courtesey of ESRI
Plant sections from Terracon 2005, Phase I Environmental Site Assessment Koenig and Vits Facility
Tramontina only operated in Plants 5-B, 5-D, and 5-E

Site Layout Map

Mirro Co Plt 2 (Former)
BRRTS # 02-36-588656
2009 Mirro Drive
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Figure 3

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Legend

- TRC PFOA Concentration Below Recommended NR 140 ES
- TRC PFOA Concentration Above Recommended NR 140 ES
- AECOM PFOA Concentration Above Recommended NR 140 ES
- Approximate Property Boundary
- Wisconsin Central Railroad

Notes:
Basemap Courtesey of ESRI
Proposed groundwater monitoring well locations are approximate
ES - Enforcement Standard

Previous TRC and AECOM PFAS Investigation Map

Mirro Co Plt 2 (Former)
BRRTS # 02-36-588656
2009 Mirro Drive
Manitowoc, Wisconsin

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Figure **4**

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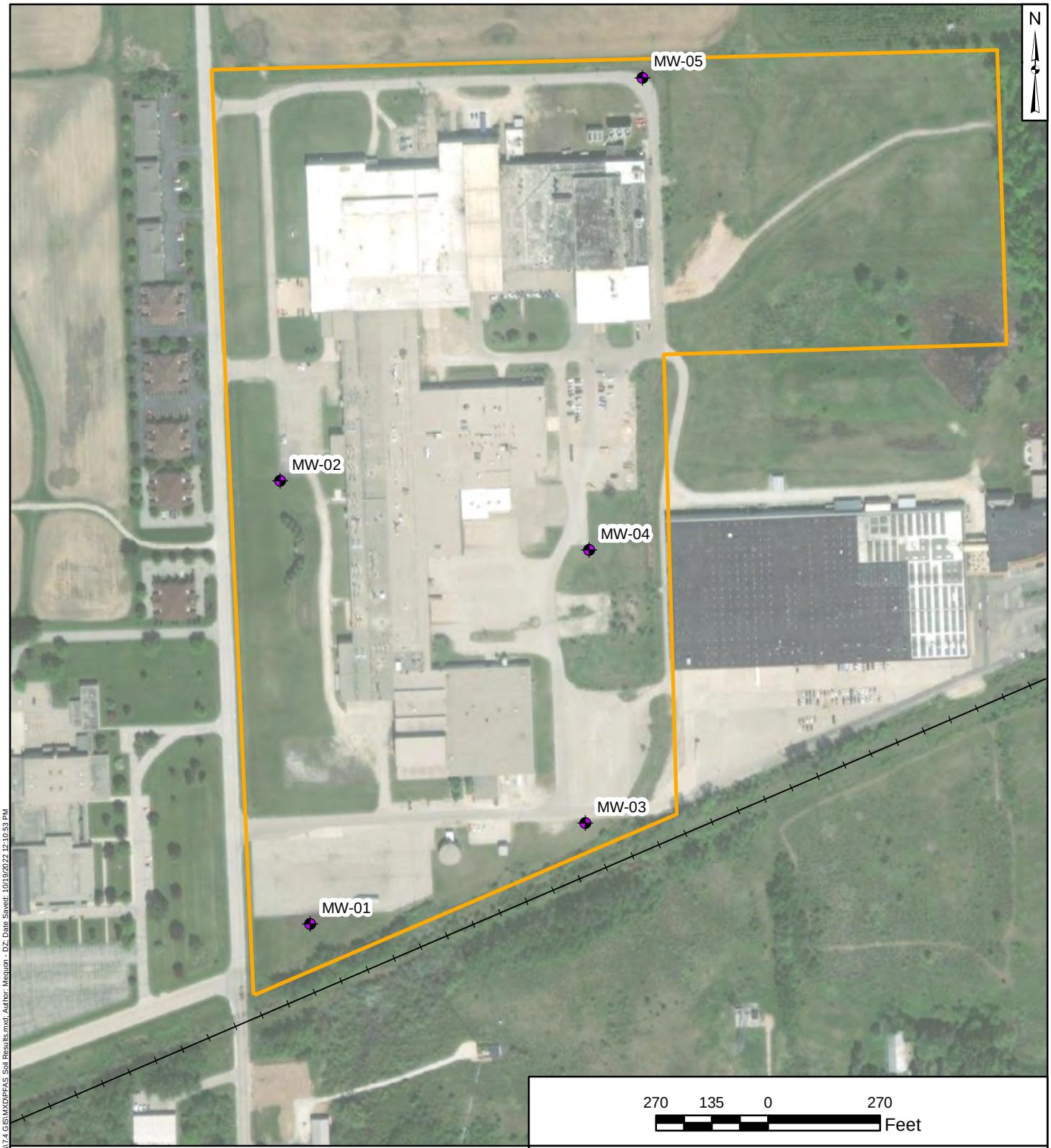

270 135 0 270
Feet

Legend

- No Exceedance of Recommended EF
- Exceedance of Recommended EF
- Approximate Property Boundary
- Wisconsin Central Railroad

Notes:
Basemap Courtesey of ESRI
EF: Enforcement Standard
PFAS: Per- and Polyfluoroalkyl Substances

Previous Geosyntec Groundwater PFAS Investigation Map

Mirro Co Plt 2 (Former)
BRRTS # 02-36-588656
2009 Mirro Drive
Manitowoc, Wisconsin

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Figure **5**

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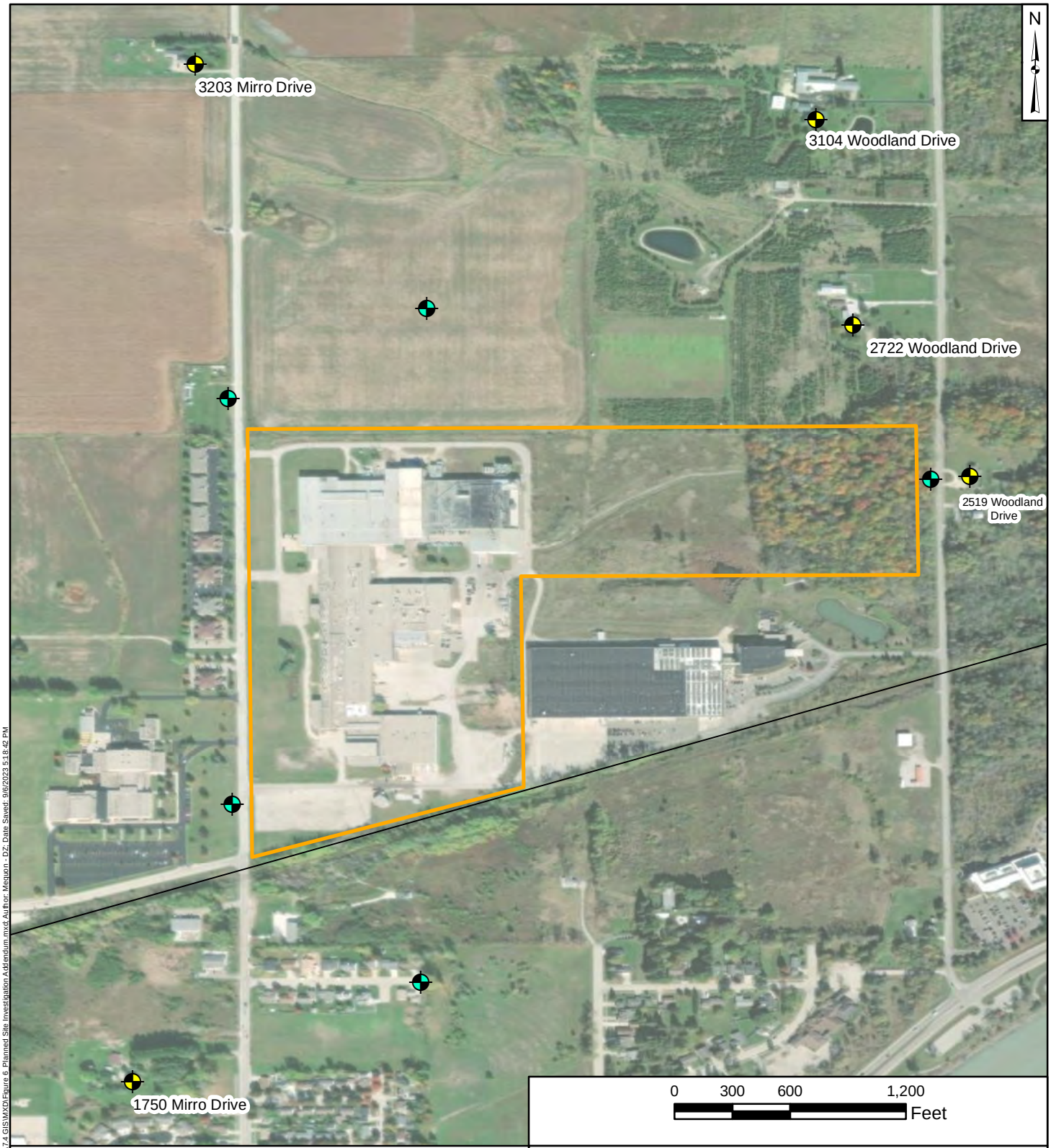

Legend

- Proposed Monitoring Well
- Surrounding Potable Well
- Approximate Property Boundary
- Wisconsin Central Railroad

Notes:
Basemap Courtesey of ESRI
Proposed groundwater monitoring well locations are approximate

Planned Site Investigation Map

Mirro Co Plt 2 (Former)
BRRTS # 02-36-588656
2009 Mirro Drive
Manitowoc, Wisconsin

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Figure **6**

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APPENDIX 1 – NR 712.09 SUBMITTAL CERTIFICATION
MIRRO CO PLT 2 (FORMER)
SITE INVESTIGATION WORK PLAN

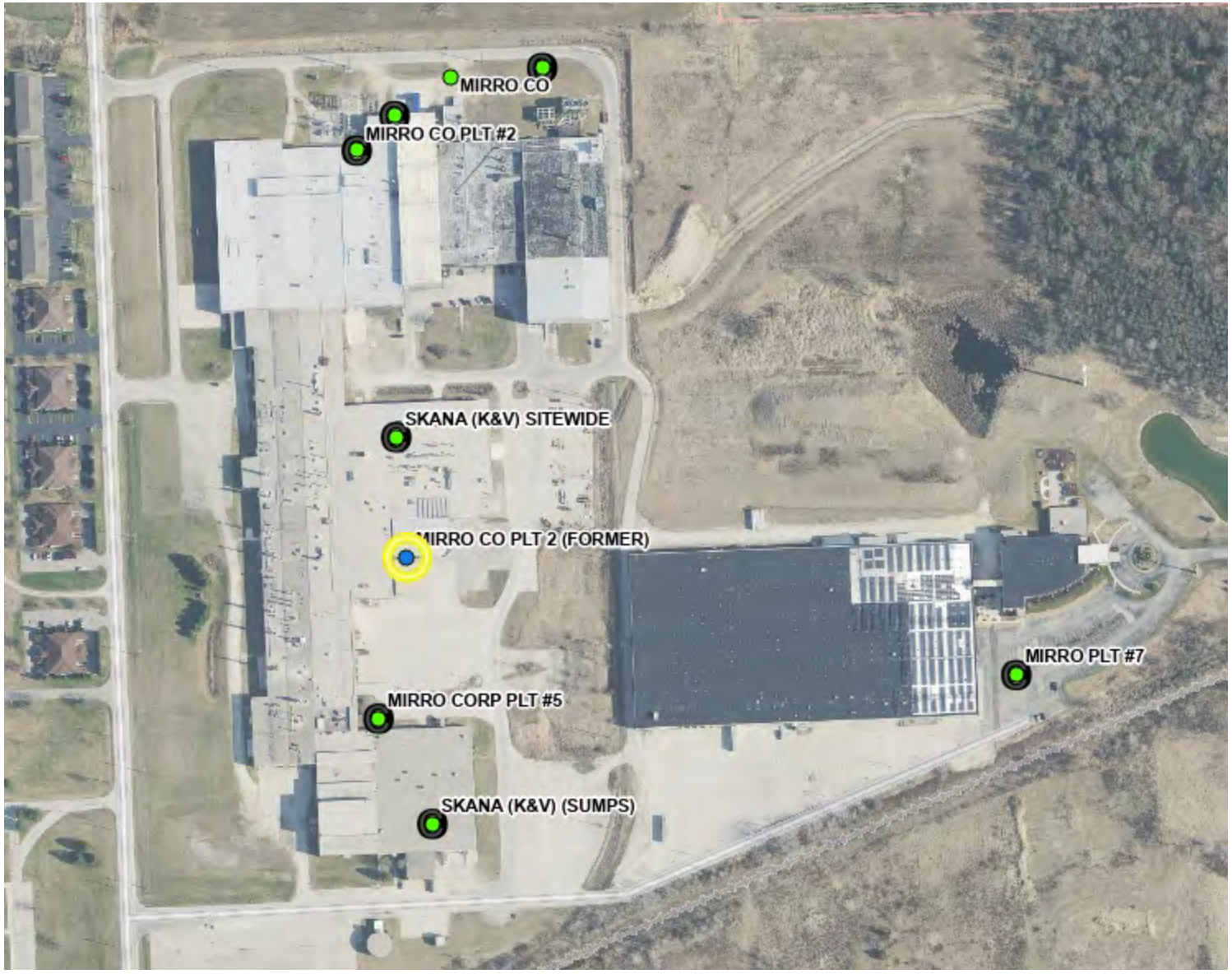
NR 712.09 Submittal certification.

