Site Investigation Work Plan for Per- and Polyfluoroalkyl Substances, General Mitchell International Airport, Milwaukee County, Wisconsin

County Project reference: 5055-19808
AECOM Project number: 60620401

March 30, 2020

Quality information

Prepared by	Checked by	Verified by	Approved by
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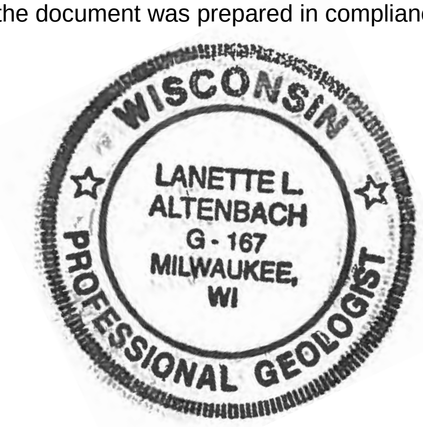
NR712 Certification

This Site Investigation Work Plan was conducted by personnel with the appropriate qualifications required by NR 712.02 (1), NR 712.05 and NR 712.07. AECOM provides the following certification as required by NR712.09:

I, Lanette Altenbach, 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, 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.



3-30-2020

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Table of Contents

Tables

Figures

Appendices

1. Site Information

[NR 716.09(2)(A)(B) AND (C)]

Project Title: MKE PFAS Investigation
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Milwaukee, Wisconsin 53207

Responsible Party (RP): Milwaukee County
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Milwaukee, Wisconsin 53207

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Site Name: GENERAL MITCHELL INTERNATIONAL AIRPORT PFAS
BRRTS#: 02-41-584547
WDNR FID: 241280270
SIC Code: 4581
NAICS Code: 488119

Location: Parts of Sections 27, 28, 29, 32, 33, and 34, T06N, R22E
5300 South Howell Avenue
City of Milwaukee
Milwaukee County, Wisconsin

2. Scoping Information

[NR 716.09(2)(d)] and [NR 716.07]

2.1 Background Information

2.1.1 Site Description

General Mitchell International Airport (GMIA) is approximately 2200 acres located in the southeastern portion of Milwaukee County. The site is listed on the Wisconsin Department of Natural Resources (WDNR) sites database under BRRTS # 02-41-584547 and mapped on the RR Sites map with WTM91 coordinates 277973 North and 691325 East (SW 1/4 of the NE 1/4 of Sec 28, T06N, R22E). GMIA has five runways (01L/19R, 01R/19L, 07L/25R, 07R/25L, and 13/31) and numerous buildings/structures across the property. Primary areas where buildings are located include the main passenger terminal, West Ramp, North Ramp, private hangers in the northeast (near burn pit area), Cargo Ramp, Maintenance/ Fire Department area and South Ramp. The site location map is shown on Figure 1 and the site layout map is shown on Figure 2.

2.1.2 Site History

GMIA is an active international airport with millions of passengers passing through annually. The Milwaukee County Board initially purchased the current airport land in October 1926. In 1941, the name of the Milwaukee County Airport was changed to General Mitchell Field. Finally, in 1986 the airport was renamed to General Mitchell International Airport as it is called today. The airport has completed many expansions and renovations since its beginning.

GMIA has a shared history with military aviation. The 128th Air Refueling Wing of the Wisconsin Air National Guard (128th) has been operating since 1947 and is located on the East Ramp of Milwaukee Mitchell International Airport. Additionally, the 440th Airlift Wing of the Air Force Reserve (440th) operated from the 1950s until 2008 at the South Ramp of GMIA. The 440th was closed as part of the federal Base Realignment and Closure Act and the South Ramp area is now the location of a business park.

According the United States Environmental Protection Agency, per- and polyfluoroalkyl substances (PFAS) are a group of man-made chemicals that includes PFOA, PFOS, GenX, and many other chemicals. PFOA and PFOS are persistent in the environment and in the human body. There is evidence that exposure to PFAS can lead to adverse health outcomes in humans.

Since around 1970, firefighting foams have been commonly employed by military and municipal fire departments for firefighting. A significant potential source of PFAS at the airport is associated with the historic use and storage of aqueous film forming foam (AFFF); used for emergency response and fire suppression. No other significant sources are anticipated from GMIA. Locations of foam storage and use are spread across GMIA and include AFFF suppression systems in select hangars and AFFF stored at the Fire Department. Examples of potential releases to the environment may include:

- testing of AFFF suppression system in airplane hangars,
- accidental or purposeful release of AFFF from hangars,
- fire training (including initiating and suppressing fires),
- annual testing of fire department equipment,
- fire suppression from aircraft accidents/incidents,
- and disposal of AFFF.

Potential off-site sources of PFAS may derive from industrial activities at immediately adjacent parcels such as manufacturing of stain protection products, non-stick products (e.g., Teflon®), painting and coating manufacturing, chrome plating fume suppression, landfills or wastewater processes and its subsequent transport to the airports via groundwater flow or air deposition.

Class B fluorine-containing firefighting foam use has been documented at GMIA and has been used by the 128th, 440th, and the County Fire Department. PFAS investigations for the 128th and 440th are separate from this investigation. More information is provided on these sites as listed in Section 2.1.3.

2.1.3 Previous Investigations

Nearly 100 tracking numbers have been assigned to GMIA relating to various incidents including spills and storage tanks as reported on the Wisconsin Bureau for Remediation and Redevelopment Tracking System (BRRTS) on the Web. There are currently three open cases including Hertz Rent-A-Car (03-41-259163), GMIA Fuel Facility (03-41-261592), and General Mitchell International Airport PFAS (02-41-584547). The following discussion focuses on previous investigations relating to the investigation of PFAS that have been completed at or adjacent to GMIA.

Select reports and brief summaries are as follows:

- *Final Report FY16 Phase I Regional Site Inspections for Perfluorinated Compounds Volume I of VII*, General Mitchell Air National Guard Base, Milwaukee, Wisconsin, conducted by Amec Foster Wheeler, dated February 2019.

  In November 2017, Amec Foster Wheeler collected soil, groundwater, surface water and sediment samples at the 128th ANG for analysis of PFAS. Eleven of the 13 potential release locations had screening criteria exceedances warranting further investigation. Elevated PFAS concentrations were especially observed around select hangars and at the north end of the base adjacent to Bailey's Pond.

- *Final Perfluorooctane Sulfonic Acid and Perfluorooctanoic Acid (PFOS and PFOA) Site Inspections at Multiple United States Air Forces (USAF) Base Realignment and Closure (BRAC) Installations*, Former General Mitchell Air Reserve Station, Wisconsin, conducted by Amec Foster Wheeler, dated August 2019.

  Amec Foster Wheeler collected soil, groundwater, surface water and sediment samples at the former 440th General Mitchell Air Reserve Station in July 2015 and September 2017 for analysis of PFAS. Screening levels for PFAS were generally not exceeded across the former station. PFAS was detected in many surface soil and water samples. Highest PFAS concentrations were identified around the fire training area at the north end of the site and in surface water drainage ditches.

- *USGS Surface Water Analytical Report October 2019* (Attachment 3 of Request for Proposal for MKE PFAS Investigation, Project No. 5055-19809, dated November 2019), conducted by the United States Geological Society, dated October 2019.

  Between April and June 2019, the United States Geological Survey collected surface water samples across GMIA and analyzed them for PFAS. Surface water samples were collected from major surface water drainage inlets and outlets for GMIA. PFAS were detected in all samples with the greatest concentrations at the outflow samples to the Oak Creek in the southeast and the Bailey's Pond area.

Two other potential off-site sources include inactive landfills that lie adjacent to the GMIA property boundary to the northeast and southeast as shown on Figure 2. To the southeast is the North College Avenue Landfill #428 (BRRTS# 02-41-000873) which is owned by the City of Milwaukee. To the northeast is the WI DOT Lake Arterial Municipal Landfill (BRRTS# 02-41-000614) which is owned by the City of Cudahy.

2.1.4 Potential Migration Pathways and Potential Receptors

Exposures to receptors from potential contamination include:

- direct contact with soil;
- soil impacts extending to and migrating within the groundwater system;
- groundwater migration to drinking water wells;
- migration to surface water.

Other potential receptors include surface water and streams that lead to Lake Michigan which is located approximately 2.5 miles east. The City of Milwaukee supplies drinking water to the area, obtained from Lake Michigan.

According to the U.S. Fish and Wildlife Service, the following animals are listed as endangered or threatened species in Milwaukee County (fws.org, Jan 2018):

- Birds: Red knot (*Calidris canutus rufa*) – Threatened
- Insects: Rusty patched bumble bee (*Bombus affinis*) – Endangered
- Mammals: Northern Long-Eared Bat (*Myotis septentrionalis*) – Threatened

These species are not known to be present at GMIA. During a site visit on February 7, 2020, GMIA staff indicated that wildlife within the airport property is closely monitored and engineering controls are enforced to prevent and reduce wildlife presence onsite. The Federal Aviation Administration maintains a comprehensive program to address wildlife hazards. GMIA property is generally composed of paved surface, mowed grassy surfaces and buildings. A wooded area (approximately five acres) is located at the southeast corner of the site.

3. Site Description

[NR 716.09(2)(e)]

The following sections provide information on the environmental setting at GMIA.

3.1 Topography

The USGS 7.5-minute topographic map of the Greendale, Wisconsin quadrangle (dated 2018) shows the area topography and surface water features in and around the subject property (Figure 1). The topographic map shows the subject property as generally flat. The elevations of proposed sample locations range from approximately 654 to 726 feet above mean sea level (AMSL). GMIA is approximately two and a half miles west of Lake Michigan and six miles south of downtown Milwaukee.

3.2 Site Drainage

Drainage at GMIA is regulated closely to keep runways and taxiways clear of standing water. The property has mixture of paved and grassy areas. Surface water comes onto the property from the east and west, primarily at Bailey's Pond (near E Grange Ave) and near the intersection of S Pennsylvania Ave and E Edgerton Ave and from near the 6th Street Airport Observation Area. Surface drainage is generally out to the northwest (to Kinnickinnic River Watershed) and the southeast (to Oak Creek Watershed).

3.3 Surficial Soils

Soils at General Mitchell and adjacent areas are mapped as clayey land, which is a term used to describe areas where severe cutting and filling have occurred in populated areas (highly disturbed and industrialized), such as the area surrounding the airport. Soils adjacent to the site are mapped as Morley silt loam with two percent to six percent slopes. The Morley series consists of well drained and moderately well-drained silty soils over calcareous silty clay loam glacial till. Morley soils have a moderately slow permeability and high available water capacity.

According to a soil Map by the Wisconsin Geological and Natural History Survey (W.J. Geib and T.J. Dunnewald), the GMIA property was constructed over a natural swamp. The original soils prior to airport construction were documented as Clyde clay loam with smaller portions of peat, Miami silty clay loam and Fox silt loam.

Based on recent subsurface investigations at and around the site, the surficial fill soil is mainly brown to black clay with trace amounts of sand and gravel and lenses of silt.

3.4 Regional Geology

The regional geology consists of glacial unconsolidated deposits that overlay dolomite bedrock. Depths to bedrock range from approximately 50 to 100 feet. The Niagara Dolomite (Silurian) is underlain by the Maquoketa Shale and a series of Ordovician and Cambrian sandstone units (SWRPC, 2002).

3.5 Site Hydrogeology

Groundwater beneath General Mitchell occurs within the unconsolidated glacial deposits and the underlying bedrock. Regional shallow groundwater within the glacial tills exists under artesian and semi-confined conditions and flows to the southeast across the station. This shallow aquifer is not used as a source of drinking water. Based on review of previous reports from the 128th, former 440th, and site investigations, the water table across the site ranges from approximately four to 15 feet below the ground surface.

4. Sampling Plan

[NR 716.09(2)(f)]

4.1 Pre-Investigation Tasks

AECOM will contact Digger's Hotline for the location of public utilities in the area of the investigation prior to commencing work. AECOM will confirm the status of the utilities with airport facility personnel prior to conducting subsurface investigation. AECOM cannot be held responsible for damage to subsurface features not identified by the property owner or by the precautionary measures proposed to identify such features, including utilities, pipes or tanks.

A site-specific Health and Safety Plan will be prepared for this assessment. The Health and Safety Plan contains a summary of known site contaminants and other site hazards, emergency resources available, personnel protection, decontamination procedures and emergency procedures recommended for this project. Project field personnel will read and be familiar with the plan prior to beginning the fieldwork.

4.2 Site Investigation

GMIA is planning to complete investigative activities to test specific media for the presence of PFAS. The field investigation will utilize soil, groundwater and surface water sampling to evaluate the nature, degree and extent of PFAS contamination. A phased approach has been proposed whereas the initial phase will cover a broad range of potential sources and the second phase, if necessary, will further investigate areas with detected PFAS in the initial phase. The planned investigation area will be limited to the main airport operational area and facilities (approximately 1500 of the 2200 total acres), corresponding to the area between Layton Avenue to the north, College Avenue to the south, Howell Avenue/S 6th St to the west, and the airport boundary to the east. Investigation activities will occur where PFAS-containing products (e.g. AFFF) were released to the ground surface during fire-fighting or equipment calibration activities because PFAS compounds are generally found in shallow soils where those activities occurred. Surface water and groundwater will also be tested because of interactions of soil to surface water, soil to groundwater, and surface water to groundwater back to groundwater, to soil, or surface water.

Based on information reviewed, discussion during the initial kickoff meeting on January 29th, 2020, and fire department interviews on February 7th, 2020, AECOM has identified several areas at GMIA that will be included in the investigation as potential PFAS sources. These are as follows:

1. Cargo Ramp area including the 2007 Air Freight collision site (Figure 3)
2. Far West - Potential off-site sources (Figure 4)
3. West Pad / West Ramp area (Figure 5)
4. the Southeast area of GMIA (Figure 6)
5. Bailey's Pond (Figure 7)
6. Burn pit and former fire training areas (Figure 8)
7. GMIA Fire Department and maintenance area (Figure 9)

The site investigation will be composed of three tasks to collect necessary soil, surface water, and groundwater samples. Proposed samples are depicted on Figures 3 through 9 as indicated above. The following types of samples will be collected at the facility:

- **Surface water:** Water samples will be collected from some of the same locations as the USGS report (Oct 2019), with additional samples for further source delineation. Table 1 indicates the AECOM surface water sample IDs and corresponding USGS sample IDs, where applicable. Surface water samples will be analyzed for PFAS to provide trend data on residual concentrations of target PFAS compounds associated with releases.

- **Soil:** Soil borings are proposed in some of the identified areas; specifically, the Burn Pit, Fire Department, West Pad, and Cargo Ramp areas. Up to two soil samples will be collected from each boring as described below.
- **Groundwater:** Groundwater samples will be collected from three existing groundwater monitoring wells at the burn pit and two rounds of groundwater samples from the proposed monitoring wells to determine concentrations and monitor trends. Additional groundwater samples may be collected if necessary.

The rationale for the sample location and the planned number of samples are included in Table 1.

4.2.1 Sample Locations and Rationale

Samples will be collected from various locations at GMIA based on past use, storage, or releases of AFFF. The seven areas where AFFF is known or suspected of being used or released are listed in Section 4.2. Figure 2 depicts the site investigation focus areas at GMIA. Table 1 provides additional details of the number of samples and rationale.

The number and type of samples to be collected are summarized below.

1. Cargo Ramp area including the 2007 Air Freight collision site (Figure 3), to evaluate possible releases from hangar fire suppression systems and a former cargo plane crash where foam was deployed.
   - Four soil borings, two samples per boring for a total of eight samples (CR-SB-1, CR-SB-2, CR-SB-3 and CR-MW-4)
   - Two groundwater samples from the boring completed as a temporary monitoring well (CR-MW-4)
   - Two surface water samples from one location (SW-1)

2. Far West - Potential off-site sources (Figure 4), to confirm former USGS sample results and evaluate whether PFAS are migrating onto the airport from upstream sources.
   - Four surface water samples, two from each location (SW-4 and SW-5)

3. West Pad (West Ramp) area (Figure 5), to evaluate suspected releases from hangar fire suppression systems and to confirm USGS results from surface water exiting GMIA.
   - Four soil borings, two samples per boring for a total of eight samples (WP-MW-17, WP-MW-18, WP-MW-19, and WP-MW-20)
   - Eight groundwater samples, two from each boring completed as a temporary monitoring well (WP-MW-17, WP-MW-18, WP-MW-19, and WP-MW-20)
   - Four surface water samples, two from each location (SW-15 and SW-16)

4. The Southeast area of GMIA (Figure 6), to confirm USGS surface water sample results and evaluate other potential sources.
   - Eight surface water samples, two from each location (SW-9, SW-10, SW-11, SW-12)

5. Bailey's Pond (Figure 7), to confirm USGS surface water sample results and evaluate surface water entering GMIA.
   - Four surface water samples, two from each location (SW-13, SW-14)

6. Burn pits and former fire training areas (Figure 8), to evaluate impacts to soil and groundwater from fire training activities at the Burn Pits, and to evaluate surface water conditions entering GMIA.
   - Eight soil borings, two samples per boring for a total of 16 samples (BP-MW-5, BP-MW-6, BP-MW-7, BP-MW-8, BP-MW-9, BP-MW-10, BP-MW-11, and BP-MW-12)
   - 19 groundwater samples, two from each boring completed as a monitoring well (BP-MW-5, BP-MW-6, BP-MW-7, BP-MW-8, BP-MW-9, BP-MW-10, BP-MW-11, and BP-MW-12) and one from each existing monitoring well (LFG MW1, LFG MW2, and LFG MW3)
   - Four surface water samples, two from each location (SW-2 and SW-3)

7. GMIA Fire Department and maintenance area (Figure 9), to evaluate impacts to soil and groundwater from testing fire-fighting equipment near the Fire Department buildings and evaluate migration of PFAS from Fire Department and Maintenance areas.
   - Four soil borings, two samples per boring for a total of eight samples (FD-MW-13, FD-MW-14, FD-MW-15 and FD-MW-16)
   - Eight groundwater samples, two from each boring completed as a monitoring well (FD-MW-13, FD-MW-14, FD-MW-15 and FD-MW-16)
   - Six surface water samples, two from each location (SW-6, SW-7 and SW-8)

4.2.2 Soil Sample Collection

Soil probe borings will be advanced using PFAS-free protocols by a hydraulic push soil probe (e.g. GeoProbe®). The proposed push probes have an overhead clearance of approximately 14 feet. The hydraulic push-probe will utilize a two-inch diameter drive rod to collect continuous soil samples to the desired completion depth. Where monitoring wells are to be installed, the soil probe will be advanced to a depth of approximately 15 feet below ground surface (bgs). At soil probe locations where monitoring wells will not be installed, borings will be advanced to the perched groundwater table, anticipated to be between five and ten ft bgs. Depending on the depth to the perched groundwater table, up to two soil samples will be collected for laboratory analysis from each of the soil borings. If the perched water table is less than five ft bgs only one sample will be collected. If the perched water table is greater than five ft bgs two soil samples per boring will be collected.

One soil sample will be a shallow sample collected approximately from the one to two ft bgs interval. If the perched groundwater surface is found at a depth greater than five ft bgs, a second sample is proposed to be collected from the immediately above the perched groundwater surface.

Soil samples will be collected inside of a polyethylene sheath inserted into the end of the drive rod. The soil samples will be subdivided by depth and described in the field with respect to the soil type, grain size distribution, and color (or discoloration), odor, and moisture content. Visual observations of the recovered material will also be documented in accordance with ASTM Method D-2488-93. Field observations from the borings will be recorded on the soil boring log. Samples for laboratory analysis will be transferred to laboratory-provided containers. Duplicate samples and equipment blanks will be collected as specified in the Quality Assurance section below.

If additional borings are necessary, another mobilization will occur later in 2020. Deeper soil borings may also be proposed for a later phase to further refine the site conceptual model.