Document Name	SITE INVESTIGATION WORK PLAN ADDENDUM
Document Date	9/26/2023
Site Name	Mirro Co Plt 2 (Former)
WDNR BRRTS #	02-36-588656

"I, _____, hereby certify that I am a registered professional engineer in the State of Wisconsin, registered in accordance with the requirements of ch. A-E 4, Wis. Adm. Code; that this document has been prepared in accordance with the Rules of Professional Conduct in ch. A-E 8, Wis. Adm. Code; and that, to the best of my knowledge, all information contained in this document is correct and the document was prepared in compliance with all applicable requirements in chs. NR 700 to 726, Wis. Adm. Code."	
Signature, title and P.E. number	P.E. stamp
"I, Jeff Tracy, hereby certify that I am a hydrogeologist as that term is defined in s. NR 712.03 (1), Wis. Adm. Code, am registered in accordance with the requirements of ch. GHSS 2, Wis. Adm. Code, or licensed in accordance with the requirements of ch. GHSS 3, Wis. Adm. Code, and that, to the best of my knowledge, all of the information contained in this document is correct and the document was prepared in compliance with all applicable requirements in chs. NR 700 to 726, Wis. Adm. Code."	
 Jeff Tracy, P.G. (WI) Principal Geologist	9/26/2023
Signature and title	Date
"I, _____, hereby certify that I am a scientist as that term is defined in s. NR 712.03 (3), Wis. Adm. Code, and that, to the best of my knowledge, all of the information contained in this document is correct and the document was prepared in compliance with all applicable requirements in chs. NR 700 to 726, Wis. Adm. Code."	
Signature and title	Date

APPENDIX 2 – WDNR REMEDIATION AND REDEVELOPMENT SITES MAP
MIRRO CO PLT 2 (FORMER)
SITE INVESTIGATION WORK PLAN

RR Sites Map



Legend

- Open Site
- Closed Site
- Continuing Obligations Apply
- Railroads

0.1 0 0.06 0.1 Miles

NAD_1983_HARN_Wisconsin_TM

1: 3,960

Note: Not all sites are mapped.

Notes

APPENDIX 3 – STANDARD OPERATING PROCEDURES
MIRRO CO PLT 2 (FORMER)
SITE INVESTIGATION WORK PLAN

STANDARD OPERATING PROCEDURE FOR SAMPLING WITH AND ANALYSIS OF PER- AND POLYFLUOROALKYL SUBSTANCES (PFAS)

1. INTRODUCTION

1.1 Purpose and Scope

Standard operating procedures (SOPs) were prepared to guide per- and polyfluoroalkyl substance (PFAS) sampling activities. This SOP describes recommended general procedures to be used by Geosyntec field personnel when collecting samples using various techniques for PFAS analysis. Because PFAS are potentially present in a variety of materials that may come into contact with samples, and because laboratory analytical method detection limits are low (low to sub nanogram per liter concentrations), conservative precautions are recommended to avoid sample cross-contamination and false positive results. The procedures in this SOP are consistent with best practices at the time of authoring.

1.2 Definitions and Acronyms

1.2.1 Definitions

PFAS-free water	Water that has been analyzed by an accredited laboratory (see Section 3.1) and determined to be below the method detection limit (i.e., non-detect) for the suite of PFAS to be analyzed for in environmental samples. Method detection limits (MDLs) used during analysis of PFAS-free water should be at or below the MDLs used for environmental samples.
Potable water	Water that meets state and federal drinking water requirements. Note this water may or may not have detectable PFAS concentrations.

1.2.2 Acronyms

CoC	chain of custody
DPT	direct push technology
DoD	Department of Defense
ETFE	ethylene tetrafluoroethylene
FEP	fluorinated ethylene propylene
FDEP	Florida Department of Environmental Protection
HDPE	high-density polyethylene
LDPE	low-density polyethylene
MDL	method detection limit

MS	matrix spike
MSD	matrix spike duplicate
PFAS	per- and polyfluoroalkyl substances
PFTE	polytetrafluoroethylene
PPE	personal protective equipment
PVC	polyvinyl chloride
PVDF	polyvinylidene fluoride
QA	quality assurance
QC	quality control
SIS/SOLCP	Site Investigation Section/State-owned Lands Cleanup Program
SOP	standard operating procedure

1.3 Equipment and Products

Sections 1.3.1 and 1.3.2 detail items that are safe to use versus not recommended for use on the job site to protect PFAS samples from potential cross-contamination. Science-based evidence is not currently available to support a determination of the realistic impact of these commonly used field items and materials on PFAS samples. In the absence of scientific-based sampling guidance, field staff, contractors, and analytical laboratories should try to avoid using items that may pose a risk for cross-contamination and false positive results and instead use acceptable alternatives identified in this section. If the field team needs to use products and equipment on site that are not recommended, additional quality assurance/quality control (QA/QC) samples may be collected to evaluate any potential impact on PFAS environmental samples. This information is also provided in an abbreviated format as a checklist for field staff to reference (attached).

1.3.1 Field Equipment

Items that are **safe to use** on site when sampling for PFAS include the following:

- Sampling containers, screw caps and other equipment made from high-density polyethylene (HDPE)[1], polypropylene, silicone, acetate, or stainless steel;
- Sample preservatives (e.g., Trizma®);
- QA/QC samples (e.g., temperature and field blanks);

[1] HDPE plastics are commonly identified by a recycling symbol with a number 2 inside it.

- Low-density polyethylene (LDPE)[2] materials not in direct contact with the sample (e.g., Ziploc® bags);
- Materials made of HDPE, silicone, acetate, or stainless steel;
- Masonite or aluminum clipboards;
- Sampling forms, loose paper or field notebooks, chain of custody (CoC) record, and sample container labels;
- Ballpoint pens;
- Alconox®, Liquinox® and Luminox® detergents;
- Paper towels;
- Trash bags;
- HDPE sheeting;
- Hard-shell coolers;
- Shipping and handling labels;
- Regular (wet) ice;
- Bubble wrap;
- Duct tape and packing tape;
- Large (e.g., 55-gallon) containers;
- DPT rig, rods, and related tools;
- HDPE or stainless steel bailer and cable;
- Submersible pumps, bladder pumps, peristaltic pumps, and inertia pumps that do not have Teflon components;
- Dedicated Silicon and/or HDPE tubing;
- Analytical field meter (e.g., temperature, pH, conductivity, oxidation-reduction potential, dissolved oxygen, and turbidity); and
- Water level probe(s).

[2] LDPE plastics are commonly identified by a recycling symbol with a number 4 inside it.

Items **to be avoided (i.e. not recommended) for use** during PFAS sampling include the following:

- Glass sample containers, due to PFAS adherence to glass surfaces;
- Water-resistant paper, notebooks, and labels (e.g., certain Rite in the Rain® products), due to use of PFAS in water-resistant inks and coatings;
- Sticky notes (e.g., certain Post-It® products), due to potential use of a paper coating product Zonyl™ or similar fluorotelomer compounds;
- Plastic clipboards, binders, and spiral hardcover notebooks;
- Pens with water-resistant ink;
- Felt pens and markers (e.g., certain Sharpie® products);
    - Some PFAS SOPs (e.g., Michigan) specifically allow Fine or Ultra-Fine Point Sharpies®;
    - TestAmerica Laboratories, Inc. routinely uses Sharpies® in the laboratory following unpublished analytical tests that reportedly showed no impact on PFAS sample results;
    - Some clients have requested the use of Sharpies® for labeling samples that are submitted to the laboratory and should be discussed by the project team prior to field work;
- Aluminum foil, as PFAS are sometimes used as a protective layer;
- Decon 90™ liquid detergent, which reportedly contain fluorosurfactants;
- Chemical (e.g., blue) ice packs, unless it is contained in a sealed bag. Blue ice has the potential to be contaminated from previous field sampling events;
- Materials containing polytetrafluoroethylene (PFTE) including Teflon™ and Hostaflon® (e.g., tubing, tape, plumbing paste, O-rings);
- Equipment with Viton™ components (i.e., fluoroelastomers);
- Stain- or water-resistant materials, as these are typically fluoropolymer-based;
- Material containing LDPE, particularly if used in direct contact with the sample (e.g., LDPE tubing, as PFAS can sorb to the porous tubing); and
- Material containing “fluoro” in the name – this includes, but is not limited to, fluorinated ethylene propylene (FEP), ethylene tetrafluoroethylene (ETFE), and polyvinylidene fluoride (PVDF).

1.3.2 Clothing, Personal Protective Equipment (PPE), and Consumer Products

Items that are **safe to use** when sampling for PFAS include the following:

- Boots made of polyurethane, polyvinyl chloride (PVC), rubber, or untreated leather;
- Other field boots covered by PFAS-free (e.g., polypropylene) over-boots;
- Rain gear made of polyurethane, PVC, wax-coated, vinyl, or rubber;
- Clothing made of synthetic (e.g., polyester) or natural (e.g., cotton) fibers;
- Safety glasses;
- Reflective safety vests;
- Hardhats;
- Disposable powder-free nitrile gloves;
- Uncoated HDPE suits (e.g., certain Tyvek® products);
- Sunscreens[3] and insect repellants[4] that have been tested and found to be PFAS-free; and
- Bottled water and hydration drinks.

Items **to be avoided (i.e., not recommended) for use** during PFAS sampling include the following:

- Water- or stain-resistant boots and clothing (e.g., products containing GORE-TEX®);
- Flame resistant clothing (FRC);
- Clothing recently laundered with a fabric softener;

[3] Examples of PFAS-free sunscreens include Alba Organics Natural, Aubrey Organics, Banana Boat Sport Performance Sunscreen Lotion Broad Spectrum SPF 30, Banana Boat for Men Triple Defense Continuous Spray Sunscreen SPF 30, Banana Boat Sport Performance Coolzone Broad Spectrum SPF 30, Banana Boat Sport Performance Sunscreen Stick SPF 50, Coppertone Sunscreen Lotion Ultra Guard Broad Spectrum SPF 50, Coppertone Sport High-Performance AccuSpray Sunscreen SPF 30, Coppertone Sunscreen Stick Kids SPF 55, Jason Natural Sun Block, Kiss my Face, L'Oréal Silky Sheer Face Lotion 50+, Meijer Clear Zinc Sunscreen Lotion Broad Spectrum SPF 15, 30 and 50, Meijer Wet Skin Kids Sunscreen Continuous Spray Broad Spectrum SPF 70, Neutrogena Beach Defense Water + Sun Barrier Lotion SPF 70, Neutrogena Beach Defense Water + Sun Barrier Spray Broad Spectrum SPF 30, Neutrogena Pure & Free Baby Sunscreen Broad Spectrum SPF 60+, Neutrogena Ultra-Sheer Dry-Touch Sunscreen Broad Spectrum SPF 30, Yes to Cucumbers, and sunscreens for infants. Products with fluorinated compounds in their ingredients (e.g., polyfluoroalkyl phosphate esters) should not be worn during sampling.

[4] Examples of PFAS-free insect repellent include Jason Natural Quit Bugging Me, Repel Lemon Eucalyptus Insect repellant, Herbal Armor, California Baby Natural Bug Spray, BabyGanics, OFF! Deep Woods® spray for clothing and skin, Sawyer® do-it-yourself permethrin treatment for clothing, Insect Shield Insect® pretreated clothing, DEET products, and sunscreen/insect repellent combination product Avon Skin so Soft Bug Guard-SPF 30. Products with fluorinated compounds in their ingredients (e.g., polyfluoroalkyl phosphate esters) should not be worn during sampling.

- Coated HDPE suits (e.g., certain Tyvek® products);
- Sunscreen and insect repellants containing fluorinated compounds as ingredients, such as polyfluoroalkyl phosphate esters;
- Latex gloves;
- Cosmetics, moisturizers, hand cream, and other related products;
- Food wrappers and packaging; and
- Food and drinks other than bottled water or hydration drinks.

Field staff should try to find acceptable alternatives to these items that still allow them to complete the field work safely and efficiently. For example, wearing long-sleeved clothing and a hard hat or sun hat may eliminate the need to use sunscreen in some climates. If an item cannot be easily avoided or if requested by the client, note the use of the product on the daily checklist (attached) and additional consideration should be given to QA/QC samples to evaluate the potential impact of sample cross-contamination (e.g., field blanks).