4.2.3 Monitoring Well Installation and Development

During the initial phase, approximately 17 temporary and NR-141 compliant monitoring wells will be constructed. In the Cargo Ramp and West Pad areas, temporary monitoring wells will be constructed in the soil probe boring using one-inch diameter PVC well screen and riser. In the Burn Pit and Fire Department areas, NR-141 compliant two-inch diameter monitoring wells will be constructed in each soil boring using PVC well screen and riser. For both temporary and NR 141 compliant wells, a ten-foot long slotted section and a solid riser will be placed so the screened interval begins two or three feet above the observed saturated zone. If the water table is less than five feet bgs, the top of the screen will be placed level with the observed water level to permit a minimum of a two-foot bentonite seal. Filter pack sand will be placed around the screen to a depth of approximately two feet above the top of the well screen, and the remaining annular space will be filled with bentonite to the ground surface. If the water table is encountered at depths less than seven feet bgs, the filter pack height above the well screen will be reduced to six inches to allow for annular space sealant. Wells will be completed flush with the ground surface and a one-foot square concrete pad will be created around the two-inch wells. Flush mount wells are proposed due to airport restrictions and the need for regular field mowing. Each well will be surveyed to establish the well location, elevation of ground surface and elevation of the top of the PVC casing (depth to groundwater reference point).

Additional monitoring wells may also be installed as part of a second mobilization to delineate PFAS extent and evaluate deeper groundwater quality, if necessary.

Samples will be collected following development of the monitoring wells. Based on AECOM's experience at GMIA, silty sand and fine sandy soils are generally found in the areas near the surface water conveyances, allowing more efficient extraction of perched groundwater from wells. Monitoring wells in these areas will be developed for a minimum of 30 minutes, removing approximately ten well volumes with occasional surging. Monitoring wells located in other areas where fine-grained, lower permeability soils are encountered will likely be able to be purged dry. Monitoring wells in these areas will be considered developed after slowly purging the well dry two times and limiting agitation.

4.2.4 Surface Water Sampling

In order to fully evaluate the nature and extent of PFAS impacts, the groundwater-surface water dynamic must be understood. At GMIA, perched groundwater and surface water in ditches and marshy areas (i.e. around Bailey's Pond) are interconnected allowing the movement of contaminants between the two media. Surface water samples will be collected directly into laboratory-supplied HDPE bottles from zero to two inches below the water surface. Samples will be collected from 16 locations.

4.2.5 Groundwater Sampling

Monitoring wells will be sampled using PFAS-free protocols with a peristaltic pump and tubing using low-flow sample techniques. The groundwater samples will be placed directly into laboratory-supplied HDPE bottles. Duplicate samples, and equipment and field blanks will be collected as specified in the Quality Assurance section below. The filled sample bottles will be labeled, logged on the chain-of-custody, stored on ice in insulated coolers, and then shipped by common carrier to the laboratory using chain-of-custody protocols.

A second groundwater sampling event of the 17 temporary and NR-141 compliant monitoring wells will be conducted approximately three months after the initial sampling event is conducted. The purpose of the second sampling event is to confirm the results of the first event as well as address seasonal variation. Temporary one-inch wells will be abandoned after the second groundwater sampling event.

It should be noted that WDNR typically requires at least four quarterly groundwater sampling events during WAC NR716 site investigations and can require up to eight quarterly groundwater sampling events before a site can be considered for case closure. We recommend that a discussion with the WDNR be held following the review of analytical data from the proposed two sampling events to determine what additional groundwater sampling is appropriate.

4.3 Screening Levels

For the purposes of this investigation, soil and groundwater results will be compared to screening values as shown on Table 2. Values have only been established for three of the analytes on the Wisconsin PFAS list of 36 compounds. The soil residual contaminant levels (RCL) are from the WDNR Remediation and Redevelopment program spreadsheet (updated December 2018). In December 2019, the United States EPA issued interim recommendations of using a screening level of 40 parts per trillion (ppt) to determine if PFOA and/or PFOS is present at a site. Currently, there are no established surface water guidelines for PFAS in the state of Wisconsin. Surface water samples will be evaluated for the presence of PFAS.

Table 2. Health-based Project Screening Values

Analyte	Abbreviation	CAS#	Soil Direct Contact RCL Non-industrial (ug/Kg)	Soil Direct Contact RCL industrial (ug/Kg)	EPA interim groundwater screening level (ng/L) Dec 2019
Perfluorobutanesulfonic acid	PFBS	375-73-5	1,260,000	16,400,000	NA
Perfluorooctanoic acid	PFOA	335-67-1	1,260	16,400	40
Perfluorooctanesulfonic acid	PFOS	1763-23-1	1,260	16,400	40

NA = not applicable
CAS# = Chemical Abstract Service number

4.4 Quality Control

4.4.1 Soil and Water Samples

Samples submitted for analysis will be immediately placed in appropriate laboratory-supplied containers, labeled, and maintained in coolers at four degrees Celsius. A State of Wisconsin certified laboratory will perform laboratory analyses.

Completed chain-of-custody forms will be required for all samples to be analyzed. Chain-of-custody forms will be prepared by the field sampling crew during the daily sample collection events. The chain-of-custody form will contain the following information:

- Unique sample identification number
- Sample location
- Sample date and time
- Sample description
- Sample type
- Sample preservation
- Analyses required
- Sampling staff

The original chain-of-custody form will accompany the samples to the laboratory. The chain-of-custody forms will remain with the samples at all times and will be signed by a representative of the laboratory upon receipt of the samples.

Soil, groundwater and surface water samples will be analyzed by VISTA Analytical Laboratory, a woman-owned business from El Dorado Hills, California. Samples will be analyzed using EPA Method 537-Modified, Isotope Dilution for the State of Wisconsin 36-compound list. Level II quality control reporting will be provided by the lab. At least one level IV quality report may be requested from the laboratory to assess quality control of the laboratory.

4.4.2 Quality Assurance/Quality Control

Sampling and analytical testing will be conducted in accordance with the Work Plan. Duplicate groundwater and surface water samples will be collected for quality control purposes at a frequency of one per ten field samples in accordance with WAC NR140 requirements. Matrix spike/matrix spike duplicate sample collection is not required due to the isotope method used for determining PFAS concentrations.

Sampling protocols for PFAS compounds include the use of field and equipment blanks due to the possible presence of these compounds in sampling equipment and supplies, and to assess the possibility of cross-contamination during sampling, transport and storage of samples. To evaluate the sampling technique, a field blank sample will be prepared by pouring laboratory-certified PFAS-free water into a laboratory-provided sampling container in the field and shipping the sample to the laboratory with the field samples. One field blank will be collected per sampling event.

Equipment blanks will also be collected to evaluate the sampling equipment by using laboratory-certified PFAS-free water, or process water, and passing the water over and through disposable or decontaminated field sampling equipment to assess the adequacy of the decontamination process and/or to evaluate potential contamination from the equipment used during sampling. The equipment blanks will be shipped to the laboratory with the field samples. At least three equipment blanks will be collected from the following equipment: the hydraulic push probe, PVC well materials, and sampling equipment (peristaltic pump tubing).

4.4.3 Other PFAS Sampling Considerations

Sampling will be conducted by AECOM-certified PFAS sampling teams. AECOM certification requires attending an AECOM internal PFAS sampling training course and reviewing the PFAS Sampling Guidance document designed to make AECOM samplers aware of the products that are known to have tested positive for PFAS compounds, as well as identifying products that are appropriate to use in the sampling environment. Care will be taken by the AECOM sample teams to use PFAS-free sampling protocols. A PFAS sampling checklist (Appendix A) will be completed during each morning safety tailgate meeting.

PFASs are present in hundreds of commercial items (e.g. waterproof clothing, cookware, dental products). With analytical reporting limits for PFAS compounds being in the parts per trillion range, care must be taken to assure non-site-related PFAS compounds are not introduced into the samples.

Specific items that must not be brought on-site include:

- Field sampling items or equipment that contain Teflon® that will be in direct contact with the sampling media,
- Gore-Tex® treated fabrics or clothing
- Any item in the ingredient list that includes the term “fluoro”
- Aluminum foil
- Teflon-bearing plumber’s tape
- Blue (or chemical) ice
- Clothing or boots described as waterproof, water-resistant, or stain-treated
- Tyvek® or coated Tyvek
- Clothing that has been washed with fabric softener as fabric softeners may contain PFAS
- Waterproof field books (e.g. Rite in the Rain®)
- Plastic clipboards, binders, or spiral hard cover notebooks
- Post-it Notes®
- Food packaging material
- Markers

4.4.4 Procedures to Prevent Cross-Contamination

The soil and groundwater sampling equipment (e.g., water level indicator, bowls) will be decontaminated before use, between sample locations, and at the conclusion of sampling.

The procedures outlined below will be used to decontaminate field sampling equipment where dedicated equipment is not used.

- Wash equipment with laboratory-grade Alconox® detergent and rinse with potable tap water from an approved potable water source to remove visible contamination.
- Rinse equipment with distilled or deionized water.

- Record information concerning decontamination methodology, date, time, and personnel in the field logbook.

Decontamination fluids and solids will be contained and disposed in the same manner as the investigation derived wastes.

4.4.5 Investigative Waste Handling

Investigation derived waste (IDW) will be managed in accordance with facility procedures, and state and federal requirements. Soil cuttings and groundwater will be collected in 55-gallon drums for off-site disposal. PFAS-containing wastes must be segregated from other waste while disposal options are evaluated. AECOM recommends working with the WDNR to evaluate the best management practices for IDW of PFAS-contaminated wastes. Currently, the only means to truly destroy PFAS in IDW is via incineration, which is cost prohibitive. AECOM's proposal does not include fees for off-site disposal of the investigative waste. AECOM will work with Milwaukee County to determine proper disposal, if requested.

4.5 Site Restoration

[NR 716.09(2)(g)]

Soil borings that will not be converted to monitoring wells will be abandoned by filling boreholes with bentonite and completing a borehole abandonment form (Form 3300-005). Temporary monitoring wells that are no longer needed due to the absence of PFAS impacts as demonstrated by soil and groundwater samples will be abandoned in accordance with NR 141.25. Two-inch monitoring wells may be left on site to allow additional sample collections to evaluate contaminant migration, or until site closure is obtained.

The ground surface at abandoned boreholes and monitoring wells will be restored to conditions similar to the surrounding ground surface, such as concrete, asphalt, or vegetative cover.

5. Reporting

[NR 716.15]

A report will be prepared presenting the results of the investigation. The report will address PFAS concentrations in the soil, surface water, and groundwater, and will contain text, drawings, tables and appendices describing the results. The report will be prepared in general conformance with ch. NR 716.15, Wis. Adm. Code requirements. The report will include a discussion of field methods, tabulated field and laboratory data, laboratory reports with chain-of-custody documentation, a site location map and a site features map.

5.1 Data Validation

Data quality objectives (DQOs) are quantitative and qualitative criteria intended to ensure that the data collected during the investigation are of an adequate level of quality for their intended uses. Limited (Level II) data validation will be performed using procedures outlined in *Data Review and Validation Guidelines for Perfluoroalkyl Substances (PFASs) Analyzed Using EPA Method 537* (EPA 910-R-18-001, 2018), while isotope dilution data review will be performed using appropriate guidance (*National Functional Guidance for High Resolution Superfund Methods Data Review* (EPA 542-B-16-001, 2016), as applicable to the matrices analyzed. The laboratory quality control limits will be used as the basis for data validation actions.

5.1.1 Investigation Data Quality Objectives

The following specific DQOs have been identified for this investigation:

- Obtain representative analytical results for groundwater and soil samples.
- Identify areas with PFAS impacts and the media impacted.
- Identify areas without PFAS impacts.
- Determine if additional investigation is required in the impacted areas or if the horizontal and vertical extent of impact has been defined.

5.1.2 Data Quality Indicators

Data quality indicators (DQIs) are measures that are used to assess data quality and to verify that DQOs are met. The four DQIs (accuracy, precision, completeness and comparability) are discussed below.

5.1.3 Accuracy

Accuracy reflects the degree of bias in a measurement. To determine accuracy, a laboratory or field value is compared to a known or true concentration. Accuracy is determined by such QC indicators as: laboratory control samples (or ongoing precision and recovery (ORP) samples) and labeled analog recoveries. Accuracy will be assessed using percent recovery, calculated as follows:

$$\%R = 100 \times (A-B)/C$$

Where:
%R = percent recovery
A = analyte concentration from spiked sample
B = analyte concentration from unspiked sample
C = analyte concentration of spike added

5.1.4 Precision

Precision is a measure of the reproducibility of data measurements under similar conditions and is typically assessed by measuring the degree of mutual agreement between or among independent measurements of the same sample. The common measure of precision is the relative percent difference (RPD), calculated as follows:

RPD = 100 x (X1 – X2)/ [(X1 + X2)/2]

Where: X1 = original sample value
X2 = duplicate sample value.

RPD relates to the analysis of duplicate laboratory or field samples. Typically, field precision is assessed by co-located samples, field duplicates, or field splits and laboratory precision is assessed using laboratory duplicates, or laboratory control sample duplicates.

For this investigation, field duplicate precision will be assessed using a 30% RPD limit for groundwater and surface water, and a 50% RPD limit for soil. RPDs will not be calculated if the observed concentration is less than five times the reporting limit in either the sample or field duplicate.

5.1.5 Completeness

Completeness measures the quantity of valid data obtained during the investigation, compared to the quantity of valid data expected. For this investigation, it is expected that all data will be valid. Completeness is calculated as follows:

Completeness = 100 x (number of valid samples obtained)/ (number of samples collected)

The completeness goal for this investigation is 95%.

5.1.6 Comparability

Comparability expresses the confidence with which one data set can be compared to another. For this investigation, comparability will be assessed by documenting conformance to the work plan and noting deviations and documenting the reasons for the deviations. The data quality assurance review will also be considered in assessing data comparability. It should be noted that the current lack of a standardized methodology for the analysis of PFAS in soil and groundwater matrices must be considered when comparing data generated from different analytical laboratories.

5.2 Site Investigation Report

The site investigation report will include site general and background information, investigation methods, and field and laboratory analysis results. The data will be summarized in graphical and tabular format as appropriate to present the investigation results. Conclusions will be presented, and recommendations may include supplemental investigation such as additional delineation of identified PFAS impacts and suggested locations for NR141-compliant two-inch diameter monitoring wells.

Laboratory reports, WDNR groundwater monitoring well construction and development forms (4400-113a and 4400-113b), soil boring logs, field sampling data forms, and well/borehole abandonment forms will be provided as attachments to the report.

6. Anticipated Schedule

[NR 716.09(2)(h)]

The following schedule approximates the time frame in which the investigation will be performed.

Task	Estimated Duration
Pre-Investigation Tasks	2 weeks
Field Activities	
Soil	Approximately 2 weeks for borings and monitoring well installation
Surface Water	3-4 months (sampling will take one or 2 days for each event; Fall and Spring 2020)
Groundwater	3-4 months (2 quarterly sampling events)
Laboratory Analysis	2 to 3 weeks turnaround time
Site Investigation Report	2 to 4 weeks (after last results received)
Project Management	Ongoing
ESTIMATED TOTAL	Approximately 1 year

7. References

Final Report FY16 Phase I Regional Site Inspections for Perfluorinated Compounds Volume I of VII, General Mitchell Air National Guard Base, Milwaukee, Wisconsin, conducted by Amec Foster Wheeler, dated February 2019.

Final Perfluorooctane Sulfonic Acid and Perfluorooctanoic Acid (PFOS and PFOA) Site Inspections at Multiple United States Air Forces (USAF) Base Realignment and Closure (BRAC) Installations, Former General Mitchell Air Reserve Station, Wisconsin, conducted by Amec Foster Wheeler, dated August 2019.

USGS Surface Water Analytical Report October 2019 (Attachment 3 of Request for Proposal for MKE PFAS Investigation, Project No. 5055-19809, dated November 2019), conducted by the United States Geological Society, dated October 2019.

https://www.epa.gov/pfas/basic-information-pfas

Wisconsin County Distribution of Federally-listed Endangered, Threatened and Proposed Species, U.S. Fish & Wildlife Service, Jan 2018.
https://www.fws.gov/midwest/endangered/lists/pdf/WisconsinCtyList10Jan2018.pdf

https://www.faa.gov/airports/airport_safety/wildlife/

Soil Map: Wisconsin Milwaukee County Sheet, the Wisconsin Geological and Natural History Survey. Surveyed by W.J. Geib and T.J. Dunnewald. https://wgnhs.wisc.edu/pubs/b056amap01/

Groundwater Resources of Southeastern Wisconsin, prepared by the Southeastern Wisconsin Regional Planning Commission (SWRPC), technical report number 37, June 2002

USEPA. Data Review and Validation Guidelines for Perfluoroalkyl Substances (PFASs) Analyzed Using EPA Method 537 (EPA 910-R-18-001, 2018)

USEPA. National Functional Guidance for High Resolution Superfund Methods Data Review (EPA 542-B-16-001, 2016