2. FIELD PROCEDURES

Field procedures are provided separately in a site-specific work plan. Considerations for field staff who are developing the work plan are described in this section.

2.1 Pre-Mobilization Activities

2.1.1 Health and Safety Plan

Prior to each field event, the site health and safety plan should be reviewed and updated, as necessary. Health and safety plan requirements should be reviewed for consistency with this SOP and modified as appropriate to resolve any differences.

2.1.2 Source of PFAS-Free Water

PFAS-free water may be needed for equipment decontamination during sample collection (i.e., water that has been analyzed by an accredited laboratory and determined to be below the method detection limit [MDL] or reporting limit [RL] for the suite of PFAS to be analyzed for in environmental samples). MDLs or RLs used during analysis of PFAS-free water should be at or below the MDLs or RLs used for environmental samples.

If an on-site water source is available, the project team may consider whether the water source can be tested for PFAS and determined to be PFAS-free ahead of the sampling event. PFAS-free deionized water can also be purchased from the analytical laboratory and shipped with the bottle order.

2.1.3 Laboratory Coordination

Field personnel should communicate with the laboratory that will conduct PFAS analysis regarding the following items:

- Laboratory accreditation for PFAS analysis;
- Appropriate sample containers, labels, and preservatives;
- Turnaround times;
- Sample storage conditions and holding time (see Section 2.2.5); and
- The number and type of QA/QC samples (see Section 2.3).

Because there is no standard United States Environmental Protection Agency method for analyzing PFAS samples in media other than drinking water, commercial laboratories typically offer analysis for a suite of approximately 18 PFAS using a modified version of Method 537.1. Laboratories may therefore have developed their own variations to this method or another method. Project staff may consider the impact of differences in reported PFAS concentrations and the potential value of collecting and sending a split sample to a second commercial laboratory to assess variability in reported PFAS concentrations.

Accreditation: Laboratories conducting PFAS analysis for Department of Defense (DoD) facilities should be accredited by the United States DoD Environmental Laboratory Accreditation Program (i.e. use a PFAS method that is compliant with Table B-15 of the DoD and Department of Energy consolidated Quality Systems Manual for Environmental Laboratories). States may also require that analytical laboratories are National Environmental Laboratory Accreditation Program accredited for their state and that PFAS analytical methods follow state guidelines.

Turnaround Times: Analytical laboratories may offer a range of turnaround times at varying costs per sample, however, turnaround times for receiving PFAS results typically range from 2 to 3 weeks, with expedited turnaround times of 3 to 5 days. The laboratory's capacity and acceptable project schedule for receiving results may affect the project team's choice of analytical laboratory.

Sample Containers: HDPE containers with screw caps are commonly used for PFAS sample collection. Different laboratories may supply sample containers of varying sizes. Sample container caps are typically unlined.

Preservatives: Field personnel should communicate with the laboratory to determine what, if any, sample preservatives will be used. Trizma is typically added to PFAS drinking water samples analyzed using EPA Method 537.1; no preservatives are used for soil, groundwater, or other media.

2.1.4 Sample Kit Receiving

Sample kits should be inspected prior to sampling to ensure that they are properly received and include all of the necessary supplies.

Complete the following prior to sampling for Site Investigation Section/State-owned Lands Cleanup Program (SIS/SOLCP) projects:

- Review the Florida Department of Environmental Protection (FDEP) PFAS Sampling and Shipping Instructions;
- Complete the Sample Kit Receipt Checklist; and
- Save a copy of the completed checklist to the project folder and ship a completed copy to the FDEP Laboratory with the samples.

2.1.5 Equipment Decontamination

Equipment should be decontaminated on site before work begins. Equipment decontamination should follow the steps outlined in Section 2.4.

2.2 Sampling

2.2.1 Pre-Sampling Activities

At the beginning of each sampling day, field staff should complete the Daily PFAS Sampling Checklist (attached).

2.2.2 Sampling PPE

Gloves: Disposable powder-free nitrile gloves should be worn at all times during sample collection and handling of sampling equipment.

At a minimum, field personnel should put on a new pair of nitrile gloves after the following activities:

- Handling samples, including QA/QC samples and blanks; and
- Handling sampling equipment.

At a minimum, personnel should (1) thoroughly wash their hands with detergent (preferably Alconox®, Liquinox®, or Luminox®) and PFAS-free water; (2) thoroughly dry their hands with paper towels; and (3) put on a new pair of nitrile gloves after the following activities:

- Contact with a material potentially containing PFAS;
- Change in sampling locations;

- Breaks in work;
- Washroom breaks; and
- Exit and entry into the project site exclusion zone.

2.2.3 Sampling Equipment

Sampling equipment will vary based on the sample media and sample collection method. The field staff should consider preparing an equipment list prior to the sampling event and evaluating whether equipment may contain Teflon™ or other PFAS-containing materials, potential alternatives, and whether equipment will be dedicated, disposable, or require decontamination. For example, pump components, fittings, O-rings, sampling tubing and other sampling materials should not include Teflon™ or other PFAS-containing materials. Additionally, analytical field meters to measure these parameters should be free of Teflon™ and other PFAS materials (e.g., tubing, O-rings). All equipment and field meters that come into contact with the sample (e.g. water level meters, field meters, hand augers, bailers, pumps, tools for mixing, safe cutting tools, etc.) should be decontaminated prior to and after each sampling location using PFAS-free water, as described in Section 2.4.

2.2.4 Sample Collection and Labeling

Container Rinsing: Sample containers should not be rinsed prior to sampling.

Labels: Some water-resistant inks may be potential sources of PFAS. PFAS-free container labels should be filled out using a ballpoint pen that does not have water-resistant ink, if possible. Field staff should try to avoid filling out container labels using felt pens and markers (e.g., certain Sharpie® products), unless requested by the client.

- Some clients have requested the use of Sharpies® for labeling samples that are submitted to the laboratory and should be discussed by the project team prior to field work.

Chain of Custody: If applicable, the following remarks should be added to the CoC record:

- A request for rapid turnaround time; and
- To assist the laboratory with analytical procedures, include a note indicating that the sample may potentially have high concentrations of PFAS or was collected in an area that aqueous film forming foam (i.e., AFFF) was released.

Wet Weather Considerations: Field sampling during wet weather (e.g., rainfall and snowfall) should be conducted wearing appropriate clothing that does not pose a risk for cross-contamination. Field personnel should try to avoid water-resistant clothing and boots. Rain gear made of polyurethane, PVC, vinyl, or rubber is an acceptable alternative. Samples and sample containers should not be opened prior to sample collection to avoid collecting precipitation.

2.2.5 Sample Handling, Storage, Quality Control, and Shipment

Handling: Clean nitrile gloves should be worn when handling sample containers. Sample containers should **not** be placed in close proximity to a potential PFAS source.

Storage and Holding Times: Storage conditions and holding times will be determined by the laboratory. Measures should be taken to meet storage and holding time criteria (e.g., expedited shipping).

Quality Control: Prior to shipping, the sample containers should be inspected to ensure their integrity. The following additional steps should be completed.

- Compare the sample dates, times, and IDs recorded in the field notes, CoC, and bottle labels to ensure that they match.
- Compare the RQ number and Bottle Group on the samples to the RQ provided by the FDEP Laboratory and the CoC to ensure they are the same. The RQ number and Bottle Groups must be consistent
- Any discrepancies should be corrected on the field notes, CoC, and/or bottle labels and a reason for the discrepancy should be noted on the Sample Packaging/Shipping Checklist (attached).

Shipment (SIS/SOLCP Projects): Complete the Sample Packaging/Shipping Checklist. A copy of the completed checklist should be saved to the project folder and be returned to the FDEP Laboratory with the samples. Sample containers should be packed for shipment using the following steps:

1. Seal containers for each sample in the FDEP-provided Ziploc bag to prevent melt water from getting into the sample or degrading the sample label.
2. Place a heavy-duty garbage bag in the cooler and place un-bagged ice in the bottom of the bag.
3. Place the Ziploc bags containing the samples (includes trip and temperature blanks) on the ice and photograph this step. Sample containers should be placed into the cooler with their caps in an upright position.
4. Place additional un-bagged ice on top of the Ziploc bags containing the samples and photograph this step. The samples (includes trip and temperature blanks) should be surrounded by ice on all sides.
5. Seal the garbage bag. Place the CoC, FDEP RQ, and copies of the completed Sample Kit Receipt Checklist and Sample/Packaging/Shipping Checklists in a ZipLoc bag, tape the Ziploc bag to the underside of the cooler lid, and photograph this step.
6. Fill any excess space within the cooler with bubble wrap (avoid using paper, cardboard, or polystyrene foam).

7. If shipping the samples via an overnight carrier, seal the entire cooler with tape, particularly the lid, to prevent leaks.

8. Notify the FDEP Site Manager and FDEP Laboratory of the shipping date, method of shipment, and expected arrive date/time.

Shipment (Other Projects): Sample containers should be packed for shipment using the following steps:

1. Seal each sample container in a sample bag to prevent melt water from getting into the sample or degrading the sample label.
2. Place sample containers into the cooler with their caps upright.
3. Fill remaining space from the top of the sample containers to the top of the cooler with wet ice that is double-bagged and sealed. The samples should be surrounded by ice.
4. Fill any excess space within the cooler with bubble wrap (avoid using paper, cardboard, or polystyrene foam).
5. Seal the entire cooler with tape, particularly the lid, to prevent leaks.

2.3 Sampling QA/QC

2.3.1 Duplicates

Duplicates are samples collected in the same manner and at the same time and location as a primary sample. They should be collected from locations of known or suspected contamination. Duplicates are used to assess field and analytical precision and sample heterogeneity. Typically, at least one duplicate is collected for every 10 primary samples. Duplicates should be labeled with a unique sample identifier and not be indicated as a duplicate (i.e., submitted as "blind").

The FDEP Laboratory requested no blind duplicates. The label for a duplicate sample should be consistent with the parent sample and include "Duplicate" or "Dup" in the ID to designate it as a duplicate sample.

2.3.2 Matrix Spike and Matrix Spike Duplicate Samples

Matrix spike and matrix spike duplicate (MS/MSD) samples are aliquots of environmental samples that are spiked with a known concentration of PFAS by the laboratory. MS/MSD samples are used to assess interferences caused by the sample matrix. MS/MSD samples are not needed if the analytical laboratory is using an isotopic dilution method but are technically required to meet Department of Defense (DoD) accreditation requirements. If necessary, MS/MSD samples are to be collected in the same manner and at the same time and location as a primary sample (i.e., additional sample volume). It is preferred that this location have little to no PFAS contamination. Samples should have the same matrix to ensure a valid result; if the samples do not appear visually similar (e.g., discoloration, suspended solids), choose another location for collection of MS/MSD

samples. The number of required MS/MSD samples should be determined based on discussions with the laboratory. Typically, at least one MS/MSD sample is collected for every 20 primary samples. MS/MSD samples should be labeled with the same sample name and time as the primary sample and denoted as MS/MSD samples on the CoC and sample label.

2.3.3 Blanks

Blanks should be shipped and handled in the same manner as environmental samples. Field blanks should be labeled as such on sample bottles and on the CoC. The number and type of blanks should be determined by discussions with the laboratory.

Equipment Blanks: Equipment blanks are used to assess sources of field and laboratory contamination. Equipment blanks are prepared by pouring PFAS-free water over or through decontaminated reusable field sampling equipment and collecting the rinsate in a sample container. Typically, at least one equipment blank is collected for every 10 primary samples with at least one blank collected for each media sampled (e.g. soil, sediment, surface water, groundwater, etc.).

SIS/SOLCP has indicated that at least one equipment blank should be collected for every 20 primary samples. However, equipment blanks can be collected on a 1:10 ratio unless requested otherwise by SIS/SOLCP.

Field Blanks: Field blanks are used to assess ambient contamination within the field and laboratory. Field blanks should be prepared by filling a sample container with PFAS-free water in the field in the same manner as environmental samples. Field blanks are an effective way of assessing potential cross-contamination as a result of sample handling. Typically, one field blank is collected for each shipping container (i.e. cooler).

The SIS/SOLCP does not require that one field blank be included in each shipping container (i.e. cooler). The SIS/SOLCP has indicated that at least one field blank should be collected for each type of water-sampling activity, and sampling containers should be requested for one additional field blank in case the scope of work is revised or conditions change. For field blanks associated with equipment blank sampling, the field blank should be collected immediately after an equipment blank is collected from equipment that was decontaminated using a process with the highest potential for cross-contamination (e.g. pressure washing).

Temperature Blanks: Temperature blanks are used to assess the temperature of samples during shipping. Temperature blanks should be provided by the laboratory and prepared by filling a sample container with PFAS-free water prior to shipment of the sample containers. The blank should be kept in the cooler during sampling and shipment to the laboratory. Once the cooler returns to the laboratory, the temperature of the blank should be measured to ensure that recommended sample storage criteria are met (typically less than 6 degrees Celsius).