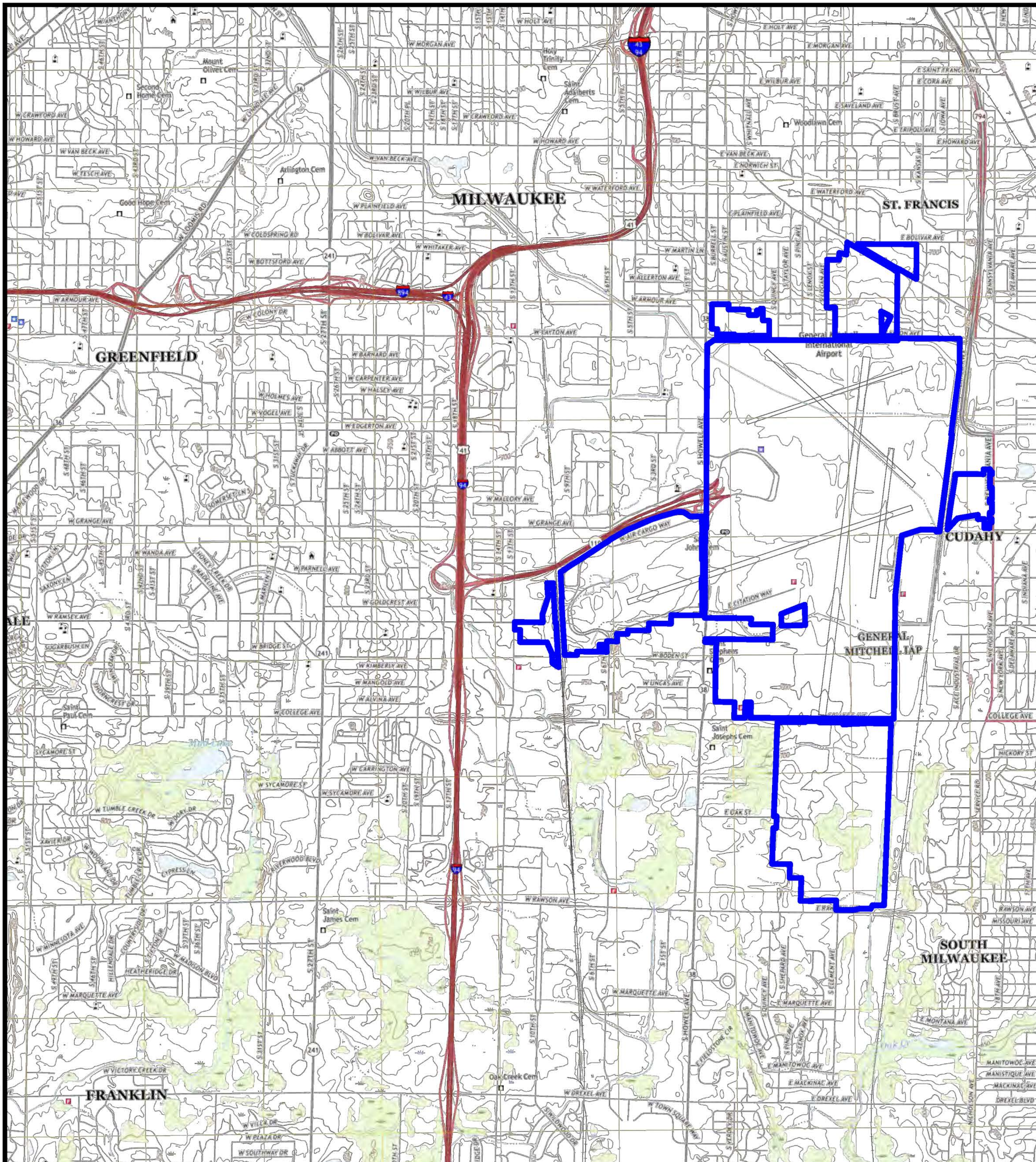
Tables

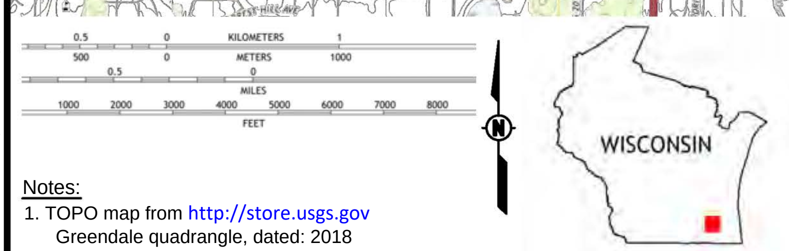
Table 1
Proposed Soil, Groundwater and Surface Water Samples
MKE PFAS Investigation, Milwaukee, Wisconsin

Sample Area	Sample ID	Description/Rationale	Sample Type	Planned Frequency	No. of samples	Planned Sample Information
Cargo Ramp	CR-MW-4	Evaluate PFAS near hangar containing AFFF supression system	Soil	Spring 2020	2	1 - 2 ft bgs and 1 ft above WT
			GW		2	1" temporary well - stick up
	SW-1	USGS Sample Location "OUT1"	SW	Spring and Summer 2020	2	
Far West	SW-4	USGS Sample Location "OUT3-US"	SW	Spring and Summer 2020	2	
	SW-5	Upstream to evaluate potential source entering GMIA	SW		2	
West Pad	WP-MW-17	Evaluate historic AFFF release	Soil	Spring and Summer 2020	2	1 - 2 ft bgs and 1 ft above WT
			GW		2	1" temporary well - stick up
	WP-MW-18		Soil		2	1 - 2 ft bgs and 1 ft above WT
			GW		2	1" temporary well - stick up
	WP-MW-19	Evaluate PFAS near hangar containing AFFF supression system	Soil	Spring and Summer 2020	2	1 - 2 ft bgs and 1 ft above WT
			GW		2	1" temporary well - stick up
	WP-MW-20		Soil		2	1 - 2 ft bgs and 1 ft above WT
			GW		2	1" temporary well - stick up
	SW-15	USGS Sample Location "OUT7"	SW	Spring and Summer 2020	2	
	SW-16	Combined surface water flow exiting GMIA			2	
Southeast	SW-9	Evaluate potential source contribution to SW	SW	Spring and Summer 2020	2	
	SW-10	USGS Sample Location "OUT3-1LE"			2	
	SW-11	Evaluate potential source contribution to SW			2	
	SW-12	USGS Sample Location "OUT3"			2	
Bailey's Pond	SW-13	USGS Sample Location "IN"	SW	Spring and Summer 2020	2	
	SW-14	Upstream to evaluate potential source entering GMIA			2	
Burn Pit	BP-MW-5	South pit - Identify potential source area from fire training	Soil	Spring 2020	2	1 - 2 ft bgs and 1 ft above WT
			GW	Spring and Summer 2020	2	NR-141-compliant Monitoring Well - stick up
	BP-MW-6		Soil	Spring 2020	2	1 - 2 ft bgs and 1 ft above WT
			GW	Spring and Summer 2020	2	NR-141-compliant Monitoring Well - stick up
	BP-MW-7	Evaluate PFAS Between north and south pit	Soil	Spring 2020	2	1 - 2 ft bgs and 1 ft above WT
			GW	Spring and Summer 2020	2	NR-141-compliant Monitoring Well - stick up
	LFG-MW-2	Existing Monitoring Well	GW	Summer 2020	1	Monitoring Well - stick up
	LFG-MW-3	Existing Monitoring Well	GW	Summer 2020	1	Monitoring Well - stick up
	BP-MW-8	Center of North pit to evaluate PFAS at source	Soil	Spring 2020	2	1 - 2 ft bgs and 1 ft above WT
			GW	Spring and Summer 2020	2	NR-141-compliant Monitoring Well - stick up
	LFG-MW-1	Existing Monitoring Well	GW	Summer 2020	1	Monitoring Well - stick up
	BP-MW-9	Evaluate extent and potential migration of PFAS	Soil	Spring 2020	2	1 - 2 ft bgs and 1 ft above WT
			GW	Spring and Summer 2020	2	NR-141-compliant Monitoring Well - stick up
	BP-MW-10		Soil	Spring 2020	2	1 - 2 ft bgs and 1 ft above WT
			GW	Spring and Summer 2020	2	NR-141-compliant Monitoring Well - stick up
	BP-MW-11		Soil	Spring 2020	2	1 - 2 ft bgs and 1 ft above WT
			GW	Spring and Summer 2020	2	NR-141-compliant Monitoring Well - stick up
	BP-MW-12		Soil	Spring 2020	2	1 - 2 ft bgs and 1 ft above WT
			GW	Spring and Summer 2020	2	NR-141-compliant Monitoring Well - stick up
	SW-2	Upstream to evaluate potential source entering GMIA	SW	Spring and Summer 2020	2	
	SW-3	Evaluate potential source contribution to SW	SW	Spring and Summer 2020	2	
Fire Department	FD-MW-13	Identify potential source area from fire department testing and training	Soil	Spring 2020	2	1 - 2 ft bgs and 1 ft above WT
			GW	Spring and Summer 2020	2	NR-141-compliant Monitoring Well - flush
	FD-MW-14		Soil	Spring 2020	2	1 - 2 ft bgs and 1 ft above WT
			GW	Spring and Summer 2020	2	NR-141-compliant Monitoring Well - flush
	FD-MW-15		Soil	Spring 2020	2	1 - 2 ft bgs and 1 ft above WT
			GW	Spring and Summer 2020	2	NR-141-compliant Monitoring Well - flush
	FD-MW-16		Soil	Spring 2020	2	1 - 2 ft bgs and 1 ft above WT
			GW	Spring and Summer 2020	2	NR-141-compliant Monitoring Well - flush
	SW-6	Evaluate Fire department contribution to SW	SW	Spring and Summer 2020	2	
	SW-7	Evaluate maintenance area contribution to SW			2	
	SW-8	USGS Sample Location "OUT3-440"			2	
Cargo Ramp	CR-SB-1	2007 Freight Runners Express Collision Area	Soil	Fall 2020	2	1 - 2 ft bgs and 1 ft above WT
	CR-SB-2				2	1 - 2 ft bgs and 1 ft above WT
	CR-SB-3				2	1 - 2 ft bgs and 1 ft above WT

Notes:
All samples will be analyzed for PFAS
GW = groundwater
SW = surface water
WT = water table
ft = feet
bgs = below ground surface

Figures





Notes:

1. TOPO map from http://store.usgs.gov
   Greendale quadrangle, dated: 2018

AECOM
1555 RiverCenter Dr
Milwaukee, WI
414.944.6080

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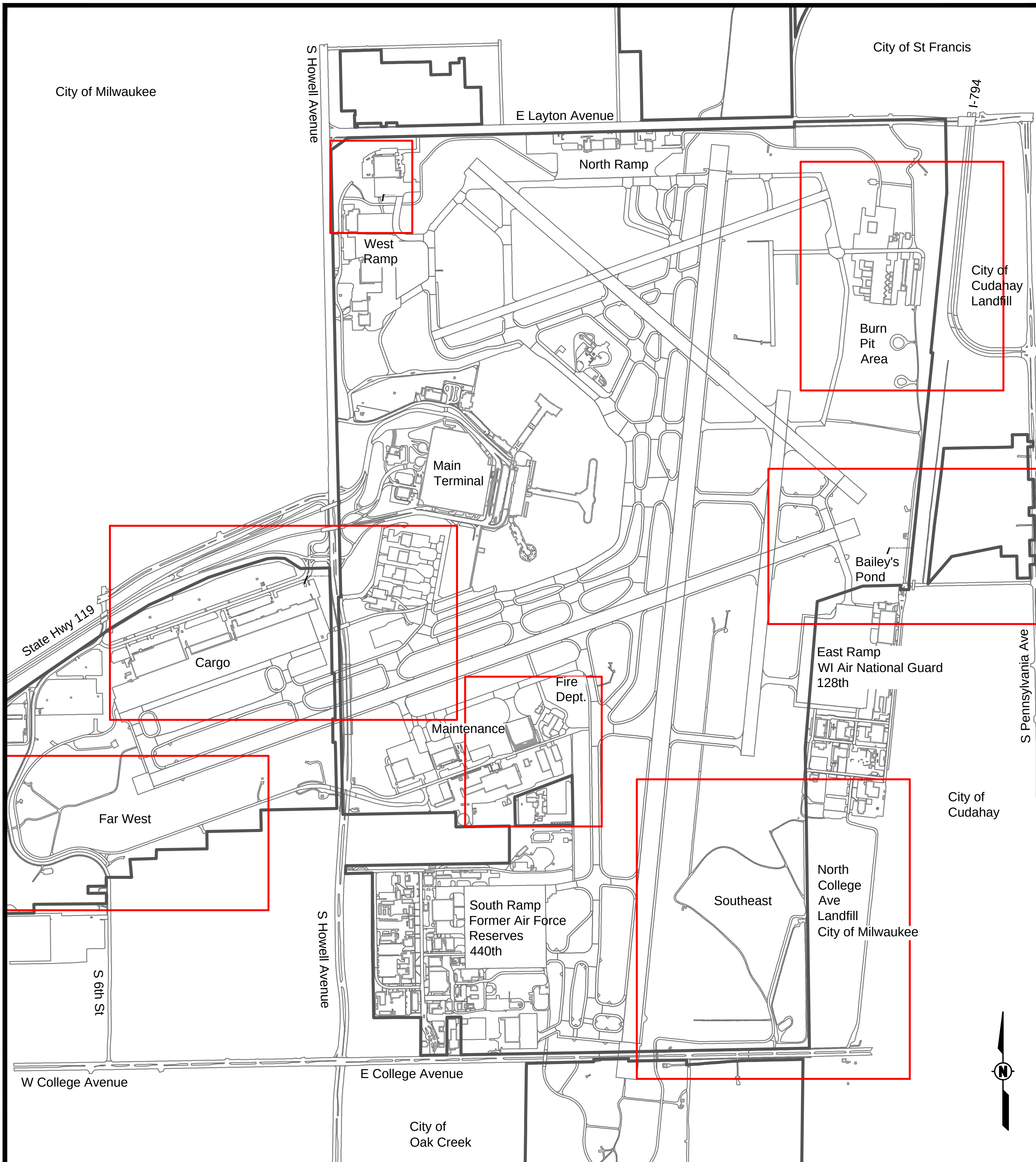
MKE PFAS Investigation
5300 S Howell Ave
Milwaukee, WI

SITE LOCATION

Project Number:	Drawn By:	Date:	Figure No. 1
60620401	JSM	3/17/2020	

File: \\usmwk1fs001\prod\Data\Projects\60620401\900_CAD_GIS\910_CAD\MKE PFAS GMIA R1.dwg; USER: MACKINNEY, JOEL; PLOTTED:March 17, 2020 - 3:50 PM



0' 750' 1500' 3000'

SCALE

Legend:

Approximate Property Boundary

Investigation Areas

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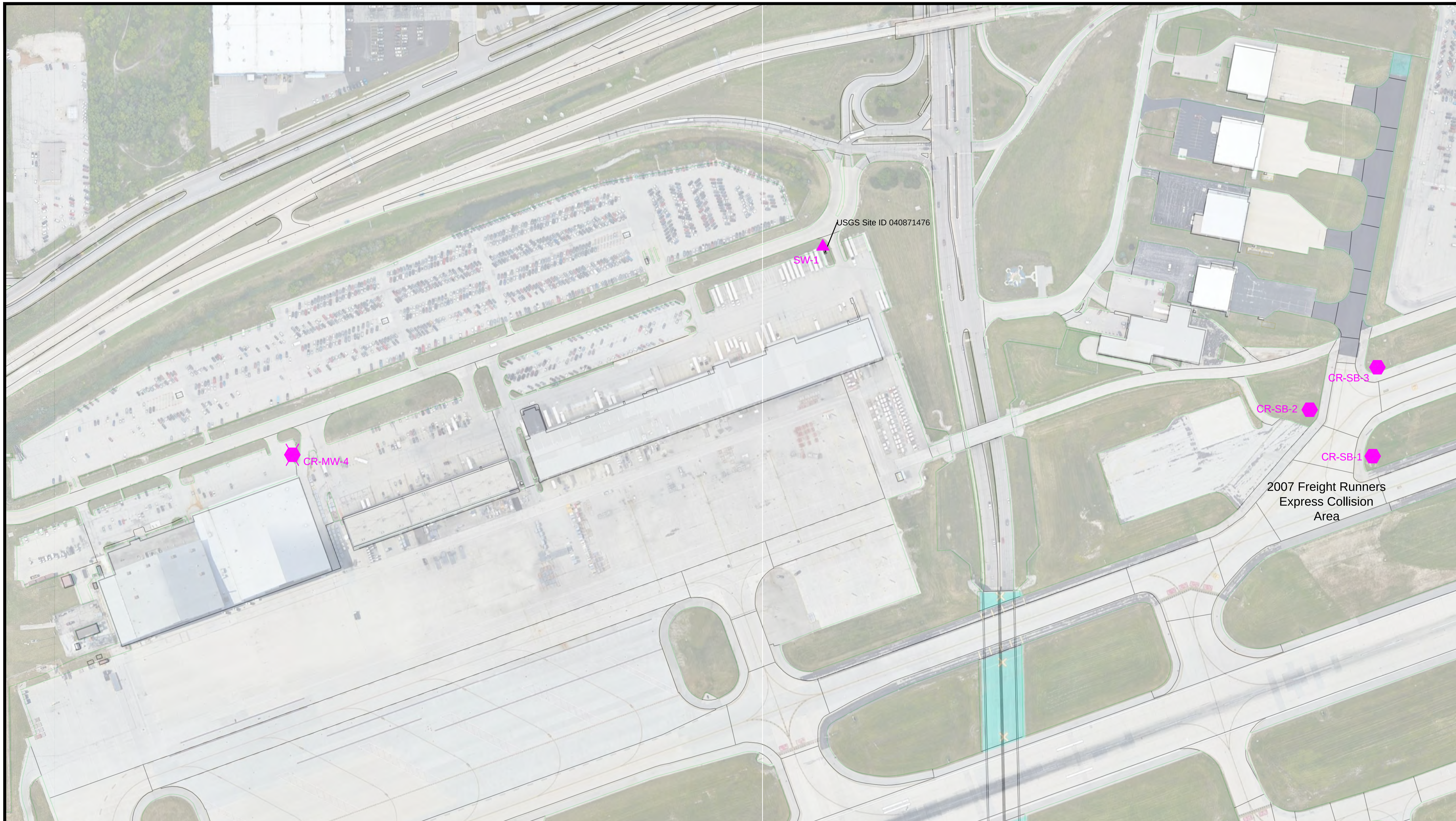
SITE LAYOUT

Project Number:	Drawn By:	Date:	
60620401	JSM	3/17/2020	Figure No. 2

File: \\usmwk1fs001\prod\Data\Projects\60620401\900_CAD_GIS\910_CAD\MKE PFAS GMIA R1.dwg; USER: MACKINNEY, JOEL; PLOTTED:March 17, 2020 - 3:50 PM



Legend:

- Proposed Surface Water Sample Location
- Proposed Soil Boring and 1-inch Well Location
- Proposed Soil Boring Location

0' 125' 250' 500'
SCALE

Notes:
Aerial image from Google Earth Pro, image dated 8/1/2019

N

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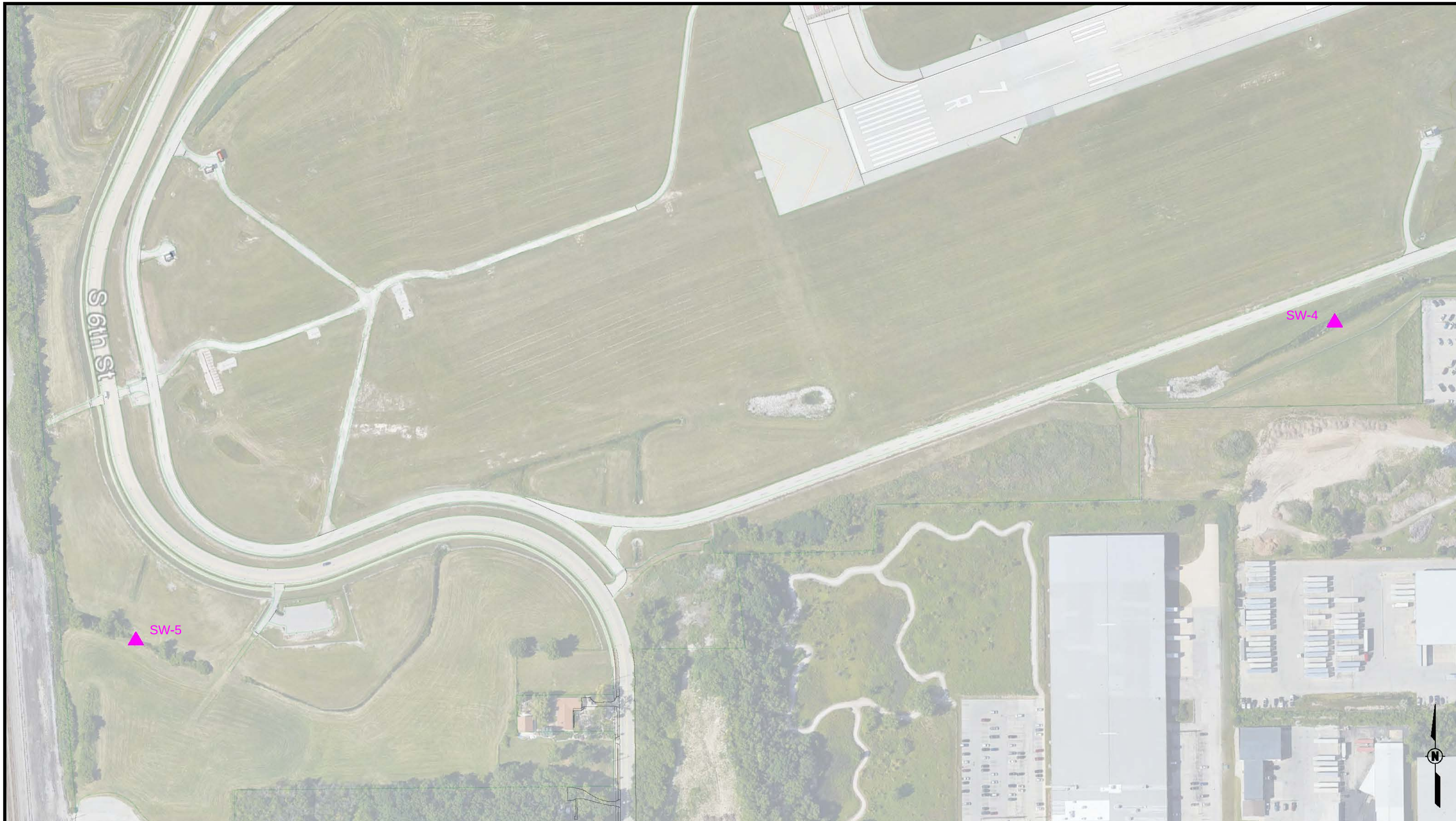
Proposed Sample Locations - Cargo Ramp