2.3.4 SIS/SOLCP QC Samples

For groundwater sampling, the FDEP Laboratory includes two sampling containers in a Ziploc bag, and both containers should be filled at each sampling location. For every 10 samples collected, the FDEP Laboratory will include 4 sampling containers in a Ziploc bag for their internal QC purposes. All four sampling containers should be filled at a selected sampling location (preferably with low concentrations). The four sampling containers should not be split and used for other purposes and must remain together in the same bag before, during, and after sampling. Please notify Geosyntec's Project Manager and Project Director if the containers are not packaged in Ziploc bags.

2.4 Decontamination

Decontamination should occur prior to leaving the sampling area or at a central decontamination location and at the end of each work day. Additionally, sampling equipment exposed to PFAS-contaminated water should be decontaminated between sample locations.

Alconox®, Liquinox®, and Luminox® detergents are acceptable for decontamination purposes from the perspective of PFAS sampling. Use of Decon 90™ should be avoided. Decontamination wastes must be properly contained and disposed of in accordance with applicable local, state and federal regulations.

2.4.1 Field Equipment Decontamination

Cleaning and decontamination of the equipment should be accomplished in stages and in such a way that the contamination does not discharge into the environment. Disposable sample tubing is required to minimize the need for decontamination. More detailed decontamination procedures are provided below.

Drilling Equipment: Drillers typically have multiple rods, augers, spoons, and samplers on hand and thoroughly decontaminate them as a group once they have been used. As drill rods are pulled up, they are wiped down with a rag rinsed in soapy water. Inner rods are placed into a 5-gallon bucket and rinsed with a rag using soapy water (Alconox®, Liquinox®, and Luminox®). Drilling equipment is fully decontaminated using the following procedures:

1. Remove any gross (e.g. soil) contamination from sampling equipment.
2. If heavy petroleum residuals are encountered during sampling, use methanol or another appropriate solvent to remove any residues from sampling equipment;
3. In a constructed decontamination pit, rinse the interior and exterior of the samplers with PFAS-free or potable water using a pressure washer or pressurized hose and a brush or clean rag (1st rinse). Equipment should be laid horizontally and raised above the floor of the decontamination pit, typically on non-wooden sawhorses or other non-wooden structures (see Photographs 1, 2, 8, and 9). Rods, augers, and screens should be rotated midway through the rinse so that the entire exterior of the equipment is sprayed. If using

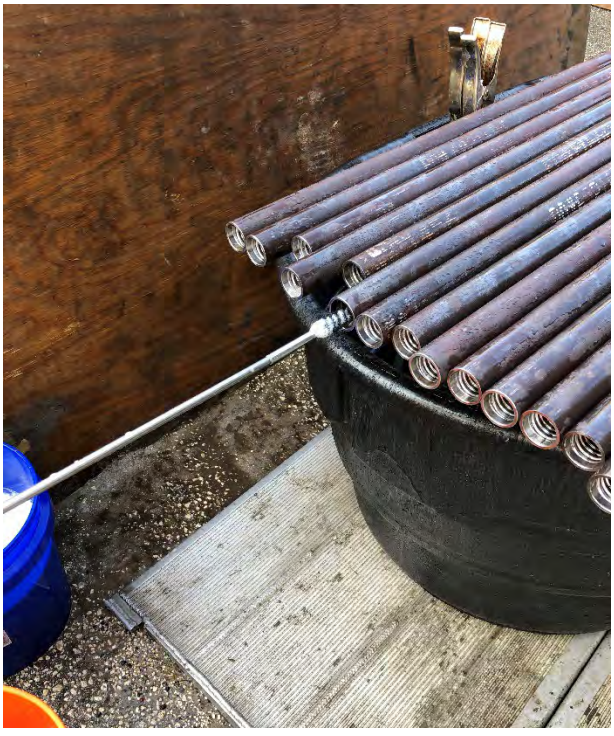
DPT samplers, remove the screen from the sampling rod and the grout plug from the screen as part of the 1st rinse. Clean the interior of the sampling rod and screen with a wire brush. The grout plug can be re-used if in good condition and cleaned using the procedures described in this section;

Photograph 1

Photograph 2

4. Clean (using a brush or clean rag) the exterior of the equipment with soapy, PFAS-free or potable water and clean (using a second, different wire brush) the interior of the equipment with soapy, PFAS-free or potable water;

Photograph 3



Photograph 4

5. If using DPT samplers, follow the procedures listed below for 2nd and 3rd rinses:
    a. In a 5-gallon bucket, hold the screen vertically and use a water hose with a nozzle to spray the interior and exterior of each screen using PFAS-free water (2nd rinse);
    b. Hold the nozzle close to the exterior of the sampler and move the nozzle up and down along the length of the sampler to flush out any residual soils within the screen;
    c. Flip the sampler up-side down in the opposite orientation and repeat Steps 5a and 5b so that water is flushed through both ends of the sampler (3rd rinse);

Photograph 5

Photograph 6

Photograph 7

6. For other drilling equipment and DPT equipment (excluding the screen), rinse the interior and exterior thoroughly with PFAS-free water (2nd rinse);

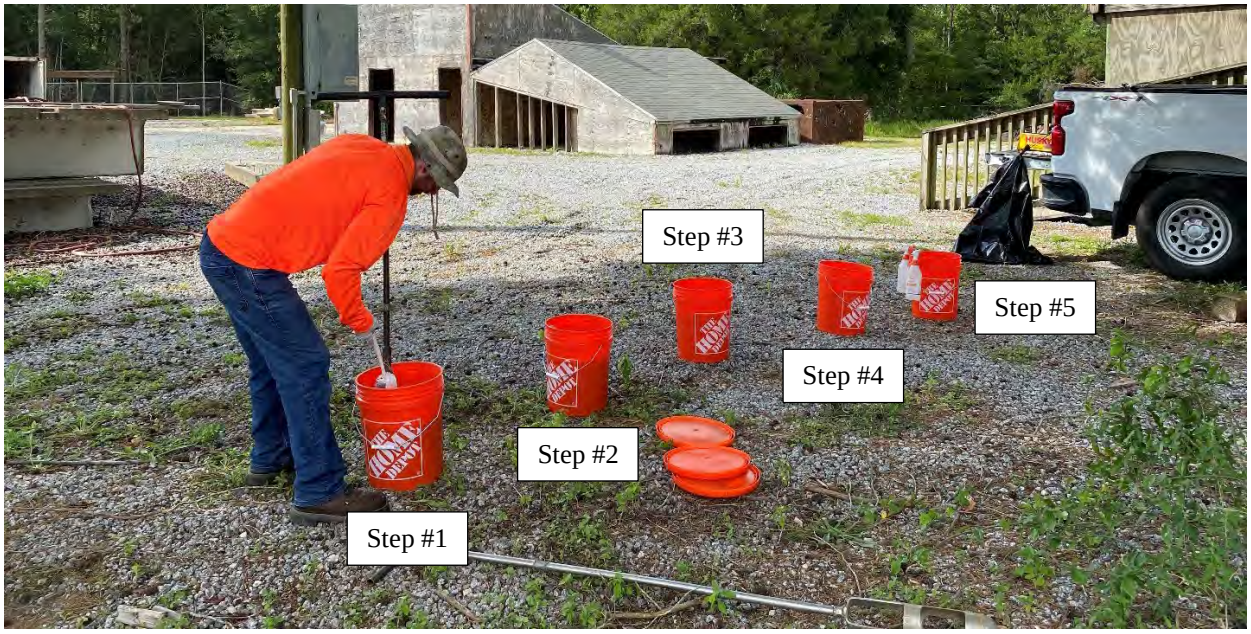
Photograph 8

Photograph 9

7. Leave the equipment to air dry in a location away from dust and fugitive contaminants. All equipment should be dry before reuse.

Other Field Equipment: All non-disposable sampling equipment that is in contact with contaminated soil, groundwater, or decontamination water (e.g., hand augers, post-hole diggers, 5-gallon bucket, field meters, etc.) must be cleaned prior to and between uses at each groundwater sampling location according to the following procedures:

1. Remove any gross (e.g., soil) contamination from sampling equipment with a brush and/or rag (especially in clayey soils).
    a. If heavy petroleum residuals are encountered during sampling, use methanol or another appropriate solvent to remove any residues from sampling equipment.
2. Wash water-resistant equipment thoroughly and vigorously with PFAS-free or potable water containing detergent (Alconox®, Liquinox®, and Luminox®) using a bristle brush or similar utensil to remove any remaining residual contamination.
3. Rinse equipment thoroughly with potable water (1st rinse).
4. Rinse equipment thoroughly with PFAS-free water (2nd rinse).
5. For field instruments and sampling equipment, complete a free-standing (i.e. non-bucket) rinse with PFAS-free water (3rd rinse). This free-standing rinse can be conducted with a spray bottle or by pumping PFAS-free water from a tote.



Photograph 10

6. Dry the wet equipment with a paper towel or leave the equipment to air dry in a location away from dust or fugitive contaminants. All equipment should be dry before reuse.

2.4.2 Personnel and PPE Decontamination

A decontamination area for personnel and portable equipment may be specified in the health and safety plan. The area may include basins or tubs to capture decontamination wastes, which can be transferred to larger containers as necessary. Decontamination following groundwater sampling should follow these steps:

1. Gross (e.g., soil) contamination should be scraped and wiped from boots, safety glasses, hardhats, reflective vests, and other reusable PPE. Once gross contamination has been removed, gloves should be removed by rolling off the hands in such a way to avoid exposing skin to PFAS-contaminated materials;
2. If personnel need to stand within the decontamination pit when decontaminating drilling or other sampling equipment, their boots should be cleaned using the steps outlined in Section 2.4.1 prior to continued sample collection.
3. A new pair of gloves should be put on and reusable PPE should be decontaminated using PFAS-free water mixed with detergent (preferably Alconox®, Liquinox®, and Luminox®) and brushes, or similar means. After debris is removed, reusable PPE should be rinsed with PFAS-free water; and
4. Hands and any exposed body parts should be washed thoroughly using detergent (preferably Alconox®, Liquinox®, and Luminox®) and PFAS-free water. Hands should be dried with paper towels.

2.5 Food and Drink

Food and drink should not be brought within the exclusion zone. Food that is kept in the staging area should preferably be contained in HDPE or stainless-steel containers.

Daily PFAS Sampling Checklist

Date: _____

Site Name: _____

Weather (*temperature/precipitation*): _____

Please check all boxes that apply and describe any exceptions in the notes section below along with QA/QC methods used to assess potential sample cross-contamination as a result.

Field Clothing and PPE:

- ☐ No water- or stain-resistant clothing (e.g., GORE-TEX®)
- ☐ During collection of water and sediment samples, no water- or stain-resistant boots OR water- or stain-resistant boots covered by PFAS-free over-boots
- ☐ Field boots (or over-boots) are made of polyurethane, PVC, rubber, or untreated leather
- ☐ Waders or rain gear are made of polyurethane, PVC, vinyl, wax-coated or rubber
- ☐ Clothing has not been recently laundered with a fabric softener
- ☐ No coated HDPE suits (e.g., coated Tyvek® suits)
- ☐ Field crew has not used cosmetics, moisturizers, or other related products today
- ☐ Field crew has not used sunscreen or insect repellants today, other than products approved as PFAS-free

Field Equipment:

- ☐ Sample containers and equipment in direct contact with the sample are made of HDPE, polypropylene, silicone, acetate or stainless steel, not LDPE or glass
- ☐ Sample caps are made of HDPE or polypropylene and are not lined with Teflon™
- ☐ No materials containing Teflon™, Viton™, or fluoropolymers
- ☐ No materials containing LDPE in direct contact with the sample (e.g., LDPE tubing, Ziploc® bags)
- ☐ No plastic clipboards, binders, or spiral hard cover notebooks
- ☐ No waterproof field books
- ☐ No waterproof or felt pens or markers (e.g., certain Sharpie® products)
- ☐ No chemical (blue) ice, unless it is contained in a sealed bag
- ☐ No aluminum foil
- ☐ No sticky notes (e.g., certain Post-It® products)

Decontamination:

- ☐ Reusable field equipment (e.g., inner drill rods, samplers) decontaminated prior to reuse
- ☐ "PFAS-free" water is on-site for decontamination of field equipment
- ☐ Alconox® or Liquinox® used as decontamination detergent

Food and Drink:

- ☐ No food or drink on-site, except within staging area
- ☐ Food in staging area is contained in HDPE or stainless steel container

Notes:

_____

_____

_____

_____

_____

Field Team Leader Name (Print): _____

Field Team Leader Signature: _____

Date/Time: _____

STANDARD OPERATING PROCEDURE FOR DRILLING ACTIVITIES AT SITES FOR ASSESSMENT OF PER- AND POLYFLUOROALKYL SUBSTANCES (PFAS)

1. INTRODUCTION

1.1 Purpose and Scope

Standard operating procedures (SOPs) were prepared to guide per- and polyfluoroalkyl substance (PFAS) sampling activities. This SOP describes recommended general procedures to be used by Geosyntec and drilling subcontractor field personnel when collecting samples using various techniques for PFAS analysis. Because PFAS are potentially present in a variety of materials that may come into contact with field equipment or samples, and because laboratory analytical method detection limits are low (low to sub nanogram per liter concentrations), conservative precautions are recommended to avoid cross-contamination and false positive results. The procedures in this SOP are consistent with best practices at the time of authoring.

1.2 Definitions and Acronyms

PFAS-free water — Water that has been analyzed by an accredited laboratory and determined to be below the method detection limit (i.e., non-detect) for the suite of PFAS to be analyzed for in environmental samples. Method detection limits (MDLs) used during analysis of PFAS-free water should be at or below the MDLs used for environmental samples.

Potable water — Water that meets state and federal drinking water requirements. Note this water may or may not have detectable PFAS concentrations.

1.3 Equipment and Products

Sections 1.3.1 and 1.3.2 detail items that are safe to use versus not recommended for use on the job site to protect PFAS samples from potential cross-contamination. Science-based evidence is not currently available to support a determination of the realistic impact of these commonly used field items and materials on PFAS samples. In the absence of scientific-based sampling guidance, field staff, subcontractors, and analytical laboratories should try to avoid using items that may pose a risk for cross-contamination and false positive results and instead use acceptable alternatives identified in this section. If the field team needs to use products and equipment on site that are not recommended, additional quality assurance/quality control (QA/QC) samples may be collected to evaluate any potential impact on PFAS environmental samples. This information is also provided in an abbreviated format as a checklist for field staff to reference (**Attachment**).

1.3.1 Field Equipment

Items that are **safe to use** on site when investigating for PFAS include the following:

- Equipment made from high-density polyethylene (HDPE)[1], polypropylene, silicone, acetate, or stainless steel;
- Low-density polyethylene (LDPE)[2] materials not in direct contact with the sampling equipment (e.g., Ziploc® bags);
- Materials made of HDPE, silicone, acetate, or stainless steel;
- Masonite or aluminum clipboards;
- Sampling forms and loose paper or field notebooks;
- Ballpoint pens;
- Alconox®, Liquinox® and Luminox® detergents;
- Trash bags;
- Large (e.g., 55-gallon) containers;
- DPT rig, rods, and related tools;
- Paper towels;
- HDPE sheeting;
- Hard-shell coolers;
- Shipping and handling labels;
- Regular (wet) ice;
- Bubble wrap;
- Duct tape and packing tape;
- HDPE or stainless-steel bailer and cable;
- Submersible pumps, bladder pumps, peristaltic pumps, and inertia pumps that do not have Teflon components;
- Dedicated Silicon and/or HDPE tubing; and
- Water level probe.

[1] HDPE plastics are commonly identified by a recycling symbol with a number 2 inside it.
[2] LDPE plastics are commonly identified by a recycling symbol with a number 4 inside it.

Items **to be avoided (i.e. not recommended) for use** during PFAS investigations include the following:

- Glass materials in contact with sampling equipment, due to PFAS adherence to glass surfaces
- Sticky notes (e.g., certain Post-It® products), due to potential use of a paper coating product
- Pens with water-resistant ink
- Aluminum foil, as PFAS are sometimes used as a protective layer
- Chemical (e.g., blue) ice packs, unless it is contained in a sealed bag.
- Equipment with Viton™ components (i.e., fluoroelastomers)
- Material containing LDPE, particularly if used in direct contact with the sample (e.g., LDPE tubing, as PFAS can sorb to the porous tubing
- Water-resistant paper, notebooks, and labels (e.g., certain Rite in the Rain® products), due to use of PFAS in water-resistant inks and coatings
- Plastic clipboards, binders, and spiral hardcover notebooks
- Felt pens and markers (e.g., certain Sharpie® products)[3]
- Decon 90™ liquid detergent, which reportedly contain fluorosurfactants
- Materials containing polytetrafluoroethylene (PFTE) including Teflon™ and Hostaflon® (e.g., tubing, tape, plumbing paste, O-rings)
- Stain- or water-resistant materials, as these are typically fluoropolymer-based

1.3.2 Clothing, Personal Protective Equipment (PPE), and Consumer Products

Items that are **safe to use** when investigating for PFAS include the following:

- Boots made of polyurethane, polyvinyl chloride (PVC), rubber, or untreated leather
- Other field boots covered by PFAS-free (e.g., polypropylene) over-boots
- Rain gear made of polyurethane, PVC, wax-coated, vinyl, or rubber
- Clothing made of synthetic (e.g., polyester) or natural (e.g., cotton) fibers

[3] Some PFAS SOPs (e.g., Michigan) specifically allow Fine or Ultra-Fine Point Sharpies® and TestAmerica Laboratories, Inc. routinely uses Sharpies® in the laboratory following unpublished analytical tests that reportedly showed no impact on PFAS sample results. Some clients have requested the use of Sharpies® for labeling samples that are submitted to the laboratory.

- Safety glasses
- Reflective safety vests
- Hardhats
- Disposable powder-free nitrile gloves
- Uncoated HDPE suits (e.g., certain Tyvek® products)
- Sunscreens[4] and insect repellants[5] that have been tested and found to be PFAS-free
- Bottled water and hydration drinks

Items **to be avoided (i.e., not recommended) for use** during PFAS sampling include the following:

- Water- or stain-resistant boots and clothing (e.g., products containing GORE-TEX®)
- Flame resistant clothing (FRC)
- Clothing recently laundered with a fabric softener
- Coated HDPE suits (e.g., certain Tyvek® products)
- Sunscreen and insect repellants containing fluorinated compounds as ingredients, such as polyfluoroalkyl phosphate esters
- Latex gloves
- Cosmetics, moisturizers, hand cream, and other related products
- Food wrappers and packaging
- Food and drinks other than bottled water or hydration drinks

[4] Examples of PFAS-free sunscreens include Alba Organics Natural, Aubrey Organics, Banana Boat Sport Performance Sunscreen Lotion Broad Spectrum SPF 30, Banana Boat for Men Triple Defense Continuous Spray Sunscreen SPF 30, Banana Boat Sport Performance Coolzone Broad Spectrum SPF 30, Banana Boat Sport Performance Sunscreen Stick SPF 50, Coppertone Sunscreen Lotion Ultra Guard Broad Spectrum SPF 50, Coppertone Sport High-Performance AccuSpray Sunscreen SPF 30, Coppertone Sunscreen Stick Kids SPF 55, Jason Natural Sun Block, Kiss my Face, L'Oréal Silky Sheer Face Lotion 50+, Meijer Clear Zinc Sunscreen Lotion Broad Spectrum SPF 15, 30 and 50, Meijer Wet Skin Kids Sunscreen Continuous Spray Broad Spectrum SPF 70, Neutrogena Beach Defense Water + Sun Barrier Lotion SPF 70, Neutrogena Beach Defense Water + Sun Barrier Spray Broad Spectrum SPF 30, Neutrogena Pure & Free Baby Sunscreen Broad Spectrum SPF 60+, Neutrogena Ultra-Sheer Dry-Touch Sunscreen Broad Spectrum SPF 30, Yes to Cucumbers, and sunscreens for infants. Products with fluorinated compounds in their ingredients (e.g., polyfluoroalkyl phosphate esters) should not be worn during sampling.

[5] Examples of PFAS-free insect repellent include Jason Natural Quit Bugging Me, Repel Lemon Eucalyptus Insect repellant, Herbal Armor, California Baby Natural Bug Spray, BabyGanics, OFF! Deep Woods® spray for clothing and skin, Sawyer® do-it-yourself permethrin treatment for clothing, Insect Shield Insect® pretreated clothing, DEET products, and sunscreen/insect repellent combination product Avon Skin so Soft Bug Guard-SPF 30. Products with fluorinated compounds in their ingredients (e.g., polyfluoroalkyl phosphate esters) should not be worn during sampling.

DRILLER should try to find acceptable alternatives to these items that still allow them to complete the field work safely and efficiently. For example, wearing long-sleeved clothing and a hard hat or sun hat may eliminate the need to use sunscreen in some climates. If an item cannot be easily avoided, DRILLER should discuss with Geosyntec prior to mobilization.

2. FIELD PROCEDURES

This section details considerations that should be made regarding adjustments to standard field procedures to limit the potential for cross-contamination during PFAS sampling.

2.1 Source of PFAS-Free Water

PFAS-free water may be needed for equipment decontamination during sample collection (i.e., water that has been analyzed by an accredited laboratory and determined to be below the method detection limit [MDL] or reporting limit [RL] for the suite of PFAS to be analyzed for in environmental samples). MDLs or RLs used during analysis of PFAS-free water should be at or below the MDLs or RLs used for environmental samples.

If an on-site or off-site water source is available, the project team may consider whether the water source can be tested for PFAS and determined to be PFAS-free ahead of the sampling event. PFAS-free deionized water can also be purchased from the analytical laboratory and shipped with the bottle order.

2.2 PPE

Gloves: Disposable powder-free nitrile gloves should be worn at all times during field activities (e.g., drilling, sampling, and handling of sampling equipment and downhole equipment). At a minimum, field personnel should put on a new pair of nitrile gloves after the following activities:

- Handling samples, including QA/QC samples and blanks; and
- Handling sampling equipment.

Hygiene: At a minimum, personnel should (1) thoroughly wash their hands with detergent (preferably Alconox®, Liquinox® or Luminox®) and PFAS-free water; (2) thoroughly dry their hands with paper towels; and (3) put on a new pair of nitrile gloves after the following activities:

- Contact with a material potentially containing PFAS including downhole equipment and tools;
- Change in sampling locations;
- Breaks in work;
- Washroom breaks; and
- Exit and entry into the project site exclusion zone.

Wet Weather Considerations: Field sampling during wet weather should be conducted wearing appropriate clothing that does not pose a risk for cross-contamination. Field personnel should try to avoid water-resistant clothing and boots. Rain gear made of polyurethane, PVC, vinyl, or rubber is an acceptable alternative.

2.3 Equipment and Personnel Decontamination

Decontamination should occur prior to leaving the sampling area or at a central decontamination location and at the end of each work day. Additionally, sampling equipment exposed to PFAS-contaminated water should be decontaminated between sample locations.

Alconox®, Liquinox® and Luminox® detergents are acceptable for decontamination purposes from the perspective of PFAS sampling. Use of Decon 90 should be avoided. Decontamination wastes must be properly contained and disposed of in accordance with applicable local, state and federal regulations.

2.3.1 Decon Pit Construction

Decontamination activities will take place in accordance with PFAS SOPs and at a designated staging and laydown area. DRILLER will need to provide drilling equipment, as described in the Scope of Work.

- A water source is not available at Site and DRILLER will need to provide a sufficient volume of water to complete decontamination activities.
- Place two sheets of 4-ft by 8-ft plywood side-by-side on a smooth surface. If feasible, consider the natural slope of area and position the plywood to facilitate drainage to a corner of the decontamination pad. The DRILLER is responsible for ensuring the pad is large enough to hold drilling equipment to be decontaminated and the back of the drill rig for decontamination.
- Install and secure 2-inch by 4-ft by 8-ft length framing around the perimeter of the plywood.
- Install and secure one sheet of 4-ft by 8-ft plywood perpendicular to the base plywood sheets in order to contain fluids during pressure washing of drill rods and samplers.
- Place a minimum of two layers of 6 mil (minimum) PFAS-free sheeting (See SOPs) over the plywood and framing. The PFAS-free sheeting should overlap all sides of the pad structure and **must not have intervening seams.**

Photograph 1

- During the performance of decontamination procedures within the pad structure, fluids accumulating within the pad area should be routinely removed and drummed. If any leakage through the sheeting is observed, the PFAS-free sheeting must be replaced.

- During decontamination procedures, rods and casing shall be elevated to around 3 ft above the bottom of the decontamination pad but will not exceed the plywood that is perpendicular to the base. Rods and casing can be elevated using sawhorses or racks.

- At the end of each day of field work, all accumulated fluids within the pad area shall be removed, and at a minimum the upper PFAS-free sheeting layer should be removed and replaced. Removed PFAS-free sheeting shall be disposed as solid waste by the contractor.

- Under no circumstances shall any fluids within the pad area be discharged to grade (even if the fluids in the pad area are documented to be 100% from rainfall).

In addition to the required permanent decontamination pit, the DRILLER may be allowed to use a temporary decon pit that uses a plastic trough (Photograph 2) or series of 5-gallon buckets to clean rods during drilling. Samplers, however, shall be decontaminated within the permanent decon pit, as described above.

Photograph 2

2.3.2 Field Equipment Decontamination

Cleaning and decontamination of the equipment should be accomplished in stages and in such a way that the contamination does not discharge into the environment. Disposable sample tubing is required to minimize the need for decontamination. More detailed decontamination procedures are provided below.

Drillers typically have multiple rods, augers, spoons, and samplers on hand and thoroughly decontaminate them as a group once they have been used. As drill rods are pulled up, they are wiped down with a rag rinsed in soapy water. Inner rods are placed into a 5-gallon bucket and rinsed with a rag using soapy water (Alconox®, Liquinox® and Luminox®). All non-disposable sampling equipment that is in contact with contaminated soil, groundwater, or decontamination water (e.g., hand augers, post-hole diggers, 5-gallon bucket, field meters) must be cleaned prior to and between uses at each groundwater sampling location.

Equipment is fully decontaminated using the following procedures:

1. Remove any gross (e.g., soil) contamination from downhole equipment.
2. If heavy petroleum residuals are encountered during sampling, use methanol or another appropriate solvent to remove any residues from sampling equipment;
3. In a constructed decontamination pit, rinse the exterior and interior of the samplers with PFAS-free or potable water using a pressure washer or pressurized hose and a brush or clean rag (1st rinse). Equipment should be laid horizontally and raised above the floor of the decontamination pit, typically on non-wooden sawhorses or other non-wooden structures (see Photographs 3, 4, 10, and 11). Rods, augers, and screens should be rotated

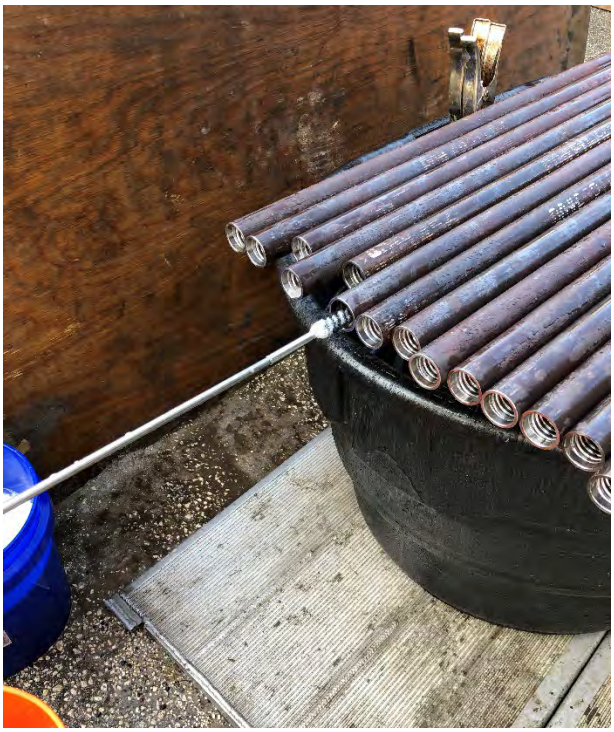
midway through the rinse so that the entire exterior of the equipment is sprayed. If using DPT samplers, remove the screen from the sampling rod and the grout plug from the screen as part of the 1st rinse. Clean the interior of the sampling rod and screen with a wire brush. The grout plug can be re-used if in good condition and cleaned using the procedures described in this section;

Photograph 3

Photograph 4

4. Clean (using a brush or clean rag) the exterior of the equipment with soapy, PFAS-free or potable water and clean (using a second, different wire brush) the interior of the equipment with soapy, PFAS-free or potable water;

Photograph 5



Photograph 6

5. If using DPT samplers, follow the procedures listed below for 2nd and 3rd rinses:

a. In a 5-gallon bucket, hold the sampler vertically and use a water hose with a nozzle or a pressure washer to spray the interior and exterior of each sampler using PFAS-free water (2nd rinse);

b. Hold the nozzle close to the exterior of the sampler and move the nozzle up and down along the length of the sampler to flush out any residual soils within the screen;

c. Flip the sampler up-side down in the opposite orientation and repeat Steps 5b and 5c so that water is flushed through both ends of the sampler (3rd rinse);

Photograph 7

Photograph 8

Photograph 9

6. For other drilling equipment, rinse the interior and exterior thoroughly with PFAS-free water (2nd rinse);

Photograph 10

Photograph 11

7. For field instruments and non-disposable sampling equipment, complete a free-standing (i.e. non-bucket) rinse again with PFAS-free water (3rd rinse). This free-standing rinse can be conducted with a spray bottle or by pumping PFAS-free water from a tote.
8. Leave the equipment to air dry in a location away from dust and fugitive contaminants. All equipment should be dry before reuse.

2.3.3 Personnel and PPE Decontamination

A decontamination area for personnel and portable equipment may be specified in the health and safety plan. The area may include basins or tubs to capture decontamination wastes, which can be transferred to larger containers as necessary. Decontamination following groundwater sampling should follow these steps:

1. Gross (e.g., soil) contamination should be scraped and wiped from boots, safety glasses, hardhats, reflective vests, and other reusable PPE. Once gross contamination has been removed, gloves should be removed by rolling off the hands in such a way to avoid exposing skin to PFAS-contaminated materials;
2. If personnel need to stand within the decontamination pit when decontaminating drilling or other sampling equipment, their boots should be cleaned using the steps outlined in Section 2.4.1 prior to continued sample collection.
3. A new pair of gloves should be put on and reusable PPE should be decontaminated using PFAS-free water mixed with detergent (preferably Alconox®, Liquinox® or Luminox®) and brushes, or similar means. After debris is removed, reusable PPE should be rinsed with PFAS-free water; and
4. Hands and any exposed body parts should be washed thoroughly using detergent (preferably Alconox®, Liquinox® or Luminox®) and PFAS-free water. Hands should be dried with paper towels.

2.4 Food and Drink

Food and drink should not be brought within the exclusion zone. Food that is kept in the staging area should preferably be contained in HDPE or stainless-steel containers.

Attachment - Daily PFAS Investigation Checklist

Date: _____

Site Name: _____

Weather (*temperature/precipitation*): _____

Please check all boxes that apply and describe any exceptions in the notes section below along with QA/QC methods used to assess potential sample cross-contamination as a result.

Field Clothing and PPE:

- ☐ No water- or stain-resistant clothing (e.g., GORE-TEX®)
- ☐ During collection of water and sediment samples, no water- or stain-resistant boots OR water- or stain-resistant boots covered by PFAS-free over-boots
- ☐ Field boots (or over-boots) are made of polyurethane, PVC, rubber, or untreated leather
- ☐ Waders or rain gear are made of polyurethane, PVC, vinyl, wax-coated or rubber
- ☐ Clothing has not been recently laundered with a fabric softener
- ☐ No coated HDPE suits (e.g., coated Tyvek® suits)
- ☐ Field crew has not used cosmetics, moisturizers, or other related products today
- ☐ Field crew has not used sunscreen or insect repellants today, other than products approved as PFAS-free

Field Equipment:

- ☐ Sample containers and equipment in direct contact with the sample are made of HDPE, polypropylene, silicone, acetate or stainless steel, not LDPE or glass
- ☐ Sample caps are made of HDPE or polypropylene and are not lined with Teflon™
- ☐ No materials containing Teflon™, Viton™, or fluoropolymers
- ☐ No materials containing LDPE in direct contact with the sample (e.g., LDPE tubing, Ziploc® bags)
- ☐ No plastic clipboards, binders, or spiral hard cover notebooks
- ☐ No waterproof field books
- ☐ No waterproof or felt pens or markers (e.g., certain Sharpie® products)
- ☐ No chemical (blue) ice, unless it is contained in a sealed bag
- ☐ No aluminum foil
- ☐ No sticky notes (e.g., certain Post-It® products)

Decontamination:

- ☐ Reusable field equipment (e.g., inner drill rods, samplers) decontaminated prior to reuse
- ☐ "PFAS-free" water is on-site for decontamination of field equipment
- ☐ Alconox® or Liquinox® used as decontamination detergent

Food and Drink:

- ☐ No food or drink on-site, except within staging area
- ☐ Food in staging area is contained in HDPE or stainless-steel container

Notes:

_____

_____

_____

_____

_____

Field Team Leader Name (Print): _____

Field Team Leader Signature: _____

Date/Time: _____

Geosyntec consultants

DRAFT STANDARD OPERATING PROCEDURE FOR GROUNDWATER SAMPLING OF MONITORING WELLS AND ANALYSIS OF PER- AND POLYFLUOROALKYL SUBSTANCES (PFAS)

1. INTRODUCTION

1.1 Purpose and Scope

Standard operating procedures (SOPs) were prepared to guide per- and polyfluoroalkyl substance (PFAS) sampling activities. This SOP describes recommended procedures to be used by Geosyntec field personnel when collecting groundwater samples from monitoring wells. Because PFAS are potentially present in a variety of materials that may come into contact with water samples, and because laboratory analytical method detection limits are low (low to sub nanogram per liter concentrations), conservative precautions are recommended to avoid sample cross-contamination and false positive results. The procedures in this SOP are consistent with best practices at the time of authoring.

1.2 Definitions and Acronyms

1.2.1 Definitions

Bladder pump	A positive displacement pump that is acceptable for collection of all analytes and depths. Can be small enough to sample from wells as small as 3/4-inch in diameter.
Dedicated equipment	Equipment that is installed in or used in just one monitoring well for purging and sampling, and that remains in that well for the duration of the monitoring program. Dedicated equipment does not need to be decontaminated between sampling events.
Inertia pump	A riser tube fitted with a one-way foot valve. Best used on small diameter wells (2 inches or less). Can be used if the depth to water is less than approximately 25 feet.
Peristaltic pump	A positive displacement pump that can be used to move fluids at a fixed rate. Peristaltic pumps are typically used if the depth to water is less than approximately 25 feet.
PFAS-free water	Water that has been analyzed by an accredited laboratory (see Section 3.1) and determined to be below the method detection limit (i.e., non-detect) for the suite of PFAS to be analyzed for in environmental samples. Method detection limits (MDLs) used during analysis of PFAS-free water should be at or below the MDLs used for environmental samples.

Potable water	Water that meets state and federal drinking water requirements. Note this water may or may not have detectable PFAS concentrations.
Submersible pump	A positive-pressure pump that is acceptable for collection of all analytes. Achievable depths are limited by the power of the pump and length of wiring. Well must be at least 2 inches in diameter.

1.2.2 Acronyms

ASTM	American Society for Testing and Materials
CoC	chain of custody
DO	dissolved oxygen
DoD	Department of Defense
DOT	Department of Transportation
ETFE	ethylene tetrafluoroethylene
FEP	fluorinated ethylene propylene
HDPE	high-density polyethylene
IATA	International Air Transport Association
ICAO	International Civil Aviation Organization
LDPE	low-density polyethylene
MDL	method detection limit
MS	matrix spike
MSD	matrix spike duplicate
ORP	oxidation-reduction potential
PFAS	per- and polyfluoroalkyl substances
PFTE	polytetrafluoroethylene
PPE	personal protective equipment
PVC	polyvinyl chloride
PVDF	polyvinylidene fluoride
QA	quality assurance
QC	quality control
QSM	quality systems manual
SOP	standard operating procedure
USGS	United States Geological Survey

1.3 Equipment and Products

Sections 1.3.1 and 1.3.2 detail items that are safe to use versus not recommended for use on the job site to protect PFAS samples from potential cross-contamination. Science-based evidence is not currently available to support a determination of the realistic impact of these commonly used field items and materials on PFAS samples. In the absence of scientific-based sampling guidance, field staff, contractors, and analytical laboratories should try to avoid using items that may pose a risk for cross-contamination and false positive results and instead use acceptable alternatives identified in this section. If the field team needs to use products and equipment on site that are not recommended, additional quality assurance/quality control (QA/QC) samples may be collected to evaluate any potential impact on PFAS environmental samples. This information is also provided in an abbreviated format as a checklist for field staff to reference (Attachment A).

1.3.1 Field Equipment

Items that are **safe to use** on site when sampling for PFAS include the following:

- Sampling containers, screw caps and other equipment made from high-density polyethylene (HDPE)[1], polypropylene, silicone, acetate, or stainless steel;
- Sample preservatives (e.g., Trizma®);
- QA/QC samples (e.g., temperature and field blanks);
- Low-density polyethylene (LDPE)[2] materials not in direct contact with the sample (e.g., Ziploc® bags);
- Materials made of HDPE, silicone, acetate, or stainless steel;
- Masonite or aluminum clipboards;
- Ballpoint pens;
- Sampling forms, loose paper or field notebooks, chain of custody (CoC) record, and sample container labels;
- Alconox®, Liquinox® and Luminox® detergents;
- Paper towels;
- Trash bags;
- HDPE sheeting;
- Hard-shell coolers;

[1] HDPE plastics are commonly identified by a recycling symbol with a number 2 inside it.
[2] LDPE plastics are commonly identified by a recycling symbol with a number 4 inside it.

- Shipping and handling labels;
- Regular (wet) ice;
- Bubble wrap;
- Duct tape and packing tape;
- Large (e.g., 55-gallon) containers;
- Submersible pumps, bladder pumps, peristaltic pumps, and inertia pumps that do not have Teflon components;
- Dedicated Silicon and/or HDPE tubing;
- Analytical field meter (e.g., temperature, pH, conductivity, oxidation-reduction potential [ORP], dissolved oxygen [DO], and turbidity); and
- Water level probe(s).

Items **to be avoided (i.e. not recommended) for use** on site include the following:

- Glass sample containers, due to PFAS adherence to glass surfaces;
- Water-resistant paper, notebooks, and labels (e.g., certain Rite in the Rain® products), due to use of PFAS in water-resistant inks and coatings;
- Sticky notes (e.g., certain Post-It® products), due to potential use of a paper coating product Zonyl™ or similar fluorotelomer compounds;
- Plastic clipboards, binders, and spiral hardcover notebooks;
- Pens with water-resistant ink;
- Felt pens and markers (e.g., certain Sharpie® products) – some PFAS SOPs (e.g., Michigan) specifically allow Fine or Ultra-Fine Point Sharpies® and TestAmerica Laboratories, Inc. routinely uses Sharpies® in the laboratory following unpublished analytical tests that reportedly showed no impact on PFAS sample results;
- Aluminum foil, as PFAS are sometimes used as a protective layer;
- Decon 90™ liquid detergent, which reportedly contain fluorosurfactants;
- Chemical (e.g., blue) ice packs, unless it is contained in a sealed bag. Blue ice has the potential to be contaminated from previous field sampling events;
- Materials containing polytetrafluoroethylene (PFTE) including Teflon™ and Hostaflon® (e.g., tubing, tape, plumbing paste, O-rings);
- Equipment with Viton™ components (i.e., fluoroelastomers);
- Stain- or water-resistant materials, as these are typically fluoropolymer-based;

- Material containing LDPE, particularly if used in direct contact with the sample (e.g., LDPE tubing, as PFAS can sorb to the porous tubing); and
- Material containing "fluoro" in the name – this includes, but is not limited to, fluorinated ethylene propylene (FEP), ethylene tetrafluoroethylene (ETFE), and polyvinylidene fluoride (PVDF).

1.3.2 Clothing, Personal Protective Equipment (PPE), and Consumer Products

Items that are **safe to use** on site when sampling for PFAS include the following:

- Boots made of polyurethane, polyvinyl chloride (PVC), rubber, or untreated leather;
- Other field boots covered by PFAS-free (e.g., polypropylene) over-boots;
- Rain gear made of neoprene, polyurethane, PVC, wax-coated, vinyl, or rubber;
- Clothing made of synthetic (e.g., polyester) or natural (e.g., cotton) fibers;
- Safety glasses;
- Reflective safety vests;
- Hardhats;
- Disposable powder-free nitrile gloves;
- Uncoated HDPE suits (e.g., certain Tyvek® products);
- Bottled water and hydration drinks; and
- Sunscreens[3] and insect repellants[4] that have been tested and found to be PFAS-free.

[3] Examples of PFAS-free sunscreens include Alba Organics Natural, Aubrey Organics, Banana Boat Sport Performance Sunscreen Lotion Broad Spectrum SPF 30, Banana Boat for Men Triple Defense Continuous Spray Sunscreen SPF 30, Banana Boat Sport Performance Coolzone Broad Spectrum SPF 30, Banana Boat Sport Performance Sunscreen Stick SPF 50, Coppertone Sunscreen Lotion Ultra Guard Broad Spectrum SPF 50, Coppertone Sport High-Performance AccuSpray Sunscreen SPF 30, Coppertone Sunscreen Stick Kids SPF 55, Jason Natural Sun Block, Kiss my Face, L'Oréal Silky Sheer Face Lotion 50+, Meijer Clear Zinc Sunscreen Lotion Broad Spectrum SPF 15, 30 and 50, Meijer Wet Skin Kids Sunscreen Continuous Spray Broad Spectrum SPF 70, Neutrogena Beach Defense Water + Sun Barrier Lotion SPF 70, Neutrogena Beach Defense Water + Sun Barrier Spray Broad Spectrum SPF 30, Neutrogena Pure & Free Baby Sunscreen Broad Spectrum SPF 60+, Neutrogena Ultra-Sheer Dry-Touch Sunscreen Broad Spectrum SPF 30, Yes to Cucumbers, and sunscreens for infants. Products with fluorinated compounds as ingredients (e.g., polyfluoroalkyl phosphate esters) should not be worn during sampling.

[4] Examples of PFAS-free insect repellent include Jason Natural Quit Bugging Me, Repel Lemon Eucalyptus Insect repellant, Herbal Armor, California Baby Natural Bug Spray, BabyGanics, OFF! Deep Woods® spray for clothing and skin, Sawyer® do-it-yourself permethrin treatment for clothing, Insect Shield Insect® pretreated clothing, DEET products, and sunscreen/insect repellent combination product Avon Skin so Soft Bug Guard-SPF 30. Products with fluorinated compounds in their ingredients (e.g., polyfluoroalkyl phosphate esters) should not be worn during sampling.

Items **to be avoided (i.e., not recommended) for use** on site include the following:

- Water- or stain-resistant boots and clothing (e.g., products containing GORE-TEX®);
- Clothing recently laundered with a fabric softener;
- Coated HDPE suits (e.g., certain Tyvek® products);
- Sunscreen and insect repellants containing fluorinated compounds as ingredients, such as polyfluoroalkyl phosphate esters;
- Latex gloves;
- Cosmetics, moisturizers, hand cream, and other related products;
- Food wrappers and packaging; and
- Food and drinks other than bottled water or hydration drinks.

Field staff should try to find acceptable alternatives to these items that still allow them to complete the field work safely and efficiently. For example, wearing long-sleeved clothing and a hard hat or sun hat may eliminate the need to use sunscreen in some climates. If an item cannot be easily avoided, additional consideration should be given to QA/QC samples to evaluate the potential impact of sample cross-contamination (e.g., field blanks).

2. FIELD PROCEDURES

2.1 Pre-Mobilization Activities

2.1.1 Health and Safety Plan

Prior to each field event, the site health and safety plan should be reviewed and updated, as necessary. Health and safety plan requirements should be reviewed for consistency with this SOP and modified as appropriate to resolve any differences.

2.1.2 Laboratory Coordination

Field personnel should communicate with the laboratory that will conduct PFAS analysis regarding the following items:

- Laboratory accreditation for PFAS analysis (see Section 3.1);
- Appropriate sample containers, labels, and preservatives (see Sections 2.2.3 and 2.2.4);
- Sample storage conditions and holding time (see Section 2.2.5); and
- The number and type of QA/QC samples (see Section 2.3).

Because there is no standard United States Environmental Protection Agency method for analyzing PFAS samples in media other than drinking water, commercial laboratories typically offer analysis

for a suite of approximately 18 PFAS using a modified version of Method 537.1. Laboratories may have developed their own variations. Project staff may consider the impact of differences in reported PFAS concentrations and the potential value of collecting and sending a split sample to a second commercial laboratory to assess variability in reported PFAS concentrations.

Laboratories conducting PFAS analysis at DoD facilities should be accredited by the United States Department of Defense Environmental Laboratory Accreditation Program (i.e. use a PFAS method that is compliant with Table B-15 of the DoD and Department of Energy consolidated Quality Systems Manual for Environmental Laboratories). States may also require that analytical laboratories are National Environmental Laboratory Accreditation Program accredited for their state and that PFAS analytical methods follow state guidelines.

2.1.3 Equipment Decontamination

Equipment should be decontaminated on site before work begins. Equipment decontamination should follow the steps outlined in Section 2.4.

2.2 Sampling

2.2.1 Pre-Sampling Activities

Prior to the sampling event, field staff can review information from previous groundwater monitoring events to inform their knowledge of well locations, field equipment, and field conditions. Field staff should also identify upgradient wells and downgradient wells relative to potential source area wells. Wells with the lowest anticipated PFAS concentrations should be sampled first.

At the beginning of each sampling day, field staff should prepare for sampling as follows:

1. Inspect field equipment to ensure that it is in good working order; and
2. Calibrate analytical field meter(s) according to the instrument manufacturers' specifications. Record calibration results on the appropriate form(s). Instruments that cannot be calibrated should not be used.

2.2.2 Sampling PPE

Gloves: Disposable powder-free nitrile gloves should be worn at all times during sample collection and handling of sampling equipment.

At a minimum, field personnel should put on a new pair of nitrile gloves after the following activities:

- Handling samples, including QA/QC samples and blanks; and
- Handling sampling equipment.

At a minimum, personnel should (1) thoroughly wash their hands with detergent (preferably Alconox®, Liquinox® or Luminox®) and PFAS-free water; (2) thoroughly dry their hands with paper towels; and (3) put on a new pair of nitrile gloves after the following activities:

- Contact with a material potentially containing PFAS;
- Change in sampling locations;
- Breaks in work;
- Washroom breaks; and
- Exit and entry into the project site exclusion zone.

2.2.3 Sampling Equipment

Sample Containers: HDPE containers with screw caps are commonly used for sample collection. Different laboratories may supply sample containers of varying sizes. Sample container caps are typically unlined.

Preservatives: Field personnel should communicate with the laboratory to determine what, if any, sample preservatives will be used..

Pumps: A variety of pumps, including submersible pumps, bladder pumps, peristaltic pumps, or inertia pumps, may be used for groundwater sampling. The choice of sampling device should be based on site-specific considerations, including well diameter, depth to groundwater, and purge rates. Regardless of the type of pump, the pump components, fittings, O-rings, sampling tubing, and other sampling equipment should not include Teflon™ or other PFAS-containing materials. Dedicated HDPE or silicon tubing is recommended for sampling each groundwater monitoring well.

Analytical Field Meter(s): Water quality parameters commonly evaluated during sampling of groundwater monitoring wells include temperature, pH, conductivity, ORP, DO, and turbidity. Salinity and total dissolved solids may also be measured and recorded. Analytical field meters to measure these parameters should be free of Teflon™ and other PFAS materials (e.g., tubing, O-rings).

Water Level Meter: A water level meter is typically used to monitor drawdown during groundwater purging prior to sampling. Water level meters should be decontaminated prior to and after each sampling location using PFAS-free water, as described in Section 2.4.

2.2.4 Sample Collection and Labeling

Container Rinsing: Sample containers should not to be rinsed prior to sampling.

Well Purging and Sample Collection: If known, wells with the lowest PFAS concentrations should be sampled first and wells with the highest PFAS concentrations sampled last. Well purging

and sample collection should be conducted in accordance with applicable state regulations and sampling requirements. The following sampling method should be used:

1. Measure and record the static groundwater level using a groundwater elevation probe;
2. Place the pump or bottom of the dedicated tubing into the well within the screened interval;
3. Secure the outlet of the tubing from the well to the influent of the analytical field meter;
4. Start the pump;
5. Adjust the purge rate to minimize and stabilize drawdown, as measured by the water level probe;
6. Once drawdown is stable, start recording water quality parameters;
7. Routinely measure and record water level, temperature, pH, conductivity, ORP, salinity, total dissolved solids, DO, and turbidity throughout well purging at approximately 2- to 3-minute intervals. Record the parameters on a Groundwater Sampling Form;
8. Continue to measure and record the groundwater parameters until the parameters stabilize in accordance with FDEP SOPs;
9. Disconnect the tubing from the analytical field meter;
10. Remove the cap from the sample container;
11. Place the sample container under the water stream. Fill the container to the level specified by the laboratory (samples do not need to be collected headspace free) and then turn off the pump;
12. Close the container by screwing on the cap; and
13. Using a paper towel, dry the outside of the sample container if necessary.
14. Decontaminate reusable equipment prior to proceeding to the next groundwater monitoring well location, as described in Section 2.4.

Labels: Some water-resistant inks may be potential sources of PFAS. PFAS-free container labels should be filled out using a ballpoint pen that does not have water-resistant ink, if possible. Field staff should try to avoid filling out container labels using felt pens and markers (e.g., certain Sharpie® products). Container labels should include the following information:

- A unique sample identifier;
- QA/QC sample type, if applicable;
- Sampling date and time (24-hour format);
- Sampler's name or initials; and
- Method of sample preservation.

Except for temperature blanks, all QC samples should be labeled and included on the CoC record. Duplicate samples should not be indicated as duplicates.

Wet Weather Considerations: Field sampling during wet weather (e.g., rainfall and snowfall) should be conducted wearing appropriate clothing that does not pose a risk for cross-contamination. Field personnel should try to avoid water-resistant clothing and boots. Rain gear made of polyurethane, PVC, vinyl, or rubber is an acceptable alternative. Samples and sample containers should not be opened prior to sample collection to avoid collecting precipitation. Should samples or sample containers become contaminated with precipitation, they should be discarded.

2.2.5 Sample Handling, Storage, and Shipment

Handling: Clean nitrile gloves should be worn when handling sample containers. Precautions should be taken to not drop or otherwise damage sample containers. Sample containers should **not** be placed in close proximity to a potential PFAS source.

Storage and Holding Times: Storage conditions and holding times should be determined by the laboratory. Measures should be taken to meet storage and holding time criteria (e.g., expedited shipping).

Shipment: Sample containers should be packed for shipment using the following steps:

15. Choose a cooler with structural integrity that will withstand shipment.
16. Secure and tape the drain plug with duct tape from the inside and outside.
17. Check that the caps on all sample containers are tight and will not leak.
18. Check that the sample labels are intact, filled out, legible, and that the sample identifier exactly matches the CoC record.
19. Seal each sample container in a sample bag to prevent melt water from getting into the sample or degrading the sample label.
20. Place sample containers into the cooler with their caps upright.
21. Fill any excess space within the cooler with bubble wrap (try to avoid using paper, cardboard, or polystyrene foam).
22. Fill remaining space from the top of the sample containers to the top of the cooler with wet ice that is double-bagged and sealed.
23. Seal the entire cooler with duct tape, particularly the lid, to prevent leaks.

Ship samples as non-hazardous material unless the samples meet the established Department of Transportation (DOT) criteria for a “hazardous material” or the International Air Transport Association (IATA)/International Civil Aviation Organization (ICAO) for air definition of “dangerous goods.” If the samples meet criteria for hazardous materials or dangerous goods, then DOT and IATA/ICAO regulations must be followed. Prior to shipping samples, field personnel

should complete the appropriate air waybill or manifest. A copy of the air waybill or manifest should be kept for recordkeeping.

2.3 Sampling QA/QC

2.3.1 Field Duplicates

Field duplicates are samples collected in the same manner and at the same time and location as a primary sample. They should be collected from locations of known or suspected contamination. Field duplicates are used to assess field and analytical precision and sample heterogeneity. Typically, at least one field duplicate is collected for every 10 primary samples. Field duplicates should be labeled with a unique sample identifier and not be indicated as a duplicate (i.e., submitted as "blind").

2.3.2 Matrix Spike and Matrix Spike Duplicate Samples

Matrix spike and matrix spike duplicate (MS/MSD) samples are aliquots of environmental samples that are spiked with a known concentration of PFAS by the laboratory. MS/MSD samples are used to assess interferences caused by the sample matrix. MS/MSD samples are not needed if the analytical laboratory is using an isotopic dilution method but are technically required to meet Department of Defense (DoD) accreditation requirements. If necessary, MS/MSD samples are to be collected in the same manner and at the same time and location as a primary sample (i.e., additional sample volume). It is preferred that this location have little to no PFAS contamination. Samples should have the same matrix to ensure a valid result; if the samples do not appear visually similar (e.g., discoloration, suspended solids), choose another location for collection of MS/MSD samples. The number of required MS/MSD samples should be determined based on discussions with the laboratory. Typically, at least one MS/MSD sample is collected for every 20 primary samples. MS/MSD samples should be labeled with the same sample name and time as the primary sample and denoted as MS/MSD samples on the CoC and sample label.

2.3.3 Blanks

Blanks should be shipped and handled in the same manner as environmental samples. Field blanks should be labeled as such on sample bottles and on the CoC. The number and type of blanks should be determined by discussions with the laboratory.

Equipment Blanks: Equipment blanks are used to assess sources of field and laboratory contamination. Equipment blanks are prepared by pouring PFAS-free water over or through decontaminated reusable field sampling equipment and collecting the rinsate in a sample container. Typically, at least one equipment blank is collected for every 10 primary samples.

Field Blanks: Field blanks are used to assess ambient contamination within the field and laboratory. Field blanks should be prepared by filling a sample container with PFAS-free water in the field in the same manner as environmental samples. Field blanks are an effective way of

assessing potential cross-contamination as a result of sample handling. Typically, one field blank is collected for each shipping container.

Temperature Blanks: Temperature blanks are used to assess the temperature of samples during shipping. Temperature blanks should be provided by the laboratory and prepared by filling a sample container with PFAS-free water prior to shipment of the sample containers. The blank should be kept in the cooler during sampling and shipment to the laboratory. Once the cooler returns to the laboratory, the temperature of the blank should be measured to ensure that recommended sample storage criteria are met (typically less than 6 degrees Celsius).

2.4 Decontamination

Decontamination should occur prior to leaving the sampling area or at a central decontamination location and at the end of each work day. Additionally, sampling equipment exposed to PFAS-contaminated water should be decontaminated between sample locations.

Alconox®, Liquinox® and Luminox ® detergents are acceptable for decontamination purposes. Use of Decon 90 should be avoided. Decontamination wastes must be properly contained and disposed of in accordance with applicable local, state and federal regulations.

2.4.1 Field Equipment Decontamination

All non-disposable sampling equipment that is in contact with groundwater (e.g., field probes, pumps) must be cleaned prior to and between uses at each groundwater sampling location according to the following procedures:

24. Remove any gross (e.g., soil) contamination from sampling equipment.
25. If heavy petroleum residuals are encountered during sampling, use methanol or another appropriate solvent to remove any residues from sampling equipment.
26. Wash water-resistant equipment thoroughly and vigorously with potable water containing detergent (Alconox®, Liquinox® or Luminox®) using a bristle brush or similar utensil to remove any remaining residual contamination.
27. Rinse equipment thoroughly with potable water (1st rinse).
28. Rinse equipment thoroughly with PFAS-free water (2nd rinse).
29. For field instruments, rinse again with PFAS-free water (3rd rinse).
30. Dry the wet equipment with a paper towel or leave the equipment to air dry in a location away from dust or fugitive contaminants. All equipment should be dry before reuse.

Cleaning and decontamination of the equipment should be accomplished in stages and in such a way that the contamination does not discharge into the environment. Dedicated or disposable sampling equipment should be considered to minimize the need for decontamination.

2.4.2 Personnel and PPE Decontamination

A decontamination area for personnel and portable equipment may be specified in the health and safety plan. The area may include basins or tubs to capture decontamination wastes, which can be transferred to larger containers as necessary. Decontamination following groundwater monitoring well sampling should follow these steps:

31. Gross (e.g., soil) contamination should be scraped and wiped from boots, safety glasses, hardhats, reflective vests, and other reusable PPE. Once gross contamination has been removed, gloves should be removed by rolling off the hands in such a way to avoid exposing skin to PFAS-contaminated materials;
32. A new pair of gloves should be put on and reusable PPE should be decontaminated using PFAS-free water mixed with detergent (preferably Alconox®, Liquinox® or Luminox®) and brushes, or similar means. After debris is removed, reusable PPE should be rinsed with PFAS-free water; and
33. Hands and any exposed body parts should be washed thoroughly using detergent (preferably Alconox®, Liquinox® or Luminox®) and PFAS-free water. Hands should be dried with paper towels.

2.5 Food and Drink

Food and drink should not be brought within the exclusion zone. Food that is kept in the staging area should preferably be contained in HDPE or stainless-steel containers.

3. LABORATORY PROCEDURES

3.1 Accreditations

Laboratories conducting PFAS analysis for DoD facilities should be accredited by the United States Department of Defense Environmental Laboratory Accreditation Program, that is, use a PFAS method that is compliant with Table B-15 of the DoD and DOE consolidated QSM 5.2 for Environmental Laboratories. States may also require that analytical laboratories are National Environmental Laboratory Accreditation Program accredited for their state and that PFAS analytical methods follow state guidelines.

4. DOCUMENTATION

4.1 Chain of Custody

4.1.1 Field Custody Procedures

A sample is considered to be in custody if the following conditions have been observed:

- It is in possession or view of the person in custody;

- It is locked in a secure area;
- It is placed in an area restricted to authorized personnel; or
- It is placed in a container and secured with an official seal, so that the sample cannot be reached without breaking the seal.

The following practices should be observed by field personnel to ensure sample custody:

- As few persons as possible will handle samples;
- The sample collector is personally responsible for the care and custody of samples collected until they are transferred to the laboratory;
- The sample collector will record sample data in the field notebook; and
- Sample labels will be completed for each sample.

4.1.2 Chain of Custody Record

All samples should be accompanied by a CoC record. The CoC record is typically provided by the laboratory. The CoC record should be fully completed in duplicate (e.g., a carbon copy). At the minimum, the following information should be included on a CoC record:

- Project name and number;
- Laboratory name and address;
- Name of person that collected the samples;
- Sample identifier;
- Sample date and time (time in 24-hour format);
- Laboratory analysis requested;
- Preservatives added to each sample;
- Sample matrix (e.g., soil, water);
- Number of containers per sample; and
- Airway bill tracking number.

As applicable, the following remarks should be added to the CoC record:

- Contractor name and address;
- MS/MSD sample volume (if necessary);
- A request for rapid turnaround time; and
- A note regarding the potential concentrations in a highly-contaminated sample.

Indication of a duplicate sample should **not** be included on a CoC record.

4.1.3 Sample Packaging

The CoC record should accompany all sample shipments. One CoC record should be prepared for each cooler and the cooler number recorded on the CoC. The samples in the cooler should be listed on the CoC record. The CoC record should be placed in a sealed plastic bag (e.g., Ziploc®) and taped to the inside lid of the cooler. If one sample is contained in two coolers (i.e., one sample has too many containers to fit in one cooler), then the original CoC should be placed in the first cooler and a copy of the CoC record should be placed in the second cooler. The duplicate copy of the CoC record should be retained by the sampler.

Custody seals should be signed and dated at the time of use. Sample shipping containers should be sealed in as many places as necessary to ensure that the container cannot be opened without breaking a custody seal. Tape should be placed over the seals to ensure that seals are not accidentally broken during shipment. If the sampler transports the samples to the laboratory without sample shipment, custody seals are not required.

4.1.4 Transfer of Custody

When transferring the possession of samples from the field sampler to a transporter or to the laboratory, the sampler should sign, date, and note the time as “relinquished by” on the CoC record. The receiver should also sign, date, and note the time as “received by” on the CoC record. The date and time of the receiver and relinquisher should be the same.

When samples are transported by a commercial carrier, the carrier will not sign the CoC record. However, the airway bill tracking number should be recorded on the CoC record. Airway bills should also be retained with the CoC record as documentation of transport. For this reason, the date and time of the receiver and relinquisher will not match when shipping with a commercial carrier.

4.1.5 Laboratory Custody Procedures

A designated sample custodian should accept custody of the shipped samples and verify that the sample identification number matches the CoC record. Pertinent information about shipment, pickup, and courier should be entered in the “Remarks” section. The temperature of the temperature blanks at the time of receiving should be noted on the CoC record.

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Geosyntec consultants

Attachment A. Daily PFAS Sampling Checklist

Date: _____

Site Name: _____

Weather (*temperature/precipitation*): _____

Please check all boxes that apply and describe any exceptions in the notes section below along with QA/QC methods used to assess potential sample cross-contamination as a result.

Field Clothing and PPE:

- ☐ No water- or stain-resistant clothing (e.g., GORE-TEX®)
- ☐ During collection of water and sediment samples, no water- or stain-resistant boots OR water- or stain-resistant boots covered by PFAS-free over-boots
- ☐ Field boots (or over-boots) are made of polyurethane, PVC, rubber, or untreated leather
- ☐ Waders or rain gear are made of polyurethane, PVC, vinyl, wax-coated or rubber
- ☐ Clothing has not been recently laundered with a fabric softener
- ☐ No coated HDPE suits (e.g., coated Tyvek® suits)
- ☐ Field crew has not used cosmetics, moisturizers, or other related products today
- ☐ Field crew has not used sunscreen or insect repellants today, other than products approved as PFAS-free

Field Equipment:

- ☐ Sample containers and equipment in direct contact with the sample are made of HDPE, polypropylene, silicone, acetate or stainless steel, not LDPE or glass
- ☐ Sample caps are made of HDPE or polypropylene and are not lined with Teflon™
- ☐ No materials containing Teflon™, Viton™, or fluoropolymers
- ☐ No materials containing LDPE in direct contact with the sample (e.g., LDPE tubing, Ziploc® bags)
- ☐ No plastic clipboards, binders, or spiral hard cover notebooks
- ☐ No waterproof field books
- ☐ No waterproof or felt pens or markers (e.g., certain Sharpie® products)
- ☐ No chemical (blue) ice, unless it is contained in a sealed bag
- ☐ No aluminum foil
- ☐ No sticky notes (e.g., certain Post-It® products)

Decontamination:

- ☐ Reusable field equipment decontaminated prior to reuse
- ☐ “PFAS-free” water is on-site for decontamination of field equipment
- ☐ Alconox®, Liquinox® or Luminox® used as decontamination detergent

Food and Drink:

- No food or drink on-site, except within staging area
- Food in staging area is contained in HDPE or stainless steel container

Notes:

_____

_____

_____

_____

_____

Field Team Leader Name (Print): _____

Field Team Leader Signature: _____

Date/Time: _____