Project Number:	Drawn By:	Date:	
60620401	JSM	3/18/2020	Figure No. 3



Legend:

▲ Proposed Surface Water Sample Location

0' 100' 200' 400'
SCALE

Notes:
Aerial image from Google Earth Pro, image dated 8/1/2019

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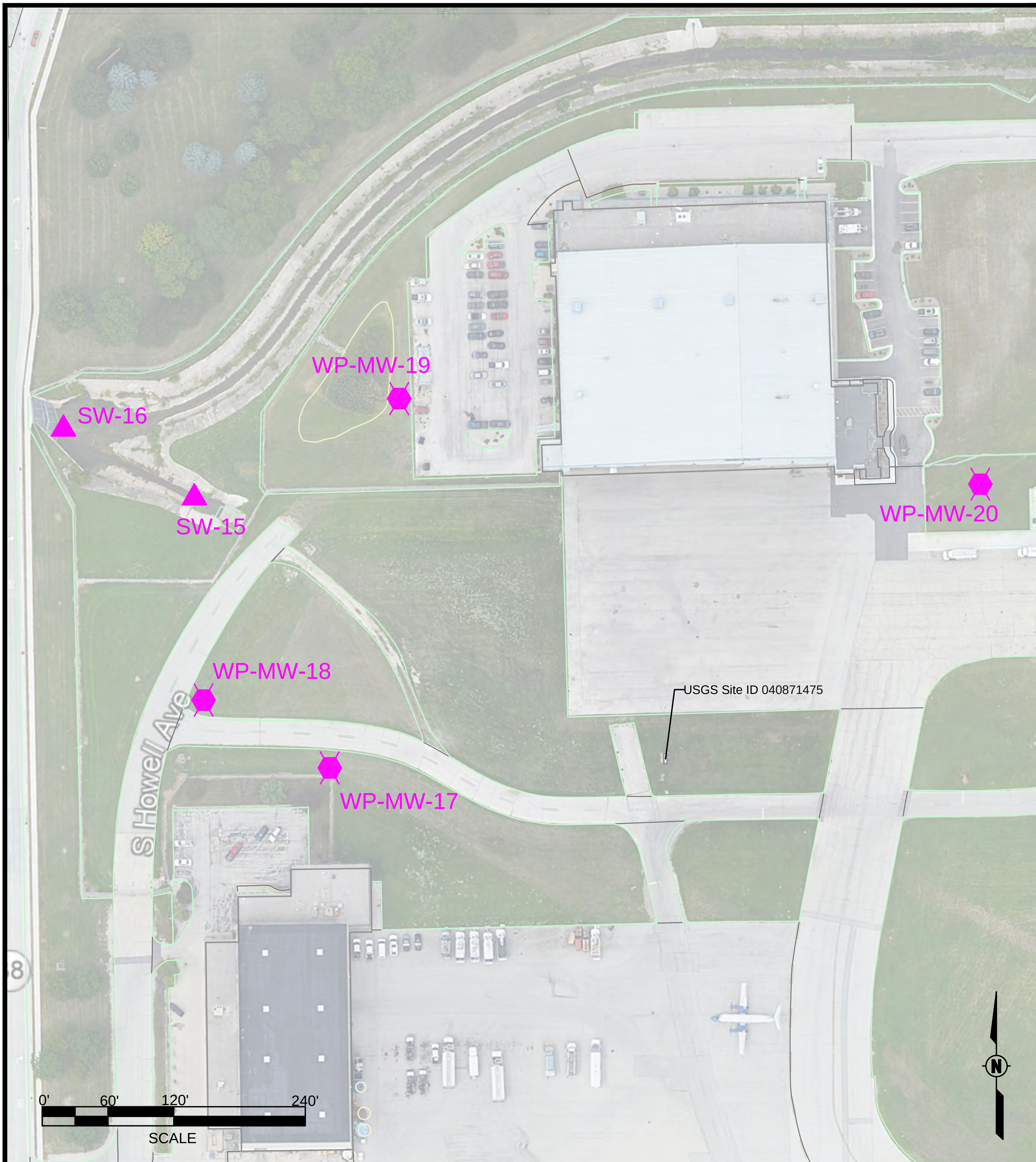
Proposed Sample Locations - Far West

Project Number:	Drawn By:	Date:	
60620401	JSM	3/17/2020	Figure No. 4

File: \\usmwk1fs001\prod\Data\Projects\60620401\900_CAD_GIS\910_CAD\MKE PFAS GMIA R1.dwg; USER: MACKINNEY, JOEL; PLOTTED:March 17, 2020 - 3:50 PM



Legend:

Proposed Soil Boring and 1-Inch Well Location

Proposed Surface Water Sample Location

Notes:
Aerial image from Google Earth Pro, image dated 8/1/2019

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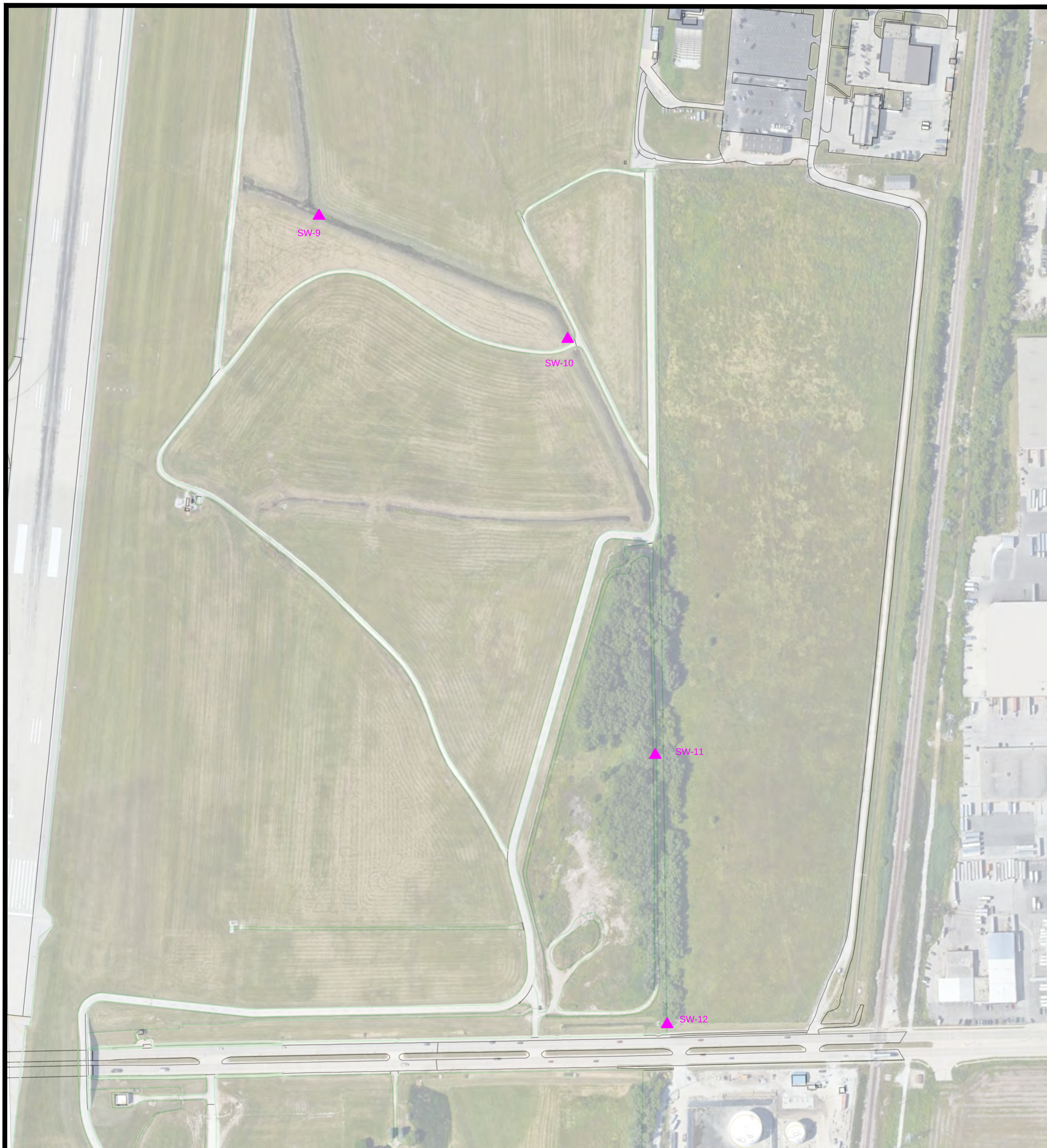
Proposed Sample Locations - West Pad

Project Number:	Drawn By:	Date:	
60620401	JSM	3/17/2020	Figure No. 5

File: \\usmwk1fs001\prod\Data\Projects\60620401\900_CAD_GIS\910_CAD\MKE PFAS GMIA R1.dwg; USER: MACKINNEY, JOEL; PLOTTED:March 17, 2020 - 3:50 PM



Legend:

Proposed Surface Water Sample Location

Notes:
Aerial image from Google Earth Pro, image dated 8/1/2019

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Proposed Sample Locations - Southeast

Project Number:	Drawn By:	Date:	
60620401	JSM	3/17/2020	Figure No. 6

File: \\usmwk1fs001\prod\Data\Projects\60620401\900_CAD_GIS\910_CAD\MKE PFAS GMIA R1.dwg; USER: MACKINNEY, JOEL; PLOTTED:March 17, 2020 - 3:50 PM

Legend:

▲ Proposed Surface Water Sample Location

0' 100' 200' 400'

SCALE

N

Notes:
Aerial image from Google Earth Pro, image dated 8/1/2019

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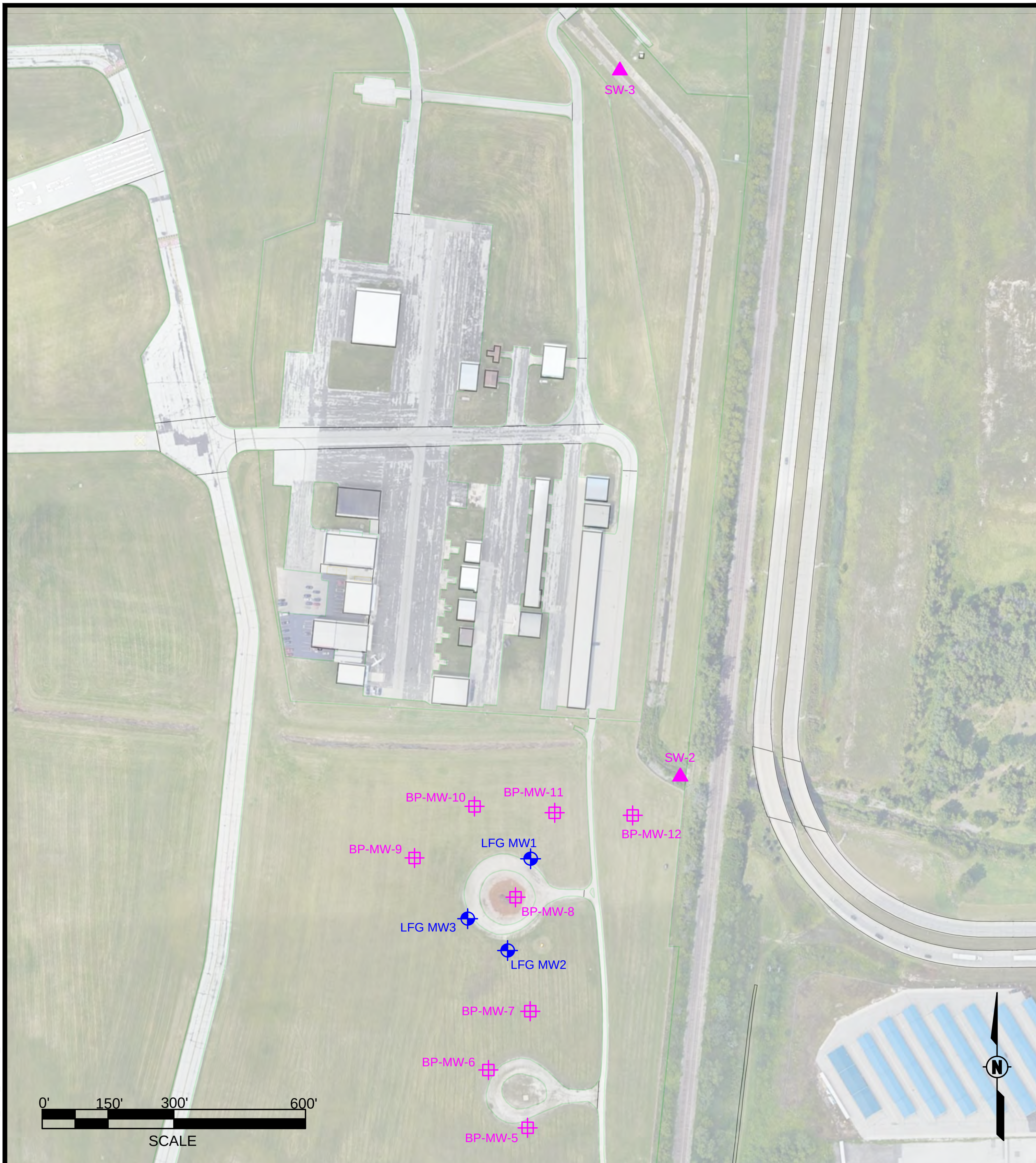
Proposed Sample Locations - Bailey's Pond

Project Number:	Drawn By:	Date:	Figure No. 7
60620401	JSM	3/17/2020	



Legend:

- Existing Monitoring Well
- Proposed Soil Boring and 2-inch Well Location
- Proposed Surface Water Sample Location

Notes:
Aerial image from Google Earth Pro, image dated 8/1/2019

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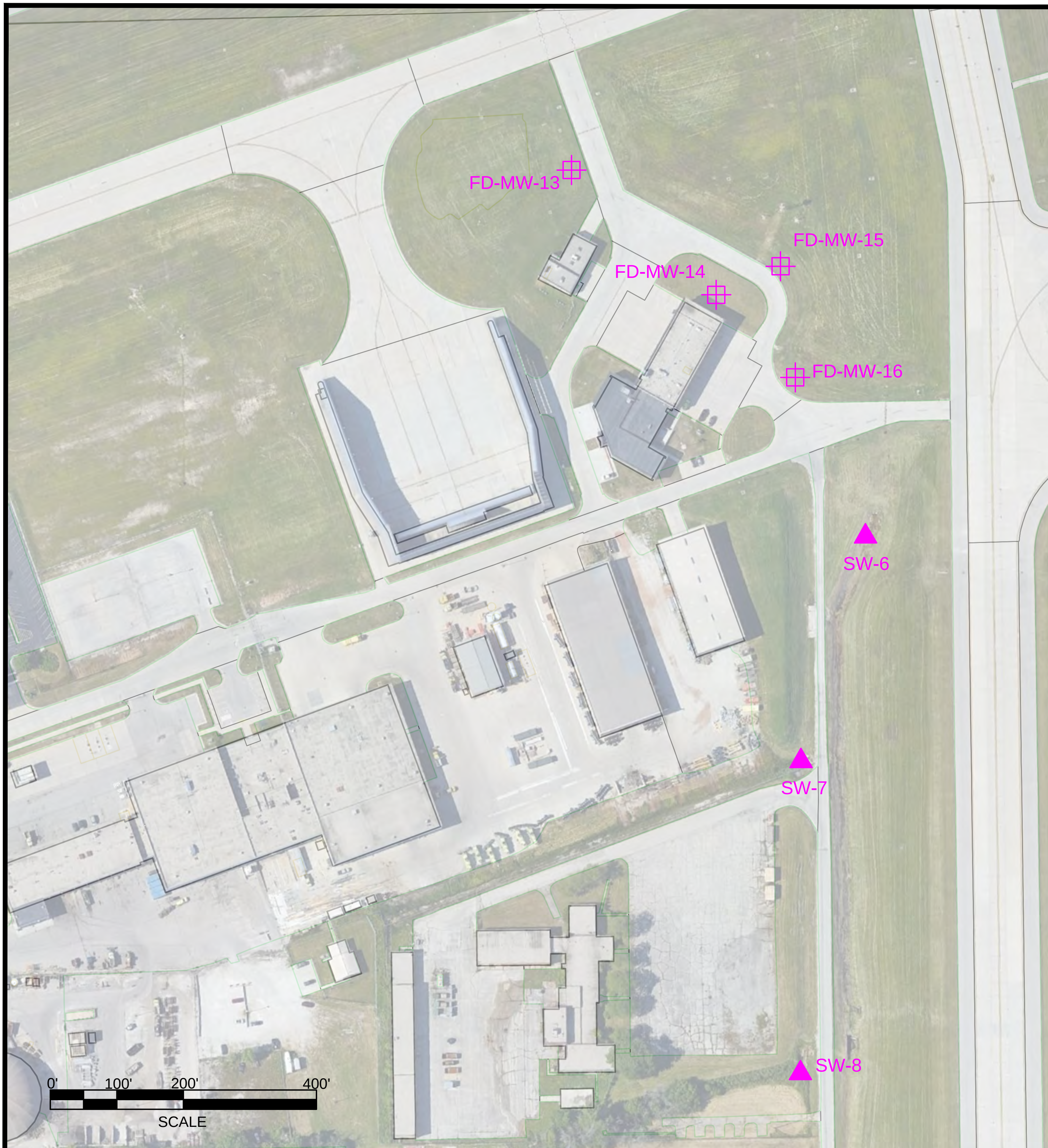
Proposed Sample Locations - Burn Pit

Project Number:	Drawn By:	Date:	
60620401	JSM	3/17/2020	Figure No. 8



Legend:

- Proposed Soil Boring and 2-inch Well Location
- Proposed Surface Water Sample Location

Notes:
Aerial image from Google Earth Pro, image dated 8/1/2019

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Proposed Sample Locations - Fire Department

Project Number:	Drawn By:	Date:	
60620401	JSM	3/17/2020	Figure No. 9

Appendix A PFAS Sampling Checklist

PFAS Sampling Checklist

Project No.: 60620401
Project Location: MKE PFAS Investigation
Signature:
Date:

Team Members

Yes	No	Description
		Has AECOM PFAS Sampling guidance been reviewed by all team members?
		Comments:
Yes	No	Has AECOM field sampling staff received needed training certification?
		Comments:
Yes	No	Was a briefing held for field sampling staff?
		Comments:
Yes	No	Were additional PFAS sampling instructions given to field sampling staff?
		Comments:
Yes	No	Have personal clothing and PPE requirements been followed by all field sampling staff?
		Comments:
Yes	No	Were lotions and sunscreen used for field sampling staff?
		Comment:

Sample Collection

Yes	No	
		Comment
		Source of PFAS-free water:
Yes	No	Have all sampling items, parts and equipment been inspected to be free of PFAS?
		Comment:
Yes	No	Has sampling location sequence been communicated to avoid cross-contaminations?
		Comment:
Yes	No	Have drilling fluids been evaluated and shown to be free of PFAS?
		Comment:
Yes	No	Use of PFAS-free decontamination solution?
		Brand name of decontamination solution:
Yes	No	Have all field logs, notebooks, pens, labels been inspected, and do they meet AECOM PFAS sampling guidance requirements?
		Comment:
Yes	No	Have all sample shipping materials (ice, Ziploc® bags or similar style bags) been inspected, and do they meet AECOM PFAS sampling guidance requirements?
		Comment:
Yes	No	Have all blanks arrived at the site and will they be collected to verify cross-contamination?
		Comment:

Document Control

Yes	No	Have all variances from sampling guidance been documented?
		Comment:

Other Comments: