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September 24, 2018

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Subject: **Draft Final Phase 2 PFCs Site Inspection Report**
Selfridge Air National Guard Base, Mt. Clemens, Michigan
Contract No. W9133L-14-D-0001, TO 0007
AECOM Project Number: 60520893

Dear Mr. Quackenbush & Mr. Ostaszewski,

Please find an electronic copy of the Site Inspection Report for the above referenced installation. Please contact me at (301) 820-3246 or via e-mail (mike.myers@aecom.com) if you have any questions or comments.

Yours Sincerely,

Mike Myers
Project Manager

Cc:

Mr. James King	ANG Program Manager
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Draft Final Site Inspection Report
Air National Guard Phase II Regional Site Inspections for Per- and Polyfluoroalkyl Substances

Selfridge Air National Guard Base
Mt. Clemens, Michigan
NGB/A4OR

Contract No. W9133L-14-D-0001, Task Order No. 0007

September 2018

NGB/A4OR
Shepperd Hall
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List of Acronyms and Abbreviations

ACC	Air Combat Command
AFFF	aqueous film-forming foam
AMC	Air Mobility Command
amsl	above mean sea level
ANG	Air National Guard
ANGB	Air National Guard Base
AST	above ground storage tank
BB&E	BB&E, Inc.
bgs	below ground surface
btoc	below top of casing
COPC	chemical of potential concern
CSM	conceptual site model
DHS	Department of Homeland Security
DoD	Department of Defense
DPT	direct-push technology
DQO	data quality objective
ESS	environmental sequence stratigraphy
FD	Fire Department
ft	foot or feet
FSS	fire suppression system
FTA	Fire Training Area
HA	Health Advisory
IDW	investigation-derived waste
IRP	Installation Restoration Program
LOD	limit of detection
LOQ	level of quantitation
MDEQ	Michigan Department of Environmental Quality
MS	matrix spike
MSD	matrix spike duplicate
NA	Not Applicable
NFA	No Further Action
NGB/A4OR	National Guard Bureau, Operations Division, Restoration Branch
ng/g	nanograms per grams
ng/L	nanograms per liter
NOV	Notice of Violation
NRCS	Natural Resources Conservation Service
NTA	nozzle test area
OWS	oil/water separator
PA	Preliminary Assessment
PAL	project action level
PFAS	per- and polyfluoroalkyl substances

PFBS	Perfluorobutanesulfonate
PFCs	Perfluorinated compounds
PFHpA	Perfluoroheptanoic acid
PFHxS	Perfluorohexanesulfonate
PFNA	Perfluorononanoic acid
PFOA	Perfluorooctanoic acid
PFOS	Perfluoro-octanesulfonate
PID	photoionization detector
PRL	potential release location
QC	Quality Control
RSL	Regional Screening Level
SI	Site Inspection
SOP	Standard Operating Procedure
St.	Saint
SVOC	semivolatile organic compound
THQ	target hazard quotient
TPH	total petroleum hydrocarbons
UCMR-3	Unregulated Contaminant Monitoring Rule
US	United States
USDA	United States Department of Agriculture
US EPA	United States Environmental Protection Agency
USAF	United States Air Force
USCG	United States Coast Guard
USGS	United States Geological Survey
VOC	volatile organic compound
WP	Work Plan
WQS	Water Quality Standards
WWTP	wastewater treatment plant

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Executive Summary

Under contract to the National Guard Bureau, Operations Division, Restoration Branch (NGB/A4OR), AECOM has conducted a basewide Comprehensive Environmental Response, Compensation, and Liability Act Site Inspection (SI) for per- and polyfluoroalkyl substances (PFAS) at Selfridge Air National Guard Base (ANGB), 127th Wing in Macomb County, Selfridge Air National Guard Base, Mt. Clemens, Michigan. The objectives for the SI were to: (1) determine the presence or absence of PFAS in soil, surface water, or sediment at 25 potential release locations (PRLs) and in groundwater immediately downgradient of each PRL, (2) assess if PFAS from the base are migrating off site and (3) determine if the concentrations of PFAS at each PRL are present in quantities or concentrations that warrant no further action (NFA) or additional investigation as part of the Expanded SI or Remedial Investigation / Feasibility Study phase, and if so, what the appropriate data quality objectives (DQOs) should be.

PFAS are not currently regulated at the federal level; however, Perfluoro-octanesulfonate (PFOS) and Perfluorooctanoic acid (PFOA) in groundwater and surface water are regulated by the Michigan Department of Environmental Quality (MDEQ). MDEQ has adopted the United States Environmental Protection Agency (US EPA) Lifetime Health Advisory (HA) levels for PFOS and PFOA to protect against potential risk from exposure to these compounds via drinking water (MDEQ 2018a). For Perfluorobutanesulfonate (PFBS), the US EPA tapwater regional screening level (RSL) was used that is protective of the drinking water exposure pathway for a residential receptor (US EPA, 2018).

The MDEQ has established Water Quality Standards (WQS) that are protective of surface waters for both drinking water and non-drinking water sources. The WQS for drinking water is 11 ng/L and the WQS for non-drinking water standard is 12 ng/L for PFOS. As shown on **Figure 4-1** (located in **Appendix A**), Wet Wells/Drainage Basins 340 (PRL 20), 980 (PRL 23), and 990 (PRL 24) are all located on shore of Lake Saint (St.) Clair, which is a drinking water source. Wet Wells/Drainage Basins 507 (PRL 21) and 508 (PRL 22) are located on the Clinton River, which is not a drinking water source but does discharge to Lake St. Clair. Since municipal drinking water is obtained from Lake St Clair, the WQS for drinking water (11 ng/L) was selected to conservatively screen all surface water that is discharging from Selfridge ANGB.

The MDEQ has not developed direct contact soil screening levels; therefore, the US EPA residential soil direct contact RSLs were calculated for PFOS, PFOA, and PFBS (US EPA, 2018). These values were considered in establishing the project action levels (PALs) that are provided in Appendix C, Laboratory Quality Assurance Project Plan, in the Final SI Work Plan (WP) (AECOM, 2017). The purpose of the PAL is to select an analytical laboratory method that can provide accurate data (i.e., quantitative results with known precision and bias) that is protective of regulatory limits (e.g., the drinking water HAs and MDEQ WQS) and risk-based screening criteria (e.g., RSLs) to define the presence or absence of PFAS to the best extent practicable. There are no PALs for Perfluoroheptanoic acid (PFHpA), Perfluorohexanesulfonate (PFHxS), or Perfluorononanoic acid (PFNA) due to lack of toxicity data.

- Groundwater:
  - PFOS and PFOA: A PAL of 70 nanograms per liter (ng/L) was promulgated in 2018 by the State of Michigan for PFOS and PFOA; the individual and combined concentrations of PFOA and PFOS will be compared with the 70 ng/L PAL (MDEQ, 2018a).
  - PFBS: A PAL of 400,000 ng/L was developed for PFBS utilizing the US EPA tapwater RSLs most recently updated in May 2018, using a target hazard quotient (THQ) equal to 1.0 (US EPA, 2018).
- Soil
  - PFOS and PFOA: PALs of 1,260 nanograms per gram (ng/g) for both PFOS and PFOA were conservatively calculated using the US EPA RSL calculator (May 2018 version). The calculated PALs were derived using a THQ equal to 1.0 and are protective of a residential receptor coming into direct contact with soil (i.e., incidental ingestion of soil, dermal contact and outdoor inhalation of particulates) (US EPA, 2018).
  - PFBS: A PAL of 1.26×10^6 ng/g was conservatively calculated using the US EPA RSL calculator (May 2018 version). The calculated PAL was derived using a THQ equal to 1.0 and

is protective of a residential receptor coming into direct contact with soil (i.e., incidental ingestion of soil, dermal contact and outdoor inhalation of particulates) (US EPA, 2018). US EPA does provide a generic residential direct contact soil RSL of 1.30×10^6 ng/g dated May 2018 (US EPA, 2018). However, the ANGBs around the country have chosen to use the more stringent, calculated RSL for screening PFBS.

- Surface Water:
  - PFOS and PFOA: WQS were obtained from the June 2018 Table 1 Residential and Nonresidential Groundwater Criteria by the State of Michigan after the SI WP was finalized and were set at 11 ng/L for PFOS and 420 ng/L for PFOA for surface waters that are used for drinking water (MDEQ, 2018a). These levels are used as the PALs for this SI Report.
  - PFBS: The State of Michigan has not promulgated a surface water screening level for PFBS; therefore, the surface water PAL is equivalent to the groundwater PAL, defined above.
- Sediment:
  - PFOS, PFOA, and PFBS: PALs were not specifically defined for sediment in the SI WP (AECOM, 2017), and there are no federal or state sediment-specific screening criteria readily available. For purposes of this SI Report, the sediment PALs are equivalent to the soil PALs, defined above.

Twenty-five PRLs at Selfridge ANGB were selected for SI activities based on a Preliminary Assessment (PA) site visit conducted in March 2016. The results of the PA site visit were documented in the *Final Perfluorinated Compounds Preliminary Assessment Site Visit Report* (BB&E, Inc. [BB&E], 2016). During the PA site visit, 28 PRLs were identified and of those 28 locations, 25 were recommended for additional investigation. Installation Restoration Program (IRP) Site 3 - Fire Training Area (FTA) #1 (PRL 2) and IRP Site 15 - FTA Area #3 (PRL 3) were recommended for NFA. IRP Site 3 - FTA #1 was used from 1952 to 1959 and IRP Site 15 - FTA #3 was used from 1959 through 1964. During that time frame, it was assumed that aqueous film-forming foam (AFFF) was not used based on information obtained. Building 105 - Supply (PRL 19) was recommended for NFA since there were no known AFFF releases (BB&E, 2016).

The SI field activities were completed between December 2017 and June 2018 culminating in the collection of 142 soil samples, 37 groundwater samples, eight sediment samples, and eight surface water samples that were analyzed for six PFAS consistent with the US EPA third Unregulated Contaminant Monitoring Rule (UCMR-3) (US EPA, 2012). A summary of the maximum sampling results exceeding PALs for each PRL is provided in **Table ES-1.**

Table ES-1. Summary of Maximum Sampling Results Exceeding PALs

PRL Number	PRL Name	Media	Result Exceeding PAL[a, b, c, d]		
			PFOS	PFOA	PFBS
1	**IRP Site 2 (Fire Training Area #2)**	**Groundwater**	**17,000 ng/L**	**5,500 ng/L**	--
		Soil	--	--	--
4	**Building 154 – Fuel System Repair**	**Groundwater**	**Combined total exceeded the PAL (116 U ng/L)[d]**		--
		Soil	--	--	--
5	Building 1401 – USCG Hangar	Groundwater	Combined total does not exceed the PAL		--
		Soil	--	-	--
6	Building 1461 – USCG Hangar	Groundwater	Combined total does not exceed the PAL		--
		Soil	--	--	--
7	Building 1416 – Army National Guard Hangar	Groundwater	Combined total does not exceed the PAL		--
		Soil	--	--	--
8	**Building 1422 – DHS Hangar**	**Groundwater**	**11,000 ng/L**	**850 ng/L**	--
		Soil	--	--	--
9	Building 1436 – DHS Hangar	Groundwater	Combined total does not exceed the PAL		--
		Soil	--	--	--
10	**Building 859 – Fire Department**	**Groundwater**	**530 ng/L**	**890 ng/L**	--
		Soil	--	--	--
11	Building 501 – Former Wastewater Treatment Plant	Groundwater	Combined total does not exceed the PAL		--
		Soil	--	--	--
12	**Nozzle Testing Area**	**Groundwater**	**84 J+ ng/L**	--	--
		Soil	**1,900 ng/g**	--	--
13	**C16 – AOC**	**Groundwater**	**84 U* ng/L**	**370 ng/L**	--
		Soil	**1,700 ng/g**	--	--
14	CRF – AOC	Groundwater	Combined total does not exceed the PAL		--
		Soil	--	--	--
15	**East Ramp**	**Groundwater**	**Combined PFOS + PFOA exceeds the PAL (80 J+ ng/L)[d]**		--
		Soil	--	--	--
16	West Ramp	Groundwater	Combined total does not exceed the PAL		--
		Soil	--	--	--
17	**Former Building 33 – Fire Department**	**Groundwater**	**3,200 J+ ng/L**	**400 J+ ng/L**	--
		Soil	--	--	--
18	Former Building 176 – Vehicle Maintenance	Groundwater	Combined total does not exceed the PAL		--
		Soil	--	--	--
20	**Wet Well/Drainage Basin 340**	**Surface Water**	**170 ng/L**	--	--
		Sediment	--	--	--
21	**Wet Well/Drainage Basin 507**	**Surface Water**	**2,400 ng/L**	--	--
		Sediment	--	--	--
22	**Wet Well/Drainage Basin 508**	**Surface Water**	**2,000 ng/L**	--	--
		Sediment	--	--	--
23	**Wet Well/Drainage Basin 980**	**Surface Water**	**33 ng/L**	--	--
		Sediment	--	--	--
24	**Wet Well/Drainage Basin 990**	**Surface Water**	**490 ng/L**	--	--
		Sediment	--	--	--

PRL Number	PRL Name	Media	Result Exceeding PAL[a, b, c, d]		
			PFOS	PFOA	PFBS[d]
25	Aircraft Crash Sites	Groundwater	Combined total does not exceed the PAL		--
		Soil	--	--	--
26	**Drainage Basin 1420/Outfall 006A**	**Surface Water**	**970 ng/L**	--	--
		Sediment	--	--	--
27	Sludge Drying Beds	Groundwater	Combined total does not exceed the PAL		--
		Soil	--	--	--
28	IRP Site 9- Sludge Application Area	Groundwater	Combined total does not exceed the PAL		--
		Soil	--	--	--
NA	Base Boundary Wells	Groundwater	Combined total does not exceed the PAL		--

Note: PRL 2 - IRP Site 3 (Fire Training Area #1), PRL 3 - IRP Site 15 (Fire Training Area #3) and PRL 19- Building 105 - Supply were recommended for NFA and are not included in the table (BB&E, 2016).

(a) MDEQ, 2018a. Remediation and Redevelopment Division. Environmental Contamination Response Activity Rules. Table 1. Groundwater: Residential and Nonresidential, Part 201 Generic Cleanup Criteria and Screening Levels. Effective 10 January 2018 and updated on 25 June 2018.

(b) US EPA, 2018. RSLs, May 2018. PFBS groundwater PAL based on RSL for tap water. Soil PALs were calculated using the RSL calculator. The RSLs are protective of a residential receptor and a THQ equal to 1.0.

(c) MDEQ, 2018b. Rule 57 Water Quality Values. Surface Water Assessment Section.15 March 2018. Values are protective of drinking water.

(d) While both PFOS and PFOA were not detected above the PAL, combined (PFOS + PFOA) groundwater concentration exceeded the PAL.

Table ES-1 lists the compounds that exceed the following PALs. Compounds without PALs are included in the **Section 5** Tables.

Summary of the Screening Criteria

Analyte	Groundwater (ng/L)	Soil and Sediment (ng/g)	Surface Water (ng/L)
PFOS	70	1,260	11
PFOA	70	1,260	420
PFOA+PFOS	70	NA	NA
PFBS	400,000	1.26×10^6	400,000

Bolded value indicates that the analyte was detected above the PAL.

-- indicates that the analyte was not detected above the PAL.AOC = Area of Concern
DHS = Department of Homeland Security
FTA = Fire Training Area
IRP = Installation Restoration Program
J+ = Reported value may not be accurate or precise, and the result may be biased high.
NA = Not Applicable
NFA = no further action
ng/L = nanograms per liter
ng/g = nanograms per gram
PFBS = Perfluorobutanesulfonate
PFOA = Perfluorooctanoic acid
PFOS = Perfluoro-octanesulfonate
PRL = potential release location
THQ = target hazard quotient
U* = Positive value reported by laboratory was changed during data validation to non-detect at elevated quantitation limit due to blank detection but is still considered to be a positive detect-See Section 5.1.
USCG = United States Coast Guard

PFAS were detected in groundwater, soil, surface water and/or sediment sampled at each PRL. PFAS were detected above the PALs in groundwater at eight of the 25 PRLs investigated and were detected in soil above the PALs at two of the 25 PRLs. PFAS concentrations exceeded PALs in surface water at six of the PRLs sampled; however, it was not detected above PALs in any of the co-located sediment samples.

As provided in **Table ES-1,** the highest detected concentrations in groundwater were recorded at IRP Site 2 - FTA #2 (PRL 1) where PFOS was detected at a concentration of 17,000 ng/L, which exceeds the individual PAL of 70 ng/L. For soil, the only PFAS detected above the PAL was in one sample where PFOS was detected at a concentration of 1,900 ng/g from the Nozzle Testing Area (PRL 12). The highest detection of PFAS in surface water that exceeded the PAL of 11 ng/L was PFOS detected at a concentration of 2,400 ng/L from a sample taken from Wet Well/Drainage Basin 507 (PRL 21). PFAS were not detected above the PAL in any sediment sample.

Based on the groundwater data obtained from base boundary wells, it does not appear that PFAS were detected, so off-base migration of PFAS in groundwater is not likely. However, the off-base migration of PFAS in surface water has been established because PFAS were detected in all five Wet Well/Drainage Basins.

The following recommendations are provided for consideration based on the SI results:

- Further investigation at all 25 PRLs is necessary to determine the nature and extent of PFAS contamination due to detectable levels at all PRLs.
- Develop an expanded conceptual site model (CSM) that considers localized groundwater and surface water flow paths to select future sampling locations. To refine the CSM for Selfridge ANGB, an environmental sequence stratigraphy (ESS) analysis could be performed to generate new cross sections. This information could:
    - Identify and map (the composition, shape, and interconnectivity of) potentially undefined fluvial channels and other geologic features at the plume scale.
    - Construct a geologically defensible framework of the subsurface that better defines subsurface heterogeneity, accurately predicts preferential pathways, and reduces data gaps.
    - Achieve a greater understanding of groundwater and dissolved contaminant flow preferential pathways and thus target areas for active remedial implementation.
    - Reduce the number of future wells for plume measurements through stratigraphic guidance.
- Conduct a synoptic basewide groundwater sampling event to confirm the groundwater flow direction.
- Complete the delineation of PFAS as part of an Expanded SI or a Remedial Investigation that could consist of:
    - Expanding the groundwater sampling program to complete horizontal and vertical delineation of the PFAS impacts. Further groundwater investigation at the base boundary is recommended due to the presence of PFAS in groundwater above their respective PALs.
    - Installing and sampling new and existing downgradient off-base monitoring wells to better define the PFAS that may have migrated off-base and installation of upgradient monitoring wells to better define the PFAS that may have migrated on-base (from off-base sources) .
    - Conducting additional surface water and sediment sampling both on-base and off-base to determine the nature and extent of PFAS impacts in these media. Potential locations include the Clinton River to the south and Lake St. Clair, a drinking water source, to the east.

  - Perform additional groundwater and soil sampling and analysis of an expanded list of PFAS (in addition to the six UCMR-3) and precursor analysis to determine if significant source areas related to precursor substances are present. Precursor substances have been demonstrated to oxidize into PFOS and PFOA via biological and abiotic processes and thus could provide a lingering source of PFOS and PFOA in soil and groundwater.

- Conduct preliminary site-specific risk assessment calculations in order to identify contaminants of potential concern in every media and establish preliminary remedial goals for screening purposes.

DQOs are proposed based on the results of the SI and are presented in **Section 6.6.** A summary of these DQOs are presented in **Table ES-2**. Additional sampling and analysis is required at each PRL not achieving a NFA status to establish the nature and extent of PFAS for each applicable media and determine if there is a complete receptor pathway. For soil, additional sampling and analysis is required to determine if a source area exists, and if so, what is the vertical and horizontal extent for both the vadose and saturated zones. For groundwater, additional sampling is proposed to better define potential groundwater impacts both vertically and horizontally through the sampling of existing and additional new monitoring wells in both upgradient and off-base locations. Additional surface water and sediment samples are required at PRLs where the presence of PFAS in surface water has been identified including upstream and downstream surface water and sediment sampling at on- and off-base locations.

Samples from all five wet wells exceeded the MDEQ WQS. Three of the five wet wells discharge to Lake St. Clair directly and two wet wells discharge to the Clinton River, which flows into Lake St. Clair. At the request of MDEQ, an Outfall Surface Water Sampling Results letter report was submitted to MDEQ on 20 April 2018 in advance of this SI Report. A Notice of Violation (NOV) was submitted to the ANG dated 19 July 2018 as a result of the analytical results presented in the referenced letter report. The following items are recommended to address the NOV.

- Complete a short-term storm water characterization study under wet and dry conditions in compliance with the conditions of the NOV;
- Evaluate the stormwater conveyance system which should include a study to determine if groundwater is infiltrating the storm water system;
- Conduct a dye test study in the Clinton River and Lake St. Clair to evaluate the mixing zone and potential for impacts to the Mount Clemens water treatment plant and water intake. Collect a representative number of samples in the Clinton River and Lake St. Clair during the dye test and analyze for PFAS compounds to calibrate the dye test results;
- Conduct a PFAS loading storm water management model to evaluate impacts under multiple remedial options; and
- Determine if an interim remedial action is feasible to reduce PFAS impacts to the Clinton River and Lake St. Clair.

Table ES-2. Relevant Data Quality Objectives

PRL No.	PRL Description	Compounds Above PALs	Sampling Recommendation(s) and Objectives
1	IRP Site 2 (Fire Training Area #2)	Groundwater: PFOS, PFOA	Groundwater: Determine the nature and extent both vertically and horizontally through the sampling of existing and additional new monitoring wells. Soil: Although PALs were not exceeded, PFAS were detected in soil samples. Therefore, additional surface and subsurface soil samples are proposed to determine if an unidentified source exists and if so, to determine the nature and extent in the vertical and horizontal directions given the potential for soil to groundwater migration.
4	Building 154 – Fuel System Repair	Groundwater: Combined PFOS + PFOA[1]	
5	Building 1401 – USCG Hangar	None[2]	Groundwater: Although PALs for the individual compounds were not exceeded, PFAS were detected in some groundwater samples. Therefore, additional groundwater sampling is proposed to better define potential groundwater impacts both vertically and horizontally through the sampling of existing and additional new monitoring wells. Soil: Although PALs were not exceeded, PFAS were detected in soil samples. Therefore, additional surface and subsurface soil samples are proposed to determine if an unidentified source exists and if so, to determine the nature and extent in the vertical and horizontal directions given the potential for soil to groundwater migration.
6	Building 1461 – USCG Hangar	None[2]	
7	Building 1416 – Army National Guard Hangar	None[2]	
8	Building 1422 – DHS Hangar	Groundwater: PFOS, PFOA	Groundwater: Determine the nature and extent both vertically and horizontally through the sampling of existing and additional new monitoring wells. Soil: Although PALs were not exceeded, PFAS were detected in soil samples. Therefore, additional surface and subsurface soil samples are proposed to determine if an unidentified source exists and if so, to determine the nature and extent in the vertical and horizontal directions given the potential for soil to groundwater migration.
9	Building 1436 – DHS Hangar	None[2]	Groundwater: Although PALs were not exceeded, PFAS were detected in the groundwater sample. Therefore, additional groundwater sampling is proposed to better define potential groundwater impacts both vertically and horizontally through the sampling of existing and additional new monitoring wells. Soil: Although PALs were not exceeded, PFAS were detected in soil samples. Therefore, additional surface and subsurface soil samples are proposed to determine if an unidentified source exists and if so, to determine the nature and extent in the vertical and horizontal directions given the potential for soil to groundwater migration.
10	Building 859 – Fire Department	Groundwater: PFOS, PFOA	Groundwater: Determine the nature and extent both vertically and horizontally through the sampling of existing and additional new monitoring wells. Soil: Although PALs were not exceeded, PFAS were detected in soil samples. Therefore, additional surface and subsurface soil samples are proposed to determine if an unidentified source exists and if so, to determine the nature and extent in the vertical and horizontal directions given the potential for soil to groundwater migration.
11	Building 501 – Former Wastewater Treatment Plant	None[2]	Groundwater: Although PALs were not exceeded, additional groundwater sampling is proposed to better define potential groundwater impacts both vertically and horizontally through the sampling of existing and additional new monitoring wells. Soil: Although PALs were not exceeded, additional PFAS were detected in soil samples. Therefore, surface and subsurface soil samples are proposed to determine if an unidentified source exists and if so, to determine the nature and extent in the vertical and horizontal directions given the potential for soil to groundwater migration.

PRL No.	PRL Description	Compounds Above PALs	Sampling Recommendation(s) and Objectives
12	Nozzle Testing Area	Groundwater: PFOS Soil: PFOS	Groundwater: Determine the nature and extent both vertically and horizontally through the sampling of existing and additional new monitoring wells. Soil: Additional surface and subsurface soil samples is proposed to determine the nature and extent in the vertical and horizontal directions given the potential for a fire department to have soil impacts in a spatial direction.
13	C16 – AOC	Groundwater: PFOS, PFOA Soil: PFOS	
14	CRF – AOC	None[2]	Groundwater: Although PALs were not exceeded, additional groundwater sampling is proposed to better define potential groundwater impacts both vertically and horizontally through the sampling of existing and additional new monitoring wells. Soil: Although PALs were not exceeded, PFAS were detected in two soil samples. Therefore, additional surface and subsurface soil samples are proposed to determine if an unidentified source exists and if so, to determine the nature and extent in the vertical and horizontal directions given the potential for soil to groundwater migration.
15	East Ramp	Groundwater: PFOS + PFOA	Groundwater: Determine the nature and extent both vertically and horizontally through the sampling of existing and additional new monitoring wells. Soil: Although PALs were not exceeded, PFAS were detected in soil samples. Therefore, additional surface and subsurface soil samples are proposed to determine if an unidentified source exists and if so, to determine the nature and extent in the vertical and horizontal directions given the potential for soil to groundwater migration.
16	West Ramp	None[2]	Groundwater: Although PALs were not exceeded, PFAS were detected in groundwater samples. Therefore, additional groundwater sampling is proposed to better define potential groundwater impacts both vertically and horizontally through the sampling of existing and additional new monitoring wells. Soil: Although PALs were not exceeded, PFAS were detected in soil samples. Therefore, additional surface and subsurface soil samples are proposed to determine if an unidentified source exists and if so, to determine the nature and extent in the vertical and horizontal directions given the potential for soil to groundwater migration.
17	Former Building 33 – Fire Department	Groundwater: PFOS, PFOA	Groundwater: Determine the nature and extent both vertically and horizontally through the sampling of existing and additional new monitoring wells. Soil: Although PALs were not exceeded, PFAS were detected in soil samples. Therefore, additional surface and subsurface soil samples are proposed to determine if an unidentified source exists and if so, to determine the nature and extent in the vertical and horizontal directions given the potential for soil to groundwater migration.
18	Former Building 176 – Vehicle Maintenance	None[2]	Groundwater: Although PALs were not exceeded, PFAS were detected in the groundwater sample. Therefore, additional groundwater sampling is proposed to better define potential groundwater impacts both vertically and horizontally through the sampling of existing and additional new monitoring wells. Soil: Although PALs were not exceeded, PFAS were detected in soil samples. Therefore, additional surface and subsurface soil samples are proposed to determine if an unidentified source exists and if so, to determine the nature and extent in the vertical and horizontal directions given the potential for soil to groundwater migration.

PRL No.	PRL Description	Compounds Above PALs	Sampling Recommendation(s) and Objectives
20	Wet Well/ Drainage Basin 340	Surface Water: PFOS	Surface Water and Sediment: Complete a short-term storm water characterization study in compliance with the MDEQ NOV. Conduct additional sampling of surface water and sediment downstream beyond the base boundary to determine the extent of surface water and sediment impacts and support the evaluation of whether there are unacceptable risks to ecological or human health receptors.
21	Wet Well/ Drainage Basin 507	Surface Water: PFOS	
22	Wet Well/ Drainage Basin 508	Surface Water: PFOS	
23	Wet Well/ Drainage Basin 980	Surface Water: PFOS	
24	Wet Well/ Drainage Basin 990	Surface Water: PFOS	
25	Aircraft Crash Sites	None[2]	Groundwater: Although PALs were not exceeded, PFAS were detected in groundwater samples. Therefore, additional groundwater sampling is proposed to better define potential groundwater impacts both vertically and horizontally through the sampling of existing and additional new monitoring wells. Soil: Although PALs were not exceeded, PFAS were detected in soil samples. Therefore, additional surface and subsurface soil samples are proposed to determine if an unidentified source exists and if so, to determine the nature and extent in the vertical and horizontal directions given the potential for soil to groundwater migration.
26	Drainage Basin 1420/Outfall 006A	Surface Water: PFOS	Surface Water and Sediment: PFAS were detected in surface water and sediment samples, but PALs were not exceeded in sediment samples. Additional sampling of surface water and sediment downstream beyond the base boundary is proposed to determine the extent of surface water and sediment impacts and support the evaluation of whether there are unacceptable risks to ecological or human health receptors.
27	Sludge Drying Beds	None[2]	Groundwater: Although PALs were not exceeded, PFAS were detected in the groundwater. Therefore, additional groundwater sampling is proposed to better define potential groundwater impacts both vertically and horizontally through the sampling of existing and additional new monitoring wells.
28	IRP Site 9- Sludge Application Area	None[2]	Soil: Although PALs were not exceeded, PFAS were detected in soil samples. Therefore, additional surface and subsurface soil samples are proposed to determine if an unidentified source exists and if so, to determine the nature and extent in the vertical and horizontal directions given the potential for soil to groundwater migration.
General			Groundwater: (1) Collect additional groundwater samples in upgradient locations to quantify potential impacts from upgradient sources; (2) collect additional groundwater samples off-base from a limited number of new monitoring wells to determine if PFAS impacts beyond the base boundary are increasing or decreasing.

Note:

1 PFOS and PFOA were not detected at the PRL; however, the analytical results were above the screening criteria and the combined value of the non-detect reported value for PFOS + PFOA was above the PAL.

2 The combined value of PFOS + PFOA was less than the PAL.

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1. Introduction

Under contract to National Guard Bureau, Operations Division, Restoration Branch (NGB/A4OR), AECOM has prepared this Site Inspection (SI) Report to document the per- and polyfluoroalkyl substances (PFAS) focused field activities. Twenty-eight potential release locations (PRLs) were identified and of those 28 locations, 25 were recommended for additional investigation by the Air National Guard (ANG) at Selfridge Air National Guard Base (ANGB) (base), 127th Wing in Macomb County, Mt. Clemens, Michigan. **Figure 1-1**, located in **Appendix A,** provides a general location map for Selfridge ANGB.

The SI, which follows the Preliminary Assessment (PA) in the Comprehensive Environmental Response, Compensation, and Liability Act process, is not intended as a full-scale study of the nature and extent of contamination. The United States Environmental Protection Agency (US EPA) identifies the SI as the on-site inspection to determine what hazardous substances are present and if they are being released to the environment. Its purpose is to augment the data collected in the PA and to generate, if necessary, sampling and other field data to determine if further response action or remedial investigation is appropriate.

A detailed description of the field procedures and scope of work that was intended to be performed during this SI is included in the Final SI Work Plan (WP) (AECOM, 2017). Field activities for the SI were conducted between December 2017 and June 2018. This SI Report presents the analytical results of the soil, groundwater, surface water, and sediment sampling. Finally, it provides conclusions and recommendations based on the results of the SI.

1.1 PFAS Overview

Perfluorinated compounds (PFCs), which are more recently referred to as PFAS, comprise a diverse group of synthetic chemicals used for over 50 years in various military and industrial applications and consumer products. The term “PFAS” will be used hereafter throughout the SI report when referring to “PFCs”. PFAS are detected in aqueous film-forming foams (AFFF) used for firefighting and fire suppression systems (FSS) starting in the 1970s. Sources of PFAS used by military and commercial airports can include: firefighting training areas (FTAs), nozzle test areas (NTAs), hangars and other buildings equipped with fire suppression equipment, fire stations, AFFF loading, handling and storage areas, aircraft and vehicle crash response areas, and AFFF ponds, sumps, tanks, landfills and/or other areas of disposal. The United States Air Force (USAF) estimates PFAS-containing AFFF may have been used at approximately 200 active and former USAF bases, including ANG and USAF Reserve facilities.

Properties of some PFAS that were analyzed for in this SI include:

- Limited sorption to soil and sediments
- Highly water soluble, non-volatile and extremely mobile in water
- Exceptional stability
- Persistent with very little natural attenuation
- Widely present in the environment, bioaccumulative, and detected in plants, many animals, and humans

Potential health effects are based on toxicological data that is generally limited for most PFAS with the exception of a few more highly studied compounds. The C8 Science Panel identified the following probable links to Perfluorooctanoic acid (PFOA) exposures (C8 Science Panel, 2018):

- Ulcerative colitis
- Thyroid disease
- Testicular and kidney cancer
- Pregnancy-induced hypertension
- Diagnosed high cholesterol

Concerns associated with PFAS prompted the US EPA to include six PFAS on its third Unregulated Contaminant Monitoring Rule (UCMR-3) that required sampling for PFAS in many large public water systems (US EPA, 2012). This sampling resulted in the discovery of impacted drinking water supplies, several linked to Department of Defense (DoD) and commercial airport sites.

The State of Michigan Department of Environmental Quality (MDEQ) has established statutory action levels for Perfluoro-octanesulfonate (PFOS) and PFOA in groundwater and surface water (MDEQ, 2018a,b). For Perfluorobutanesulfonate (PFBS), the US EPA tapwater regional screening level (RSL) was selected as the project action level (PAL) and was used for screening groundwater and surface water (US EPA, 2018). MDEQ has not established direct contact soil screening levels for these compounds; therefore US EPA residential soil direct contact RSLs were calculated for PFOS, PFOA, and PFBS that are protective of a residential receptor and a target hazard quotient (THQ) equal to 1.0 (US EPA, 2018). The other three compounds included in the UCMR-3 are Perfluoroheptanoic acid (PFHpA), Perfluorohexanesulfonate (PFHxS), and Perfluorononanoic acid (PFNA). Since there is no state or federal criteria for these compounds, there are no PALs to use for screening these compounds. See Section 2.3 for additional discussion of the regulatory framework.

1.2 Scope and Objectives

The objectives for the SI are to: (1) determine the presence or absence of PFAS in soil, surface water, and/or sediment at 25 PRLs and in groundwater immediately downgradient of each PRL, (2) assess if PFAS from the base are migrating off-base, and (3) determine if the concentrations of PFAS at each PRL are present in quantities or concentrations that warrant no further action (NFA) or additional investigation as part of the Expanded SI or Remedial Investigation / Feasibility Study phase, and if so, what the appropriate data quality objectives (DQOs) should be. The scope of work included the completion of soil borings and groundwater monitoring wells, and the collection of soil and groundwater samples, and sediment and surface water samples to evaluate the presence or absence of SI chemicals of potential concern (COPCs).

1.3 Report Organization

This SI Report is organized into the following eight sections:

- Section 1, Introduction
- Section 2, Base Description
- Section 3, Environmental Setting
- Section 4, Investigation Activities
- Section 5, Site Inspection Results
- Section 6, Analysis of Results
- Section 7, Conclusions and Recommendations
- Section 8, References

2. Base Description

2.1 Site History

Prior to 1900s, the property on which the Selfridge ANGB is located was covered in marshlands. In 1916, Henry B. Joy of Packard Motor Car Company purchased the land and began developing 600 acres into an airfield on which the company began building and testing engines used for aircraft engaged in World War I combat in Europe.

In May 1917, three months after the United States entered World War I, the Joy Aviation Field (640 acres) was leased to the government and officially activated as a military installation named Selfridge Field to be utilized as a training camp. The first aircraft, a Curtiss JN-4D, arrived at the new airfield in July of 1917 and the base began to train men in flying, bombing, radio, and photography for the war effort.

In 1918, Selfridge Field was converted into an aerial gunnery school. After the end of World War I, the base changed its missions from training field to a pursuit (fighter) field, becoming the 1st Pursuit Group. In 1921, the Army officially purchased the site, and Selfridge Field was declared a permanent military post in 1922 (AMEC, 2016).

During the years leading up to World War II, the Army acquired land along the lakefront, built a seawall, and upgraded and added to the drainage system, and created a permanent housing community. During World War II the base was expanded by 2,224 acres, and in 1947, the United States Army transferred control of the base to the newly formed USAF, at which point, the installation became known as the Selfridge Air Force Base. The Air Force transferred the land to the Michigan Air National Guard in 1971, and the base became Selfridge ANGB. In 1992, the unit was re-designated the 127th Fighter. Unit members began flying F-16C and F-16D fighters in 1994. In April 1996, the unit was re-designated the 127th Wing of the Michigan Air National Guard, a combined Air Combat Command (ACC) and Air Mobility Command (AMC) organization that was established by consolidating the former 127th Fighter Wing and the 191st Airlift Group. The 107th Fighter Squadron flies the A-10C Thunderbolt II (A-10 Warthog) assigned to Selfridge ANGB. The AMC 127th Airlift Group was re-designated the 127th Air Refueling Group and its 171st Air Refueling Squadron now flies the KC-135T Stratotanker supporting the Selfridge ANGB mission.

Due to its operational history, personnel of the Selfridge ANGB have engaged in various activities, which required the use, dispensing, and storage, of AFFF. Throughout the past, AFFF may have entered the environment through accidental spills, leaks in supply piping, maintenance operations, storage and disposal, extinguishing staged fires during fire training exercises, and the cumulative effects of operations conducted at the ANGB's flight line and industrial area.

2.2 PRL History

PFAS focused investigations have not been completed at Selfridge ANGB. As mentioned in **Section 1**, a basewide PA was conducted at Selfridge ANGB in 2016 to assess known and potential releases of PFAS at various areas known to have stored or released AFFF or other PFAS containing products (BB&E, 2016). The PA Report included assessments of sites to determine if there was sufficient information to indicate if a potential release of PFAS could impact human health and the environment.

As part of the PA Report, a total of 28 PRLs were identified and of those 28 locations, the ANG determined that further investigation was warranted at 25 PRLs to provide consistency within the ANG program in evaluating potential PFAS releases. PRLs 2, 3 and 19 did not warrant further investigation and are not discussed in this report (BB&E, 2016). **Figure 2-1** provides the locations for each of these 25 PRLs. Brief histories associated with PFAS usage at the PRLs are provided below.

2.2.1 Site 2 - Fire Training Area #2 (PRL 1)

Installation Restoration Program (IRP) Site 2 was an FTA including approximately 4 acres of land located northwest of Taxiway C in the southwestern part of the base. The FTA was an unlined pit, excavated to a depth of 1 to 1.5 feet (ft) below ground surface (bgs) and filled with flammable debris. According to the PA Site Visit Report, FTA #2 was used for 8 to 12 fires per year beginning in 1964 and continuing until December 1989 (BB&E, 2016).

In 2004, remedial activities were conducted at the FTA which included the removal of 7,926 tons of soil impacted by volatile organic compounds (VOCs) and metals. MDEQ concurred with a NFA designation in a letter dated 25 January 2007. During the 2016 PA site visit, base personnel reported that AFFF was utilized at the site, but the exact quantity was unknown. The site was never tested for presence of PFAS (BB&E, 2016).

2.2.2 Building 154 – Fuel System Repair (PRL 4)

Building 154 was constructed in 1991 and used as a maintenance facility for aircraft fuel systems. The building was equipped with an AFFF FSS, consisting of an overhead system connected to underwing cannons and hose reels. During the 2016 PA site visit, AFFF was stored in a 300-gallon above ground storage tank (AST), in 55-gallon drums, and 5-gallon pails, all housed in the mechanical room. Since the PA site visit, the AFFF 55-gallon drums and 5-gallon pails were removed from Building 154 mechanical room and properly disposed in September 2018. Squat tanks connected to the hose reels hold approximately 10 to 15 gallons of AFFF. Base personnel could not confirm whether the drains in the mechanical room lead to an oil/water separator (OWS) prior to the sanitary sewer system. Trench drains were located throughout the hangar bay that lead to the sanitary sewer system through the OWS. In addition, the PA Site Visit Report noted that no known testing has been completed on the FSS, and no known releases have occurred within the building (BB&E, 2016).

2.2.3 Building 1401 – USCG Hangar (PRL 5)

Building 1401 was constructed in 1965 and is currently occupied by the United States Coast Guard (USCG) for helicopter maintenance and storage. As noted during the 2016 PA site visit, the hangar was equipped with an AFFF FSS and AFFF was stored in two 400-gallon ASTs in the mechanical room. The floor drains within the mechanical room lead to the sanitary sewer system. Trench drains located throughout the hangar bay lead to the sanitary sewer system through an OWS. No known testing has been conducted on the FSS. As of the 2016 site visit, no known releases had occurred at Building 1401 (BB&E, 2016).

2.2.4 Building 1461 – USCG Hangar (PRL 6)

Building 1461 was constructed in 2002 and is utilized by the USCG for helicopter maintenance and storage. The hangar is equipped with an AFFF FSS. As noted during the March 2016 PA site visit, AFFF was stored in two 350-gallon ASTs in the mechanical room. The floor drain within the mechanical room leads to the sanitary sewer system. Trench drains located throughout the hangar bay lead to the sanitary sewer system through an OWS. As of the 2016 PA site visit, no known testing has been conducted on the FSS and no known releases had occurred at Building 1461 (BB&E, 2016).

2.2.5 Building 1416 – Army National Guard Hangar (PRL 7)

Building 1416 was constructed in 1981 and was utilized by the Army National Guard for helicopter storage and maintenance (BB&E, 2016). The hangar is equipped with an AFFF FSS which consists of an overhead system and underwing cannons. The underwing cannons are not connected to the AFFF FSS. During the March 2016 PA site visit, AFFF was stored in two 1,500-gallon ASTs. There were also two 600-gallon ASTs that could contain AFFF but had never been activated. Building 1416 is equipped with floor trench drains in the main hangar area which lead to the sanitary sewer system through an OWS. A floor drain is located in the FSS room and leads to the sanitary sewer system. As of the 2016 PA site visit, no

known testing has been completed on the FSS and no known releases had occurred at Building 1416 (BB&E, 2016).

2.2.6 Building 1422 – DHS Hangar (PRL 8)

Building 1422 was constructed in 1985 and is used by the Department of Homeland Security (DHS) for aircraft maintenance and storage. Building 1422 is equipped with an AFFF FSS which consists of two 1,500-gallon ASTs within the mechanical room. The floor drain in the mechanical room likely leads directly to the sanitary sewer system. Trench drains located throughout the hangar floor discharge to the sanitary sewer system through an OWS. As of the March 2016 PA site visit, no known testing using AFFF has been completed on the FSS and no known releases have occurred at Building 1422. It was reported that the system was tested with water during hangar renovations (BB&E, 2016).

2.2.7 Building 1436 – DHS Hangar (PRL 9)

Building 1436 was constructed in 1982 and as of the PA site visit in March 2016, is currently utilized by the DHS for aircraft maintenance and storage. The building is equipped with an AFFF FSS that is supplied by a 300-gallon AST. As noted in the PA Report, no known testing has been completed on the FSS; however, one known AFFF release occurred in 2008 when the fire panel short-circuited due to moisture triggering the FSS to discharge fully. Most of the AFFF was contained within the hangar and discharged to the floor trench drains which lead to an OWS and then the sanitary sewer system. Some AFFF may have escaped through the main hangar doors; however, due to the inclement weather at the time, it was reported that the high winds blew the AFFF back into the hangar (BB&E, 2016).

2.2.8 Building 859 – Fire Department (PRL 10)

Building 859 is the current Fire Department (FD), which was constructed in 2001. As of the March 2016 PA site visit, AFFF is stored within firefighting vehicles, in 55-gallon drums, and 5-gallon pails inside the FD. Twenty-six 55-gallon drums and five 5-gallon pails of AFFF were stored within the storage area at the FD. Vehicles are gravity or pump filled from the drums, pails, or the foam trailer within the FD. Trench drains are located throughout the FD bays and lead to the sanitary sewer system through an OWS (BB&E, 2016).

The PA Report also noted that empty AFFF drums were stored outside the north side of the FD near the dumpsters. It was reported that any AFFF disposed of off-site in the past was also stored outside to the north of the FD in the waste collection area. Vehicles are washed daily within the FD bays (BB&E, 2016).

Since the PA site visit, approximately 91,000 of pounds of legacy AFFF were removed from all Installation Fire/Crash Response Vehicles, and fire department stock and were replaced with USAF approved AFFF.

2.2.9 Building 501 – Former Wastewater Treatment Plant (PRL 11)

Building 501 was utilized as the base wastewater treatment plant (WWTP) from construction in 1941 until 1971. The WWTP was the last collection point of all sanitary sewer wastewater from the base. The plant consisted of a treatment building and concrete holding basins that are no longer utilized. Any AFFF that might have entered the sanitary sewer system on base would come through Building 501 (BB&E, 2016). The base no longer has a wastewater treatment plant and has a contract with Harrison Township to discharge base sanitary flow into their system for treatment at the Great Lakes Water Authority wastewater treatment plant.

2.2.10 Nozzle Testing Area (PRL 12)

According to the 2016 PA Report, nozzle testing of AFFF was reported to have been conducted one time per year from 1987 until 2015 on the asphalt Mike Taxiway. The AFFF would be allowed to dissipate naturally and may have impacted the grassy area adjacent to the unused Mike Taxiway. According to the 2016 PA Report, the quantity of AFFF discharged during each test was unknown (BB&E, 2016).

2.2.11 C16 – AOC (PRL 13)

In 1993, an F-16 airplane crashed in a flat, open, grassy area east of Taxiway B and southwest of Building 563. During the crash, the aircraft overturned, spilled fuel, and burned. In 2003, remedial investigation activities were conducted at the PRL impacted by VOCs, semivolatile organic compounds (SVOCs), and metals. MDEQ concurred with a NFA designation in a letter dated 27 April 2006. The PRL was never tested for presence of PFAS. The 2016 PA report stated that the use of AFFF during response activities was assumed, but could not be confirmed. The topography is very flat and access to this PRL is limited due to the adjacent primary runway and taxiways (BB&E, 2016).

2.2.12 CRF – AOC (PRL 14)

In 1971, a RF-101 aircraft overturned, spilled fuel, and burned in a flat, open, grassy area northeast of the intersection of the North-South Runway and Taxiway L. In 2003, remedial investigation activities were conducted at the AOC impacted by VOCs, SVOCs, and metals. MDEQ concurred with a NFA designation in a letter dated 27 April 2006. The site was never tested for presence of PFAS. The 2016 PA Report stated that the use of AFFF during response activities was assumed, but could not be confirmed (BB&E, 2016).

2.2.13 East Ramp (PRL 15)

The East Ramp is a concrete apron used for aircraft parking and minor maintenance activities. Stormwater catch basins are located throughout the East Ramp and lead to Wet Wells/Drainage Basin 340 (PRL 20) and Wet Well/Drainage Basin 508 (PRL 22). Several investigation activities were conducted at IRP Site 7 – East Ramp impacted by total petroleum hydrocarbons (TPH) and VOCs. MDEQ concurred with a NFA designation in a letter dated 20 June 2003. The site was never tested for presence of PFAS. The 2016 PA Report noted that although there have been no reports of AFFF releases on the East Ramp, it is adjacent to the Former Building 33 – Fire Department (PRL 17) and Building 154 – Fuel System Repair (PRL 4) and may have been impacted by AFFF, due to historical presence of aircraft (BB&E, 2016).

2.2.14 West Ramp (PRL 16)

The West Ramp consists of a concrete apron which is utilized for aircraft parking and minor maintenance activities. Stormwater catch basins are located throughout the West Ramp and lead to Wet Well/Drainage Basin 990 (PRL 24). Several investigation activities were conducted at IRP Site 4 – West Ramp impacted by TPH and VOCs. MDEQ concurred with a NFA designation in a letter dated 24 June 2003. The site was never tested for presence of PFAS. The 2016 PA Report noted that although there have been no reports of AFFF releases on the West Ramp, it is adjacent to the Former Building 33 – Fire Department (PRL 17) and Building 1422 – DHS Hangar (PRL 8) and may have been impacted by AFFF used at these buildings (BB&E, 2016).

2.2.15 Former Building 33 – Fire Department (PRL 17)

Former Building 33 was used as the FD at the base from 1951 until 2001 when the current FD was constructed. Former Building 33 was demolished prior to 2006. The 2016 PA Report noted that AFFF was stored in 55-gallon drums, pails and firefighting vehicles. The 2016 PA Report also noted that floor drains in Former Building 33 lead to the stormwater system and Wet Well/Drainage Basin 340 (PRL 20). No known releases of AFFF have been reported (BB&E, 2016).

2.2.16 Former Building 176 – Vehicle Maintenance (PRL 18)

Former Building 176 was used for vehicle maintenance activities from construction in 1942 until it was demolished prior to 2006 and the area was paved over. During maintenance on a firefighting vehicle, AFFF was released in the Former Building 176 and discharged to both the sanitary and stormwater sewer

systems, Wet Well/Drainage Basin 980 (PRL 23). The exact quantity of AFFF released is unknown (BB&E, 2016).

2.2.17 Wet Well/Drainage Basin 340 (PRL 20)

Drainage Basin 340 discharges directly to Lake St. Clair through Outfall 003A. Outfall 003A is constructed of corrugated steel and the wet well is one of the current stormwater compliance sampling points. A combination of drainage ditches and underground pipes carry stormwater to a lift station (wet well) located on the southeastern border of the base. AFFF usage within the drainage basin includes Former Building 33 – Fire Department (PRL17), East Ramp (PRL 15), and Building 154 – Fuel Cell Maintenance (PRL 4) (BB&E, 2016).

2.2.18 Wet Well/Drainage Basin 507 (PRL 21)

Drainage Basin 507 discharges through Outfall 001A to the south to the Clinton River, which flows east into Lake St. Clair. Outfall 001A is built of reinforced concrete and the wet well is one of the current stormwater compliance sampling points. A combination of drainage ditches and underground pipes carry stormwater to a lift station (wet well) located on the southwestern border of the base. AFFF usage within the drainage basin includes FTA #2 (PRL 1), Nozzle Testing Area (PRL 12), and Aircraft Crash Sites (PRL 25) (BB&E, 2016).

2.2.19 Wet Well/Drainage Basin 508 (PRL 22)

Drainage Basin 508 discharges south through Outfall 002A to the Clinton River, which flows east into Lake St. Clair. Outfall 002A is constructed of reinforced concrete and the wet well is one of the current stormwater compliance sampling points. A combination of drainage ditches and underground pipes carry stormwater to a lift station (wet well) located on the south-central border of the base. AFFF usage within the drainage basin includes Building 859 – Fire Department (PRL 10), Building 501 – Former WWTP (PRL 11), Nozzle Testing Area (PRL 12), CRF-AOC (PRL 14), East Ramp (PRL 15), Aircraft Crash Sites (PRL 25), Sludge Drying Beds (PRL 27), and IRP Site 9 – Sludge Activation Areas (PRL 28) (BB&E, 2016).

2.2.20 Wet Well/Drainage Basin 980 (PRL 23)

The outfall associated with Wet Well/Drainage Basin 980 is designated as Outfall 004A. Outfall 004A is corrugated steel. The wet well is one of the current stormwater compliance sampling points. A combination of drainage ditches and underground pipes carry stormwater to a lift station (wet well) located on the eastern border of the base. Drainage Basin 980 discharges directly into Lake St. Clair. AFFF usage within the drainage basin includes Former Building 176 – Vehicle Maintenance (PRL 18) (BB&E, 2016).

2.2.21 Wet Well/Drainage Basin 990 (PRL 24)

Drainage Basin 990 discharges through Outfall 005A directly into Lake St. Clair. Outfall 005A is constructed of corrugated steel and the wet well is one of the current stormwater compliance sampling points. A combination of drainage ditches and underground pipes carry stormwater to a lift station (wet well) located on the northeastern border of the base. AFFF usage within the drainage basin includes West Ramp (PRL 16), Building 1401 – USCG Hangar (PRL 5), Building 1461 – USCG Hangar (PRL 6), Building 1416 – ANG Hangar (PRL 7), Building 1422 – DHS Hangar (PRL 8), Building 1436 – DHS Hangar (PRL 9), C16-AOC (PRL 13), CRF-AOC (PRL 14), and Aircraft Crash Sites (PRL 25) (BB&E, 2016).

2.2.22 Aircraft Crash Sites (PRL 25)

Between 1970 and 2004, eleven aircraft crashes may have impacted base property along the flightline; however, the actual crash locations, other than for C16-AOC (PRL 13) and CRF-AOC (PRL 14) were not

available at the time of the PA site visit in 2016. It is also unknown if AFFF was utilized in firefighting response activities (BB&E, 2016)

2.2.23 Drainage Basin 1420/Outfall 006A (PRL 26)

Drainage Basin 1420 discharges through Outfall 006A into the Irwin Drain, which flows north and then east and ultimately discharges into Lake St. Clair, one of the current stormwater compliance sampling points. Outfall 006A is constructed of corrugated steel and is located at the Petroleum, Oil, and Lubricant Management Facility on the western edge of the base. A combination of drainage ditches and underground pipes carries stormwater to the Irwin Drain via gravity flow, north of the Petroleum, Oil, and Lubricant Management Facility. According to base personnel interviewed during the March 2016 PA site visit, the unnamed tributary of the Irwin Drain is a ditch located on base property (BB&E, 2016).

2.2.24 Sludge Drying Beds (PRL 27)

The Sludge Drying Beds are located on the southeast portion of the base, immediately east of Building 501 – Former Wastewater Treatment Plant (PRL 11). Sludge from the Former WWTP (PRL 11) was allowed to dry in this area prior to be relocated to the Sludge Application Area (IRP Site 9). Sludge Drying Beds were utilized until the WWTP treatment activities ended in 1971. In 2005, remedial activities were conducted at the IRP Site 34 – Sludge Drying Beds which included the removal of 1,389 cubic yards of soil impacted by VOCs and metals. MDEQ concurred with a NFA designation in a letter dated 29 January 2007. The site was never tested for the presence of PFAS (BB&E, 2016).

2.2.25 IRP Site 9 – Sludge Application Area (PRL 28)

IRP Site 9 – Sludge Application Area, is located on the southeast portion of the base. The area was used from 1941 to 1977 to dispose of anaerobically digested sludge from Building 501 – WWTP (PRL 27) through land application. The sludge applications area has been investigated under the IRP and MDEQ concurred with a NFA letter dated 20 June 2003; however, the site was never tested for PFAS (BB&E, 2016).

2.3 Regulatory Framework

PFAS are not currently regulated at the federal level; however, PFOS and PFOA in groundwater and surface water are regulated by the MDEQ. MDEQ has adopted the US EPA Lifetime Health Advisory (HA) levels for PFOS and PFOA to protect against potential risk from exposure to these compounds via drinking water (MDEQ 2018a). For PFBS, the US EPA has established a tapwater RSL that is protective of the drinking water exposure pathway for a residential receptor (US EPA, 2018). The MDEQ has established Water Quality Standards (WQS) that are protective of surface waters for both drinking water and non-drinking water sources. The WQS for drinking water is 11 ng/L and the WQS for non-drinking water sources is 12 ng/L for PFOS. For PFOA, the WQS for drinking water and non-drinking water sources are 420 ng/L and 12,000 ng/L, respectively. The Wet Wells/Drainage Basins 340 (PRL 20), 980 (PRL 23), and 990 (PRL 24) are all located on shore of Lake St. Clair, which is a drinking water source. The Wet Wells/Drainage Basins 507 (PRL 21) and 508 (PRL 22) are located on the Clinton River, which is not a drinking water source but does discharge to Lake St. Clair. Since municipal drinking water is obtained from Lake St. Clair, the WQS for drinking water (11 ng/L) was selected to conservatively screen all surface water that is discharging from Selfridge ANGB.

MDEQ has not developed direct contact soil screening levels; therefore the US EPA RSL calculator was used to derive direct contact soil screening levels for PFOA, PFOS, and PFBS (US EPA, 2018).

These values were considered in establishing the PALs that are provided in Appendix C, Laboratory Quality Assurance Project Plan in the Final SI WP (AECOM, 2017). The purpose of the PAL is to select an analytical laboratory method that can provide accurate data (i.e., quantitative results with known precision and bias) that is protective of regulatory limits (e.g., the drinking water HAs and MDEQ WQS) and risk-

based screening criteria (e.g., RSLs) to define the presence or absence of PFAS to the best extent practicable. There are no PALs for PFHpA, PFHxS, or PFNA.

The PALs for PFOS, PFOA, and PFBS include:

- Groundwater:
  - PFOS and PFOA: A PAL of 70 nanograms per liter (ng/L) was promulgated in 2018 by the State of Michigan for PFOS and PFOA; the individual and combined concentrations of PFOA and PFOS are also compared with the 70 ng/L PAL (MDEQ, 2018a).
  - PFBS: A PAL of 400,000 ng/L was developed for PFBS utilizing the US EPA tapwater RSLs most recently updated in May 2018, using a THQ equal to 1.0 (US EPA, 2018).
- Soil
  - PFOS and PFOA: PALs of 1,260 nanograms per gram (ng/g) for both PFOS and PFOA were conservatively developed using the US EPA RSL calculator (May 2018 version). The calculated PALs were derived using a THQ equal to 1.0 and are protective of a residential receptor coming into direct contact with soil (i.e., incidental ingestion of soil, dermal contact and outdoor inhalation of particulates) (US EPA 2018).
  - PFBS: A PAL of 1.26×10^6 ng/g was conservatively developed using the US EPA RSL calculator (May 2018 version). The calculated PAL was derived using a THQ equal to 1.0 and is protective of a residential receptor coming into direct contact with soil (i.e., incidental ingestion of soil, dermal contact and outdoor inhalation of particulates) (US EPA, 2018). US EPA does provide a generic residential direct contact soil RSL of 1.30×10^6 ng/g dated May 2018 (US EPA 2018). However, the ANGBs around the country have chosen to use the more stringent, calculated RSL for screening PFBS.
- Surface Water:
  - PFOS and PFOA: WQS were obtained from the June 2018 Table 1 Residential and Nonresidential Groundwater Criteria by the State of Michigan after the SI WP was finalized and were set at 11 ng/L for PFOS and 420 ng/L for PFOA for surface waters that are used for drinking water (MDEQ, 2018a). Lake St. Clair, which is adjacent to the base, is a drinking water source and receives stormwater runoff from the base. The most conservative MDEQ surface water screening criteria were selected even though the base-specific National Pollutant Discharge Elimination System permitted discharges for the Clinton River (also adjacent to the base) uses the non-source drinking water MDEQ surface water screening criteria for PFOS (12 ng/L) and PFOA (12,0000 ng/L).
  - PFBS: The State of Michigan has not promulgated a surface water screening level for PFBS; therefore, the surface water PAL is equivalent to the groundwater PAL, defined above.
- Sediment:
  - PFOS, PFOA, and PFBS: PALs were not specifically defined for sediment in the WP (AECOM, 2017), and there are no federal or state sediment-specific screening criteria readily available. For purposes of this SI Report, the sediment PALs are equivalent to the soil PALs, defined above. Where multiple criteria exist, the more conservative screening value was used. The PAL for each COPC by media is presented below.

Analyte	Groundwater (ng/L)	Soil and Sediment (ng/g)	Surface Water (ng/L)
PFOS	70	1,260	11
PFOA	70	1,260	420
PFOS+PFOA	70	Not applicable (NA)	NA
PFBS	400,000	1.26×10^6	400,000

Analytical data are compared to these PALs and included in **Appendix B.**

3. Environmental Setting

This section describes the topography and site conditions for Selfridge ANGB.

3.1 Site Topography and Drainage

Selfridge ANGB is located approximately 30 miles north of Detroit and approximately two miles east of the City of Mount Clemens, in Macomb County, Michigan. The base is directly adjacent to Lake St. Clair along the southwestern shoreline of Anchor Bay and on the north bank of the Clinton River. The topography of the base is relatively flat with a gradual downward slope to the east. Surface elevations range from greater than 590 ft above mean sea level (amsl) near the western property border, to 570 ft amsl where the base eastern property boundary adjoins Lake St. Clair (AMEC, 2016).

The natural drainage of the base is generally to the east, ultimately into Lake St. Clair either naturally or via a series of lift stations operated by the ANGB, which pump storm water to Lake St. Clair and the Clinton River. Surface water drainage is generally poor due to the relatively flat surface and poorly drained soils that occur across the base.

3.2 Site Geology/Hydrogeology

The southeast corner of Michigan is geologically composed of an array of glacial deposits overlying Silurian to Mississippian-age sedimentary rocks. The geology beneath the base consists of glacial lake sediments made up of clays and silts deposited during the Wisconsin Glaciation period. The glacial lake sediments overlie Upper Devonian age Antrim Shale (Milstein, 1987). The groundwater table at Selfridge ANGB fluctuates based on seasonal variations in precipitation and also corresponds to water level fluctuations in both Lake St. Clair and the Clinton River. Groundwater generally flows east across the base to Lake St. Clair, but is influenced by the fluctuations previously referred to and can vary by PRL (BB&E, 2005). The hydrogeology at Selfridge ANGB generally consists of water producing sand and gravel lenses within the clay unit as shallow as 2 and 6 ft bgs.

Four main soil types at Selfridge ANGB have been mapped by the United States Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS) (USDA NRCS, 2013). The soil types primarily present at the areas of the base include:

- Udorthents (EtmaaE) ~53.2% of the base – nearly level, well drained.
- Lamson fine sandy loam (La) ~16.5% of the base – 0 to 2 percent slopes, poorly drained
- Paulding Clay (Pc) ~13.9% of the base – 0 to 1 percent slopes, very poorly drained
- Minoa fine sandy loam (MsB) ~3.3% of the base – 0 to 4 percent slopes, somewhat poorly drained

Udorthents comprises most of the base which consists of well-drained soils that have been mixed by land leveling, filling, or excavation. The Lamson fine sandy loam, generally found in the southwest portion of the base, consists of very deep, poorly drained and very poorly drained soils formed in glacio-fluvial, glacio-lacustrine and deltaic deposits. The saturated hydraulic conductivity of the Lamson series is moderately high through high in the mineral soil (National Cooperative Soil Survey, 2012). The Paulding Clay, generally located west-central and east-central of the airfield, consists of very deep, very poorly drained soils that are moderately deep or deep to dense clayey lacustrine material formed in clayey glaciolacustrine deposits. The saturated hydraulic conductivity of the Paulding Series is low in the subsoil and very low in the substratum (National Cooperative Soil Survey, 2014). The Minoa fine sandy loam, generally found in the south and southeast of the base, largely making up the soils of IRP Site 9 (PRL 28), consists of very deep, somewhat poorly drained soils formed in deltaic sediments. Permeability is moderate in the solum, and moderate or moderately rapid in the substratum (National Cooperative Soil Survey, 2011).

3.3 Critical Habitat and Threatened/Endangered Species

Lake St. Clair is one of Michigan's important natural resources and is vital for its ecological role locally and along the Great Lakes. The lake provides an essential habitat for a number of fish, birds, and other wildlife. Marshes and mudflats along the shoreline of the lake contribute nutrients and energy to the local and regional food web. Lake St. Clair's diverse combination of ecological, scenic, and cultural resources makes it a major recreational and economic resource for the region.

A state-protected wetland is located adjacent to the southeast corner of Selfridge ANGB. A number of other areas within the boundaries of Selfridge ANGB also qualify as wetlands according to wetland delineation surveys (ANG, 2013)

The following mammals and reptiles are federally endangered, threatened, proposed, and/or are listed as candidate species in the vicinity of Selfridge ANGB, Macomb County, Michigan (United States Fish and Wildlife Service, 2017):

- Indiana Bat (Endangered)
- Northern Long-Eared Bat (Threatened)
- Eastern Massasauga Rattlesnake (Threatened)
- Red knot (Threatened)

Critical habitats for these species have not been identified on the base.

3.4 Potential Receptors

3.4.1 Groundwater

Potential human exposure pathways related to groundwater are the use of any drinking water wells and irrigation wells for public or private water supply or irrigation purposes.

An EDR DataMap™ Well Search Report was prepared on 15 December 2015 as part of the PA Report and showed 24 water wells within a one-mile radius of the Selfridge ANGB as listed in the United States Geological Survey (USGS) and MDEQ Well Databases. One of these wells is reported as a USGS well and 23 wells are listed as a household or state water wells. No public water supply system wells were identified. Three oil and gas wells are also listed within one mile of the Selfridge ANGB. The 2016 PA reported no drinking water wells are located on Selfridge ANGB and water is supplied through the local municipality supplier, the City of Mount Clemens. Macomb County Health Department has specific regulations preventing potable water well installation unless authorized by the county department. Additionally, Selfridge ANGB land-use controls prevent groundwater use on-site (BB&E, 2016).

Depth to groundwater was measured at 37 monitoring wells as part of the SI. Depth to groundwater varies from near surface to 12 ft bgs (See **Table 3-1**) and generally flows to the north-northeast (See **Figure 3-1**). Depths to groundwater were measured prior to sampling the wells over a four month period. Therefore, seasonal and tidal changes likely influenced the potentiometric map. It is recommended that a comprehensive basewide depth to groundwater sampling event be conducted to confirm the basewide groundwater flow.

3.4.2 Surface Water and Sediment

The hydrology of Selfridge ANGB is largely influenced by its close proximity to Lake St. Clair and the Clinton River. The elevation of Selfridge ANGB is lower than the lake which can result in hydraulic connection between surface water and groundwater. Surface water drainage is generally poor due to the relatively flat surface and the poorly drained soils at the base; surface water flows into drainage ditches near or adjacent to the Perimeter Road along the northern, western and southern base boundaries and collected in a stormwater drainage network. Most of the stormwater flows into five wet wells located along the east and southern perimeter of the base that discharge into the Clinton River or Lake St. Clair by

pump/lift stations (Selfridge ANGB, 2015). The remaining stormwater flows into an outfall at the western side of the base, which discharges to Seven acres of the southern boundary of the Selfridge ANGB is located within the 100-year floodplain of the Clinton River (BB&E, 2016).

The surface water on-base is not used as a primary source of drinking water or for recreational activities so humans have limited exposure to surface water while working at or near the drainage ditches or pump/lift stations. However, Lake St. Clair is the primary drinking water source for the population around Selfridge ANGB and is also used for recreational activities such as boating, fishing, and paddle sports. As stated in **Section 3.3**, critical habitats have not been identified on the base. Ecological receptors are more likely to find water and food in the adjacent wetlands and Lake St. Clair which provide a more attractive ecological habitat.

3.4.3 Soil

Humans may be exposed to surface and sub-surface soils during routine activities or during construction and excavation activities. Ecological receptors may also be exposed to soils if sufficient habitat is present to support or attract terrestrial flora and fauna including burrowing animals.

Selfridge ANGB is currently zoned as Industrial. The base includes paved and landscaped areas and as such, there are limited pathways to soil and air migration from disturbed soils under normal operating conditions; however, during excavation, a worker could be exposed to soil and dust from soil.

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4. Investigation Activities

Field activities were completed to achieve the field objectives which were to determine the presence or absence of PFAS at Selfridge ANGB in various media and to determine if PFAS migrated off-base. The field activities were conducted between December 2017 and June of 2018, in accordance with the SI WP except as noted in **Section 4.10**.

4.1 Pre-Investigation Activities

4.1.1 Public and Selfridge ANGB Utility Clearance

Proper clearance was obtained prior to completing subsurface disturbance activities. On 30 November 2017, information was provided to Mr. Jason Cabra, Base Engineer, to facilitate the base utility clearance via Civil Engineering. The base utility clearance process also included a public utility clearance process via Michigan MISSDIG one-call system. The drilling subcontractor (Cascade Technical Services) also submitted a request for public utility clearance via Michigan MISSDIG on 1 December 2017. AECOM reviewed and finalized the boring locations on 4 December 2017.

4.1.2 Source Water

A sample of the potable water was collected on 25 October 2017 prior to starting drilling activities to confirm that this water was PFAS-free. The sample was analyzed for the six UCMR-3 PFAS and results indicated detectable levels of PFAS for PFOS (3 ng/L) and PFOA (2 ng/L). These levels are greater than ½ the limit of quantitation (LOQ) for PFOS and PFOA, which is the AECOM definition of PFAS-free water. The analytical results are provided in **Appendix D**. Even though the potable water contained PFAS at low levels, it was still used to remove debris from large equipment followed by a rinse with certified PFAS-free water supplied by the analytical laboratory, Eurofins Lancaster Laboratory Environmental LLC, for final decontamination. All other equipment and sampling tools were decontaminated solely with the certified PFAS-free water provided by the laboratory.

4.2 Environmental Investigation and Sampling

The SI sampling locations were based on historical data, potential source areas, and site conditions as observed during the site walk conducted during the Selfridge ANG SI kick-off meeting. The fieldwork commenced following utility clearance and Accident Prevention Plan review and documentation. The fieldwork occurred from 20 December 2017 through 5 June 2018 and included extensive boring activities and soil, groundwater, surface water, and sediment sampling.

All samples were collected into laboratory-supplied containers and submitted to the analytical laboratory for analysis of selected parameters. Samples were packaged on ice and transported daily via overnight commercial carrier under standard chain-of-custody procedures to the laboratory.

Quality control (QC) samples collected as part of the SI included field duplicates, matrix spike and matrix spike duplicate (MS/MSD) samples, and trip blanks. Field duplicates were collected at a rate of 10% with MS/MSD samples collected at the rate of 5%. QC samples were analyzed for the same parameters as the accompanying parent samples. Field reagent blanks accompanied each cooler containing samples for select PFAS analysis. A temperature blank was also placed in each cooler to check that samples were preserved at or below four degrees Celsius during shipment. All samples were analyzed for PFAS via US EPA Method 537 rev 1.1 modified.

The following samples were collected at Selfridge ANGB and analyzed for PFAS via US EPA Method 537 rev 1.1 modified to support the project objectives:

- Collection of 142 soil samples, plus 11 duplicate samples, from 72 soil boring locations;
- Collection of 37 groundwater samples, plus five duplicate samples, from new and existing monitoring wells downgradient from the PRLs and at the base boundary; and

- Collection of eight surface water samples and eight sediment samples.

Figure 4-1 provides the sample locations for all media across the entire base.

4.3 Soil Borings

Soil samples were collected via direct push technology (DPT). The soil cores were screened for VOCs with a photoionization detector (PID) immediately upon opening the liner. Lithology for each soil core was recorded on a soil boring log (See **Appendix C-1**). Recorded information included depth interval, recovery thickness, PID concentrations, moisture, relative density, color, texture, lithological descriptions, odors, groundwater or perched water depth, organic material, cultural debris, or color changes indicating staining. It should be noted that PFAS do not volatilize similar to VOCs or other gases; therefore, PID results are not necessarily indicative of the presence of PFAS. However, PID readings can be used to evaluate the presence of other potential contaminants which may have been released with PFAS, e.g., IRP Site 2 - FTA #2 (PRL 1) and Fuel System Repair (PRL 4). Additionally, other contaminants, e.g., VOCs, can impact the fate and transport of PFAS in soil and groundwater.

Two soil samples were collected from each boring, with the first sample collected from the surface to 1.0 ft bgs and the second from 4.0 to 5.0 ft bgs, in accordance with the WP. At locations where the borings targeted underground structures (tanks, oil water separators, drywells, etc.) the deep sample was collected near the bottom elevation of the structure. Most soil samples were collected from borings separate from the monitoring well locations as the soil boring locations were strategically positioned to maximize the potential for identifying “source” level releases of PFAS; whereas monitoring well locations were positioned to evaluate groundwater downgradient of the PRLs (and at the base boundary), and may not represent the highest concentrations in groundwater.

Following collection of the soil and groundwater samples, DPT boreholes were abandoned with bentonite and completed at ground surface with concrete or asphalt to match the existing surface.

4.4 Monitoring Well Installation/Groundwater Sampling

Permanent wells were installed using DPT and constructed of 10-ft sections of riser, 10-ft sections of 0.010-inch slotted well screen of 2-inch diameter Schedule 40 polyvinyl chloride with a threaded bottom cap. Monitoring wells were installed in accordance with US EPA guidance, and the *Environmental Restoration Program, Air National Guard Investigation Guidance (ANG, 2009)*. The well screens “straddled” the water table. A filter pack of 20/40 silica sand was installed in the annulus around the well screen to a minimum of 2-ft above the well screen. A 2-ft thick bentonite seal was placed above the filter sand and hydrated with distilled water. Bentonite grout was placed in the well annulus from the top of the bentonite seal to ground surface. The bentonite grout was allowed to set for a period of 24-hours prior to well completion. Following installation, the permanent wells were allowed to equilibrate with the surrounding formation until they contained a sufficient amount of water to fill the required sample containers. Soil generated during the sampling event was containerized in 55-gallon drums as investigation-derived waste (IDW) as discussed in **Section 4.9. Table 4-1** provides a summary of the monitoring well construction details for the 30 wells that were included in this SI. **Appendix C-1** includes boring logs and well construction diagrams for the new wells.

Newly installed groundwater monitoring wells were developed no sooner than 24-hours after installation and prior to collecting groundwater samples in order to remove fine soils from the bottom of each well and from the surrounding sand pack. Well development was completed in accordance with the SI WP and AECOM standard operating procedure (SOP) 3-13 “Monitoring Well Development”. **Appendix C-2** includes well development logs including water level, turbidity and flow rates. Water obtained during development was containerized in 55-gallon drums as IDW.

Groundwater samples were obtained from 30 new and seven existing monitoring wells. The six existing wells are located at the base boundary and monitoring well TU060, located near Building 1436 - DHS Hangar (PRL 8). Monitoring wells were purged with either a peristaltic or submersible bladder pump utilizing low-flow methods prior to sample collection in accordance with the SI WP and AECOM SOP 3-14

"Monitoring Well Sampling". Purge water was containerized in 55-gallon drums as IDW. New dedicated high-density polyethylene tubing was used at each well. Non-dedicated equipment was decontaminated in accordance with the SI WP. Equipment blanks were collected to monitor the potential for cross-contamination between wells. Field parameters including flow rate, depth to water, turbidity, temperature, specific conductivity, pH, dissolved oxygen, and oxidation-reduction potential were collected to ensure that the groundwater was stabilized prior to sample collection. Groundwater sampling logs are provided in **Appendix C-2**.

4.5 Surface Water and Sediment Sampling

Surface water and sediment samples were collected at five wet wells (PRL 20, PRL 21, PRL 22, PRL 23, and PRL 24) on 8 February 2018 and one outfall (PRL 26) on 13 April 2018. Samples were collected form the location where wet well discharged to drainage channels on the base. Per the SI WP, samples were collected within the base property boundary and in accordance with AECOM SOPs 3-10 "Stormwater Sampling" and 3-22 "Sediment Sampling". Samples were collected utilizing PFAS-free collection devices. No dry outfalls were encountered. For the samples collected on 8 February 2018, relevant meteorological data consisted of no precipitation during sample collection, 0.1 inches of snow within 24 hours, and another 0.3 inches of snow within 72 hours prior to sampling. For the samples collected on 13 April 2018, relevant meteorological data consisted of 0.1 inch of rain the day of sample collection, 0.12 inches of rain within 24 hours, and another 0.07 inches of rain within 72 hours prior to sampling. Sample logs are provided in **Appendix C-2**.

4.6 Potential Release Location Activities

The following sections describe the field activities at each PRL as well as groundwater monitoring activities at the base boundary wells. **Figure 4-1** provides the sample locations for all media across the entire base.

4.6.1 IRP Site 2 (Fire Training Area) (PRL 1)

Three borings (FTA2-SB01, FTA2-SB02, and FTA2-SB03) were advanced using DPT to 5 ft bgs and were completed on 15 March 2018. Two soil samples were collected from each boring: surface soil was collected from 0.0-1.0 ft bgs, and subsurface soil was collected from 4.0-5.0 ft bgs, in accordance with the SI WP. One groundwater well (FTA2-MW01) was advanced using DPT to 15 ft bgs at boring location FTA2-SB01 on 15 March 2018 and a groundwater sample was collected on 12 April 2018.

4.6.2 Building 154 – Fuel System Repair (PRL 4)

One boring (154-SB01) was advanced using DPT to 5 ft bgs and was completed on 21 December 2017, and two borings (154-SB02 and 154-SB03) were advanced using DPT to 5 ft bgs and were completed on 14 March 2018. Two soil samples were collected from each boring: surface soil was collected from 0.0-1.0 ft bgs, and subsurface soil was collected from 4.0-5.0 ft bgs, in accordance with the SI WP. One groundwater well (154-MW01) was advanced using DPT to 15 ft bgs at boring location 154-SB01 on 22 December 2017 and the groundwater sample was collected on 9 April 2018.

4.6.3 Building 1401 – USCG Hangar (PRL 5)

Three borings (1401-SB01, 1401-SB02, and 1401-SB03) were advanced using DPT to 5 ft bgs and were completed on 11 January 2018. Two soil samples were collected from each boring: surface soil was collected from 0.0-1.0 ft bgs, and subsurface soil was collected from 4.0-5.0 ft bgs. Soil boring 1401-SS03 was moved from next to Building 1401 to approximately 100 ft south of the proposed point due to utilities in the area. The boring is still cross-gradient and was used to assess the presence of PFAS at PRL 5; moving the boring to the new location is not considered a data gap.

One groundwater well (1401-MW01) was advanced using DPT to 15 ft bgs and the groundwater sample was collected on 13 April 2018.

4.6.4 Building 1461 – USCG Hangar (PRL 6)

Two borings (1461-SB01 and 1461-SB02) were advanced using DPT to 5 ft bgs and were completed on 11 January 2018. Two soil samples were collected from each boring: surface soil was collected from 0.0-1.0 ft bgs, and subsurface soil was collected from 4.0-5.0 ft bgs. Soil boring 1461-SB02 was advanced to 5 ft bgs and two soil samples were collected but were inadvertently lost by the field team after they were collected and were never submitted to the laboratory. However, soil boring 1401-SB01 from Building 1401- USCG Hangar (PRL 5) is located within 150 ft of the Building 1461 - USCG Hangar and will be included in the evaluation of this PRL. One groundwater well (1461- MW01) was advanced using DPT to 16 ft bgs on 16 January 2018 and the groundwater sample was collected on 6 April 2018.

4.6.5 Building 1416 – Army National Guard Hangar (PRL 7)

One boring (1416-SB01) was advanced using DPT to 5 ft bgs and was completed on 21 December 2017 and two borings (1416-SB02 & SB03) were advanced using DPT to 5 ft bgs and were completed on 12 March 2018. Two soil samples were collected from each boring: surface soil was collected from 0.0-1.0 ft bgs, and subsurface soil was collected from 4.0-5.0 ft bgs, in accordance with the SI WP. One groundwater well (1416-MW01) was advanced using DPT to 15 ft bgs on 4 January 2018 and the groundwater sample was collected on 11 April 2018.

4.6.6 Building 1422 – DHS Hangar (PRL 8)

Two borings (1422-SB01 and 1422-SB02) were advanced using DPT to 5 ft bgs and were completed on 12 January 2018. Two soil samples were collected from each boring: surface soil was collected from 0.0-1.0 ft bgs, and subsurface soil was collected from 4.0-5.0 ft bgs, in accordance with the SI WP. One groundwater well (1422-MW01) was advanced using DPT to 16 ft bgs at boring location 1422-SB01 on 18 January 2018 and the groundwater sample was collected on 6 April 2018.

4.6.7 Building 1436 – DHS Hangar (PRL 9)

Three borings (1436-SB01, 1436-SB02, and 1436-SB03) were advanced using DPT to 5 ft bgs and were completed on 21 December 2017. Two soil samples were collected from each boring: surface soil was collected from 0.0-1.0 ft bgs, and subsurface soil was collected from 4.0-5.0 ft bgs, in accordance with the SI WP. One groundwater sample was collected from the existing well TU060-MW03 on 5 June 2018.

4.6.8 Building 859 – Fire Department (PRL 10)

One soil boring (859-SB01) was advanced using DPT to 5 ft bgs and was completed on 21 December 2017, and two soil borings (859-SB02 and 859-SB03) were advanced using DPT to 5 ft bgs and were completed on 14 March 2018. Two soil samples were collected from each boring: surface soil was collected from 0.0-1.0 ft bgs, and subsurface soil was collected from 4.0-5.0 ft bgs, in accordance with the SI WP. One groundwater well (859-MW01) was advanced using DPT to 15 ft bgs on 2 January 2018. One groundwater sample was collected from 859-MW01 on 9 April 2018.

4.6.9 Building 501 – Former Wastewater Treatment Plant (PRL 11)

Three borings (501-SB01, 501-SB02, and 501-SB03) were advanced using DPT to 5 ft bgs and were completed on 18 December 2017. Two soil samples were collected from each boring: surface soil was collected from 0.0- 1.0 ft bgs, and subsurface soil was collected from 4.0-5.0 ft bgs, in accordance with the SI WP. One groundwater well (501-MW01) was advanced using DPT to 15 ft bgs at boring location 501- SB01 on 19 December 2018. One groundwater sample was collected from 501- MW01 on 6 April 2018.

4.6.10 Nozzle Testing Area (PRL 12)

Three borings (NTA-SB01, NTA-SB02, and NTA-SB03) were advanced using DPT to 5 ft bgs and were completed at the NTA on 14 March 2018. Two soil samples were collected from each boring: surface soil was collected from 0.0-1.0 ft bgs, and subsurface soil was collected from 4.0-5.0 ft bgs, in accordance with the SI WP. One groundwater well (NTA-MW01) was advanced using DPT to 15.0 ft bgs on 22 March 2018 approximately 100 ft southwest of the PRL. The SI WP proposed installing the monitoring approximately 200 ft to the southwest; however, the monitoring well was moved closer to the NTA to minimize damage from the drilling equipment on the grass area, which was soft due to rain events during the field efforts. The monitoring well location remains immediately downgradient from the potential release area. One groundwater sample was collected from NTA-MW01 on 23 May 2018.

4.6.11 C16 – AOC (PRL 13)

Two borings (C16-SB02 and C16-SB03) were completed on 21 March 2018. One boring (C16-SB01) was completed on 22 March 2018. The three borings were advanced using DPT to 5 ft bgs. Two soil samples were collected from each boring: surface soil was collected from 0.0-1.0 ft bgs, and subsurface soil was collected from 4.0-5.0 ft bgs, in accordance with the SI WP. One groundwater well (C16-MW01) was advanced using DPT to 15.0 ft bgs at boring location C16-SB01 on 22 March 2018. One groundwater sample was collected from C16-MW01 on 20 May 2018.

4.6.12 CRF – AOC (PRL 14)

Three borings (CRF-SB01, CRF-SB02 and CRF-SB03) were advanced using DPT to 5 ft bgs and were completed on 24 March 2018. Two soil samples were collected from each boring: surface soil was collected from 0.0-1.0 ft bgs, and subsurface soil was collected from 4.0-5.0 ft bgs, in accordance with the SI WP. One groundwater well (CRF-MW01) was advanced using DPT to 15.0 ft bgs on 26 March 2018. One groundwater sample was collected from CRF-MW01 on 20 May 2018.

4.6.13 East Ramp (PRL 15)

Boring ER-SB01 was completed on 9 January 2018 and boring ER-SB02 was completed on 20 December 2017. Three borings (ER-SB03, ER-SB04, and ER-SB05) were completed on 14 March 2018. All the borings were advanced using DPT to 5ft bgs. Two soil samples were collected from each boring: surface soil was collected from 0.0-1.0 ft bgs, and subsurface soil was collected from 4.0-5.0 ft bgs, in accordance with the SI WP. One groundwater well (ER-MW02) was advanced using DPT to 15.0 ft bgs at boring location ER-SB02 on 8 January 2018. One groundwater well (ER-MW03) was advanced using DPT to 15.0 ft bgs to the east of boring location ER-SB03 on 8 January 2018. One groundwater well (ER-MW01) was advanced using DPT to 16.0 ft bgs at boring location ER-SB01 on 9 January 2018. One groundwater sample was collected from ER-MW01 on 11 April 2018. One groundwater sample was collected from ER-MW02 on 23 May 2018 and from ER-MW03 on 22 May 2018.

4.6.14 West Ramp (PRL 16)

Two borings (WR-SB01 and WR-SB02) were completed on 13 March 2018. Four borings (WR-SB03 through WR-SB06) were completed on 12 January 2018. All the borings were advanced using DPT to 5ft bgs. Two soil samples were collected from each boring: surface soil was collected from 0.0-1.0 ft bgs, and subsurface soil was collected from 4.0-5.0 ft bgs in accordance with the SI WP. Two groundwater wells (WR-MW01 and WR-MW02) were advanced using DPT to 15.0 ft bgs at boring locations WR-SB01 and WR-SB02 on 13 March 2018. One groundwater well (WR-MW03) was advanced using DPT to 16.0 ft bgs at boring location WR-SB03 on 18 January 2018. One groundwater sample was collected from each monitoring well (WR-MW01 and WR-MW02) on 13 April 2018. One groundwater sample was collected from WR-MW03 on 11 April 2018.

4.6.15 Former Building 33 – Fire Department (PRL 17)

Two borings (33-SB01 and 33-SB02) were completed on 20 December 2017 and one boring (33-SB03) was completed on 23 March 2018. All the borings were advanced using DPT to 5ft bgs. Two soil samples were collected from each boring: surface soil was collected from 0.0-1.0 ft bgs, and subsurface soil was collected from 4.0-5.0 ft bgs. Soil boring 33-SB02 was moved approximately 50 ft to the east to avoid utilities. The new boring location remains within the primary potential release area.

One groundwater well (33-MW01) was advanced using DPT to 16 ft bgs at boring location 33-SB01 on 10 January 2018. One groundwater sample was collected from 33-MW01 on 23 May 2018.

4.6.16 Former Building 176 – Vehicle Maintenance (PRL 18)

Three borings (176-SB01, 176-SB02, and 176-SB03) were advanced using DPT to 5 ft bgs and were completed on 20 and 21 December 2017. Two soil samples were collected from each boring: surface soil was collected from 0.0-1.0 ft bgs, and subsurface soil was collected from 4.0-5.0 ft bgs, in accordance with the SI WP. One groundwater well (176-MW01) was advanced to using DPT 15 ft bgs on 3 January 2018. One groundwater sample was collected from 176-MW01 on 9 April 2018.

4.6.17 Wet Well/Drainage Basin 340 (PRL 20)

One surface water sample was collected the Wet Well/Drainage Basin 340 outfall on 8 February 2018 and one sediment sample was collected on 2 May 2018.

4.6.18 Wet Well/Drainage Basin 507 (PRL 21)

One surface water sample was collected the Wet Well/Drainage Basin 507 outfall on 8 February 2018 and one sediment sample was collected on 27 April 2018.

4.6.19 Wet Well/Drainage Basin 508 (PRL 22)

One surface water sample was collected the Wet Well/Drainage Basin 508 outfall on 8 February 2018 and one sediment sample was collected on 23 March 2018.

4.6.20 Wet Well/Drainage Basin 980 (PRL 23)

One surface water sample was collected the Wet Well/Drainage Basin 980 outfall on 8 February 2018 and one sediment sample was collected on 23 March 2018.

4.6.21 Wet Well/Drainage Basin 990 (PRL 24)

One surface water sample was collected the Wet Well/Drainage Basin 990 outfall on 8 February 2018 and one sediment sample was collected on 23 March 2018.

4.6.22 Aircraft Crash Sites (PRL 25)

Two soil borings (AC-SB01 and AC-SB02) were completed on 25 March 2018. Two soil borings (AC-SB03 and AC-SB04) were completed on 24 March 2018. One soil boring (AC-SB05) was completed on 20 March 2018 and one soil boring (AC-SB06) was completed on 19 March 2018. All the borings were advanced using DPT to 5ft bgs. Two soil samples were collected from each boring: surface soil was collected from 0.0-1.0 ft bgs, and subsurface soil was collected from 4.0-5.0 ft bgs in accordance with the SI WP.

Two groundwater wells (AC-MW01 and AC-MW02) were advanced using DPT to 15.0 ft bgs on 25 March 2018 at boring locations AC-SB01 and AC-SB02. Two groundwater wells (AC-MW03 and AC-MW04) were advanced using DPT to 15.0 ft bgs at boring locations AC-SB03 and AC-SB04 on 24 March 2018. One groundwater well (AC-MW05) was advanced using DPT to 15.0 ft bgs at boring AC-SB05 on 20

March 2018 One groundwater well (AC-MW06) was advanced using DPT to 15.0 ft bgs at boring location AC-SB06 on 19 March 2018. Groundwater samples were collected from all PRL 25 wells on 20 May 2018.

4.6.23 Drainage Basin 1420/Outfall 006A (PRL 26)

Three surface water samples were collected from 1420/Outfall 006A on 13 April 2018. Three sediment samples were collected from 1420/Outfall 006A on 27 April 2018.

4.6.24 Sludge Drying Beds (PRL 27)

Three borings (SDB-SB01, SDB-SB02, and SDB-SB03) were advanced using DPT to 5 ft bgs and were completed on 18 December 2017. Two soil samples were collected from each boring: surface soil was collected from 0.0-1.0 ft bgs, and subsurface soil was collected from 4.0-5.0 ft bgs in accordance with the SI WP. One groundwater well (SDB-MW01) was advanced using DPT to 15 ft bgs at boring location SDB-SB01 on 19 December 2018. One groundwater sample was collected from monitoring well SDB-MW01 on 6 April 2018.

4.6.25 IRP Site 9 – Sludge Application Area (PRL 28)

Seven borings (IRP9-SB01 through IRP9-SB03 and IRP9-SB07 through IRP9-SB10) were completed on 19 March 2018. Two soil borings (IRP9-SB04 and IRP9-SB06) were completed on 15 March 2018. One soil boring (IRP9-SB05) was completed on 20 March 2018. Two soil borings (IRP9-SB11 and IRP9-SB12) were completed on 10 January 2018. All the borings were advanced using DPT to 5ft bgs. Two soil samples were collected from each boring: surface soil was collected from 0.0-1.0 ft bgs, and subsurface soil was collected from 4.0-5.0 ft bgs. Soil boring IRP9-SB02 was moved approximately 100 ft to the east to avoid an area that was saturated and could not support the heavy drilling equipment. The new boring location remains within the primary potential release area.

Groundwater well (IRP9-MW01) was advanced using DPT to 15.0 feet bgs on 21 March 2018 and sampled on 22 May 2018. Groundwater well (IRP9-MW02) was advanced using DPT to 15.0 feet bgs on 20 March 2018 and sampled on13 April 2018. Groundwater well (IRP9-MW03) was advanced using DPT to 15.0 feet bgs on 23 March 2018 and sampled on 22 May 2018.

4.6.26 Base Boundary Wells

Groundwater samples were collected from six existing BBWs (BKGW-102, BKGW-103, BKGW-104, BKGW-106, BKGW-107, and BKGW-108) located around the perimeter of the base. One groundwater sample was collected from each well on 22 and 23 May 2018.

4.7 Groundwater Level Measurements

Water levels were obtained from the 37 monitoring wells that were included in this SI. Water level measurements are provided in **Table 3-1**. A potentiometric contour map is provided as **Figure 3-1.**

4.8 Surveying

All of the monitoring wells installed as a part of the SI were surveyed by a state-licensed AECOM surveyor. Survey data collected from each well included a latitude and longitude locating the well and top of casing elevation. Surveying measurements were collected according to the Michigan State Plane Coordinate System (South International Feet), using North American Datum 88 adjustment, and are measured to an accuracy exceeding 1 foot in 10,000 ft. Elevation measurements are based on the North American Vertical Datum of 1988, and measured to an accuracy of +/-0.05 ft. Survey results are provided in **Appendix C-3**.

4.9 Investigation-Derived Waste

Forty-five drums of soil and twenty drums of decontamination water/development water/purge water were containerized in new 55-gallon steel drums for storage pending disposal, and staged onsite at a base-designated area. The IDW is currently awaiting approval for disposal as non-hazardous, non-regulated material. When available, IDW-associated documentation will be located in **Appendix E.**

4.10 Deviations from the SI WP

Deviations from the SI WP occurred based on field conditions but did not prevent the completion of initial Work Plan objectives. They are noted below:

- Building 1401 – USCG Hangar (PRL 5): Soil boring 1401-SS03 was moved from next to Building 1401 to approximately 100 ft south of the proposed point due to utilities in the area. The new boring remains within the primary potential release area.
- Building 1461 – USCG Hangar (PRL 6): Soil boring 1461-SB02 was advanced to 5 ft bgs and two soil samples were collected but were inadvertently lost and the situation not identified until after the fieldwork was completed. This is not considered a data gap as soil borings 1461-SB01 and 1401-SB01 from Building 1401- USCG Hangar (PRL 5) that is located within 150 ft of PRL 6 will be used to monitor potential releases at this PRL.
- NTA (PRL 12): Groundwater monitoring well (NTA-MW01) was installed approximately 100 ft southwest of the PRL. The SI WP proposed installing the monitoring approximately 200 ft to the southwest. The monitoring well was moved closer to the NTA to minimize damage from the drilling equipment on the grass area, which was soft due to rain events during the field efforts. The monitoring well location remains immediately downgradient of the potential release area.
- Former Building 33 – Fire Department (PRL 17): Due to utilities in the area of the planned location for soil boring 33-SB02, it was moved approximately 50 ft to the east. The new boring location remains within the primary potential release area.
- IRP Site 9 – Sludge Application Area (PRL 28): Soil boring IRP9-SB02 was moved approximately 100 ft to the east to avoid an area that was saturated and may be damaged by the heavy equipment. The new boring location remains within the primary potential release area.

5. Site Inspection Results

Analytical testing results were evaluated to determine the presence or absence of PFAS in soil, surface water, and/or sediment at each PRL and in groundwater downgradient of PRLs, and assess if PFAS from the base are migrating off-base. The six PFAS that were sampled and analyzed during the PFAS inspection per ANG (ANG, 2009) and US EPA (US EPA, 2016a,b) guidance were:

- PFBS
- PFNA
- PFHxS
- PFHpA
- PFOS
- PFOA

Analytical results for PFOS, PFOA and PFBS were compared against the PALs described in **Section 2.3**. As described above, there are no PALs for PFHpA, PFHxS, or PFNA.

5.1 Data Usability

The laboratory analytical data generated during the SI were reviewed for conformance with the project DQOs specified in the SI WP and to ensure that the precision and accuracy of the data were adequate for their intended use. All analytical data were found to be useable (as qualified). **Appendix D** contains the data validation report, which details the scope, quality assurance/QC sample collection and analysis, and results of the analytical data review and validation.

Detected concentrations below the LOQ are reported with a “J” flag. The LOQ is the lowest concentration of a substance that produces a quantitative result within specified limits of precision and bias. During data validation, the J flag was further qualified. Validation flag “J+” means the analyte is present; however, the reported value may not be accurate or precise, and the result may be biased high. Alternatively, “J-” means the analyte is present; however, the reported value may not be accurate or precise, and the result may be biased low. Measurements between the detection limit and the LOQ assure the presence of the analyte with confidence, but their numeric values are estimates (DoD, 2009).

Non-detections are reported as the limit of detection (LOD) followed by a “U” flag. The LOD is the smallest amount or concentration of a substance that must be present in a sample to be detected at a 99% confidence level. The failure to obtain a detection is reported as “<LOD” because the false-negative rate at the LOD is 1% (DoD, 2009). In the instances where a result was qualified due to a blank detection, the non-detects are reported as the LOD followed by a “U*” flag to indicate the flag was changed during data validation.

The data review and validation performed on the entire data set indicate the overall high quality of the definitive-level data collected for this base. None of the data were qualified as rejected and completeness for this data set is 100 percent. Results qualified as estimated are generally for marginal QC exceedances and blank-qualified results below or near the LOQs, and the qualifications do not significantly affect project objectives.

5.2 IRP Site 2 (Fire Training Area #2) (PRL 1)

Table 5-1 summarizes the analytical results of the groundwater and soil sampling at IRP Site 2 (Fire Training Area #2). PFAS were detected in the groundwater sample and all soil samples; detections are shown on **Figure 5-1**.

All six PFAS (PFBS, PFHpA, PFHxS, PFNA, PFOS and PFOA) were detected in the groundwater sample collected from monitoring well FTA2-MW01. PFOS and PFOA were detected in the groundwater sample at concentrations that exceeded the individual and combined PFOS + PFOA PALs (70 ng/L); PFOS was

detected at a concentration of 17,000 ng/L and PFOA was detected at a concentration of 5,500 ng/L. PFBS was not detected at a concentration that exceeded the PAL (400,000 ng/L). PFHpA was detected at a concentration of 760 ng/L, PFHxS was detected at a concentration of 8,100 ng/L, and PFNA was detected at a concentration of 180 ng/L; however, there are no PALs for these compounds.

All six PFAS (PFBS, PFHpA, PFHxS, PFNA, PFOS and PFOA) were detected in soil samples. PFOS and PFOA were detected at concentrations that did not exceed the PALs (1,260 ng/g); however, PFOS was detected close to the PAL at FTA2-SB03 with a detection of 1,200 ng/g. PFBS was detected at concentrations that did not exceed the PAL (1.26×10^6 ng/g). PFHpA was detected at a maximum concentration of 73 ng/g, PFHxS was detected at a maximum concentration of 560 ng/g, and PFNA was detected at a maximum concentration of 18 ng/g; however, there are no PALs for these compounds.

5.3 Building 154 – Fuel System Repair (PRL 4)

Table 5-2 summarizes the analytical results of the groundwater and soil sampling at Building 154 – Fuel System Repair. PFAS were detected in the groundwater sample and all soil samples; detections are shown on **Figure 5-2**.

PFOS and PFOA were not detected in the groundwater sample; however, the reported analytical results were 62 U ng/L and 54 U ng/L. Since these compounds may be present at the reporting value (i.e., treated as positive values), the combined PFOS+PFOA PAL of 70 ng/L may be exceeded. PFBS and PFHxS were detected in the groundwater sample collected from monitoring well 154-MW01. PFBS was not detected at a concentration that exceeded the PAL (400,000 ng/L). PFHxS was detected at a concentration of 440 ng/L; however, there is no PAL for this compound.

All six PFAS (PFBS, PFHpA, PFHxS, PFNA, PFOS and PFOA) were detected in soil samples. PFOS and PFOA were detected at concentrations that did not exceed the PALs (1,260 ng/g). PFBS was detected at concentrations that did not exceed the PAL (1.26×10^6 ng/g). PFHpA was detected at a maximum concentration of 1.4 ng/g, PFHxS was detected at a maximum concentration of 10 ng/g, and PFNA was detected at a maximum concentration of 1.5 ng/g; however, there are no PALs for these compounds.

5.4 Building 1401 – USCG Hangar (PRL 5)

Table 5-3 summarizes the analytical results of the groundwater and soil sampling at Building 1401 – USCG Hangar. PFAS were not detected in the groundwater sample from monitoring well 1401-MW01 and were detected in three of the seven soil samples; detections are shown on **Figure 5-3**.

PFHpA, PFNA, PFOS, and PFOA were detected in soil samples. PFOS and PFOA were detected at concentrations that did not exceed the PALs (1,260 ng/g). PFHpA was detected at a concentration of 0.69 J ng/g and PFNA was detected at a concentration of 0.82 ng/g; however, there are no PALs for these compounds.

5.5 Building 1461 – USCG Hangar (PRL 6)

Table 5-4 summarizes the analytical results of the groundwater and soil sampling at Building 1461 – USCG Hangar. PFAS were detected in the groundwater sample and in one of the two soil samples; detections are shown on **Figure 5-3**.

PFHpA and PFOA were detected in the groundwater sample collected from monitoring well 1461-MW01. PFOA was not detected at a concentration that exceeded the PAL (70 ng/L). PFHpA was detected at a concentration of 13 ng/L; however, there is no PAL for this compound.

Only PFOS was detected in soil samples and it was not detected at a concentration that exceeded the PAL (1,260 ng/g).

5.6 Building 1416 – Army National Guard Hangar (PRL 7)

Table 5-5 summarizes the analytical results of the groundwater and soil sampling at Building 1416 – Army National Guard. PFAS were detected in the groundwater sample and six of the seven soil samples and detections are shown on **Figure 5-4**.

PFBS, PFHpA, and PFHxS were detected in the groundwater sample collected from monitoring well 1416-MW01. PFBS was not detected at concentrations that exceeded the PAL (400,000 ng/L). PFHpA was detected at a concentration of 3.9 J ng/L and PFHxS was detected at a concentration of 70 ng/L; however, there are no PALs for these compounds.

PFHpA, PFHxS, PFNA, PFOS and PFOA were detected in soil samples. PFOS and PFOA were detected at concentrations that did not exceed the PALs (1,260 ng/g). PFHpA was detected at a maximum concentration of 1.2 ng/g, PFHxS was detected at a maximum concentration of 11 ng/g, and PFNA was detected at a maximum concentration of 1.3 J+ ng/g; however, there are no PALs for these compounds.

5.7 Building 1422 – DHS Hangar (PRL 8)

Table 5-6 summarizes the analytical results of the groundwater and soil sampling at Building 1422 – DHS Hangar. PFAS were detected in the groundwater sample and all soil samples; detections are shown on **Figure 5-4**.

PFBS, PFHpA, PFHxS, PFOS and PFOA were detected in the groundwater sample collected from monitoring well 1422-MW01. PFOS and PFOA were detected in the groundwater sample above the individual and combined PFOS+PFOA PALs (70 ng/L); PFOS was detected at a concentration of 11,000 ng/L and PFOA was detected at a concentration of 850 ng/L. PFBS was not detected at a concentration that exceeded the PAL (400,000 ng/L). PFHpA was detected at a concentration of 650 ng/L and PFHxS was detected at a concentration of 15,000 ng/L; however, there are no PALs for these compounds.

All six PFAS (PFBS, PFHpA, PFHxS, PFNA, PFOS and PFOA) were detected in soil samples. PFOS and PFOA were detected at concentrations that did not exceed the PALs (1,260 ng/g). PFBS was detected at concentrations that did not exceed the PAL (1.26×10^6 ng/g). PFHpA was detected at a maximum concentration of 0.39 J ng/g, PFHxS was detected at a maximum concentration of 62 ng/g, and PFNA was detected at a concentration of 0.27 J ng/g; however, there are no PALs for these compounds.

5.8 Building 1436 – DHS Hangar (PRL 9)

Table 5-7 summarizes the analytical results of the groundwater and soil sampling at Building 1436 – DHS Hangar. PFAS were detected in the groundwater sample and all soil samples; detections are shown on **Figure 5-4**.

PFBS, PFHpA, PFHxS, PFNA, and PFOA were detected in the groundwater sample collected from monitoring well TU060-MW03. PFOA was not detected at concentrations that exceeded the PAL (70 ng/L). PFBS was not detected at concentrations above the PAL (400,000 ng/L). PFHpA was detected at a concentration of 70 ng/L, PFHxS was detected at a concentration of 23 ng/L, and PFNA was detected at a concentration of 7.5 ng/L; however, there are no PALs for these compounds.

PFHpA, PFHxS, PFNA, PFOS and PFOA were detected in soil samples. PFOS and PFOA were detected at concentrations that did not exceed the PALs (1,260 ng/g). PFHpA was detected at a maximum concentration of 2.7 ng/g, PFHxS was detected at a maximum concentration of 0.44 J ng/g, and PFNA was detected at a maximum concentration of 0.87 J+ ng/g; however, there are no PALs for these compounds.

5.9 Building 859 – Fire Department (PRL 10)

Table 5-8 summarizes the analytical results of the groundwater and soil sampling at Building 859 – Fire Department. PFAS were detected in the groundwater sample and all soil samples; detections are shown on **Figure 5-5.**

PFBS, PFHpA, PFHxS, PFOS and PFOA were detected in the groundwater sample collected from monitoring well 859-MW01. PFOS and PFOA were detected in the groundwater sample above the individual and combined PFOS + PFOA PALs (70 ng/L); PFOS was detected at a concentration of 530 ng/L and PFOA was detected at a concentration of 890 ng/L. PFBS was not detected at a concentration that exceeded the PAL (400,000 ng/L). PFHpA was detected at a concentration of 39 ng/L and PFHxS was detected at a concentration of 2,100 ng/L; however, there are no PALs for these compounds.

PFBS, PFHxS, PFNA, PFOS and PFOA were detected in soil samples. PFOS and PFOA were detected at concentrations that did not exceed the PALs (1,260 ng/g). PFBS was not detected at a concentration that exceeded the PAL (1.26×10^6 ng/g). PFHxS was detected at a maximum concentration of 14 ng/g and PFNA was detected at a concentration of 0.2 J ng/g; however, there are no PALs for these compounds.

5.10 Building 501 – Former Wastewater Treatment Plant (PRL 11)

Table 5-9 summarizes the analytical results of the groundwater and soil sampling at Building 501 – Former Wastewater Treatment Plant. PFAS were detected in the groundwater sample and all soil samples; detections are shown on **Figure 5-6**.

PFBS and PFHxS were detected in the groundwater sample collected from monitoring well 501-MW01. PFBS was not detected at concentrations that exceeded the PAL (400,000 ng/L). PFHxS was detected at a concentration of 44 ng/L; however, there is no PAL for this compound.

PFHpA, PFHxS, PFNA, PFOS and PFOA were detected in soil samples. PFOS and PFOA were detected at concentrations that did not exceed the PALs (1,260 ng/g). PFHpA was detected at a concentration of 0.22 J ng/g, PFHxS was detected at a maximum concentration of 0.77 ng/g, and PFNA was detected at a concentration of 0.41 J ng/g; however, there are no PALs for these compounds.

5.11 Nozzle Testing Area (PRL 12)

Table 5-10 summarizes the analytical results of the groundwater and soil sampling at the Nozzle Testing Area. PFAS were detected in groundwater and all soil samples; detections are shown on **Figure 5-5**.

PFBS, PFHpA, PFHxS, and PFOS were detected in the groundwater sample and the duplicate sample collected from monitoring well NTA-MW01. PFOS was detected in the groundwater sample at a maximum concentration of 84 J+ ng/L, which exceeded the PAL of 70 ng/L. PFBS was not detected at concentrations that exceeded the PAL (400,000 ng/L). PFHpA was detected at a maximum concentration of 14 J- ng/L and PFHxS was detected at a maximum concentration of 32 ng/L; however, there are no PALs for these compounds.

All six PFAS (PFBS, PFHpA, PFHxS, PFNA, PFOS and PFOA) were detected in soil samples. PFOS was detected in one soil sample above the PAL (1,260 ng/g) at a concentration of 1,900 ng/g. PFOA was detected at concentrations that did not exceed the PAL (1,260 ng/g). PFBS was detected at concentrations that did not exceed the PAL (1.26×10^6 ng/g). PFHpA was detected at a maximum concentration of 2.5 ng/g, PFHxS was detected at a maximum concentration of 76 ng/g, and PFNA was detected at a maximum concentration of 16 ng/g; however, there are no PALs for these compounds.

5.12 C16 – AOC (PRL 13)

Table 5-11 summarizes the analytical results of the groundwater and soil sampling at C16-AOC. PFAS were detected in the groundwater sample and all soil samples; detections are shown on **Figure 5-7**.

PFBS, PFHpA, PFHxS, and PFOA were detected in the groundwater sample collected from monitoring well C16-MW01. PFOA was detected in the groundwater sample at concentrations of 370 ng/L, which exceeded the PAL (70 ng/L). PFOS was reported as not detected at a concentration of 84 U* ng/L; however, this concentration exceeds the PAL (70 ng/L). Since PFOS may be present at concentrations that exceed the PAL, it is conservatively considered to be detected in the groundwater. PFBS was not detected at concentrations that exceeded the PAL (400,000 ng/L). PFHpA was detected at a concentration of 750 ng/L and PFHxS was detected at a concentration of 10,000 ng/L; however, there are no PALs for these compounds.

All six PFAS (PFBS, PFHpA, PFHxS, PFNA, PFOS and PFOA) were detected in soil samples. PFOA was detected at concentrations that did not exceed the PAL (1,260 ng/g), and PFOS was detected in soil at concentrations that exceeded the PAL (1,260 ng/g) at a maximum concentration of 1,700 J ng/g. PFBS was detected at concentrations that did not exceed the PAL (1.26×10^6 ng/g). PFHpA was detected at a maximum concentration of 6.4 ng/g, PFHxS was detected at a maximum concentration of 410 ng/g, and PFNA was detected at a maximum concentration of 0.41 J ng/g; however, there are no PALs for these compounds.

5.13 CRF – AOC (PRL 14)

Table 5-12 summarizes the analytical results of the groundwater and soil sampling at CRF - AOC. PFAS were not detected in the groundwater sample collected from the monitoring well CRF-MW01 and were detected in three of the seven soil samples; detections are shown on **Figure 5-7**.

PFHxS, PFOS, and PFOA were detected in soil samples. PFOS and PFOA were detected at concentrations that did not exceed the PAL (1,260 ng/g). PFHxS was detected at a maximum concentration of 0.78 ng/g; however, there is no PAL for this compound.

5.14 East Ramp (PRL 15)

Table 5-13 summarizes the analytical results of the groundwater and soil sampling at East Ramp. PFAS were detected in all groundwater samples and in eight of the ten soil samples; detections are shown on **Figure 5-2**.

All six PFAS (PFBS, PFHpA, PFHxS, PFNA, PFOS and PFOA) were detected in the groundwater samples collected from monitoring wells ER-MW01, ER-MW02 and ER-MW03. PFOS and PFOA were detected in groundwater at concentrations that did not exceed the PALs (70 ng/L); however, the combined groundwater concentration of PFOS+PFOA was 80 J+ ng/L, which does exceed the combined PFOS + PFOA PAL of 70 ng/L. PFBS was not detected above the PAL (400,000 ng/L). PFHpA was detected at a maximum concentration of 13 ng/L, PFHxS was detected at a maximum concentration of 62 ng/L, and PFNA was detected at a maximum concentration of 2 ng/L; however, there are no PALs for these compounds.

PFHpA, PFHxS, PFNA, PFOS and PFOA were detected in soil samples. PFOS and PFOA were detected at concentrations that did not exceed the PALs (1,260 ng/g). PFHpA was detected at a maximum concentration of 0.44 J ng/g, PFHxS was detected at a maximum concentration of 5.8 ng/g, and PFNA was detected at a maximum concentration of 0.27 J ng/g; however, there are no PALs for these compounds.

5.15 West Ramp (PRL 16)

Table 5-14 summarizes the analytical results of the groundwater and soil sampling at West Ramp. PFAS were detected in all groundwater samples and in eleven of the twelve soil samples; detections are shown on **Figure 5-7**.

PFBS, PFHpA, and PFHxS were detected in groundwater samples collected from monitoring wells WR-MW01, WR-MW02, and WR-MW03. PFBS was not detected above the PAL (400,000 ng/L). PFHpA was

detected at a concentration of 16 ng/L and PFHxS was detected at a maximum concentration of 95 ng/L; however, there are no PALs for these compounds.

PFHpA, PFHxS, PFNA, PFOS and PFOA were detected in soil samples. PFOS and PFOA were detected at concentrations that did not exceed the PALs (1,260 ng/g). PFHpA was detected at a maximum concentration of 0.4 J ng/g, PFHxS was detected at a maximum concentration of 5 ng/g, and PFNA was detected at a maximum concentration of 0.43 J ng/g; however, there are no PALs for these compounds.

5.16 Former Building 33 – Fire Department (PRL 17)

Table 5-15 summarizes the analytical results of the groundwater and soil sampling at Former Building 33 – Fire Department. PFAS were detected in the groundwater sample and all soil samples; detections are shown on **Figure 5-2**.

PFBS, PFHpA, PFHxS, PFOS and PFOA were detected in the groundwater sample collected from monitoring well 33-MW01. PFOS and PFOA were detected in the groundwater sample above the individual and combined PFOS + PFOA PALs (70 ng/L); PFOS was detected at a concentration of 3,200 J+ ng/L and PFOA was detected at a concentration of 400 J+ ng/L. PFBS was not detected above the PAL (400,000 ng/L). PFHpA was detected at a concentration of 150 ng/L and PFHxS was detected at a concentration of 2,300 ng/L; however, there are no PALs for these compounds.

All six PFAS (PFBS, PFHpA, PFHxS, PFNA, PFOS and PFOA) were detected in soil samples. PFOS and PFOA were detected at concentrations that did not exceed the PALs (1,260 ng/g). PFBS was detected at concentrations that did not exceed the PAL (1.26×10^6 ng/g). PFHpA was detected at a maximum concentration of 1.2 ng/g, PFHxS was detected at a maximum concentration of 29 ng/g, and PFNA was detected at a maximum concentration of 2 ng/g; however, there are no PALs for these compounds.

5.17 Former Building 176 – Vehicle Maintenance (PRL 18)

Table 5-16 summarizes the analytical results of the groundwater and soil sampling at Former Building 176 – Vehicle Maintenance. PFAS were detected in the groundwater sample and all soil samples; detections are shown on **Figure 5-5**.

PFBS, PFHpA, PFHxS, and PFOA were detected in the groundwater sample collected from monitoring well 176-MW01. PFOA was detected at a concentration that does not exceed the PAL (70 ng/L). PFBS was not detected at a concentration that exceeded the PAL (400,000 ng/L). PFHpA was detected at a concentration of 25 ng/L and PFHxS was detected at a concentration of 52 ng/L; however, there are no PALs for these compounds.

All six PFAS (PFBS, PFHpA, PFHxS, PFNA, PFOS and PFOA) were detected in soil samples. PFOS and PFOA were detected at concentrations that did not exceed the PALs (1,260 ng/g). PFBS was detected at concentrations that did not exceed the PAL (1.26×10^6 ng/g). PFHpA was detected at a maximum concentration of 0.82 ng/g, PFHxS was detected at a maximum concentration of 31 ng/g, and PFNA was detected at a maximum concentration of 0.92 J+ ng/g; however, there are no PALs for these compounds.

5.18 Wet Well/Drainage Basin 340 (PRL 20)

Table 5-17 summarizes the analytical results of the surface water and sediment sampling at Wet Well/Drainage Basin 340. PFAS were detected in the surface water sample and the sediment sample; detections are shown on **Figure 5-8**.

PFHxS and PFOS were detected in surface water. PFOS was detected in surface water sample at a concentration of 170 ng/L which exceeded the PAL (11 ng/L). PFHxS was detected at a concentration of 120 ng/L; however, there is no PAL for this compound.

Only PFOS was detected in the sediment sample but it was not detected at a concentration that exceeded the PAL (1,260 ng/g).

5.19 Wet Well/Drainage Basin 507 (PRL 21)

Table 5-18 summarizes the analytical results of the surface water and sediment sampling at Wet Well/Drainage Basin 507. PFAS were detected in the surface water sample and the sediment sample; detections are shown on **Figure 5-8**.

All six PFAS (PFBS, PFHpA, PFHxS, PFNA, PFOS and PFOA) were detected in surface water. PFOS was detected in the surface water sample at a concentration of 2,400 ng/L which exceeded the PAL (11 ng/L). PFOA was detected in the surface water but not at concentrations that exceeded the PAL (420 ng/L). PFBS was not detected at a concentration that exceeded the PAL (400,000 ng/L). PFHpA was detected at a concentration of 140 ng/L, PFHxS was detected at a concentration of 2,000 ng/L, and PFNA was detected at a concentration of 39 ng/L; however, there are no PALs for these compounds.

Only PFOS was detected in the sediment sample but at a concentration that did not exceed the PAL (1,260 ng/g).

5.20 Wet Well/Drainage Basin 508 (PRL 22)

Table 5-19 summarizes the analytical results of the surface water and sediment sampling at Wet Well/Drainage Basin 508. PFAS were detected in the surface water sample and the sediment sample; detections are shown on **Figure 5-8**.

All six PFAS (PFBS, PFHpA, PFHxS, PFNA, PFOS and PFOA) were detected in surface water. PFOS was detected in the surface water sample at a concentration of 2,000 ng/L, which exceeded the PAL (11 ng/L). PFBS was not detected above the PAL (400,000 ng/L). PFHpA was detected at a concentration of 110 ng/L, PFHxS was detected at a concentration of 2,200 ng/L, and PFNA was detected at a concentration of 31 ng/L; however, there are no PALs for these compounds.

PFHxS, PFOS, and PFOA were detected in the sediment sample. PFOS and PFOA were detected at concentrations that did not exceed the PALs (1,260 ng/g). PFHxS was detected at a concentration of 0.25 J ng/g; however, there is no PAL this compound.

5.21 Wet Well/Drainage Basin 980 (PRL 23)

Table 5-20 summarizes the analytical results of the surface water and sediment sampling at Wet Well/Drainage Basin 980. PFAS were detected in the surface water sample and the sediment sample; detections are shown on **Figure 5-8**.

PFBS, PFHxS, and PFOS were detected in surface water. PFOS was detected in the surface water sample at a concentration of 33 ng/L which exceeded the PAL (11 ng/L). PFBS was not detected above the PAL (400,000 ng/L). PFHxS was detected at a concentration of 29 ng/L; however, there is no PAL for this compound.

Only PFOS was detected in the sediment sample but not at a concentration that exceeded the PAL (1,260 ng/g).

5.22 Wet Well/Drainage Basin 990 (PRL 24)

Table 5-21 summarizes the analytical results of the surface water and sediment sampling at Wet Well/Drainage Basin 990. PFAS were detected in the surface water sample and the sediment sample; detections are shown on **Figure 5-8**.

PFBS, PFHxS, and PFOS were detected in surface water. PFOS was detected in the surface water sample at a concentration of 490 ng/L, which exceeded the PAL (11 ng/L). PFBS was not detected above the PAL (400,000 ng/L). PFHxS was detected at a concentration of 340 ng/L; however, there is no PAL for this compound.

Only PFOS was detected in the sediment sample but not at a concentration that exceeded the PAL (1,260 ng/g).

5.23 Aircraft Crash Sites (PRL 25)

Table 5-22 summarizes the analytical results of the groundwater and soil sampling at Aircraft Crash Sites. PFAS were detected in three of the seven groundwater samples and in eight of the sixteen soil samples; detections are shown on **Figure 5-9**.

PFBS, PFHxS, and PFOS were detected in groundwater. PFOS was detected in groundwater at a concentration that does not exceed the PAL (70 ng/L); PFBS was not detected at concentrations that exceeded the PAL (400,000 ng/L). PFHxS was detected at a concentration of 110 ng/L; however, there is no PAL for this compound.

PFHxS, PFOS, and PFOA were detected in soil samples. PFOS and PFOA were detected at concentrations that did not exceed the PALs (1,260 ng/g). PFHxS was detected at a maximum concentration of 0.64 ng/g; however, there is no PAL for this compound.

5.24 Drainage Basin 1420/Outfall 006A (PRL 26)

Table 5-23 summarizes the analytical results of the surface water and sediment sampling at Drainage Basin 1420/Outfall 006A. PFAS were detected in all surface water samples and all sediment samples; detections are shown on **Figure 5-8**.

All six PFAS (PFBS, PFHpA, PFHxS, PFNA, PFOS and PFOA) were detected in the three surface water samples. PFOS was detected in surface water above the PAL (11 ng/L) at a maximum concentration of 970 ng/L. The maximum combined groundwater concentration of 1,035 ng/L at surface water sample OF006A-SW02 exceeded the combined PFOS + PFOA PAL of 70 ng/L. PFBS was not detected at concentrations that exceeded the PAL (400,000 ng/L). PFHpA was detected at a maximum concentration of 9.5 ng/L, PFHxS was detected at a maximum concentration of 100 ng/L, and PFNA was detected at a maximum concentration of 7.4 J ng/L; however, there are no PALs for these compounds.

Only PFOS was detected in the sediment samples but not at concentrations that exceeded the PAL (1,260 ng/g).

5.25 Sludge Drying Beds (PRL 27)

Table 5-24 summarizes the analytical results of the groundwater and soil sampling at Sludge Drying Beds. PFAS were detected in the groundwater sample and in five of the six soil samples; detections are shown on **Figure 5-6**.

PFBS and PFHxS were detected in the groundwater sample collected from monitoring well SDB-MW01. PFBS was not detected above the PAL (400,000 ng/L). PFHxS was detected at a concentration of 8.9 ng/L; however, there is no PAL for this compound.

PFHxS, PFOS, and PFOA were detected in soil samples. PFOS and PFOA were detected at concentrations that did not exceed the PALs (1,260 ng/g). PFHxS was detected at a maximum concentration of 0.71 ng/g; however, there is no PAL for this compound.

5.26 IRP Site 9 – Sludge Application Area (PRL 28)

Table 5-25 summarizes the analytical results of the groundwater and soil sampling at IRP Site 9 – Sludge Application Area. PFAS were detected in three of the five groundwater samples (including a duplicate sample) and in fourteen of the twenty-five soil samples; detections are shown on **Figure 5-10**.

PFBS, PFHxS, and PFOA were detected in groundwater. PFOA was detected in groundwater at concentrations that did not exceed the PAL (70 ng/L). PFBS was not detected above the PAL (400,000

ng/L). PFHxS was detected at a maximum concentration of 53 ng/L; however, there is no PAL for this compound.

PFHxS, PFNA, PFOS, and PFOA were detected in soil samples. PFOS and PFOA were detected at concentrations that did not exceed the PALs (1,260 ng/g). PFHpA was detected at a maximum concentration of 1.3 ng/g, PFHxS was detected at a maximum concentration of 19 ng/g, and PFNA was detected at a maximum concentration of 1.5 ng/g; however, there are no PALs for these compounds.

5.27 Base Boundary Wells

Table 5-26 summarizes the analytical results of the groundwater sampling at the base boundary wells. PFAS were detected in three of the five wells; detections are shown on **Figures 5-11 and 5-12**.

PFOS and PFOA were detected at concentrations that did not exceed the PALs (70 ng/L). PFBS was not detected above the PAL (400,000 ng/L). PFHxS was detected at a maximum concentration of 16 ng/L; however, there is no PAL for this compound.

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6. Analysis of Results

6.1 Soil

PFAS were detected above the PAL in only two of the 142 soil samples analyzed. PFOS was detected at a concentration of 1,900 ng/g in the subsurface soil at the Nozzle Testing Area (PRL 12) and in the surface soil at 1,700 J ng/g at C16-AOC (PRL 13). No other PFAS were detected above their respective PALs in any soil sample although the soil results at the FTA #2 (PRL 1) for PFOS was close to the PAL. The maximum detection of PFHpA was 2.7 ng/g at Building 1436-DHS Hangar (PRL 9). The maximum detection of PFHxS was 62 ng/g at Building 1422- DHS Hangar (PRL8) and the maximum detection of PFNA was 1.3 ng/g at Building 1416 - Air National Guard Hangar (PRL 7); however, there are no PALs for these three compounds.

Elevated levels of PFAS at PRLs 1, 12, and 13 indicate that source areas exist in the soils. Source areas in the remaining PRLs were not identified as PFAS in soil can be spread out making source areas difficult to identify.

6.2 Groundwater

The PFAS levels in groundwater samples exceeded the PALs for at least one constituent at eight PRLs including those results with “U” or “J” qualifiers. The highest concentration of PFAS was 17,000 ng/L for PFOS and 5,500 ng/L for PFOA detected at FTA2-MW01. PFAS were not detected above the PALs in the base boundary wells.

The maximum concentrations detected for PFHpA and PFNA were 760 ng/L and 180 ng/L, respectively, both from a groundwater sample collected from IRP Site 2 – FTA #2 (PRL 1); PFHxS was detected at a maximum concentration of 15,000 ng/L from a groundwater sample collected from Building 1422 - DHS Hangar (PRL 8); however, there are no PALs for these compounds.

6.3 Surface Water and Sediment

PFOS was detected above the PAL in seven out of eight surface water samples collected at Selfridge ANGB; however, PFOA and PFBS did not exceed their surface water PALs. In surface water, the maximum concentration of PFHpA was 140 ng/L, the maximum concentration of PFHxS was 2,200 ng/L, and the maximum concentration of PFNA was 39 ng/L; however, there are no PALs for these compounds. The maximum concentration for PFHpA, PFNA, PFOS, and PFOA were all detected in surface water sample DB507-SW01 collected from Wet Well/Drainage Basin 507 (PRL 21), which collects storm water from FTA #2 (PRL 1), Nozzle Testing Area (PRL 12), and Aircraft Crash Sites (PRL 25). PRLs 2 and 12 had elevated levels of PFAS in soil and groundwater. The maximum concentration of PFBS was 240 ng/L and the maximum concentration of PFHxS was 2,200 ng/L both from the surface water sample DB508-SW01 collected from Wet Well/Drainage Basin 508 (PRL 22). Samples from all five wet wells exceeded the MDEQ WQS. Three of the five wet wells discharge to Lake St. Clair directly and two wet wells discharge to the Clinton River, which flows into Lake St. Clair. A Notice of Violation (NOV) was submitted to the ANG dated 19 July 2018 a result of the analytical results presented in the referenced letter report.

PFOS was the only PFAS detected in sediment samples collected at the six PRLs with the maximum concentration of 24 ng/g, which is significantly below the PAL of 1,260 ng/g.

6.4 Updated Conceptual Site Model

Section 3 of this report provides the known elements of the conceptual site model (CSM) for Selfridge ANGB. The subsections below provide an update of the geological/hydrogeological and surface water elements and the relationship between the surface/subsurface conditions as they relate to the PFAS analytical results.

6.4.1 Geology/Hydrogeology

A potentiometric contour map was produced from groundwater levels of the 37 monitoring wells that were included in this SI; however, depths to groundwater were measured when each well was sampled over four months and not part of a comprehensive basewide groundwater measurement event. As shown on **Figure 3-1**, there are indications that the groundwater flow direction may have local influences dependent upon precipitation events. To confirm the groundwater flow direction and evaluate any other influences, a singular event to measure depth to groundwater across the base is recommended.

6.4.2 Surface Water

The Selfridge ANGB CSM, as it pertains to surface water flow, remains as described in **Section 3.1**. As shown on **Figure 5-8**, surface water flows to six outfalls that discharge either to the Clinton River and/or Lake St. Clair.

6.4.3 Contaminant Distribution and Impacts to Potential Receptors

Twenty-five PRLs warranting further investigation were identified in the PA Report. PFAS were detected in groundwater above a PAL at eight PRLs including those results with “U” or “J” qualifiers; however, low levels of PFAS in groundwater were present at most PRLs. The distribution of PFAS in groundwater throughout Selfridge ANGB is consistent with the greatest occurrence of AFFF use and potential to be released through historical and current activities. Thus, the highest levels of PFAS in groundwater were identified at IRP Site 2-Former FTA #2 (PRL 1), Building 1422 - DHS Hangar (PRL 8), Building 859 – Fire Department (PRL 10), and Former Building 33 – Fire Department (PRL 17). While groundwater is not currently being used as a drinking water source, the potential for future use or migration to Lake St. Clair, which is a drinking water source, may impact human or ecological receptors.

Soil samples were collected at 72 boring locations. PFAS were detected in soil at concentrations that exceeded the PAL in two of the PRLs investigated and close to the PAL at a third PRL; low levels of PFAS were present in most of the other PRLs. This indicates that there are source areas present at multiple locations throughout Selfridge ANGB. The existence of PFAS detections in soil at most of the other PRLs is more likely to be due to persistence of these contaminants in the environment at low levels rather than a confirmation of a source.

Surface water sample results from this SI indicate that PFAS were detected at the five wet wells and the one outfall (PRLs 20, 21, 22, 23, 24, and 26) exceeding the surface water PAL of 11 ng/L for PFOS. Due to the low elevation of the base and resulting shallow groundwater, it is suspected that water in the wet wells may include groundwater that is hydraulically connected to surface water or enters the storm conveyance system through breaks in the subsurface piping. Discharges from the five wet wells into the Clinton River and Lake St. Clair have potential impact to human receptors since water from the lake is used for supplying drinking water to the community in the vicinity of Selfridge ANGB. Sediment sample results do not indicate impacts to human or ecological receptors.

There are no municipal drinking water wells located in the vicinity of Selfridge ANGB, but there are 23 private wells located within a one-mile radius. Discharges from the wet wells to Lake St. Clair and the Clinton River, which discharges to Lake St. Clair exceed MDEQ WQS.

6.5 Environmental Sequence Stratigraphy

6.5.1 General Overview

Environmental Sequence Stratigraphy (ESS) is an US EPA-endorsed, state-of–the-art investigative approach that provides a detailed understanding of the subsurface geology in order to better predict the fate and transport of contaminants at complex sites. Although originally developed in the petroleum industry to find oil and natural gas reservoirs, AECOM has successfully adapted this technology to refine CSMs. In contrast to the traditional method of subsurface correlation, which involves matching sand with

sand and clay with clay, ESS depicts a detailed cross-section of sediment layering that is consistent with known depositional patterns. These cross-sections are then utilized to identify and map formations with high fluid transmissive properties.

ESS leverages all pre-existing base-wide and regional subsurface geologic data to better understand the site data within the context of the broader depositional environment. This lithologic data are reformatted to grain size logs to extract the vertical grain-size trends (coarsening-up/fining-up) of bore-hole materials. This lithologic information is then compared with established models to reveal depositional trends in the subsurface (**Figure 6-1**). This information is used to provide a more accurate characterization of subsurface conditions for the evaluation of potential PFAS migration pathways.

6.5.2 Selfridge ANGB Preliminary ESS Evaluation

Selfridge ANGB is located on the west shore of Lake St. Clair (**Figure 6-1**) in Michigan within the Great Lakes system (**Figure 6-2**). Geologically, the Site represents a glacial lake bed deposited in the ancestral Lake St. Clair when it stood at a higher stage during the melting of the last Pleistocene glaciers. The lake bed deposits are bordered on the west by a waterlaid moraine which lies on the west side of the City of Mount Clemens and roughly parallels the present shoreline. Relief on the lake bed deposits results from natural and manmade surface drainage and the presence of glacial lake shorelines representing earlier, higher lake levels. These latter features are still reflected in the topography as subdued ridges.

Previous geological investigations show that the Selfridge ANGB is primarily underlain by glacio-lacustrine, fan-deltaic and fluvial deposits controlled by several phases of glacial retreat and deglaciation. A conceptual stratigraphic model of this deposition for the area is given in **Figure 6-3**. The clay deposits of the ancient Lake St. Clair show local presence of gravel and sand lenses within the upper 35-40 ft bgs. This clay unit is underlain by glacial till deposits. Coastal splays and mouthbar deposits are more common along the northwest corner of the Selfridge ANGB.

Since surficial sediments primarily consist of unconsolidated glacial till and outwash deposits, small, interspersed pockets of sand and gravels function as the main conduits of groundwater flow. Conversely, in areas where the glacial till and outwash deposits are too poorly sorted and fine grained to transport water, they act as fundamental barriers to groundwater flow.

Google Earth images for the Site area show lacustrine deltaic and fluvial deposits in the present day geomorphology around the modern Lake St. Clair that may provide excellent analogs for understanding interconnectivity of high-transmissive and low-transmissive units in the subsurface of Selfridge ANGB in general (**Figures 6-4** and **6-5**). However, based on the preliminary ESS review of available subsurface information, site-specific sedimentary deposits cannot be mapped at this time with enough confidence to predict refined groundwater flow pathways. Recommended actions related to the refined CSM are provided in **Section 7.2.**

6.5.3 Data Quality Objectives

As discussed above, PFAS were detected in each media at all 25 PRLs. Additional investigation is required to further define the extent of PFAS contamination. The DQOs, by media, are outlined in **Table 6-1**.

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7. Conclusions and Recommendations

7.1 Conclusions

Twenty-five PRLs at Selfridge ANGB were selected for SI activities based on a Preliminary Assessment (PA) site visit conducted in March 2016. The results of the PA site visit were documented in the *Final Perfluorinated Compounds Preliminary Assessment Site Visit Report* (BB&E, 2016).

The SI field activities were completed between December 2017 and June 2018 culminating in the collection of 142 soil samples, 37 groundwater samples, eight surface water and eight sediment samples that were analyzed for six PFAS consistent with the UCMR-3 (US EPA, 2012). A summary of the maximum sampling results exceeding PALs for each PRL is provided in **Table 7-1**.

Based on the analytical data obtained during the SI, there is confirmation that PFAS exist in all media at the base. As provided in **Table 7-1**, the highest detected concentrations in soil were detected above the PAL for PFOS at the Nozzle Testing Area (PRL 12) and in groundwater were recorded at IRP Site 2-Former FTA #2 (PRL 1). Based on the groundwater data obtained from base boundary wells, it does not appear that PFAS above the PALs are migrating off-base.

PFAS were detected in all wet well samples with a maximum concentration of 2,400 ng/L for PFOS at Wet Well/Drainage Basin 507 (PRL 21) which exceeded the PAL of 11 ng/L. Samples from all five wet wells exceeded the MDEQ WQS. Three of the five wet wells discharge to Lake St. Clair directly and two wet wells discharge to the Clinton River, which flows into Lake St. Clair. At the request of MDEQ, an Outfall Surface Water Sampling Results letter report was submitted to MDEQ on 20 April 2018 in advance of this SI Report. A NOV was submitted to the ANG dated 19 July 2018 a result of the analytical results presented in the referenced letter report.

7.2 Recommendations

The following recommendations are provided for consideration based on the SI results:

- Further investigation at all 25 PRLs is necessary to determine the nature and extent of PFAS contamination due to detectable levels at all PRLs.
- Develop an expanded conceptual site model (CSM) that considers localized groundwater and surface water flow paths to select future sampling locations. To refine the CSM for Selfridge ANGB, an environmental sequence stratigraphy (ESS) analysis could be performed to generate new cross sections. This information could:
    - Identify and map (the composition, shape, and interconnectivity of) potentially undefined fluvial channels and other geologic features at the plume scale.
    - Construct a geologically defensible framework of the subsurface that better defines subsurface heterogeneity, accurately predicts preferential pathways, and reduces data gaps.
    - Achieve a greater understanding of groundwater and dissolved contaminate flow preferential pathways and thus target areas for active remedial implementation.
    - Reduce the number of future wells for plume measurements through stratigraphic guidance.
- Conduct a synoptic basewide groundwater sampling event to confirm the groundwater flow direction.
- Complete the delineation of PFAS as part of an Expanded SI or a Remedial Investigation that could consist of:
    - Expanding the groundwater sampling program to complete horizontal and vertical delineation of the PFAS impacts. Further groundwater investigation at the base boundary

is recommended due to the presence of PFAS in groundwater above their respective PALs.

- Installing and sampling new and existing downgradient off-base monitoring wells to better define the PFAS that may have migrated off-base and installation of upgradient monitoring wells to better define the PFAS that may have migrated on-base (from off-base sources) .
- Conducting additional surface water and sediment sampling both on-base and off-base to determine the nature and extent of PFAS impacts in these media. Potential locations include the Clinton River to the south and Lake St. Clair, a drinking water source, to the east.
- Perform additional soil sampling and analysis of an expanded list of PFAS (in addition to the six UCMR-3) and precursor analysis to determine if significant source areas related to precursor substances are present. Precursor substances have been demonstrated to oxidize into PFOS and PFOA via biological and abiotic processes and thus could provide a lingering source of PFOS and PFOA in soil and groundwater.

- Conduct preliminary site-specific risk assessment calculations in order to identify contaminants of potential concern in every media and establish preliminary remedial goals for screening purposes.

DQOs are proposed based on the results of the SI and are presented in **Section 6.5.3** or alternatively **Table 6-1.** A summary of these DQOs are presented in **Table ES-2**. Additional sampling and analysis is required at each PRL not achieving a NFA status to establish the nature and extent of PFAS for each applicable media and determine if there is a complete receptor pathway. For soil, additional sampling and analysis is required to determine if a source area exists, and if so, what is the vertical and horizontal extent for both the vadose and saturated zones. Additional sediment samples are required at PRLs where the presence of PFAS in surface water has been identified including upstream and downstream surface water and sediment sampling at on- and off-base locations.

Samples from all five wet wells exceeded the MDEQ WQS. Three of the five wet wells discharge to Lake St. Clair directly and two wet wells discharge to the Clinton River, which flows into Lake St. Clair. At the request of MDEQ, an Outfall Surface Water Sampling Results letter report was submitted to MDEQ on 20 April 2018 in advance of this SI Report. A Notice of Violation (NOV) was submitted to the ANG dated 19 July 2018 as a result of the analytical results presented in the referenced letter report. The following items are recommended to address the NOV.

- Complete a short-term storm water characterization study under wet and dry conditions in compliance with the conditions of the NOV;
- Evaluate the stormwater conveyance system which should include a study to determine if groundwater is infiltrating the storm water system;
- Conduct a dye test study in the Clinton River and Lake St. Clair to evaluate the mixing zone and potential for impacts to the Mount Clemens water treatment plant and water intake. Collect a representative number of samples in the Clinton River and Lake St. Clair during the dye test and analyze for PFAS compounds to calibrate the dye test results;
- Conduct a PFAS loading storm water management model to evaluate impacts under multiple remedial options; and
- Determine if an interim remedial action is feasible to reduce PFAS impacts to the Clinton River and Lake St. Clair.

8. References

AECOM, 2017. Work Plan for the Phase 2 Regional Site Investigations for Perfluorinated Compounds. November 16.

Air National Guard (ANG) Readiness Center. 2009. Air National Guard, Environmental Restoration Program, Investigation Guidance. September.

ANG, 2013. Final Wetland Delineation Report and Associated Mapping, Selfridge Air National Guard Base, Michigan. April.

AMEC Foster Wheeler [AMEC], 2016. Final Remedial Investigation/Feasibility Studies Work Plan, Great Lakes Region, Selfridge Air national Guard Base, Newly Evaluated Restoration Sites, 127th Wing, Michigan Air National Guard, Mt. Clemens, Michigan. August.

BB&E, Inc. (BB&E), 2005. Installation Restoration Program. Final Management Action Plan. 127th Wing, Michigan Air National Guard, Selfridge Air National Guard Base, Mt. Clemens, Michigan. March.

BB&E, 2016. Final Perfluorinated Compound (PFC) Preliminary Assessment Site Visit Report, Prepared for Headquarters Air National Guard Andrews AFB, Maryland. May.

C8 Science Panel, 2018. http://www.c8sciencepanel.org/index.html as accessed on 13 May 2018.

Department of Defense (DoD), 2009. Department of Defense Instruction, Emerging Contaminants. DoDI 4715.18. 11 June.

Michigan Department of Environmental Quality (MDEQ), 2018a. Remediation and Redevelopment Division. Environmental Contamination Response Activity Rules. Table 1. Groundwater: Residential and Nonresidential, Part 201 Generic Cleanup Criteria and Screening Levels. Effective 10 January 2018 and updated on 25 June 2018. https://www.michigan.gov/deq/0,4561,7-135-3311_4109-251790--,00.html as accessed on 20 August 2018.

MDEQ, 2018b. Rule 57 Water Quality Values. Surface Water Assessment Section. 15 March 2018.

Milstein, R. L., 1987. Bedrock Geology of Michigan. Geological Survey Division of the Michigan Department of Natural Resources.

National Cooperative Soil Survey, 2011. OSD Documents, Minoa Series, Web. https://soilseries.sc.egov.usda.gov/OSD_Docs/M/MINOA.html as accessed on 6 April 2018

National Cooperative Soil Survey, 2012. OSD Documents, Lamson Series, Web. https://soilseries.sc.egov.usda.gov/OSD_Docs/L/LAMSON.html as accessed on 6 April 2018

National Cooperative Soil Survey, 2014. OSD Documents, Paulding Series, Web. https://soilseries.sc.egov.usda.gov/OSD_Docs/P/PAULDING.htmlas accessed on 6 April 2018

Operational Technologies Corporation, 1993. Management Action Plan, 127th Fighter Wing, Michigan Air National Guard, Selfridge Air National Guard Base, Mt. Clemens, Michigan. August.

Selfridge Air National Guard Base (ANGB), 2015. Final Stormwater Pollution Prevention Plan. March.

United States Environmental Protection Agency (US EPA), 1986. RCRA Ground-Water Monitoring Technical Enforcement Guidance Document. September.

US EPA, 2012. Third Unregulated Contaminant Monitoring Rule (UCMR-3). https://www.epa.gov/dwucmr/third-unregulated-contaminant-monitoring-rule. May.

US EPA. 2016a. Drinking Water Health Advisory for Perfluorooctane Sulfonate Acid (PFOS). Office of Water (4304T). Health and Ecological Criteria Division, Washington, DC 20460. US EPA Document Number: 822-R-16-004. May 2016.

US EPA. 2016b. Drinking Water Health Advisory for Perfluorooctanoic Acid (PFOA). Office of Water (4304T). Health and Ecological Criteria Division, Washington, DC 20460. US EPA Document Number: 822-R-16-005. May 2016.

US EPA, 2016c.Fact Sheet, PFOA & PFOS Drinking Water Health Advisories. November 2016. https://www.epa.gov/sites/production/files/2016-06/documents/drinkingwaterhealthadvisories_pfoa_pfos_updated_5.31.16.pdf as accessed on 13 May 2018.

US EPA. 2018. Regional Screening Levels – Generic Tables (May 2018). Residential – Direct Contact Soil. https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables as accessed on 8 May 2018.

United States Department of Agriculture, Natural Resources Conservation Service (USDA NRCS), 2013. Web Soil Service. https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx as accessed on 5 July 2018.

US Fish and Wildlife Service, Species by County Report, Web. 06 Apr. 2017. https://ecos.fws.gov/ecp0/reports/species-by-current-range-county?fips=26099 as accessed on 06 April 2017.

Appendix A: Figures

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AECOM
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Project No.: 60520893

N
W E
S

0 0.85 1.7
Miles

1 inch = 1.7 miles

Figure 1-1

Selfridge ANGB Location

Selfridge ANGB
Perfluorinated Compounds Site Inspection Report
Mount Clemens, Michigan

8/6/2018 1:108,000 \\arlington\Arlington\DCS\GIS\GIS_Data\60520893_ANG_PFCs\MXDs\Selfridge\Site Investigation Report\Figure 1-1 Selfridge ANG Location.mxd

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N
W E
S

0 750 1,500
Feet

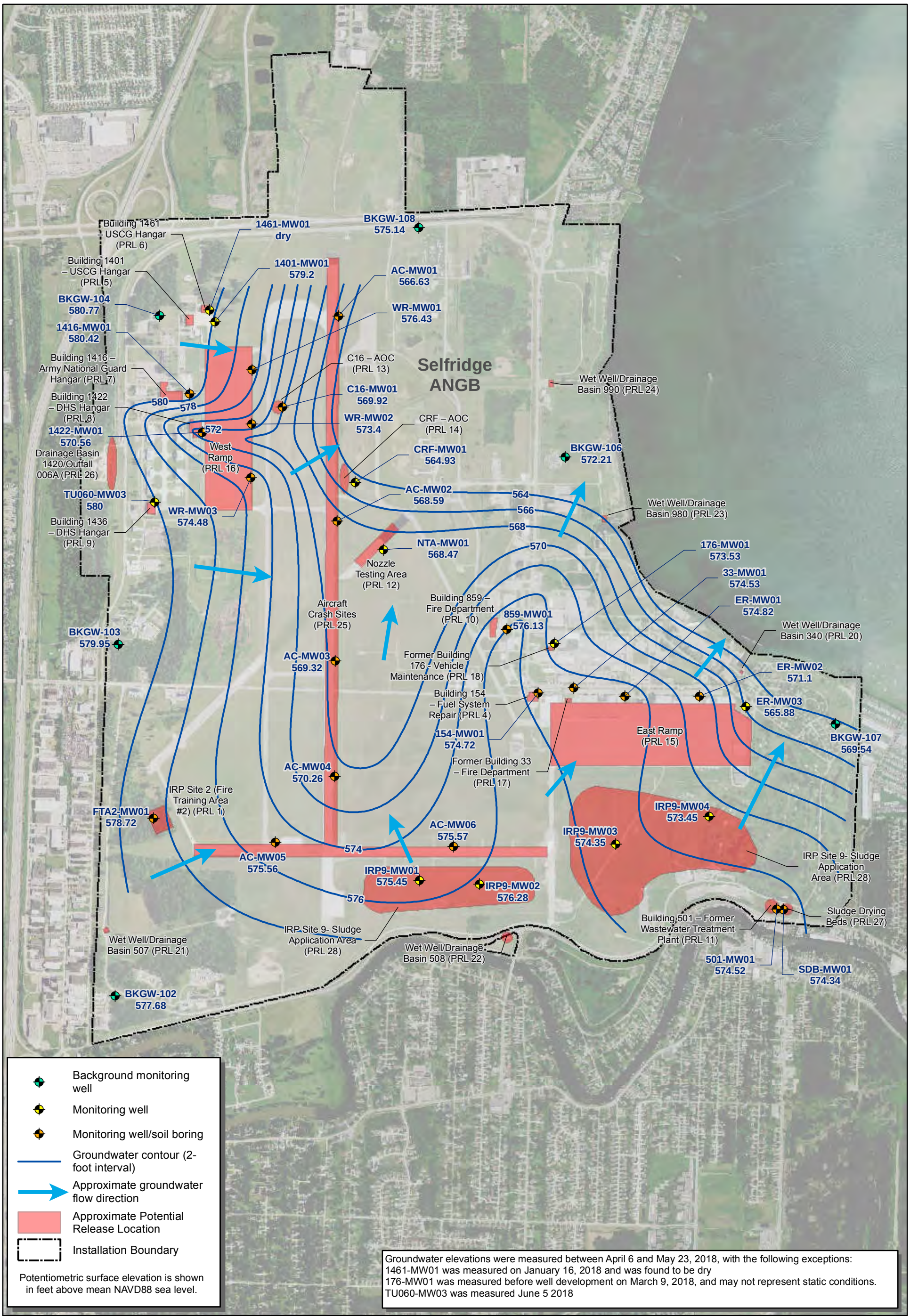
1 inch = 1,500 feet

Figure 2-1

Selfridge ANGB Potential Release Locations

Selfridge Air National Guard Base (ANGB)
Perfluorinated Compounds Site Inspection Report
Mount Clemens, Michigan

8/15/2018 1:18,000 \\arlington.na.aecomnet.com\Arlington\DCS\GIS\GIS_Data\60520893_ANG_PFCs\MXDs\Selfridge\Site Investigation Report\Figure 2-1 Selfridge PRLs.mxd



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N W E S

0 750 1,500 Feet

1 inch = 1,500 feet

Figure 3-1

Selfridge ANGB Potentiometric Surface

Selfridge Air National Guard Base (ANGB)
Perfluorinated Compounds Site Inspection Report
Mount Clemens, Michigan

9/17/2018 1:18,000 \\arlington.na.aecomnet.com\Arlington\DCS\GIS\GIS_Data\60520893_ANG_PFCs\MXDs\Selfridge\Site Investigation Report\Figure 3-1 Potentiometric Surface.mxd

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Project No.: 60520893

N W E S

0 750 1,500 Feet

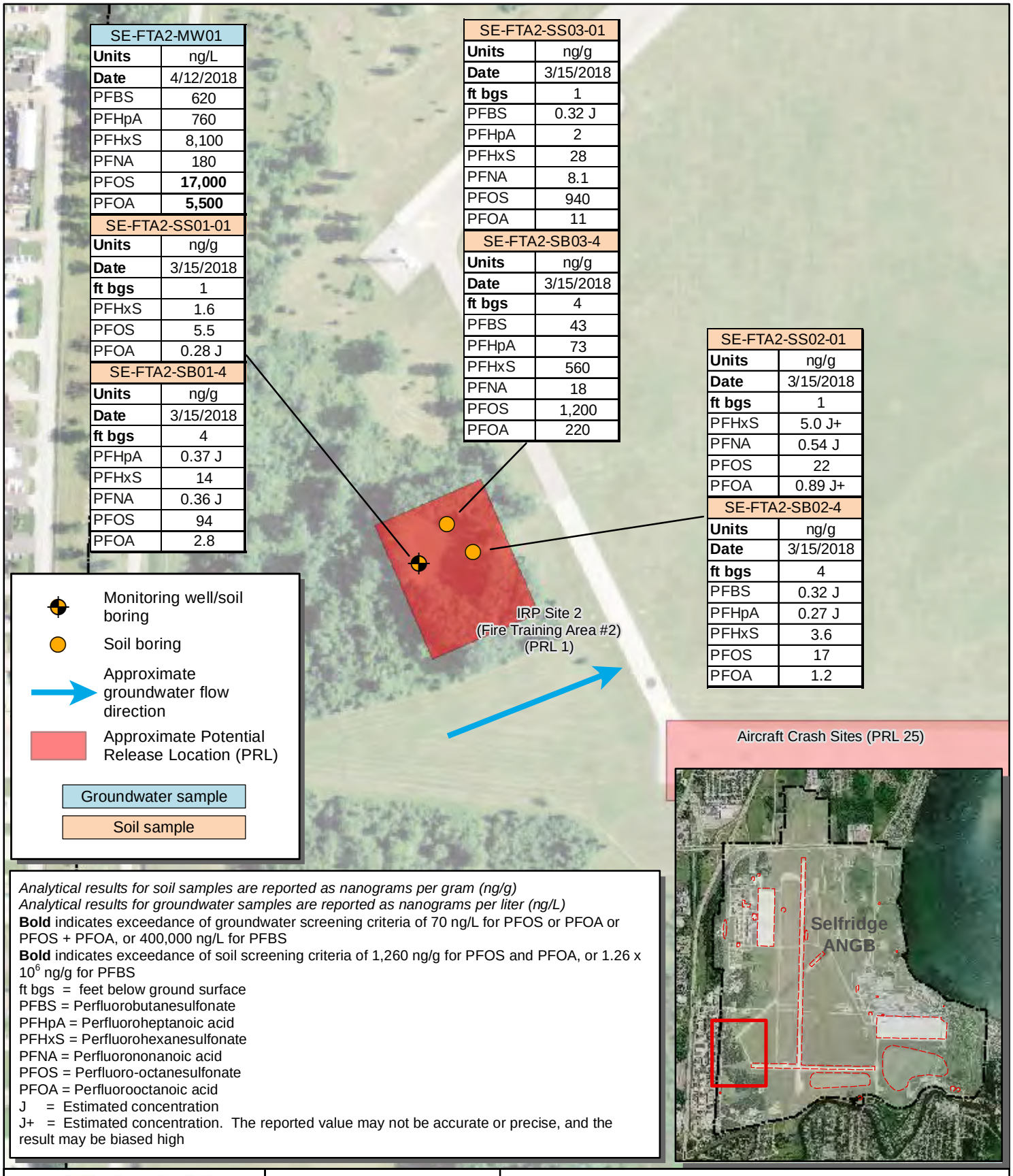
1 in = 1,500 ft

Figure 4-1

Basewide Sample Locations

Selfridge Air National Guard Base (ANGB)
Perfluorinated Compounds Site Inspection Report
Mount Clemens, Michigan

9/17/2018 1:18,000 \\arlington.na.aecomnet.com\Arlington\DCS\GIS\GIS_Data\60520893_ANG_PFCs\MXDs\Selfridge\Site Investigation Report\Figure 4-1 Basewide Sample Locations.mxd



Analytical results for soil samples are reported as nanograms per gram (ng/g)
Analytical results for groundwater samples are reported as nanograms per liter (ng/L)
Bold indicates exceedance of groundwater screening criteria of 70 ng/L for PFOS or PFOA or PFOS + PFOA, or 400,000 ng/L for PFBS
Bold indicates exceedance of soil screening criteria of 1,260 ng/g for PFOS and PFOA, or 1.26 x 10^6 ng/g for PFBS
ft bgs = feet below ground surface
PFBS = Perfluorobutanesulfonate
PFHpA = Perfluoroheptanoic acid
PFHxS = Perfluorohexanesulfonate
PFNA = Perfluorononanoic acid
PFOS = Perfluoro-octanesulfonate
PFOA = Perfluorooctanoic acid
J = Estimated concentration
J+ = Estimated concentration. The reported value may not be accurate or precise, and the result may be biased high

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Project No.: 60520893

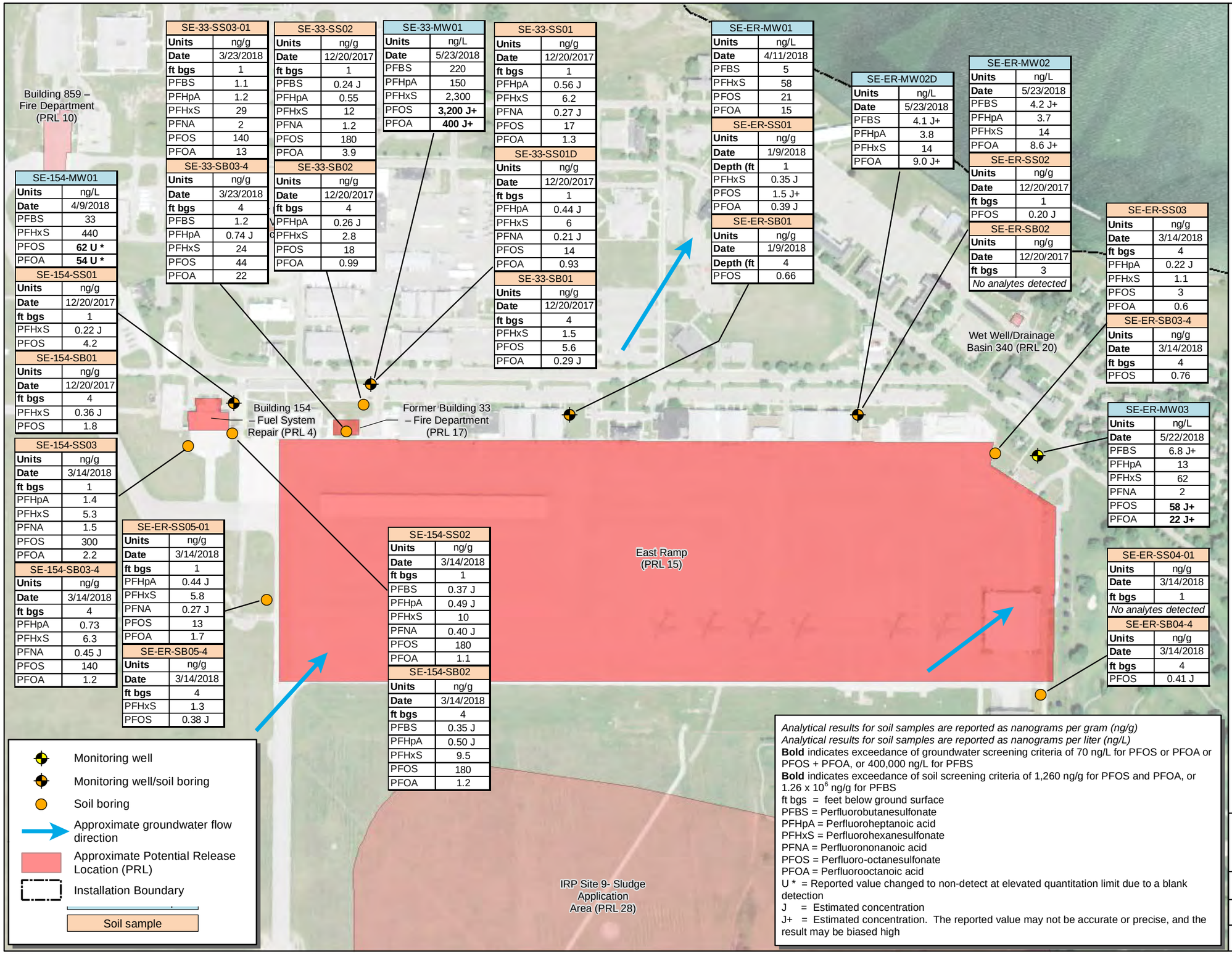
N W E S
0 175 350
Feet
1 in = 350 ft

Figure 5-1

Detected Soil and Groundwater Sample Results PRL 1: Fire Training Area #2

Selfridge Air National Guard Base (ANGB)
Perfluorinated Compounds Site Inspection Report
Mount Clemens, Michigan

8/16/2018 1:4,200 \\arlington.na.aecomnet.com\Arlington\DCS\GIS\GIS_Data\60520893_ANG_PFCs\MXDs\Selfridge\Site Investigation Report\Figure 5-1 SoilGW Results PRL 1.mxd



SE-33-SS03-01	
Units	ng/g
Date	3/23/2018
ft bgs	1
PFBS	1.1
PFHpA	1.2
PFHxS	29
PFNA	2
PFOS	140
PFOA	13

SE-33-SB03-4	
Units	ng/g
Date	3/23/2018
ft bgs	4
PFBS	1.2
PFHpA	0.74 J
PFHxS	24
PFOS	44
PFOA	22

SE-33-SS02	
Units	ng/g
Date	12/20/2017
ft bgs	1
PFBS	0.24 J
PFHpA	0.55
PFHxS	12
PFNA	1.2
PFOS	180
PFOA	3.9

SE-33-SB02	
Units	ng/g
Date	12/20/2017
ft bgs	4
PFHpA	0.26 J
PFHxS	2.8
PFOS	18
PFOA	0.99

SE-33-MW01	
Units	ng/L
Date	5/23/2018
PFBS	220
PFHpA	150
PFHxS	2,300
PFOS	**3,200 J+**
PFOA	**400 J+**

SE-33-SS01	
Units	ng/g
Date	12/20/2017
ft bgs	1
PFHpA	0.56 J
PFHxS	6.2
PFNA	0.27 J
PFOS	17
PFOA	1.3

SE-33-SS01D	
Units	ng/g
Date	12/20/2017
ft bgs	1
PFHpA	0.44 J
PFHxS	6
PFNA	0.21 J
PFOS	14
PFOA	0.93

SE-33-SB01	
Units	ng/g
Date	12/20/2017
ft bgs	4
PFHxS	1.5
PFOS	5.6
PFOA	0.29 J

SE-ER-MW01	
Units	ng/L
Date	4/11/2018
PFBS	5
PFHxS	58
PFOS	21
PFOA	15

SE-ER-SS01	
Units	ng/g
Date	1/9/2018
Depth (ft	1
PFHxS	0.35 J
PFOS	1.5 J+
PFOA	0.39 J

SE-ER-SB01	
Units	ng/g
Date	1/9/2018
Depth (ft	4
PFOS	0.66

SE-ER-MW02D	
Units	ng/L
Date	5/23/2018
PFBS	4.1 J+
PFHpA	3.8
PFHxS	14
PFOA	9.0 J+

SE-ER-MW02	
Units	ng/L
Date	5/23/2018
PFBS	4.2 J+
PFHpA	3.7
PFHxS	14
PFOA	8.6 J+

SE-ER-SS02	
Units	ng/g
Date	12/20/2017
ft bgs	1
PFOS	0.20 J

SE-ER-SB02	
Units	ng/g
Date	12/20/2017
ft bgs	3
No analytes detected	

SE-ER-SS03	
Units	ng/g
Date	3/14/2018
ft bgs	4
PFHpA	0.22 J
PFHxS	1.1
PFOS	3
PFOA	0.6

SE-ER-SB03-4	
Units	ng/g
Date	3/14/2018
ft bgs	4
PFOS	0.76

SE-ER-MW03	
Units	ng/L
Date	5/22/2018
PFBS	6.8 J+
PFHpA	13
PFHxS	62
PFNA	2
PFOS	**58 J+**
PFOA	**22 J+**

SE-ER-SS04-01	
Units	ng/g
Date	3/14/2018
ft bgs	1
No analytes detected	

SE-ER-SB04-4	
Units	ng/g
Date	3/14/2018
ft bgs	4
PFOS	0.41 J

SE-154-MW01	
Units	ng/L
Date	4/9/2018
PFBS	33
PFHxS	440
PFOS	**62 U ***
PFOA	**54 U ***

SE-154-SS01	
Units	ng/g
Date	12/20/2017
ft bgs	1
PFHxS	0.22 J
PFOS	4.2

SE-154-SB01	
Units	ng/g
Date	12/20/2017
ft bgs	4
PFHxS	0.36 J
PFOS	1.8

SE-154-SS03	
Units	ng/g
Date	3/14/2018
ft bgs	1
PFHpA	1.4
PFHxS	5.3
PFNA	1.5
PFOS	300
PFOA	2.2

SE-154-SB03-4	
Units	ng/g
Date	3/14/2018
ft bgs	4
PFHpA	0.73
PFHxS	6.3
PFNA	0.45 J
PFOS	140
PFOA	1.2

SE-ER-SS05-01	
Units	ng/g
Date	3/14/2018
ft bgs	1
PFHpA	0.44 J
PFHxS	5.8
PFNA	0.27 J
PFOS	13
PFOA	1.7

SE-ER-SB05-4	
Units	ng/g
Date	3/14/2018
ft bgs	4
PFHxS	1.3
PFOS	0.38 J

SE-154-SS02	
Units	ng/g
Date	3/14/2018
ft bgs	1
PFBS	0.37 J
PFHpA	0.49 J
PFHxS	10
PFNA	0.40 J
PFOS	180
PFOA	1.1

SE-154-SB02	
Units	ng/g
Date	3/14/2018
ft bgs	4
PFBS	0.35 J
PFHpA	0.50 J
PFHxS	9.5
PFOS	180
PFOA	1.2

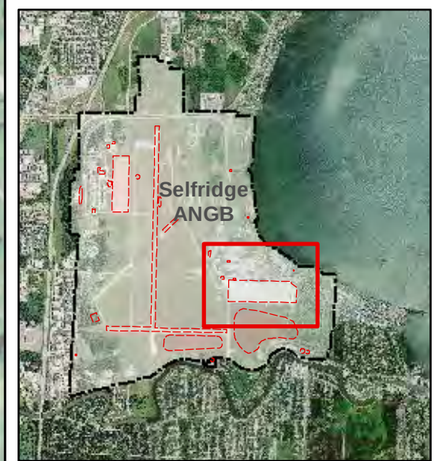
Analytical results for soil samples are reported as nanograms per gram (ng/g)
Analytical results for soil samples are reported as nanograms per liter (ng/L)
Bold indicates exceedance of groundwater screening criteria of 70 ng/L for PFOS or PFOA or PFOS + PFOA, or 400,000 ng/L for PFBS
Bold indicates exceedance of soil screening criteria of 1,260 ng/g for PFOS and PFOA, or 1.26×10^6 ng/g for PFBS
ft bgs = feet below ground surface
PFBS = Perfluorobutanesulfonate
PFHpA = Perfluoroheptanoic acid
PFHxS = Perfluorohexanesulfonate
PFNA = Perfluorononanoic acid
PFOS = Perfluoro-octanesulfonate
PFOA = Perfluorooctanoic acid
U * = Reported value changed to non-detect at elevated quantitation limit due to a blank detection
J = Estimated concentration
J+ = Estimated concentration. The reported value may not be accurate or precise, and the result may be biased high

N
W E
S
0 200 400
Feet
1 in = 400 ft

Figure 5-2

Detected Soil and Groundwater Sample Results
PRLs 4, 15, & 17: Building 154 (Fuel System Repair), East Ramp, and Former Building 33 (Fire Department)

Selfridge Air National Guard Base (ANGB)
Perfluorinated Compounds Site Inspection Report
Mount Clemens, Michigan



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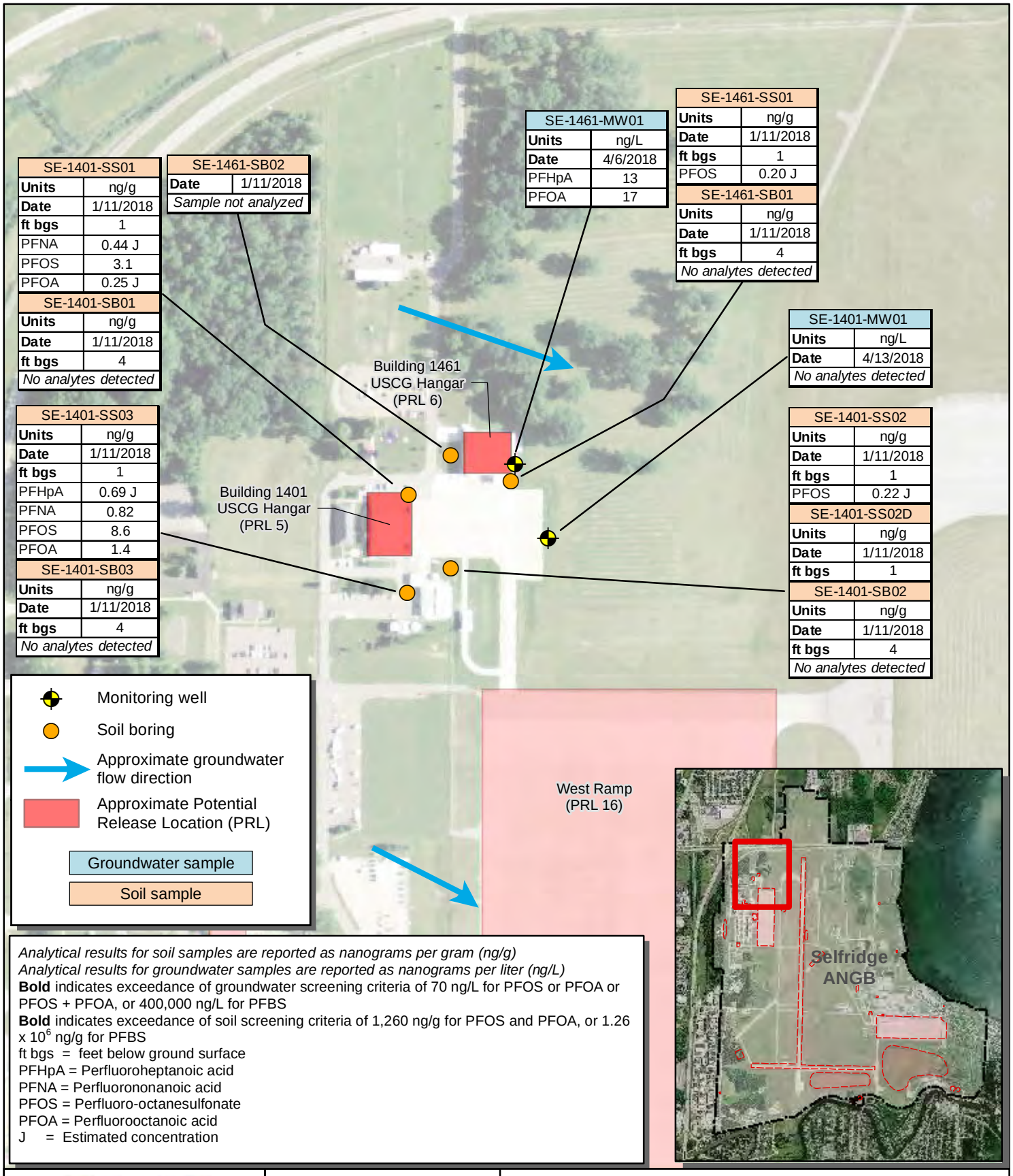

Analytical results for soil samples are reported as nanograms per gram (ng/g)
Analytical results for groundwater samples are reported as nanograms per liter (ng/L)
Bold indicates exceedance of groundwater screening criteria of 70 ng/L for PFOS or PFOA or PFOS + PFOA, or 400,000 ng/L for PFBS
Bold indicates exceedance of soil screening criteria of 1,260 ng/g for PFOS and PFOA, or 1.26 x 10^6 ng/g for PFBS
ft bgs = feet below ground surface
PFHpA = Perfluoroheptanoic acid
PFNA = Perfluorononanoic acid
PFOS = Perfluoro-octanesulfonate
PFOA = Perfluorooctanoic acid
J = Estimated concentration

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Project No.: 60520893

N W E S
0 175 350
Feet
1 in = 350 ft

Figure 5-3
Detected Soil and Groundwater Sample Results PRLs 5 & 6: Buildings 1401 and 1461 (USCG Hangars)

Selfridge Air National Guard Base (ANGB)
Perfluorinated Compounds Site Inspection Report
Mount Clemens, Michigan

8/20/2018 1:4,200 \\arlington.na.aecomnet.com\Arlington\DCS\GIS\GIS_Data\60520893_ANG_PFCs\MXDs\Selfridge\Site Investigation Report\Figure 5-3 SoilGW Results PRLS 5,6.mxd

SE-1416-SS01	
Units	ng/g
Date	12/21/2017
ft bgs	1
PFHpA	1.2
PFHxS	7.0 J
PFNA	1.3 J+
PFOS	93 J+
PFOA	1.9

SE-1416-SS01D	
Units	ng/g
Date	12/21/2017
ft bgs	1
PFHpA	0.74
PFHxS	1.2 J
PFNA	1.1 J+
PFOS	25 J+
PFOA	1.3

SE-1416-SB01	
Units	ng/g
Date	12/21/2017
ft bgs	4
PFHxS	5
PFOS	120 J+
PFOA	0.55 J

SE-1416-MW01	
Units	ng/L
Date	4/11/2018
PFBS	25
PFHpA	3.9 J
PFHxS	70

Building 1416
Army National Guard
Hangar (PRL 7)

SE-1416-SS02	
Units	ng/g
Date	3/12/2018
ft bgs	1
PFHxS	1.1
PFOS	12
PFOA	0.33 J

SE-1416-SB02	
Units	ng/g
Date	3/12/2018
ft bgs	4
No analytes detected	

SE-1416-SS03	
Units	ng/g
Date	3/12/2018
ft bgs	1
PFHxS	11
PFOS	31
PFOA	0.69

SE-1416-SB03	
Units	ng/g
Date	3/12/2018
ft bgs	4
PFHxS	2.6
PFOS	6.1

Building 1422
DHS Hangar
(PRL 8)

SE-1422-SS02	
Units	ng/g
Date	1/12/2018
ft bgs	1
PFHxS	12
PFNA	0.27 J
PFOS	180
PFOA	0.63 J

SE-1422-SB02	
Units	ng/g
Date	1/12/2018
ft bgs	4
PFHxS	5.1
PFOS	13
PFOA	0.28 J

SE-1422-MW01	
Units	ng/L
Date	4/6/2018
PFBS	3,400
PFHpA	650
PFHxS	15,000
PFOS	**11,000**
PFOA	**850**

SE-1422-SS01	
Units	ng/g
Date	1/12/2018
ft bgs	1
PFBS	1.8
PFHpA	0.39 J
PFHxS	62
PFNA	0.65 U
PFOS	120
PFOA	1.9

SE-1422-SB01	
Units	ng/g
Date	1/12/2018
ft bgs	4
PFBS	1
PFHpA	0.28 J
PFHxS	40
PFNA	0.52 U
PFOS	140
PFOA	2

Drainage Basin
1420/Outfall
006A (PRL 26)

West Ramp
(PRL 16)

SE-1436-SS01	
Units	ng/g
Date	12/21/2017
ft bgs	1
PFHpA	2.3
PFHxS	0.44 J
PFNA	0.87 J+
PFOS	1.4 J+
PFOA	4.2

SE-1436-SB01	
Units	ng/g
Date	12/21/2017
ft bgs	4
PFHpA	0.31 J

SE-TU060-MW03	
Units	ng/L
Date	6/5/2018
PFBS	3.3 J
PFHpA	70
PFHxS	23
PFNA	7.5
PFOA	51

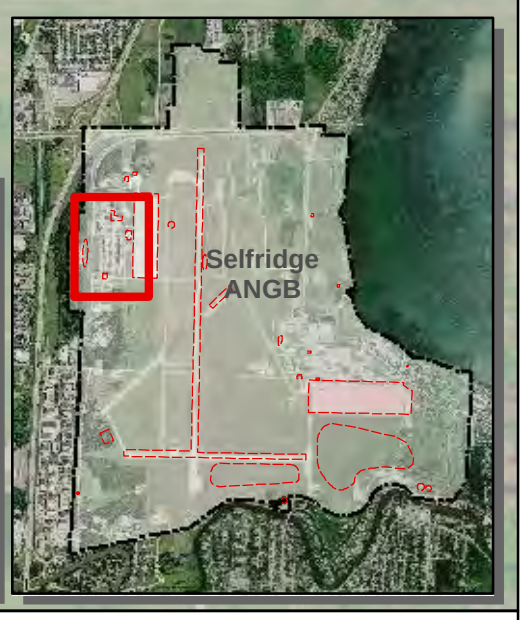
SE-1436-SS03	
Units	ng/g
Date	12/21/2017
ft bgs	1
PFHpA	0.54 J
PFHxS	0.19 J
PFNA	0.38 J+
PFOS	1.4 J+
PFOA	0.85

SE-1436-SB03	
Units	ng/g
Date	12/21/2017
ft bgs	4
PFOS	0.41 J+

Building 1436
DHS Hangar
(PRL 9)

SE-1436-SS02	
Units	ng/g
Date	12/21/2017
ft bgs	1
PFHpA	2.7
PFHxS	0.26 J
PFNA	0.69 J+
PFOS	1.2 J+
PFOA	2.6

SE-1436-SB02	
Units	ng/g
Date	12/21/2017
ft bgs	4
PFHpA	0.51 J
PFOA	0.43 J



Monitoring well
Monitoring well/soil boring
Soil boring
Approximate groundwater flow direction
Approximate Potential Release Location (PRL)
Installation Boundary

Groundwater sample
Soil sample

Analytical results for groundwater samples are reported as nanograms per liter (ng/L)
Analytical results for soil samples are reported as nanograms per gram (ng/g)
Bold indicates exceedance of groundwater screening criteria of 70 ng/L for PFOS or PFOA or PFOS + PFOA, or 400,000 ng/L for PFBS
Bold indicates exceedance of soil screening criteria of 1,260 ng/g for PFOS and PFOA, or 1.26×10^6 ng/g for PFBS
ft bgs = feet below ground surface
PFBS = Perfluorobutanesulfonate
PFHpA = Perfluoroheptanoic acid
PFHxS = Perfluorohexanesulfonate
PFNA = Perfluorononanoic acid
PFOS = Perfluoro-octanesulfonate
PFOA = Perfluorooctanoic acid
J = Estimated concentration
J+ = Estimated concentration. The reported value may not be accurate or precise, and the result may be biased high

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Project No.: 60520893

N W E S
0 125 250
Feet
1 in = 250 ft

Figure 5-4

Detected Soil and Groundwater Sample Results
PRLs 7, 8 & 9: Building 1416 (Army National Guard Hangar), and Buildings 1422 and 1436 (DHS Hangars)

Selfridge Air National Guard Base (ANGB)
Perfluorinated Compounds Site Inspection Report
Mount Clemens, Michigan

8/16/2018 1:3,000 \\arlington.na.aecomnet.com\Arlington\DCS\GIS\GIS_Data\60520893_ANG_PFCs\MXDs\Selfridge\Site Investigation Report\Figure 5-4 SoilGW Results PRLS 5,6,7.mxd

SE-NTA-SS02-01	
Units	ng/g
Date	3/14/2018
ft bgs	1
PFHpA	0.20 J
PFHxS	1.7
PFNA	0.62
PFOS	62
PFOA	0.44 J

SE-NTA-SB02-4	
Units	ng/g
Date	3/14/2018
ft bgs	4
PFBS	0.61 J
PFHpA	2.2
PFHxS	17
PFNA	1.8
PFOS	68
PFOA	5.1 B

SE-NTA-SS01-01	
Units	ng/g
Date	3/14/2018
ft bgs	1
PFBS	0.56 J
PFHpA	2.2
PFHxS	25
PFNA	12
PFOS	790
PFOA	4.3

SE-NTA-SB01-4	
Units	ng/g
Date	3/14/2018
ft bgs	4
PFBS	2.1
PFHpA	6.3 J-
PFHxS	76
PFNA	16
PFOS	**1,900**
PFOA	16 B

SE-NTA-MW01	
Units	ng/L
Date	5/23/2018
PFBS	70
PFHpA	14 J-
PFHxS	32
PFOS	**77 J+**

SE-NTA-MW01D	
Units	ng/L
Date	5/23/2018
PFBS	64
PFHpA	12
PFHxS	27
PFOS	**84 J+**

SE-NTA-SS03-01	
Units	ng/g
Date	3/14/2018
ft bgs	1
PFHpA	0.56
PFHxS	2.6
PFNA	1
PFOS	110
PFOA	0.78

SE-NTA-SB03-4	
Units	ng/g
Date	3/14/2018
ft bgs	4
PFBS	0.37 J
PFHpA	2.5
PFHxS	37
PFNA	1.5
PFOS	150
PFOA	3.9

SE-859-SS03	
Units	ng/g
Date	3/14/2018
ft bgs	1
PFHxS	6.7
PFNA	0.20 J
PFOS	68
PFOA	0.55 J

SE-859-SB03	
Units	ng/g
Date	3/14/2018
ft bgs	4
PFHxS	14
PFOS	38
PFOA	0.45 J

SE-859-SS02	
Units	ng/g
Date	3/14/2018
ft bgs	1
PFHxS	6.9
PFOS	81
PFOA	0.72

SE-859-SB02	
Units	ng/g
Date	3/14/2018
ft bgs	4
PFBS	0.31 J
PFHxS	0.65 J
PFOS	1.6

SE-859-SS01	
Units	ng/g
Date	12/21/2017
ft bgs	1
PFHxS	2.5
PFOS	11 J+
PFOA	0.44 J

SE-859-SB01	
Units	ng/g
Date	12/21/2017
ft bgs	4
PFHxS	4.5
PFOS	34 J+
PFOA	0.87

SE-859-MW01	
Units	ng/L
Date	4/9/2018
PFBS	42
PFHpA	39
PFHxS	2,100
PFOS	**530**
PFOA	**890**

SE-176-SS01	
Units	ng/g
Date	12/20/2017
ft bgs	1
PFBS	1.9
PFHpA	0.78
PFHxS	31
PFNA	0.75 J+
PFOS	77 J+
PFOA	5.1

SE-176-SB01	
Units	ng/g
Date	12/20/2017
ft bgs	4
PFBS	2.7
PFHpA	0.82
PFHxS	19
PFOS	57 J+
PFOA	3.4

SE-176-MW01	
Units	ng/L
Date	4/9/2018
PFBS	24
PFHpA	25
PFHxS	52
PFOA	13

SE-176-SS02	
Units	ng/g
Date	12/21/2017
ft bgs	1
PFHpA	0.23 J
PFHxS	1.9
PFNA	0.20 J+
PFOS	12 J+
PFOA	0.61

SE-176-SB02	
Units	ng/g
Date	12/21/2017
ft bgs	4
PFHxS	1.7
PFOS	18 J+
PFOA	0.68

SE-176-SS03	
Units	ng/g
Date	12/20/2017
ft bgs	1
PFBS	0.21 J
PFHpA	0.30 J
PFHxS	5.6
PFNA	0.30 J
PFOS	36
PFOA	0.75

SE-176-SB03	
Units	ng/g
Date	12/20/2017
ft bgs	4
PFBS	0.59 J
PFHpA	0.45 J
PFHxS	20
PFNA	0.92 J+
PFOS	170 J+
PFOA	1.7

Nozzle Testing Area (PRL 12)

Aircraft Crash Sites (PRL 25)

Wet Well/Drainage Basin 980 (PRL 23)

Building 859 – Fire Department (PRL 10)

Former Building 176 - Vehicle Maintenance (PRL 18)

Building 154 Fuel System Repair (PRL 4)

Monitoring well

Monitoring well/soil boring

Soil boring

Approximate groundwater flow direction

Approximate Potential Release Location (PRL)

Installation Boundary

Groundwater sample

Soil sample

Analytical results for soil samples are reported as nanograms per gram (ng/g)
Analytical results for soil samples are reported as nanograms per liter (ng/L)
Bold indicates exceedance of groundwater screening criteria of 70 ng/L for PFOS or PFOA or PFOS + PFOA, or 400,000 ng/L for PFBS
Bold indicates exceedance of soil screening criteria of 1,260 ng/g for PFOS and PFOA, or 1.26 x 10^6 ng/g for PFBS
ft bgs = feet below ground surface
PFBS = Perfluorobutanesulfonate
PFHpA = Perfluoroheptanoic acid
PFHxS = Perfluorohexanesulfonate
PFNA = Perfluorononanoic acid
PFOS = Perfluoro-octanesulfonate
PFOA = Perfluorooctanoic acid
J = Estimated concentration
J+ = Estimated concentration. The reported value may not be accurate or precise, and the result may be biased high
J- = Estimated concentration. The reported value may not be accurate or precise, and the result may be biased low

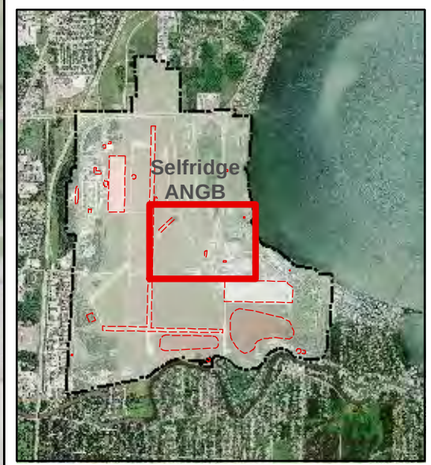
N
W E
S

0 175 350
Feet
1 in = 350 ft

Figure 5-5

Detected Soil and Groundwater Sample Results PRLs 10, 12, & 18: Building 859 (Fire Department), Nozzle Testing Area, and Former Building 176 (Vehicle Maintenance)

Selfridge Air National Guard Base (ANGB)
Perfluorinated Compounds Site Inspection Report
Mount Clemens, Michigan



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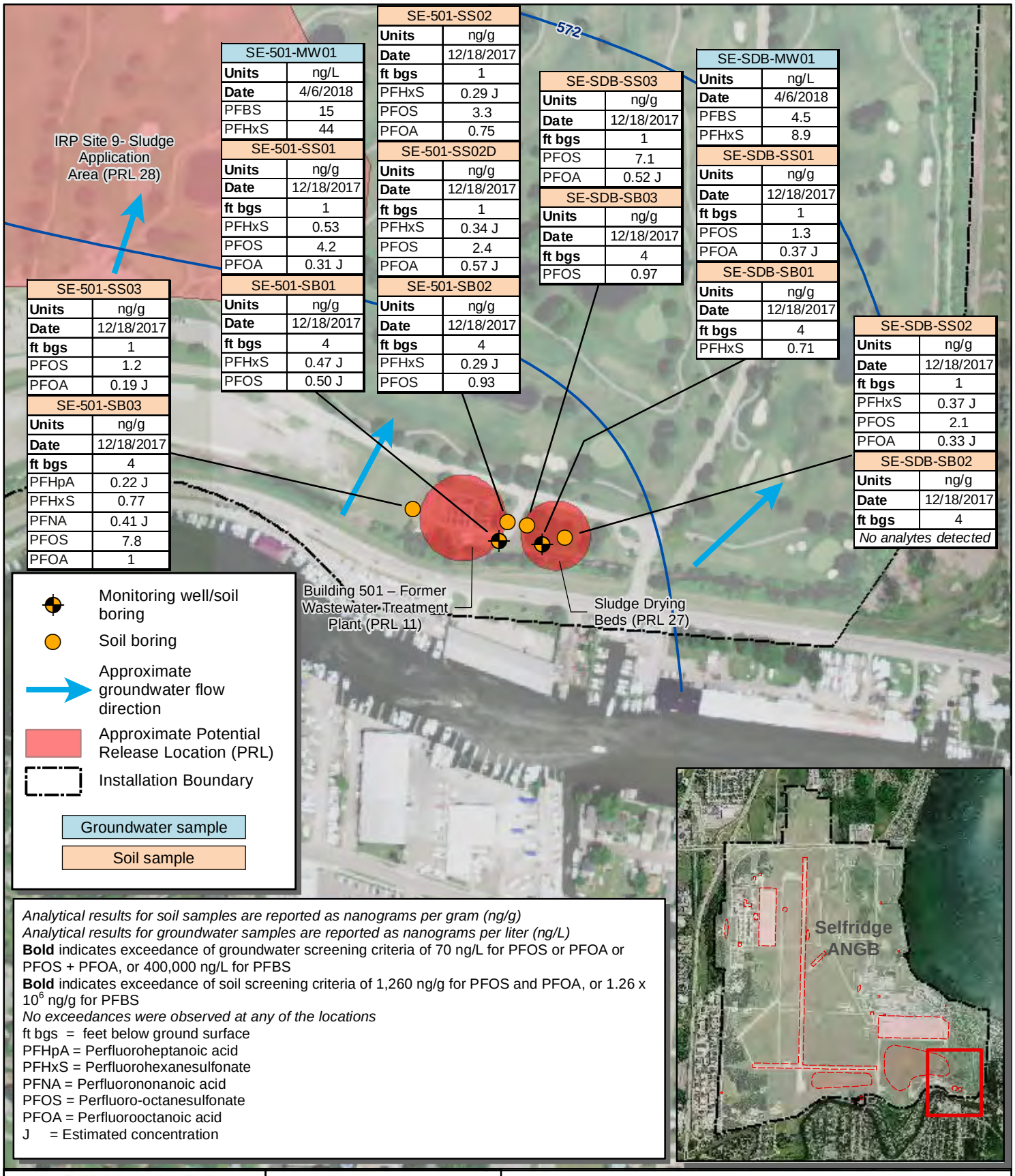
8/20/2018 1:4,200 \\arlington.na.aecomnet.com\Arlington\DCS\GIS\GIS_Data\60520893_ANG_PFCs\MXDs\Selfridge\Site Investigation Report\Figure 5-5 SoilGW Results PRLS 10,12,18.mxd



SE-501-MW01	
Units	ng/L
Date	4/6/2018
PFBS	15
PFHxS	44

SE-501-SS01	
Units	ng/g
Date	12/18/2017
ft bgs	1
PFHxS	0.53
PFOS	4.2
PFOA	0.31 J

SE-501-SB01	
Units	ng/g
Date	12/18/2017
ft bgs	4
PFHxS	0.47 J
PFOS	0.50 J

SE-501-SS02	
Units	ng/g
Date	12/18/2017
ft bgs	1
PFHxS	0.29 J
PFOS	3.3
PFOA	0.75

SE-501-SS02D	
Units	ng/g
Date	12/18/2017
ft bgs	1
PFHxS	0.34 J
PFOS	2.4
PFOA	0.57 J

SE-501-SB02	
Units	ng/g
Date	12/18/2017
ft bgs	4
PFHxS	0.29 J
PFOS	0.93

SE-501-SS03	
Units	ng/g
Date	12/18/2017
ft bgs	1
PFOS	1.2
PFOA	0.19 J

SE-501-SB03	
Units	ng/g
Date	12/18/2017
ft bgs	4
PFHpA	0.22 J
PFHxS	0.77
PFNA	0.41 J
PFOS	7.8
PFOA	1

SE-SDB-SS03	
Units	ng/g
Date	12/18/2017
ft bgs	1
PFOS	7.1
PFOA	0.52 J

SE-SDB-SB03	
Units	ng/g
Date	12/18/2017
ft bgs	4
PFOS	0.97

SE-SDB-MW01	
Units	ng/L
Date	4/6/2018
PFBS	4.5
PFHxS	8.9

SE-SDB-SS01	
Units	ng/g
Date	12/18/2017
ft bgs	1
PFOS	1.3
PFOA	0.37 J

SE-SDB-SB01	
Units	ng/g
Date	12/18/2017
ft bgs	4
PFHxS	0.71

SE-SDB-SS02	
Units	ng/g
Date	12/18/2017
ft bgs	1
PFHxS	0.37 J
PFOS	2.1
PFOA	0.33 J

SE-SDB-SB02	
Units	ng/g
Date	12/18/2017
ft bgs	4
No analytes detected	

Analytical results for soil samples are reported as nanograms per gram (ng/g)
Analytical results for groundwater samples are reported as nanograms per liter (ng/L)
Bold indicates exceedance of groundwater screening criteria of 70 ng/L for PFOS or PFOA or PFOS + PFOA, or 400,000 ng/L for PFBS
Bold indicates exceedance of soil screening criteria of 1,260 ng/g for PFOS and PFOA, or 1.26 x 10^6 ng/g for PFBS
No exceedances were observed at any of the locations
ft bgs = feet below ground surface
PFHpA = Perfluoroheptanoic acid
PFHxS = Perfluorohexanesulfonate
PFNA = Perfluorononanoic acid
PFOS = Perfluoro-octanesulfonate
PFOA = Perfluorooctanoic acid
J = Estimated concentration

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N W E S
0 175 350
Feet
1 in = 350 ft

Figure 5-6
Detected Soil and Groundwater Sample Results PRLs 11 & 27: Building 501 (Former Wastewater Treatment) and Sludge Drying Beds

Selfridge Air National Guard Base (ANGB)
Perfluorinated Compounds Site Inspection Report
Mount Clemens, Michigan

8/15/2018 1:4,200 \\arlington.na.aecomnet.com\Arlington\DCS\GIS\GIS_Data\60520893_ANG_PFCs\MXDs\Selfridge\Site Investigation Report\Figure 5-6 SoilGW Results PRLS 11,27.mxd

SE-WR-SS06	
Units	ng/g
Date	1/12/2018
ft bgs	1
PFHpA	0.24 J
PFHxS	4.5 J-
PFNA	0.32 J
PFOS	10
PFOA	0.60 J

SE-WR-MW01	
Units	ng/L
Date	4/13/2018
PFBS	45
PFHpA	16
PFHxS	95

SE-WR-SS01	
Units	ng/g
Date	3/13/2018
ft bgs	1
PFHpA	0.40 J
PFHxS	0.56
PFNA	0.43 J
PFOS	10
PFOA	0.88

SE-WR-SB01	
Units	ng/g
Date	3/13/2018
ft bgs	4
PFHpA	0.18 J
PFHxS	1.7
PFOS	1.5
PFOA	0.20 J

SE-C16-SS03-01	
Units	ng/g
Date	3/21/2018
ft bgs	1
PFBS	0.87
PFHpA	0.22 J
PFHxS	14
PFNA	0.24 J
PFOS	170
PFOA	0.45 J

SE-C16-SB03-4	
Units	ng/g
Date	3/21/2018
ft bgs	4
PFBS	8.6
PFHpA	1.5
PFHxS	80
PFNA	0.41 J
PFOS	290
PFOA	4.1

SE-C16-MW01	
Units	ng/L
Date	5/20/2018
PFBS	13,000
PFHpA	750
PFHxS	10,000
PFOS	**84 U ***
PFOA	**370**

SE-C16-SS01-01	
Units	ng/g
Date	3/22/2018
ft bgs	1
PFBS	25
PFHpA	3.9 J
PFHxS	280
PFOS	820 J
PFOA	11

SE-C16-SS01-01D	
Units	ng/g
Date	3/23/2018
ft bgs	1
PFBS	26
PFHpA	6.4
PFHxS	410
PFOS	**1,700 J**
PFOA	18

SE-C16-SB01-4	
Units	ng/g
Date	3/22/2018
ft bgs	4
PFBS	15
PFHpA	2.0 J
PFHxS	120
PFOS	250
PFOA	4.6 J

SE-C16-SS02-01	
Units	ng/g
Date	3/21/2018
ft bgs	1
PFBS	3.1
PFHpA	0.97
PFHxS	42
PFOS	73
PFOA	1.1

SE-C16-SB02-4	
Units	ng/g
Date	3/21/2018
ft bgs	4
PFBS	4.6
PFHpA	0.37 J
PFHxS	46
PFOS	36
PFOA	0.60 J

SE-WR-MW02	
Units	ng/L
Date	4/13/2018
PFBS	14
PFHxS	36

SE-WR-MW02D	
Units	ng/L
Date	4/13/2018
PFBS	13
PFHxS	29

SE-WR-SS02	
Units	ng/g
Date	3/13/2018
ft bgs	1
PFHpA	0.30 J
PFHxS	1.4
PFOS	6.2
PFOA	0.89

SE-WR-SB02	
Units	ng/g
Date	3/13/2018
ft bgs	4
No analytes detected	

SE-WR-SS05	
Units	ng/g
Date	1/12/2018
ft bgs	1
PFHxS	3
PFOS	23
PFOA	0.69

SE-WR-SB05	
Units	ng/g
Date	1/12/2018
ft bgs	4
PFHxS	2

SE-WR-SS04	
Units	ng/g
Date	1/12/2018
ft bgs	1
PFHpA	0.23 J
PFHxS	2
PFOS	5.9
PFOA	0.72

SE-WR-SB04	
Units	ng/g
Date	1/12/2018
ft bgs	4
PFHxS	2.8
PFOS	0.33 J

SE-WR-MW03	
Units	ng/L
Date	4/11/2018
PFBS	51
PFHxS	20

SE-WR-SS03	
Units	ng/g
Date	1/12/2018
ft bgs	1
PFHpA	0.27 J
PFHxS	2.5
PFNA	0.26 J
PFOS	110
PFOA	0.96

SE-WR-SB03	
Units	ng/g
Date	1/12/2018
ft bgs	4
PFHxS	5
PFOS	8.7

SE-CRF-SS03-01	
Units	ng/g
Date	3/24/2018
ft bgs	1
No analytes detected	

SE-CRF-SB03-4	
Units	ng/g
Date	3/24/2018
ft bgs	4
No analytes detected	

SE-CRF-MW01	
Units	ng/L
Date	5/20/2018
No analytes detected	

SE-CRF-SS02-01	
Units	ng/g
Date	3/24/2018
ft bgs	1
PFHxS	0.49 J

SE-CRF-SS02-01D	
Units	ng/g
Date	3/24/2018
ft bgs	1
No analytes detected	

SE-CRF-SB02-4	
Units	ng/g
Date	3/24/2018
ft bgs	4
No analytes detected	

SE-CRF-SS01-01	
Units	ng/g
Date	3/24/2018
ft bgs	1
PFHxS	0.78
PFOS	0.60 J
PFOA	0.60 J

SE-CRF-SB01-4	
Units	ng/g
Date	3/24/2018
ft bgs	4
PFHxS	0.40 J

Building 1401
USCG Hangar (PRL 5)

Building 1416 –
Army National Guard
Hangar (PRL 7)

Building 1422
DHS Hangar
(PRL 8)

Building 1436
DHS Hangar
(PRL 9)

C16 – AOC
(PRL 13)

West Ramp
(PRL 16)

Aircraft Crash
Sites (PRL 25)

CRF – AOC
(PRL 14)

Monitoring well

Monitoring well/soil boring

Soil boring

Approximate groundwater flow direction

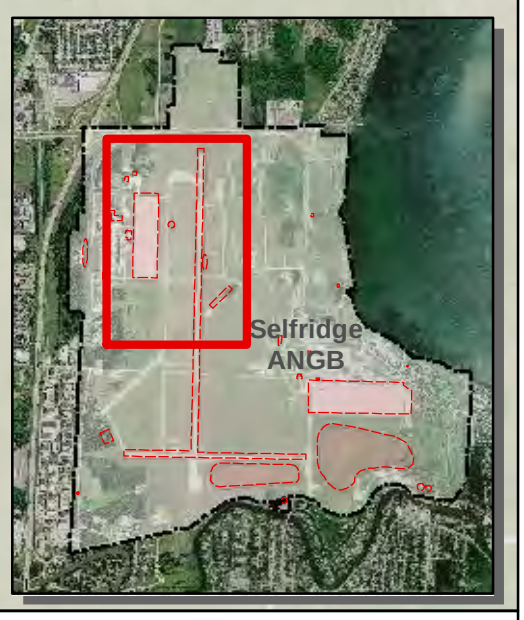
Approximate Potential Release Location (PRL)

Installation Boundary

Groundwater sample

Soil sample

Analytical results for groundwater samples are reported as nanograms per liter (ng/L)
Analytical results for soil samples are reported as nanograms per gram (ng/g)
Bold indicates exceedance of groundwater screening criteria of 70 ng/L for PFOS or PFOA or PFOS + PFOA, or 400,000 ng/L for PFBS
Bold indicates exceedance of soil screening criteria of 1,260 ng/g for PFOS and PFOA, or 1.26 x 10^6 ng/g for PFBS
ft bgs = feet below ground surface
PFBS = Perfluorobutanesulfonate
PFHpA = Perfluoroheptanoic acid
PFHxS = Perfluorohexanesulfonate
PFNA = Perfluorononanoic acid
PFOS = Perfluoro-octanesulfonate
PFOA = Perfluorooctanoic acid
U * = Reported value changed to non-detect at elevated quantitation limit due to a blank detection
J = Estimated concentration
J- = Estimated concentration. The reported value may not be accurate or precise, and the result



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N W E S

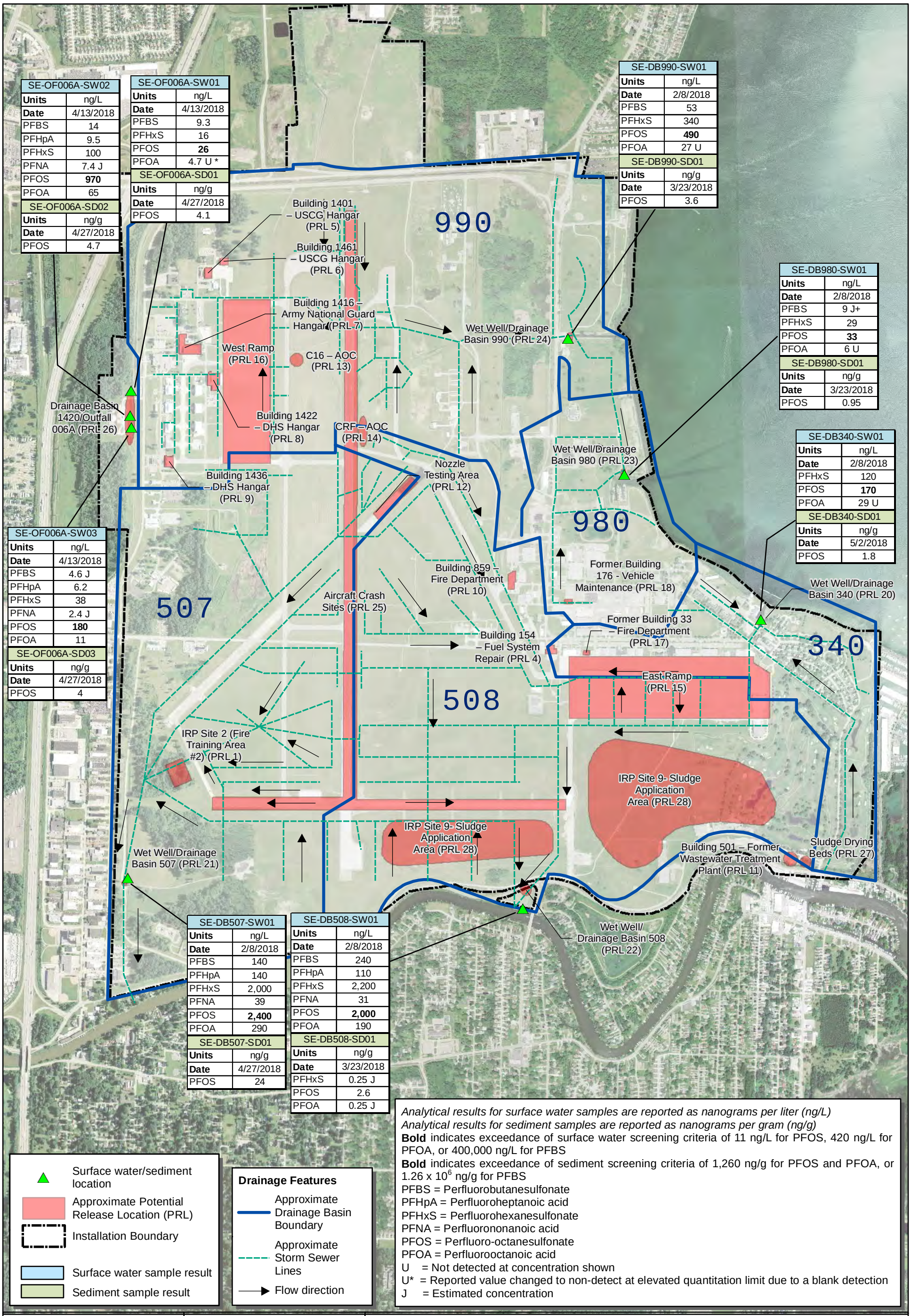
0 250 500
Feet
1 in = 500 ft

Figure 5-7

Detected Soil and Groundwater Sample Results
PRLs 13, 14 & 16: C16, CRF, and the West Ramp

Selfridge Air National Guard Base (ANGB)
Perfluorinated Compounds Site Inspection Report
Mount Clemens, Michigan

8/20/2018 1:6,000 \\arlington.na.aecomnet.com\Arlington\DCS\GIS\GIS_Data\60520893_ANG_PFCs\MXDs\Selfridge\Site Investigation Report\Figure 5-7 SoilGW Results PRLS 13,14,16.mxd



SE-OF006A-SW02	
Units	ng/L
Date	4/13/2018
PFBS	14
PFHpA	9.5
PFHxS	100
PFNA	7.4 J
PFOS	**970**
PFOA	65
SE-OF006A-SD02	
Units	ng/g
Date	4/27/2018
PFOS	4.7

SE-OF006A-SW01	
Units	ng/L
Date	4/13/2018
PFBS	9.3
PFHxS	16
PFOS	**26**
PFOA	4.7 U *
SE-OF006A-SD01	
Units	ng/g
Date	4/27/2018
PFOS	4.1

SE-DB990-SW01	
Units	ng/L
Date	2/8/2018
PFBS	53
PFHxS	340
PFOS	**490**
PFOA	27 U
SE-DB990-SD01	
Units	ng/g
Date	3/23/2018
PFOS	3.6

SE-DB980-SW01	
Units	ng/L
Date	2/8/2018
PFBS	9 J+
PFHxS	29
PFOS	**33**
PFOA	6 U
SE-DB980-SD01	
Units	ng/g
Date	3/23/2018
PFOS	0.95

SE-DB340-SW01	
Units	ng/L
Date	2/8/2018
PFHxS	120
PFOS	**170**
PFOA	29 U
SE-DB340-SD01	
Units	ng/g
Date	5/2/2018
PFOS	1.8

SE-OF006A-SW03	
Units	ng/L
Date	4/13/2018
PFBS	4.6 J
PFHpA	6.2
PFHxS	38
PFNA	2.4 J
PFOS	**180**
PFOA	11
SE-OF006A-SD03	
Units	ng/g
Date	4/27/2018
PFOS	4

SE-DB507-SW01	
Units	ng/L
Date	2/8/2018
PFBS	140
PFHpA	140
PFHxS	2,000
PFNA	39
PFOS	**2,400**
PFOA	290
SE-DB507-SD01	
Units	ng/g
Date	4/27/2018
PFOS	24

SE-DB508-SW01	
Units	ng/L
Date	2/8/2018
PFBS	240
PFHpA	110
PFHxS	2,200
PFNA	31
PFOS	**2,000**
PFOA	190
SE-DB508-SD01	
Units	ng/g
Date	3/23/2018
PFHxS	0.25 J
PFOS	2.6
PFOA	0.25 J

Surface water/sediment location

Approximate Potential Release Location (PRL)

Installation Boundary

Surface water sample result

Sediment sample result

Drainage Features

Approximate Drainage Basin Boundary

Approximate Storm Sewer Lines

Flow direction

Analytical results for surface water samples are reported as nanograms per liter (ng/L)
Analytical results for sediment samples are reported as nanograms per gram (ng/g)
Bold indicates exceedance of surface water screening criteria of 11 ng/L for PFOS, 420 ng/L for PFOA, or 400,000 ng/L for PFBS
Bold indicates exceedance of sediment screening criteria of 1,260 ng/g for PFOS and PFOA, or 1.26×10^6 ng/g for PFBS
PFBS = Perfluorobutanesulfonate
PFHpA = Perfluoroheptanoic acid
PFHxS = Perfluorohexanesulfonate
PFNA = Perfluorononanoic acid
PFOS = Perfluoro-octanesulfonate
PFOA = Perfluorooctanoic acid
U = Not detected at concentration shown
U* = Reported value changed to non-detect at elevated quantitation limit due to a blank detection
J = Estimated concentration

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N W E S

0 750 1,500 Feet

1 in = 1,500 ft

Figure 5-8

Detected Basewide Surface Water and Sediment Sample Results at Selfridge ANGB

Selfridge Air National Guard Base (ANGB)
Perfluorinated Compounds Site Inspection Report
Mount Clemens, Michigan

8/20/2018 1:18,000 \\arlington.na.aecomnet.com\Arlington\DCS\GIS\GIS_Data\60520893_ANG_PFCs\MXDs\Selfridge\Site Investigation Report\Figure 5-10 Basewide SW-Sed Results.mxd

SE-AC-MW01	
Units	ng/L
Date	5/20/2018
PFBS	30
PFHxS	22
SE-AC-SS01-01D	
Units	ng/g
Date	3/25/2018
ft bgs	1
No analytes detected	
SE-AC-SS01-01	
Units	ng/g
Date	3/25/2018
ft bgs	1
No analytes detected	
SE-AC-SB01-4	
Units	ng/g
Date	3/25/2018
ft bgs	4
No analytes detected	

SE-AC-MW02	
Units	ng/L
Date	5/20/2018
No analytes detected	
SE-AC-SS02-01	
Units	ng/g
Date	3/25/2018
ft bgs	1
No analytes detected	
SE-AC-SB02-4	
Units	ng/g
Date	3/25/2018
ft bgs	4
No analytes detected	

SE-AC-MW03	
Units	ng/L
Date	5/20/2018
No analytes detected	
SE-AC-MW03D	
Units	ng/L
Date	5/20/2018
No analytes detected	
SE-AC-SS03-01	
Units	ng/g
Date	3/24/2018
ft bgs	1
No analytes detected	
SE-AC-SB03-4	
Units	ng/g
Date	3/24/2018
ft bgs	4
No analytes detected	

SE-AC-MW04	
Units	ng/L
Date	5/20/2018
No analytes detected	
SE-AC-SS04-01	
Units	ng/g
Date	3/24/2018
ft bgs	1
PFOS	0.30 J
SE-AC-SS04-01D	
Units	ng/g
Date	3/24/2018
ft bgs	1
PFOS	0.64 J
SE-AC-SB04-4	
Units	ng/g
Date	3/24/2018
ft bgs	4
No analytes detected	

SE-AC-MW05	
Units	ng/L
Date	5/20/2018
PFBS	31
PFHxS	110
SE-AC-SS05-01	
Units	ng/g
Date	3/20/2018
ft bgs	1
PFHxS	0.30 J
PFOS	0.55 J
SE-AC-SS05-01D	
Units	ng/g
Date	3/20/2018
ft bgs	1
PFHxS	0.31 J
PFOS	1.1
SE-AC-SB05-4	
Units	ng/g
Date	3/20/2018
ft bgs	4
PFHxS	0.64
PFOS	0.24 J

SE-AC-MW06	
Units	ng/L
Date	5/20/2018
PFBS	3.5
PFHxS	28
PFOS	25
SE-AC-SS06-01	
Units	ng/g
Date	3/19/2018
ft bgs	1
PFOS	7.3
SE-AC-SS06-01D	
Units	ng/g
Date	3/19/2018
ft bgs	1
PFOS	7.5
PFOA	0.27 J
SE-AC-SB06-4	
Units	ng/g
Date	3/19/2018
ft bgs	4
PFHxS	0.30 J
PFOS	0.40 J

Building 1401 USCG Hangar (PRL 5)
Building 1461 USCG Hangar (PRL 6)
Building 1416 Army National Guard Hangar (PRL 7)
Building 1422 DHS Hangar (PRL 8)
Building 1436 DHS Hangar (PRL 9)
Drainage Basin 1420/Outfall 006A (PRL 26)
West Ramp (PRL 16)
C16 – AOC (PRL 13)
CRF – AOC (PRL 14)
Nozzle Testing Area (PRL 12)
Aircraft Crash Sites (PRL 25)
Wet Well/ Drainage Basin 990 (PRL 24)
Wet Well/ Drainage Basin 980 (PRL 23)
Former Building 176 - Vehicle Maintenance (PRL 18)
Former Building 33 Fire Department (PRL 17)
East Ramp (PRL 15)
Building 154 – Fuel System Repair (PRL 4)
IRP Site 2 (Fire Training Area #2) (PRL 1)
IRP Site 9- Sludge Application Area (PRL 28)
Wet Well/Drainage Basin 507 (PRL 21)
Wet Well/Drainage Basin 508 (PRL 22)
Selfridge ANGB

Monitoring well/soil boring
Approximate groundwater flow direction
Approximate Potential Release Location (PRL)
Installation Boundary

Groundwater sample
Soil sample

Analytical results for groundwater samples are reported as nanograms per liter (ng/L)
Analytical results for soil samples are reported as nanograms per gram (ng/g)
Bold indicates exceedance of groundwater screening criteria of 70 ng/L for PFOS or PFOA or PFOS + PFOA, or 400,000 ng/L for PFBS
Bold indicates exceedance of soil screening criteria of 1,260 ng/g for PFOS and PFOA, or 1.26×10^6 ng/g for PFBS
Note: screening criteria were not exceeded at any sample locations
ft bgs = feet below ground surface
PFBS = Perfluorobutanesulfonate
PFHxS = Perfluorohexanesulfonate
PFOS = Perfluoro-octanesulfonate
PFOA = Perfluorooctanoic acid
J = Estimated concentration

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N W E S
0 500 1,000 Feet
1 in = 1,000 ft

Figure 5-9
Detected Soil and Groundwater Sample Results
PRL 25: Aircraft Crash Sites

Selfridge Air National Guard Base (ANGB)
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Mount Clemens, Michigan

Building 859 – Fire Department (PRL 10)

Former Building 176 - Vehicle Maintenance (PRL 18)

Former Building 33 – Fire Department (PRL 17)

Wet Well/Drainage Basin 340 (PRL 20)

East Ramp (PRL 15)

Aircraft Crash Sites (PRL 25)

IRP Site 9- Sludge Application Area (PRL 28)

IRP Site 9- Sludge Application Area (PRL 28)

Wet Well/ Drainage Basin 508 (PRL 22)

Sludge Drying Beds (PRL 27)

SE-IRP9-SS01-01	
Units	ng/g
Date	3/19/2018
ft bgs	1
PFOS	2.6
PFOA	0.38 J
SE-IRP9-SB01-4	
Units	ng/g
Date	3/19/2018
ft bgs	4
No analytes detected	

SE-IRP9-SS03-01	
Units	ng/g
Date	3/19/2018
ft bgs	1
No analytes detected	
SE-IRP9-SB03-4	
Units	ng/g
Date	3/19/2018
ft bgs	4
PFHxS	0.42 J
PFOS	3.1
PFOA	0.46 J

SE-IRP9-SS05-01	
Units	
Date	3/20/2018
ft bgs	1
PFOS	2.2
PFOA	0.48 J
SE-IRP9-SB05-4	
Units	ng/g
Date	3/20/2018
ft bgs	4
No analytes detected	

SE-IRP9-SS07-01	
Units	ng/g
Date	3/19/2018
ft bgs	1
PFHpA	1.3
PFHxS	19
PFNA	1.5
PFOS	130
PFOA	5.4
SE-IRP9-SB07-4	
Units	ng/g
Date	3/19/2018
ft bgs	4
PFHpA	0.29 J
PFHxS	1.1
PFOS	0.59 J

SE-IRP9-SS08-01	
Units	ng/g
Date	3/19/2018
ft bgs	1
No analytes detected	
SE-IRP9-SB08-4	
Units	ng/g
Date	3/19/2018
ft bgs	4
No analytes detected	
SE-IRP9-SB08-4D	
Units	ng/g
Date	3/19/2018
ft bgs	4

SE-IRP9-MW03	
Units	ng/L
Date	5/22/2018
PFBS	4.8
PFHxS	49
PFOA	9.1 J+

SE-IRP9-SS10-01	
Units	ng/g
Date	3/19/2018
ft bgs	1
PFOS	0.87
SE-IRP9-SB10-4	
Units	ng/g
Date	3/19/2018
ft bgs	4
No analytes detected	

SE-IRP9-MW04	
Units	ng/L
Date	4/10/2018
No analytes detected	
SE-IRP9-MW04D	
Units	ng/L
Date	4/10/2018
No analytes detected	

SE-1RP9-SS12	
Units	ng/g
Date	1/10/2018
ft bgs	1
No analytes detected	
SE-1RP9-SB12	
Units	ng/g
Date	1/10/2018
ft bgs	4
No analytes detected	

SE-IRP9-SS09-01	
Units	ng/g
Date	3/19/2018
ft bgs	1
PFHxS	0.27 J
PFOS	1.7
PFOA	0.37 J
SE-IRP9-SB09-4	
Units	ng/g
Date	3/19/2018
ft bgs	4
No analytes detected	

SE-1RP9-SS11	
Units	ng/g
Date	1/10/2018
ft bgs	1
PFOS	0.92
PFOA	0.23 J
SE-1RP9-SB11	
Units	ng/g
Date	1/10/2018
ft bgs	4
PFHxS	0.6
PFOS	0.55
PFOA	0.41 J

SE-IRP9-MW01	
Units	ng/L
Date	5/22/2018
PFBS	2.6
PFHxS	5.1

SE-IRP9-SS02-01	
Date	3/19/2018
ft bgs	1
PFHxS	1
PFOS	3
PFOA	0.34 J
SE-IRP9-SB02-4	
Units	ng/g
Date	3/19/2018
ft bgs	4
PFHxS	0.36 J
PFOA	0.28 J

SE-IRP-SS04-01	
Units	ng/g
Date	3/15/2018
ft bgs	1
PFOS	2.9
SE-IRP-SB04-4	
Units	ng/g
Date	3/15/2018
ft bgs	4
PFOS	0.65
PFOA	0.24 J

SE-IRP9-MW02	
Units	ng/L
Date	4/13/2018
PFBS	3.4
PFHxS	53

SE-IRP-SS06-01	
Units	ng/g
Date	3/15/2018
ft bgs	1
PFHxS	0.76
PFOS	2
SE-IRP-SB06-4	
Units	ng/g
Date	3/15/2018
ft bgs	4
No analytes detected	

Monitoring well

Soil boring

Approximate groundwater flow direction

Approximate Potential Release Location (PRL)

Installation Boundary

Groundwater sample

Soil sample

Analytical results for soil samples are reported as nanograms per gram (ng/g)
Analytical results for soil samples are reported as nanograms per liter (ng/L)
Bold indicates exceedance of groundwater screening criteria of 70 ng/L for PFOS or PFOA or PFOS + PFOA, or 400,000 ng/L for PFBS
Bold indicates exceedance of soil screening criteria of 1,260 ng/g for PFOS and PFOA, or 1.26×10^6 ng/g for PFBS
ft bgs = feet below ground surface
PFBS = Perfluorobutanesulfonate
PFHpA = Perfluoroheptanoic acid
PFHxS = Perfluorohexanesulfonate
PFNA = Perfluorononanoic acid
PFOS = Perfluoro-octanesulfonate
PFOA = Perfluorooctanoic acid
J = Estimated concentration
J+ = Estimated concentration. The reported value may not be accurate or precise, and the result may be biased high

N W E S

0 375 750 Feet

1 in = 750 ft

Figure 5-10

Detected Soil and Groundwater Sample Results PRL 28: IRP Site 9 - Sludge Application Area

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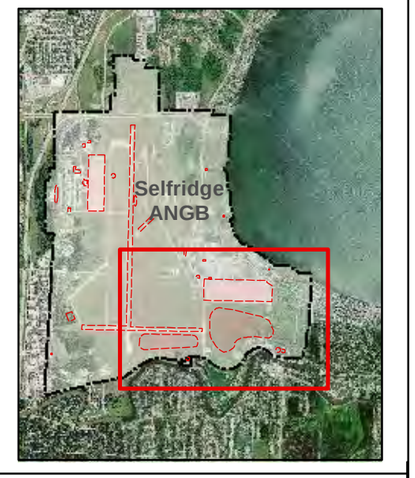

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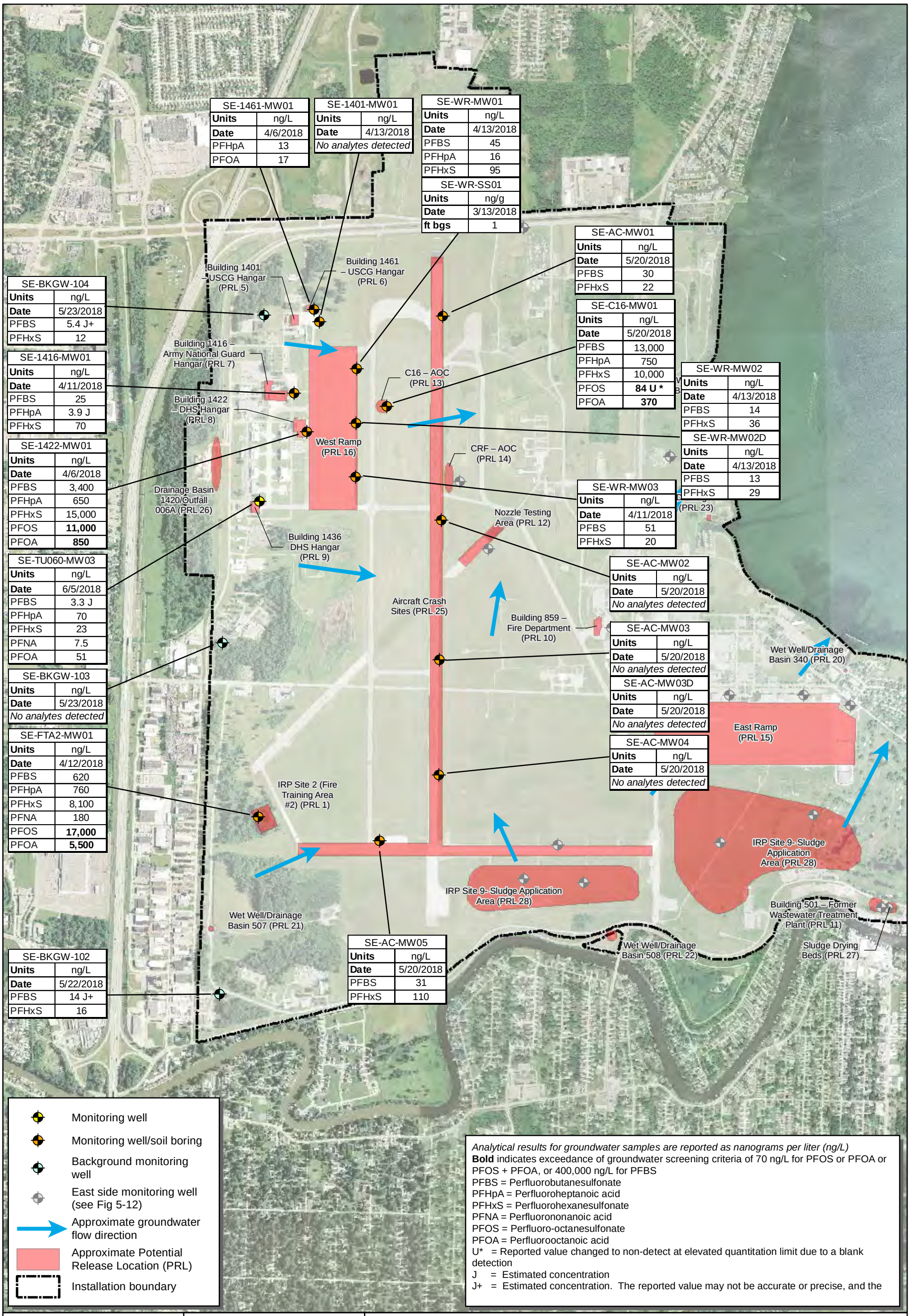

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N W E S

0 750 1,500 Feet

1 in = 1,500 ft

Figure 5-11

Detected Basewide Groundwater Sample Results - West Side

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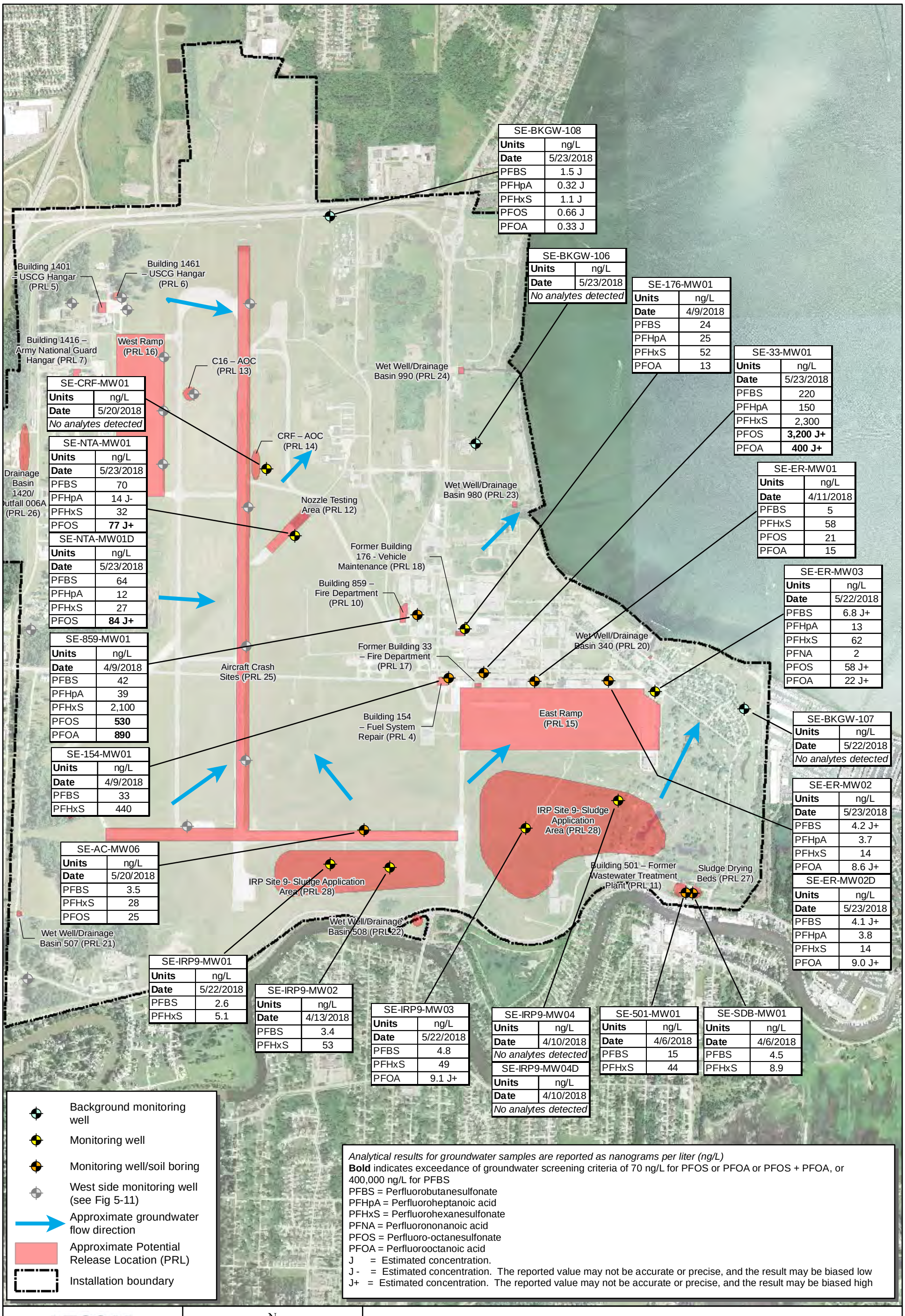
8/16/2018 1:18,000 \\arlington.na.aecomnet.com\Arlington\DCS\GIS\GIS_Data\60520893_ANG_PFCs\MXDs\Selfridge\Site Investigation Report\Figure 5-11 GW Results WEST.mxd



Analytical results for groundwater samples are reported as nanograms per liter (ng/L)
Bold indicates exceedance of groundwater screening criteria of 70 ng/L for PFOS or PFOA or PFOS + PFOA, or 400,000 ng/L for PFBS
PFBS = Perfluorobutanesulfonate
PFHpA = Perfluoroheptanoic acid
PFHxS = Perfluorohexanesulfonate
PFNA = Perfluorononanoic acid
PFOS = Perfluoro-octanesulfonate
PFOA = Perfluorooctanoic acid
J = Estimated concentration.
J - = Estimated concentration. The reported value may not be accurate or precise, and the result may be biased low
J+ = Estimated concentration. The reported value may not be accurate or precise, and the result may be biased high

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N W E S
0 750 1,500 Feet
1 in = 1,500 ft

Figure 5-12

Detected Basewide Groundwater Sample Results - East Side

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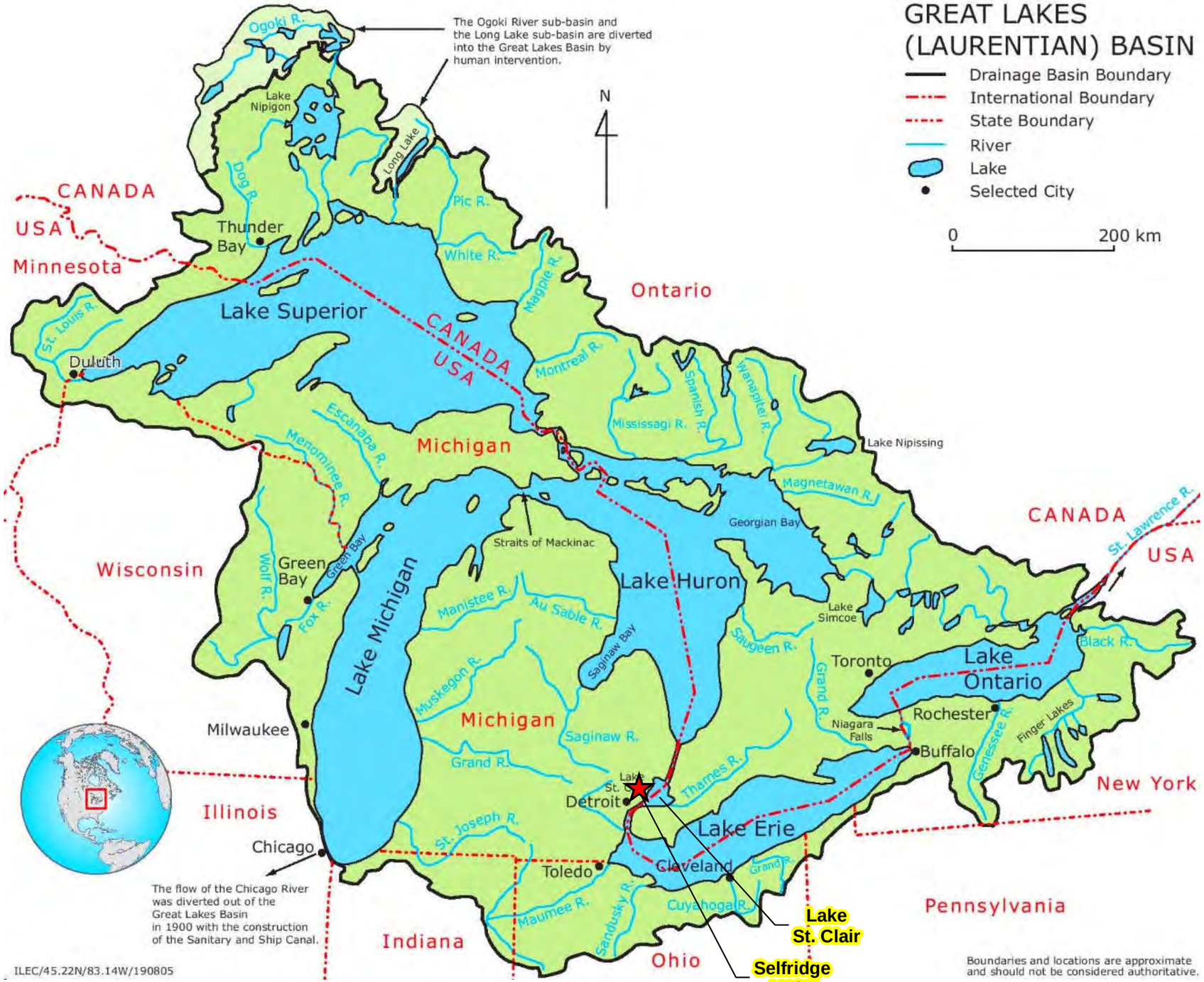
9/17/2018 1:18,000 \\arlington.na.aecomnet.com\Arlington\DCS\GIS\GIS_Data\60520893_ANG_PFCs\MXDs\Selfridge\Site Investigation Report\Figure 5-12 GW Results EAST.mxd



Source: http://ontheworldmap.com/usa/lake/great-lakes/

Figure 6-1

Overview of Selfridge ANGB in Relationship to Lake St. Clair and the Great Lakes

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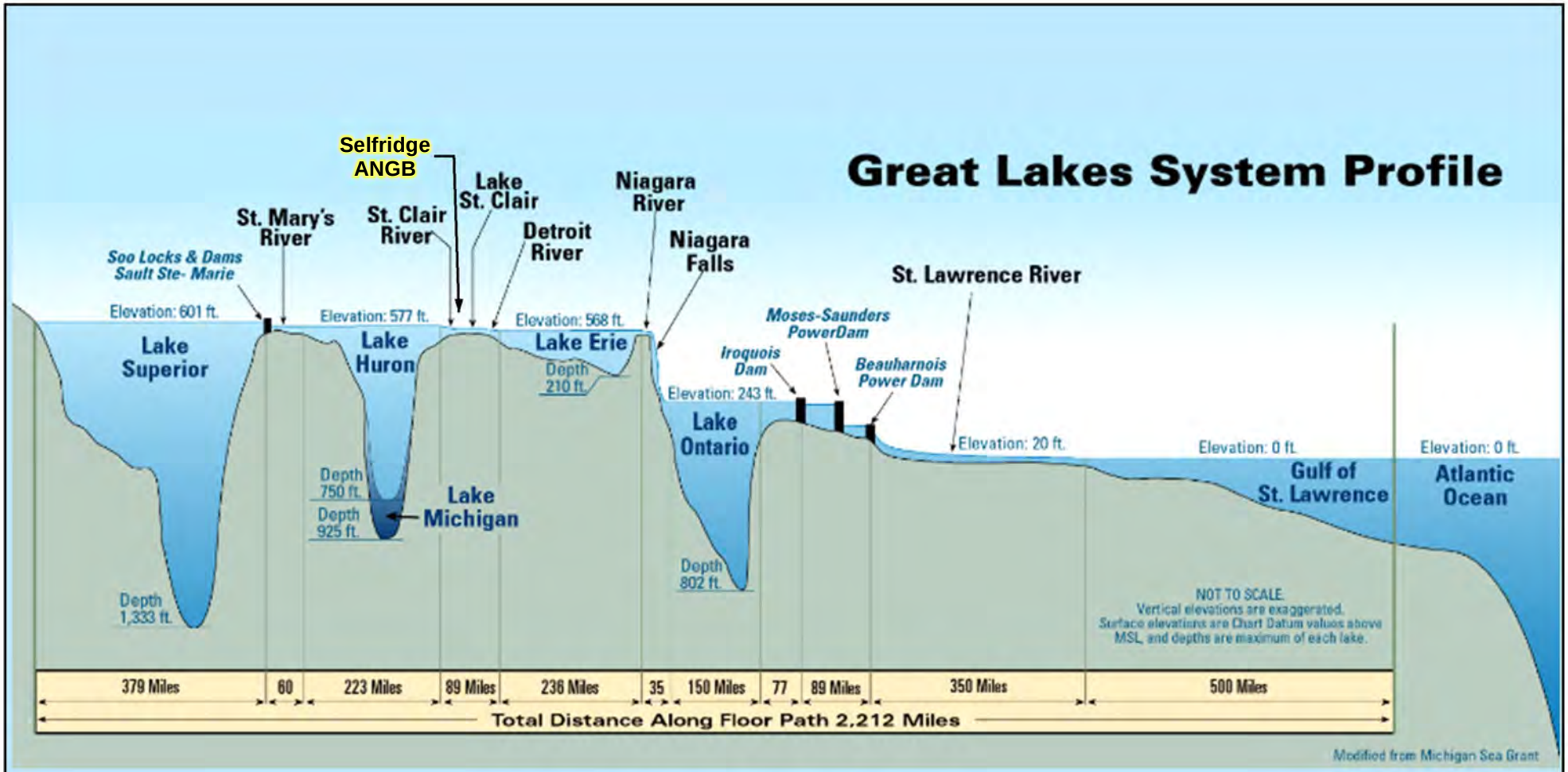

Source: http://www.ecoclimax.com/2017/01/great-lakes-system-profile.html

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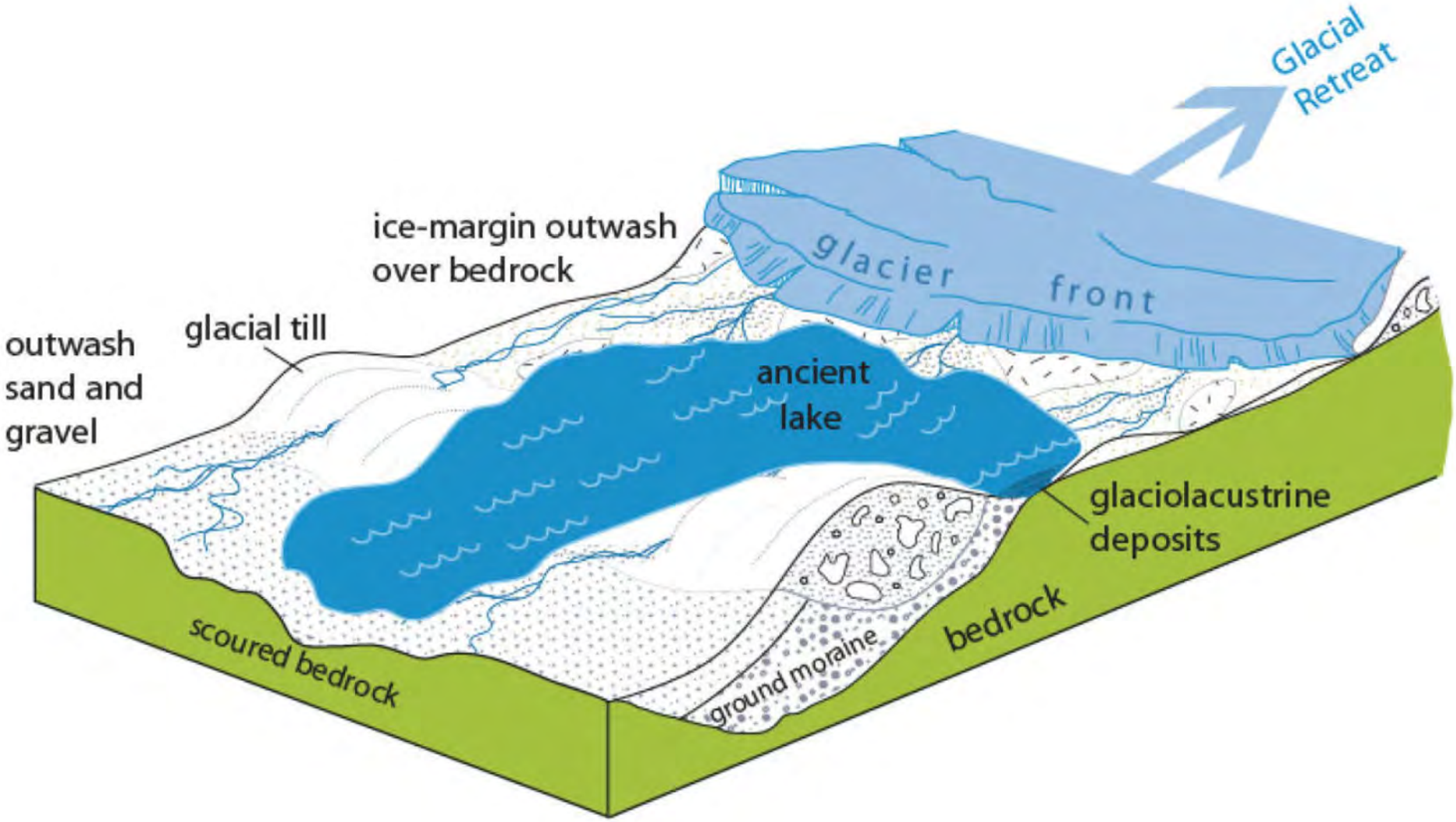
Figure 6-2

Great Lakes System Profile



Source: NPS Natural Resource Report NPS/NRPC/GRD/NRR—2008/037; https://irma.nps.gov/DataStore/DownloadFile/426457
(by Trista L. Thornberry-Ehrlich [Colorado State University])

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Figure 6-3

3-D Block Diagram and Glacial Depositional Model

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N W E S

0 2,250 4,500 Feet

1 inch = 4,500 feet

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Figure 6-4
Geomorphological Features

Selfridge Air National Guard Base (ANGB)
Perfluorinated Compounds Site Inspection Report
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8/21/2018 \\arlington.na.aecomnet.com\Arlington\DCS\GIS\GIS_Data\60520893_ANG_PFCs\MXDs\Selfridge\Site Investigation Report\Figure 6-4 Geomorph features.mxd

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N W E S

0 1.75 3.5

Miles

1 in = 3.5 miles

Figure 6-5

Large Lacustrine Delta on East Side of Lake St. Clair

Selfridge Air National Guard Base (ANGB)
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8/21/2018 1:221,760 \\arlington.na.aecomnet.com\Arlington\DCS\GIS\GIS_Data\60520893_ANG_PFCs\MXDs\Selfridge\Site Investigation Report\Figure 6-5 Eastern delta.mxd

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Appendix B: Tables

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Table 3-1. Water Level Summary

Monitoring Well	Top of Casing (ft amsl)	Water Level (ft btoc)	Water Elevation (ft amsl)
FTA2-MW01	580.46	1.74	578.72
154-MW01	578.91	4.19	574.72
1401-MW01	581.41	2.21	579.2
1461-MW01	581.56	0.3	581.26
1416-MW01	580.62	0.2	580.42
1422-MW01	579.86	9.3	570.56
TU060-MW03	582.65	2.65	580
859-MW01	579.1	2.97	576.13
501-MW01	577.72	3.2	574.52
NTA-MW01	577.99	9.52	568.47
C16-MW01	578.15	8.23	569.92
CRF-MW01	576.44	11.51	564.93
ER-MW01	575.46	0.64	574.82
ER-MW02	575.91	4.81	571.1
ER-MW03	574.26	8.38	565.88
WR-MW01	580.27	3.84	576.43
WR-MW02	579.89	6.49	573.4
WR-MW03	579.59	5.11	574.48
33-MW01	577.71	3.18	574.53
176-MW01	577.2	3.67	573.53
AC-MW01	578.28	11.65	566.63
AC-MW02	577.84	9.25	568.59
AC-MW03	578.79	9.47	569.32
AC-MW04	579.76	9.5	570.26
AC-MW05	579.69	4.13	575.56
AC-MW06	579.25	3.68	575.57
SBD-MW01	576.51	2.17	574.34
IRP9-MW01	579.08	3.63	575.45
IRP9-MW02	578.59	2.31	576.28
IRP9-MW03	576.97	2.62	574.35
IRP9-MW04	576.34	2.89	573.45
BKGW-102	578.68	1.00	577.68
BKGW-103	580.85	0.90	579.95
BKGW-104	583.6	2.83	580.77
BKGW-106	574.69	2.43	572.26
BKGW-107	572.84	3.30	569.54
BKGW-108	575.64	0.50	575.14

Notes:
ft – feet
amsl – above mean sea level
btoc - below top of casing

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Table 4-1. Monitoring Well Construction Summary

Location	Northing	Easting	Sample Type	Ground Surface Elevation (amsl)	Screen Interval (ft bgs)	Bottom of Exploration (ft bgs)	Well Diameter (in)
FTA2-MW01	405776.28	13532191.11	New Monitoring Well	580.76	5 - 15	15	2
154-MW01	407850.4	13538572.15	New Monitoring Well	579.34	5 - 15	15	2
1401-MW01	414008.52	13533210.63	New Monitoring Well	581.77	5 - 15	15	2
1461-MW01	414206.47	13533120.42	New Monitoring Well	582.01	5 - 15	16	2
1416-MW01	412812.67	13532790.34	New Monitoring Well	580.95	5 - 15	15	2
1422-MW01	412172.72	13532997.95	New Monitoring Well	580.15	5 - 15	16	2
TU060-MW03	411018.15	13532211.28	New Monitoring Well	583.16	4.5 – 14.5	15	2
859-MW01	408909.75	13538052.53	New Monitoring Well	579.57	5 - 15	15	2
501-MW01	404267.86	13542526.54	New Monitoring Well	578.12	10 - 15	10	2
NTA-MW01	410227.38	13536007.49	New Monitoring Well	578.25	5 - 15	15	2
C16-MW01	412593.19	13534327.8	New Monitoring Well	578.45	5 - 15	15	2
CRF-MW01	411344.82	13535532.83	New Monitoring Well	576.74	5 - 15	15	2
ER-MW01	407799.75	13540009.95	New Monitoring Well	575.94	5 - 15	16	2
ER-MW02	407801.33	13541243.57	New Monitoring Well	576.15	5 - 15	16	2
ER-MW03	407626.07	13542013.37	New Monitoring Well	574.56	5 - 15	15	2
WR-MW01	413215.14	13533826.54	New Monitoring Well	580.56	5 - 15	15	2
WR-MW02	412310.54	13533817.99	New Monitoring Well	580.13	5 - 15	15	2
WR-MW03	411421.44	13533806.64	New Monitoring Well	579.88	5 - 15	16	2
33-MW01	407931.84	13539158.7	New Monitoring Well	578.23	5 - 15	16	2
176-MW01	408672.67	13538841.62	New Monitoring Well	577.81	5 - 15	15	2
AC-MW01	414102.5	13535258.54	New Monitoring Well	578.98	5 - 15	15	2
AC-MW02	410701.31	13535233.07	New Monitoring Well	578.27	5 - 15	15	2
AC-MW03	408383.29	13535203.53	New Monitoring Well	579.18	5 - 15	15	2
AC-MW04	406470.73	13535193.28	New Monitoring Well	579.98	5 - 15	15	2
AC-MW05	405374.53	13534210.81	New Monitoring Well	579.9	5 - 15	15	2
AC-MW06	405305.89	13537163.38	New Monitoring Well	579.62	5 - 15	15	2

Location	Northing	Easting	Sample Type	Ground Surface Elevation (amsl)	Screen Interval (ft bgs)	Bottom of Exploration (ft bgs)	Well Diameter (in)
SBD-MW01	404258.02	13542642.38	New Monitoring Well	576.78	10 - 15	15	2
RP9-MW01	404739.86	13536597.89	New Monitoring Well	579.26	5 - 15	15	2
IRP9-MW02	404681.31	13537594.78	New Monitoring Well	579.12	5 - 15	15	2
IRP9-MW03	405345.32	13539856.74	New Monitoring Well	577.47	5 - 15	15	2
IRP9-MW04	405804.2	13541404.21	New Monitoring Well	576.89	4 - 14	14	2
BKGW-102	402828.53	13531555.15	New Monitoring Well	579.15	3 - 13	15	2
BKGW-103	408660.06	13531605.69	New Monitoring Well	581.42	2 - 12	15	2
BKGW-104	414110.98	13532289.56	New Monitoring Well	583.93	3 - 13	15	2
BKGW-106	411762.44	13539022.29	New Monitoring Well	575.17	3 - 13	15	2
BKGW-107	407332.53	13543502.75	New Monitoring Well	573.29	3 - 13	15	2
BKGW-108	415567.77	13536591.86	New Monitoring Well	576	3 - 13	15	2

Notes:
amsl = above mean sea level
bgs = below ground surface
ft = feet
in = inches

Table 5-1. IRP Site 2 (Fire Training Area #2) (PRL 1) Sample Results

		Groundwater
Sample ID	PAL[a,b,c] (ng/L)	SE-FTA2-MW01
Sample Date		4/12/2018
Perfluorinated Compounds US EPA Method 537 Rev 1.1 Modified		
Perfluorobutanesulfonate (PFBS)	***400,000***	620
Perfluoroheptanoic acid (PFHpA)	NA	760
Perfluorohexanesulfonate (PFHxS)	NA	8,100
Perfluorononanoic acid (PFNA)	NA	180
Perfluoro-octanesulfonate (PFOS)	***70***	**17,000**
Perfluorooctanoic acid (PFOA)	***70***	**5,500**

		Soil					
Sample ID	PAL[c] (ng/g)	SE-FTA2-SS01-01	SE-FTA2-SB01-4	SE-FTA2-SS03-01	SE-FTA2-SB03-4	SE-FTA2-SS02-01	SE-FTA2-SB02-4
Sample Date		3/15/2018	3/15/2018	3/15/2018	3/15/2018	3/15/2018	3/15/2018
Depth (ft bgs)		1	4	1	4	1	4
Perfluorinated Compounds US EPA Method 537 Rev 1.1 Modified							
Perfluorobutanesulfonate (PFBS)	***1.26x10^6***	0.71 U	0.62 U	0.32 J	43	0.60 U	0.32 J
Perfluoroheptanoic acid (PFHpA)	NA	0.71 U	0.37 J	2	73	0.60 U	0.27 J
Perfluorohexanesulfonate (PFHxS)	NA	1.6	14	28	560	5.0 J+	3.6
Perfluorononanoic acid (PFNA)	NA	0.71 U	0.36 J	8.1	18	0.54 J	0.69 U
Perfluoro-octanesulfonate (PFOS)	***1,260***	5.5	94	940	1,200	22	17
Perfluorooctanoic acid (PFOA)	***1,260***	0.28 J	2.8	11	220	0.89 J+	1.2

PAL = project action level ng/L = nanogram per liter ng/g = nanogram per gram NA = Not applicable

ft = feet bgs = below ground surface

Italicized and bolded value indicates screening criterion used Bold value indicates analyte detected above screening level

* = Reported value changed to non-detect at elevated quantitation limit due to a blank detection

a. United States Environmental Protection Agency (US EPA), May 2016. Drinking Water Health Advisory for PFOS and PFOA. Office of Water (4304T). Health and Ecological Criteria Division, Washington, DC 20460. EPA Document Number: 822-R-16-004 and 822-R-16-005.

b. Michigan Department of Environmental Quality, 2018. Remediation and Redevelopment Division. Environmental Contamination Response Activity Rules. Table 1. Groundwater: Residential and Nonresidential, Part 201 Generic Cleanup Criteria and Screening Levels. Effective 10 January 2018 and updated on 25 June 2018.

c. US EPA Regional Screening Levels (RSLs), May 2018. PFBS groundwater PAL based on RSL for tap water. Soil PALs calculated using the RSL calculator. The RSLs are protective of a residential receptor and a target hazard quotient = 1.0.

Data Qualifiers:

J = Estimated concentration

U = Not detected at concentration shown

J+ = Reported value may not be accurate or precise, but the result may be biased high.

Table 5-2. Building 154 - Fuel System Repair (PRL 4) Sample Results

		Groundwater
Sample ID	PAL[a,b,c] (ng/L)	SE-154-MW01
Sample Date		4/9/2018
Perfluorinated Compounds US EPA Method 537 Rev 1.1 Modified		
Perfluorobutanesulfonate (PFBS)	***400,000***	33
Perfluoroheptanoic acid (PFHpA)	NA	25 U *
Perfluorohexanesulfonate (PFHxS	NA	440
Perfluorononanoic acid (PFNA)	NA	18 U
Perfluoro-octanesulfonate (PFOS	***70***	**62 U ***
Perfluorooctanoic acid (PFOA)	***70***	**54 U ***

		Soil					
Sample ID	PAL[c] (ng/g)	SE-154-SS01	SE-154-SB01	SE-154-SS02	SE-154-SB02	SE-154-SS03	SE-154-SB03-4
Sample Date		12/20/2017	12/20/2017	3/14/2018	3/14/2018	3/14/2018	3/14/2018
Depth (ft bgs)		1	4	1	4	1	4
Perfluorinated Compounds US EPA Method 537 Rev 1.1 Modified							
Perfluorobutanesulfonate (PFBS)	***1.26x10^6***	0.48 U	0.55 U	0.37 J	0.35 J	0.54 U	0.65 U
Perfluoroheptanoic acid (PFHpA)	NA	0.48 U	0.55 U	0.49 J	0.50 J	1.4	0.73
Perfluorohexanesulfonate (PFHxS	NA	0.22 J	0.36 J	10	9.5	5.3	6.3
Perfluorononanoic acid (PFNA)	NA	0.48 U	0.55 U	0.40 J	0.63 U	1.5	0.45 J
Perfluoro-octanesulfonate (PFOS	***1,260***	4.2	1.8	180	180	300	140
Perfluorooctanoic acid (PFOA)	***1,260***	0.48 U	0.55 U	1.1	1.2	2.2	1.2

PAL = project action level ng/L = nanogram per liter ng/g = nanogram per gram NA = Not applicable

ft = feet bgs = below ground surface

Italicized and bolded value indicates screening criterion used Bold value indicates analyte detected above screening level

* = Reported value changed to non-detect at elevated quantitation limit due to a blank detection

a. United States Environmental Protection Agency (US EPA), May 2016. Drinking Water Health Advisory for PFOS and PFOA. Office of Water (4304T). Health and Ecological Criteria Division, Washington, DC 20460. EPA Document Number: 822-R-16-004 and 822-R-16-005.

b. Michigan Department of Environmental Quality, 2018. Remediation and Redevelopment Division. Environmental Contamination Response Activity Rules. Table 1. Groundwater: Residential and Nonresidential, Part 201 Generic Cleanup Criteria and Screening Levels. Effective 10 January 2018 and updated on 25 June 2018.

c. US EPA Regional Screening Levels (RSLs), May 2018. PFBS groundwater PAL based on RSL for tap water. Soil PALs calculated using the RSL calculator. The RSLs are protective of a residential receptor and a target hazard quotient = 1.0.

Data Qualifiers:

J = Estimated concentration

U = Not detected at concentration shown

Table 5-3. Building 1401 - USCG Hangar (PRL 5) Sample Results

		Groundwater
Sample ID	PAL[a,b,c] (ng/L)	SE-1401-MW01
Sample Date		4/13/2018
Perfluorinated Compounds US EPA Method 537 Rev 1.1 Modified		
Perfluorobutanesulfonate (PFBS)	***400,000***	0.92 U *
Perfluoroheptanoic acid (PFHpA)	NA	0.9 U *
Perfluorohexanesulfonate (PFHxS	NA	1.8 U *
Perfluorononanoic acid (PFNA)	NA	1.8 U
Perfluoro-octanesulfonate (PFOS)	***70***	1.8 U
Perfluorooctanoic acid (PFOA)	***70***	0.9 U *

		Soil						
Sample ID	PAL[c] (ng/g)	SE-1401-SS01	SE-1401-SB01	SE-1401-SS03	SE-1401-SB03	SE-1401-SS02	SE-1401-SS02D	SE-1401-SB02
Sample Date		1/11/2018	1/11/2018	1/11/2018	1/11/2018	1/11/2018	1/11/2018	1/11/2018
Depth (ft bgs)		1	4	1	4	1	1	4
Perfluorinated Compounds US EPA Method 537 Rev 1.1 Modified								
Perfluorobutanesulfonate (PFBS)	***1.26x10^6***	0.59 U	0.64 U	0.79 U	0.54 U	0.51 U	0.61 U	0.52 U
Perfluoroheptanoic acid (PFHpA)	NA	0.59 U	0.64 U	0.69 J	0.54 U	0.51 U	0.61 U	0.52 U
Perfluorohexanesulfonate (PFHxS	NA	0.59 U	0.64 U	0.79 U	0.54 U	0.51 U	0.61 U	0.52 U
Perfluorononanoic acid (PFNA)	NA	0.44 J	0.64 U	0.82	0.54 U	0.51 U	0.61 U	0.52 U
Perfluoro-octanesulfonate (PFOS)	***1,260***	3.1	0.64 U	8.6	0.54 U	0.22 J	0.61 U	0.52 U
Perfluorooctanoic acid (PFOA)	***1,260***	0.25 J	0.64 U	1.4	0.54 U	0.51 U	0.61 U	0.52 U

PAL = project action level ng/L = nanogram per liter ng/g = nanogram per gram NA = Not applicable D = Duplicate sample

ft = feet bgs = below ground surface

Italicized and bolded value indicates screening criterion used Bold value indicates analyte detected above screening level

* = Reported value changed to non-detect at elevated quantitation limit due to a blank detection

a. United States Environmental Protection Agency (US EPA), May 2016. Drinking Water Health Advisory for PFOS and PFOA. Office of Water (4304T). Health and Ecological Criteria Division, Washington, DC 20460. EPA Document Number: 822-R-16-004 and 822-R-16-005.

b. Michigan Department of Environmental Quality, 2018. Remediation and Redevelopment Division. Environmental Contamination Response Activity Rules. Table 1. Groundwater: Residential and Nonresidential, Part 201 Generic Cleanup Criteria and Screening Levels. Effective 10 January 2018 and updated on 25 June 2018.

c. US EPA Regional Screening Levels (RSLs), May 2018. PFBS groundwater PAL based on RSL for tap water. Soil PALs calculated using the RSL calculator. The RSLs are protective of a residential receptor and a target hazard quotient = 1.0.

Data Qualifiers:

J = Estimated concentration

U = Not detected at concentration shown

Table 5-4. Building 1461 - USCG Hangar (PRL 6) Sample Results

		Groundwater
Sample ID	PAL[a,b,c] (ng/L)	SE-1461-MW01
Sample Date		4/6/2018
Perfluorinated Compounds US EPA Method 537 Rev 1.1 Modified		
Perfluorobutanesulfonate (PFBS)	***400,000***	1.8 U *
Perfluoroheptanoic acid (PFHpA)	NA	13
Perfluorohexanesulfonate (PFHxS	NA	3.7 U *
Perfluorononanoic acid (PFNA)	NA	1.8 U *
Perfluoro-octanesulfonate (PFOS	***70***	2.0 U *
Perfluorooctanoic acid (PFOA)	***70***	17

		Soil	
Sample ID	PAL[c] (ng/g)	SE-1461-SS01	SE-1461-SB01
Sample Date		1/11/2018	1/11/2018
Depth (ft bgs)		1	4
Perfluorinated Compounds US EPA Method 537 Rev 1.1 Modified			
Perfluorobutanesulfonate (PFBS)	***1.26x10^6***	0.53 U	0.57 U
Perfluoroheptanoic acid (PFHpA)	NA	0.53 U	0.57 U
Perfluorohexanesulfonate (PFHxS	NA	0.53 U	0.57 U
Perfluorononanoic acid (PFNA)	NA	0.53 U	0.57 U
Perfluoro-octanesulfonate (PFOS	***1,260***	0.20 J	0.57 U
Perfluorooctanoic acid (PFOA)	***1,260***	0.53 U	0.57 U

PAL = project action level ng/L = nanogram per liter ng/g = nanogram per gram NA = Not applicable

ft = feet bgs = below ground surface

Italicized and bolded value indicates screening criterion used Bold value indicates analyte detected above screening level

* = Reported value changed to non-detect at elevated quantitation limit due to a blank detection

a. United States Environmental Protection Agency (US EPA), May 2016. Drinking Water Health Advisory for PFOS and PFOA. Office of Water (4304T). Health and Ecological Criteria Division, Washington, DC 20460. EPA Document Number: 822-R-16-004 and 822-R-16-005.

b. Michigan Department of Environmental Quality, 2018. Remediation and Redevelopment Division. Environmental Contamination Response Activity Rules. Table 1. Groundwater: Residential and Nonresidential, Part 201 Generic Cleanup Criteria and Screening Levels. Effective 10 January 2018 and updated on 25 June 2018.

c. US EPA Regional Screening Levels (RSLs), May 2018. PFBS groundwater PAL based on RSL for tap water. Soil PALs calculated using the RSL calculator. The RSLs are protective of a residential receptor and a target hazard quotient = 1.0.

Data Qualifiers:

J = Estimated concentration

U = Not detected at concentration shown

Table 5-5. Building 1416 - Army National Guard Hangar (PRL 7) Sample Results

		Groundwater
Sample ID	PAL[a,b,c] (ng/L)	SE-1416-MW01
Sample Date		4/11/2018
Perfluorinated Compounds US EPA Method 537 Rev 1.1 Modified		
Perfluorobutanesulfonate (PFBS)	***400,000***	25
Perfluoroheptanoic acid (PFHpA)	NA	3.9 J
Perfluorohexanesulfonate (PFHxS	NA	70
Perfluorononanoic acid (PFNA)	NA	9.9 U
Perfluoro-octanesulfonate (PFOS)	***70***	9.9 U *
Perfluorooctanoic acid (PFOA)	***70***	5.5 U *

		Soil						
Sample ID	PAL[c] (ng/g)	SE-1416-SS01	SE-1416-SB01	SE-1416-SS01D	SE-1416-SS02	SE-1416-SB02	SE-1416-SS03	SE-1416-SB03
Sample Date		12/21/2017	12/21/2017	12/21/2017	3/12/2018	3/12/2018	3/12/2018	3/12/2018
Depth (ft bgs)		1	4	1	1	4	1	4
Perfluorinated Compounds US EPA Method 537 Rev 1.1 Modified								
Perfluorobutanesulfonate (PFBS)	***1.26x10^6***	0.64 U	0.73 U	0.61 U	0.70 U	0.70 U	0.67 U	0.68 U
Perfluoroheptanoic acid (PFHpA)	NA	1.2	0.73 U	0.74	0.70 U	0.70 U	0.67 U	0.68 U
Perfluorohexanesulfonate (PFHxS	NA	7.0 J	5	1.2 J	1.1	0.70 U	11	2.6
Perfluorononanoic acid (PFNA)	NA	1.3 J+	0.73 U	1.1 J+	0.70 U	0.70 U	0.67 U	0.68 U
Perfluoro-octanesulfonate (PFOS)	***1,260***	93 J+	120 J+	25 J+	12	0.70 U	31	6.1
Perfluorooctanoic acid (PFOA)	***1,260***	1.9	0.55 J	1.3	0.33 J	0.70 U	0.69	0.68 U

PAL = project action level ng/L = nanogram per liter ng/g = nanogram per gram NA = Not applicable D = Duplicate sample

ft = feet bgs = below ground surface

Italicized and bolded value indicates screening criterion used Bold value indicates analyte detected above screening level

* = Reported value changed to non-detect at elevated quantitation limit due to a blank detection

a. United States Environmental Protection Agency (US EPA), May 2016. Drinking Water Health Advisory for PFOS and PFOA. Office of Water (4304T). Health and Ecological Criteria Division, Washington, DC 20460. EPA Document Number: 822-R-16-004 and 822-R-16-005.

b. Michigan Department of Environmental Quality, 2018. Remediation and Redevelopment Division. Environmental Contamination Response Activity Rules. Table 1. Groundwater: Residential and Nonresidential, Part 201 Generic Cleanup Criteria and Screening Levels. Effective 10 January 2018 and updated on 25 June 2018.

c. US EPA Regional Screening Levels (RSLs), May 2018. PFBS groundwater PAL based on RSL for tap water. Soil PALs calculated using the RSL calculator. The RSLs are protective of a residential receptor and a target hazard quotient = 1.0.

Data Qualifiers:

J = Estimated concentration

U = Not detected at concentration shown

J+ = Inorganic analyte present. Reported value may not be accurate or precise, but the result may be biased high.

Table 5-6. Building 1422 - DHS Hangar (PRL 8) Sample Results

		Groundwater
Sample ID	PAL[a,b,c] (ng/L)	SE-1422-MW01
Sample Date		4/6/2018
Perfluorinated Compounds US EPA Method 537 Rev 1.1 Modified		
Perfluorobutanesulfonate (PFBS)	***400,000***	3,400
Perfluoroheptanoic acid (PFHpA)	NA	650
Perfluorohexanesulfonate (PFHxS	NA	15,000
Perfluorononanoic acid (PFNA)	NA	18 U
Perfluoro-octanesulfonate (PFOS)	***70***	**11,000**
Perfluorooctanoic acid (PFOA)	***70***	**850**

		Soil			
Sample ID	PAL[c] (ng/g)	SE-1422-SS02	SE-1422-SB02	SE-1422-SS01	SE-1422-SB01
Sample Date		1/12/2018	1/12/2018	1/12/2018	1/12/2018
Depth (ft bgs)		1	4	1	4
Perfluorinated Compounds US EPA Method 537 Rev 1.1 Modified					
Perfluorobutanesulfonate (PFBS)	***1.26x10^6***	0.73 U	0.70 U	1.8	1
Perfluoroheptanoic acid (PFHpA)	NA	0.73 U	0.70 U	0.39 J	0.28 J
Perfluorohexanesulfonate (PFHxS	NA	12	5.1	62	40
Perfluorononanoic acid (PFNA)	NA	0.27 J	0.70 U	0.65 U	0.52 U
Perfluoro-octanesulfonate (PFOS)	***1,260***	180	13	120	140
Perfluorooctanoic acid (PFOA)	***1,260***	0.63 J	0.28 J	1.9	2

PAL = project action level ng/L = nanogram per liter ng/g = nanogram per gram NA = Not applicable

ft = feet bgs = below ground surface

Italicized and bolded value indicates screening criterion used Bold value indicates analyte detected above screening level

* = Reported value changed to non-detect at elevated quantitation limit due to a blank detection

a. United States Environmental Protection Agency (US EPA), May 2016. Drinking Water Health Advisory for PFOS and PFOA. Office of Water (4304T). Health and Ecological Criteria Division, Washington, DC 20460. EPA Document Number: 822-R-16-004 and 822-R-16-005.

b. Michigan Department of Environmental Quality, 2018. Remediation and Redevelopment Division. Environmental Contamination Response Activity Rules. Table 1. Groundwater: Residential and Nonresidential, Part 201 Generic Cleanup Criteria and Screening Levels. Effective 10 January 2018 and updated on 25 June 2018.

c. US EPA Regional Screening Levels (RSLs), May 2018. PFBS groundwater PAL based on RSL for tap water. Soil PALs calculated using the RSL calculator. The RSLs are protective of a residential receptor and a target hazard quotient = 1.0.

Data Qualifiers:

J = Estimated concentration

U = Not detected at concentration shown

Table 5-7. Building 1436 - DHS Hangar (PRL 9) Sample Results

		Groundwater
Sample ID	PAL[a,b,c] (ng/L)	SE-TU060-MW03
Sample Date		6/5/2018
Perfluorinated Compounds US EPA Method 537 Rev 1.1 Modified		
Perfluorobutanesulfonate (PFBS)	***400,000***	3.3 J
Perfluoroheptanoic acid (PFHpA)	NA	70
Perfluorohexanesulfonate (PFHxS	NA	23
Perfluorononanoic acid (PFNA)	NA	7.5
Perfluoro-octanesulfonate (PFOS)	***70***	8.9 U *
Perfluorooctanoic acid (PFOA)	***70***	51

		Soil					
Sample ID	PAL[c] (ng/g)	SE-1436-SS01	SE-1436-SB01	SE-1436-SS03	SE-1436-SB03	SE-1436-SS02	SE-1436-SB02
Sample Date		12/21/2017	12/21/2017	12/21/2017	12/21/2017	12/21/2017	12/21/2017
Depth (ft bgs)		1	4	1	4	1	4
Perfluorinated Compounds US EPA Method 537 Rev 1.1 Modified							
Perfluorobutanesulfonate (PFBS)	***1.26x10^6***	0.46 U	0.68 U	0.56 U	0.52 U	0.64 U	0.71 U
Perfluoroheptanoic acid (PFHpA)	NA	2.3	0.31 J	0.54 J	0.52 U	2.7	0.51 J
Perfluorohexanesulfonate (PFHxS	NA	0.44 J	0.68 U	0.19 J	0.52 U	0.26 J	0.71 U
Perfluorononanoic acid (PFNA)	NA	0.87 J+	0.68 U	0.38 J+	0.52 U	0.69 J+	0.71 U
Perfluoro-octanesulfonate (PFOS)	***1,260***	1.4 J+	0.68 U	1.4 J+	0.41 J+	1.2 J+	0.71 U
Perfluorooctanoic acid (PFOA)	***1,260***	4.2	0.68 U	0.85	0.52 U	2.6	0.43 J

PAL = project action level ng/L = nanogram per liter ng/g = nanogram per gram NA = Not applicable

ft = feet bgs = below ground surface

Italicized and bolded value indicates screening criterion used Bold value indicates analyte detected above screening level

* = Reported value changed to non-detect at elevated quantitation limit due to a blank detection

a. United States Environmental Protection Agency (US EPA), May 2016. Drinking Water Health Advisory for PFOS and PFOA. Office of Water (4304T). Health and Ecological Criteria Division, Washington, DC 20460. EPA Document Number: 822-R-16-004 and 822-R-16-005.

b. Michigan Department of Environmental Quality, 2018. Remediation and Redevelopment Division. Environmental Contamination Response Activity Rules. Table 1. Groundwater: Residential and Nonresidential, Part 201 Generic Cleanup Criteria and Screening Levels. Effective 10 January 2018 and updated on 25 June 2018.

c. US EPA Regional Screening Levels (RSLs), May 2018. PFBS groundwater PAL based on RSL for tap water. Soil PALs calculated using the RSL calculator. The RSLs are protective of a residential receptor and a target hazard quotient = 1.0.

Data Qualifiers:

J = Estimated concentration

U = Not detected at concentration shown

J+ = Inorganic analyte present. Reported value may not be accurate or precise, but the result may bebiased high.

Table 5-8. Building 859 - Fire Department (PRL 10) Sample Results

		Groundwater
Sample ID	PAL[a,b,c] (ng/L)	SE-859-MW01
Sample Date		4/9/2018
Perfluorinated Compounds US EPA Method 537 Rev 1.1 Modified		
Perfluorobutanesulfonate (PFBS)	***400,000***	42
Perfluoroheptanoic acid (PFHpA)	NA	39
Perfluorohexanesulfonate (PFHxS)	NA	2,100
Perfluorononanoic acid (PFNA)	NA	18 U *
Perfluoro-octanesulfonate (PFOS)	***70***	**530**
Perfluorooctanoic acid (PFOA)	***70***	**890**

		Soil					
Sample ID	PAL[c] (ng/g)	SE-859-SS01	SE-859-SB01	SE-859-SS02	SE-859-SB02	SE-859-SS03	SE-859-SB03
Sample Date		12/21/2017	12/21/2017	3/14/2018	3/14/2018	3/14/2018	3/14/2018
Depth (ft bgs)		1	4	1	4	1	4
Perfluorinated Compounds US EPA Method 537 Rev 1.1 Modified							
Perfluorobutanesulfonate (PFBS)	***1.26x10^6***	0.67 U	0.47 U	0.70 U	0.31 J	0.59 U	0.63 U
Perfluoroheptanoic acid (PFHpA)	NA	0.67 U	0.47 U	0.70 U	0.68 U	0.59 U	0.63 U
Perfluorohexanesulfonate (PFHxS)	NA	2.5	4.5	6.9	0.65 J	6.7	14
Perfluorononanoic acid (PFNA)	NA	0.67 U	0.47 U	0.70 U	0.68 U	0.20 J	0.63 U
Perfluoro-octanesulfonate (PFOS)	***1,260***	11 J+	34 J+	81	1.6	68	38
Perfluorooctanoic acid (PFOA)	***1,260***	0.44 J	0.87	0.72	0.68 U	0.55 J	0.45 J

PAL = project action level ng/L = nanogram per liter ng/g = nanogram per gram NA = Not applicable

ft = feet bgs = below ground surface

Italicized and bolded value indicates screening criterion used Bold value indicates analyte detected above screening level

* = Reported value changed to non-detect at elevated quantitation limit due to a blank detection

a. United States Environmental Protection Agency (US EPA), May 2016. Drinking Water Health Advisory for PFOS and PFOA. Office of Water (4304T). Health and Ecological Criteria Division, Washington, DC 20460. EPA Document Number: 822-R-16-004 and 822-R-16-005.

b. Michigan Department of Environmental Quality, 2018. Remediation and Redevelopment Division. Environmental Contamination Response Activity Rules. Table 1. Groundwater: Residential and Nonresidential, Part 201 Generic Cleanup Criteria and Screening Levels. Effective 10 January 2018 and updated on 25 June 2018.

c. US EPA Regional Screening Levels (RSLs), May 2018. PFBS groundwater PAL based on RSL for tap water. Soil PALs calculated using the RSL calculator. The RSLs are protective of a residential receptor and a target hazard quotient = 1.0.

Data Qualifiers:
J = Estimated concentration
U = Not detected at concentration shown
J+ = Inorganic analyte present. Reported value may not be accurate or precise, but the result may be biased high.

Table 5-9. Building 501 - Former Wastewater Treatment Plant (PRL 11) Sample Results

		Groundwater
Sample ID	PAL[a,b,c] (ng/L)	SE-501-MW01
Sample Date		4/6/2018
Perfluorinated Compounds US EPA Method 537 Rev 1.1 Modified		
Perfluorobutanesulfonate (PFBS)	***400,000***	15
Perfluoroheptanoic acid (PFHpA)	NA	0.98 U *
Perfluorohexanesulfonate (PFHxS)	NA	44
Perfluorononanoic acid (PFNA)	NA	2.0 U
Perfluoro-octanesulfonate (PFOS)	***70***	7.8 U *
Perfluorooctanoic acid (PFOA)	***70***	2.3 U *

		Soil						
Sample ID	PAL[c] (ng/g)	SE-501-SS01	SE-501-SB01	SE-501-SS02	SE-501-SB02	SE-501-SS02D	SE-501-SS03	SE-501-SB03
Sample Date		12/18/2017	12/18/2017	12/18/2017	12/18/2017	12/18/2017	12/18/2017	12/18/2017
Depth (ft bgs)		1	4	1	4	1	1	4
Perfluorinated Compounds US EPA Method 537 Rev 1.1 Modified								
Perfluorobutanesulfonate (PFBS)	***1.26x10^6***	0.53 U	0.61 U	0.51 U	0.51 U	0.66 U	0.49 U	0.53 U
Perfluoroheptanoic acid (PFHpA)	NA	0.53 U	0.61 U	0.51 U	0.51 U	0.66 U	0.49 U	0.22 J
Perfluorohexanesulfonate (PFHxS)	NA	0.53	0.47 J	0.29 J	0.29 J	0.34 J	0.49 U	0.77
Perfluorononanoic acid (PFNA)	NA	0.53 U	0.61 U	0.51 U	0.51 U	0.66 U	0.49 U	0.41 J
Perfluoro-octanesulfonate (PFOS)	***1,260***	4.2	0.50 J	3.3	0.93	2.4	1.2	7.8
Perfluorooctanoic acid (PFOA)	***1,260***	0.31 J	0.61 U	0.75	0.51 U	0.57 J	0.19 J	1

PAL = project action level ng/L = nanogram per liter ng/g = nanogram per gram NA = Not applicable D = Duplicate sample

ft = feet bgs = below ground surface

Italicized and bolded value indicates screening criterion used Bold value indicates analyte detected above screening level

* = Reported value changed to non-detect at elevated quantitation limit due to a blank detection

a. United States Environmental Protection Agency (US EPA), May 2016. Drinking Water Health Advisory for PFOS and PFOA. Office of Water (4304T). Health and Ecological Criteria Division, Washington, DC 20460. EPA Document Number: 822-R-16-004 and 822-R-16-005.

b. Michigan Department of Environmental Quality, 2018. Remediation and Redevelopment Division. Environmental Contamination Response Activity Rules. Table 1. Groundwater: Residential and Nonresidential, Part 201 Generic Cleanup Criteria and Screening Levels. Effective 10 January 2018 and updated on 25 June 2018.

c. US EPA Regional Screening Levels (RSLs), May 2018. PFBS groundwater PAL based on RSL for tap water. Soil PALs calculated using the RSL calculator. The RSLs are protective of a residential receptor and a target hazard quotient = 1.0.

Data Qualifiers:

J = Estimated concentration

U = Not detected at concentration shown

Table 5-10. Nozzle Testing Area (PRL 12) Sample Results

		Groundwater	
Sample ID	PAL[a,b,c] (ng/L)	SE-NTA-MW01	SE-NTA-MW01D
Sample Date		5/23/2018	5/23/2018
Perfluorinated Compounds US EPA Method 537 Rev 1.1 Modified			
Perfluorobutanesulfonate (PFBS)	***400,000***	70	64
Perfluoroheptanoic acid (PFHpA)	NA	14 J-	12
Perfluorohexanesulfonate (PFHxS	NA	32	27
Perfluorononanoic acid (PFNA)	NA	1.4 U *	1.5 U *
Perfluoro-octanesulfonate (PFOS)	***70***	**77 J+**	**84 J+**
Perfluorooctanoic acid (PFOA)	***70***	5.3 U *	4.8 U *

		Soil					
Sample ID	PAL[c] (ng/g)	SE-NTA-SS01-01	SE-NTA-SB01-4	SE-NTA-SS02-01	SE-NTA-SB02-4	SE-NTA-SS03-01	SE-NTA-SB03-4
Sample Date		3/14/2018	3/14/2018	3/14/2018	3/14/2018	3/14/2018	3/14/2018
Depth (ft bgs)		1	4	1	4	1	4
Perfluorinated Compounds US EPA Method 537 Rev 1.1 Modified							
Perfluorobutanesulfonate (PFBS)	***1.26x10^6***	0.56 J	2.1	0.50 U	0.61 J	0.53 U	0.37 J
Perfluoroheptanoic acid (PFHpA)	NA	2.2	6.3 J-	0.20 J	2.2	0.56	2.5
Perfluorohexanesulfonate (PFHxS	NA	25	76	1.7	17	2.6	37
Perfluorononanoic acid (PFNA)	NA	12	16	0.62	1.8	1	1.5
Perfluoro-octanesulfonate (PFOS)	***1,260***	790	**1,900**	62	68	110	150
Perfluorooctanoic acid (PFOA)	***1,260***	4.3	16 B	0.44 J	5.1 B	0.78	3.9

PAL = project action level ng/L = nanogram per liter ng/g = nanogram per gram NA = Not applicable D = Duplicate sample

ft = feet bgs = below ground surface

Italicized and bolded value indicates screening criterion used Bold value indicates analyte detected above screening level

* = Reported value changed to non-detect at elevated quantitation limit due to a blank detection

a. United States Environmental Protection Agency (US EPA),

b. Michigan Department of Environmental Quality, 2018. Remediation and Redevelopment Division. Environmental Contamination Response Activity Rules. Table 1. Groundwater: Residential and Nonresidential, Part 201 Generic Cleanup Criteria and Screening Levels. Effective 10 January 2018 and updated on 25 June 2018.

c. US EPA Regional Screening Levels (RSLs), May 2018. PFBS groundwater PAL based on RSL for tap water. Soil PALs calculated using the RSL calculator. The RSLs are protective of a residential receptor and a target hazard quotient = 1.0.

Data Qualifiers:

U = Not detected at concentration shown
J = Estimated concentration
J- = Reported value may not be accurate or precise, but the result may be biased low.
J+ = Reported value may not be accurate or precise, but the result may be biased high.
B = Laboratory qualifier indicating that the associated method blank displayed a detection greater than the detection limit (DL). The reported result value is unchanged and did not require further qualification by data reviewers

Table 5-11. C16 - AOC (PRL 13) Sample Results

		Groundwater
Sample ID	PAL[a,b,c] (ng/L)	SE-C16-MW01
Sample Date		5/20/2018
Perfluorinated Compounds US EPA Method 537 Rev 1.1 Modified		
Perfluorobutanesulfonate (PFBS)	***400,000***	13,000
Perfluoroheptanoic acid (PFHpA)	NA	750
Perfluorohexanesulfonate (PFHxS	NA	10,000
Perfluorononanoic acid (PFNA)	NA	11 U
Perfluoro-octanesulfonate (PFOS)	***70***	**84 U ***
Perfluorooctanoic acid (PFOA)	***70***	**370**

		Soil						
Sample ID	PAL[c] (ng/g)	SE-C16-SS01-01	SE-C16-SS01-01D	SE-C16-SB01-4	SE-C16-SS02-01	SE-C16-SB02-4	SE-C16-SS03-01	SE-C16-SB03-4
Sample Date		3/23/2018	3/23/2018	3/22/2018	3/21/2018	3/21/2018	3/21/2018	3/21/2018
Depth (ft bgs)		1	1	4	1	4	1	4
Perfluorinated Compounds US EPA Method 537 Rev 1.1 Modified								
Perfluorobutanesulfonate (PFBS)	***1.26x10^6***	25	26	15	3.1	4.6	0.87	8.6
Perfluoroheptanoic acid (PFHpA)	NA	3.9 J	6.4	2.0 J	0.97	0.37 J	0.22 J	1.5
Perfluorohexanesulfonate (PFHxS	NA	280	410	120	42	46	14	80
Perfluorononanoic acid (PFNA)	NA	6.0 U	6.3 U	5.2 U	0.76 U	0.70 U	0.24 J	0.41 J
Perfluoro-octanesulfonate (PFOS)	***1,260***	820 J	**1,700 J**	250	73	36	170	290
Perfluorooctanoic acid (PFOA)	***1,260***	11	18	4.6 J	1.1	0.60 J	0.45 J	4.1

PAL = project action level ng/L = nanogram per liter ng/g = nanogram per gram NA = Not applicable D = Duplicate sample

ft = feet bgs = below ground surface

Bold value indicates analyte detected above screening level Italicized and bolded value indicates screening criterion used

* = Reported value changed to non-detect at elevated quantitation limit due to a blank detection

a. United States Environmental Protection Agency (US EPA), May 2016. Drinking Water Health Advisory for PFOS and PFOA. Office of Water (4304T). Health and Ecological Criteria Division, Washington, DC 20460. EPA Document Number: 822-R-16-004 and 822-R-16-005.

b. Michigan Department of Environmental Quality, 2018. Remediation and Redevelopment Division. Environmental Contamination Response Activity Rules. Table 1. Groundwater: Residential and Nonresidential, Part 201 Generic Cleanup Criteria and Screening Levels. Effective 10 January 2018 and updated on 25 June 2018.

c. US EPA Regional Screening Levels (RSLs), May 2018. PFBS groundwater PAL based on RSL for tap water. Soil PALs calculated using the RSL calculator. The RSLs are protective of a residential receptor and a target hazard quotient = 1.0.

Data Qualifiers: J = Estimated concentration

U = Not detected at concentration shown

Table 5-12. CRF – AOC (PRL 14) Sample Results

		Groundwater
Sample ID	PAL[a,b,c] (ng/L)	SE-CRF-MW01
Sample Date		5/20/2018
Perfluorinated Compounds US EPA Method 537 Rev 1.1 Modified		
Perfluorobutanesulfonate (PFBS)	***400,000***	0.98 U
Perfluoroheptanoic acid (PFHpA)	NA	1.1 U *
Perfluorohexanesulfonate (PFHxS	NA	0.98 U
Perfluorononanoic acid (PFNA)	NA	1.1 U
Perfluoro-octanesulfonate (PFOS)	***70***	2.0 U
Perfluorooctanoic acid (PFOA)	***70***	1.1 U *

		Soil						
Sample ID	PAL[c] (ng/g)	SE-CRF-SS01-01	SE-CRF-SB01-4	SE-CRF-SS02-01	SE-CRF-SS02-01D	SE-CRF-SB02-4	SE-CRF-SS03-01	SE-CRF-SB03-4
Sample Date		3/24/2018	3/24/2018	3/24/2018	3/24/2018	3/24/2018	3/24/2018	3/24/2018
Depth (ft bgs)		1	4	1	1	4	1	4
Perfluorinated Compounds US EPA Method 537 Rev 1.1 Modified								
Perfluorobutanesulfonate (PFBS)	***1.26x10^6***	0.75 U	0.76 U	0.85 U	0.76 U	0.75 U	0.81 U	0.68 U
Perfluoroheptanoic acid (PFHpA)	NA	0.75 U	0.76 U	0.85 U	0.76 U	0.75 U	0.81 U	0.68 U
Perfluorohexanesulfonate (PFHxS	NA	0.78	0.40 J	0.49 J	0.76 U	0.75 U	0.81 U	0.68 U
Perfluorononanoic acid (PFNA)	NA	0.75 U	0.76 U	0.85 U	0.76 U	0.75 U	0.81 U	0.68 U
Perfluoro-octanesulfonate (PFOS)	***1,260***	0.60 J	0.76 U	0.85 U	0.76 U	0.75 U	0.81 U	0.68 U
Perfluorooctanoic acid (PFOA)	***1,260***	0.60 J	0.76 U	0.85 U	0.76 U	0.75 U	0.81 U	0.68 U

PAL = project action level ng/L = nanogram per liter ng/g = nanogram per gram NA = Not applicable D = Duplicate sample

ft = feet bgs = below ground surface

Bold value indicates analyte detected above screening level Italicized and bolded value indicates screening criterion used

* = Reported value changed to non-detect at elevated quantitation limit due to a blank detection

a. United States Environmental Protection Agency (US EPA), May 2016. Drinking Water Health Advisory for PFOS and PFOA. Office of Water (4304T). Health and Ecological Criteria Division, Washington, DC 20460. EPA Document Number: 822-R-16-004 and 822-R-16-005.

b. Michigan Department of Environmental Quality, 2018. Remediation and Redevelopment Division. Environmental Contamination Response Activity Rules. Table 1. Groundwater: Residential and Nonresidential, Part 201 Generic Cleanup Criteria and Screening Levels. Effective 10 January 2018 and updated on 25 June 2018.

c. US EPA Regional Screening Levels (RSLs), May 2018. PFBS groundwater PAL based on RSL for tap water. Soil PALs calculated using the RSL calculator. The RSLs are protective of a residential receptor and a target hazard quotient = 1.0.

Data Qualifiers: J = Estimated concentration

U = Not detected at concentration shown

Table 5-13. East Ramp (PRL 15) Sample Results

		Groundwater			
Sample ID	PAL[a,b,c] (ng/L)	SE-ER-MW01	SE-ER-MW02	SE-ER-MW02D	SE-ER-MW03
Sample Date		4/11/2018	5/23/2018	5/23/2018	5/22/2018
Perfluorinated Compounds US EPA Method 537 Rev 1.1 Modified					
Perfluorobutanesulfonate (PFBS)	***400,000***	5	4.2 J+	4.1 J+	6.8 J+
Perfluoroheptanoic acid (PFHpA)	NA	2.7 U *	3.7	3.8	13
Perfluorohexanesulfonate (PFHxS	NA	58	14	14	62
Perfluorononanoic acid (PFNA)	NA	1.8 U *	1.1 U	1.1 U	2
Perfluoro-octanesulfonate (PFOS)	***70***	21	7.4 U *	6.6 U *	**58 J+**
Perfluorooctanoic acid (PFOA)	***70***	15	8.6 J+	9.0 J+	**22 J+**

		Soil						
Sample ID	PAL[c] (ng/g)	SE-ER-SS01	SE-ER-SB01	SE-ER-SS02	SE-ER-SB02	SE-ER-SS03	SE-ER-SB03-4	SE-ER-SS04-01
Sample Date		1/9/2018	1/9/2018	12/20/2017	12/20/2017	3/14/2018	3/14/2018	3/14/2018
Depth (ft bgs)		1	4	1	4	4	4	1
Perfluorinated Compounds US EPA Method 537 Rev 1.1 Modified								
Perfluorobutanesulfonate (PFBS)	***1.26x10^6***	0.72 U	0.57 U	0.51 U	0.60 U	0.50 U	0.58 U	0.47 U
Perfluoroheptanoic acid (PFHpA)	NA	0.72 U	0.57 U	0.51 U	0.60 U	0.22 J	0.58 U	0.47 U
Perfluorohexanesulfonate (PFHxS	NA	0.35 J	0.57 U	0.51 U	0.60 U	1.1	0.58 U	0.47 U
Perfluorononanoic acid (PFNA)	NA	0.72 U	0.57 U	0.51 U	0.60 U	0.50 U	0.58 U	0.47 U
Perfluoro-octanesulfonate (PFOS)	***1,260***	1.5 J+	0.66	0.20 J	0.60 U	3	0.76	0.47 U
Perfluorooctanoic acid (PFOA)	***1,260***	0.39 J	0.57 U	0.51 U	0.60 U	0.6	0.58 U	0.47 U

Table 5-13. East Ramp (PRL 15) Sample Results (Continued)

		Soil		
Sample ID	PAL[c] (ng/g)	SE-ER-SB04-4	SE-ER-SS05-01	SE-ER-SB05-4
Sample Date		3/14/2018	3/14/2018	3/14/2018
Depth (ft bgs)		4	1	4
Perfluorinated Compounds US EPA Method 537 Rev 1.1 Modified				
Perfluorobutanesulfonate (PFBS)	***1.26x10^6***	0.49 U	0.74 U	0.55 U
Perfluoroheptanoic acid (PFHpA)	NA	0.49 U	0.44 J	0.55 U
Perfluorohexanesulfonate (PFHxS	NA	0.49 U	5.8	1.3
Perfluorononanoic acid (PFNA)	NA	0.49 U	0.27 J	0.55 U
Perfluoro-octanesulfonate (PFOS)	***1260***	0.41 J	13	0.38 J
Perfluorooctanoic acid (PFOA)	***1,260***	0.49 U	1.7	0.55 U

PAL = project action level ng/L = nanogram per liter ng/g = nanogram per gram NA = Not applicable D = Duplicate sample

ft = feet bgs = below ground surface

Italicized and bolded value indicates screening criterion used Bold value indicates analyte detected above screening level

* = Reported value changed to non-detect at elevated quantitation limit due to a blank detection

a. United States Environmental Protection Agency (US EPA), May 2016. Drinking Water Health Advisory for PFOS and PFOA. Office of Water (4304T). Health and Ecological Criteria Division, Washington, DC 20460. EPA Document Number: 822-R-16-004 and 822-R-16-005.

b. Michigan Department of Environmental Quality, 2018. Remediation and Redevelopment Division. Environmental Contamination Response Activity Rules. Table 1. Groundwater: Residential and Nonresidential, Part 201 Generic Cleanup Criteria and Screening Levels. Effective 10 January 2018 and updated on 25 June 2018.

c. US EPA Regional Screening Levels (RSLs), May 2018. PFBS groundwater PAL based on RSL for tap water. Soil PALs calculated using the RSL calculator. The RSLs are protective of a residential receptor and a target hazard quotient = 1.0.

Data Qualifiers:

J = Estimated concentration

U = Not detected at concentration shown

J+ = Reported value may not be accurate or precise, but the result may be biased high.

Table 5-14. West Ramp (PRL 16) Sample Results

		Groundwater			
Sample ID	PAL[a,b,c] (ng/L)	SE-WR-MW01	SE-WR-MW02	SE-WR-MW02D	SE-WR-MW03
Sample Date		4/13/2018	4/13/2018	4/13/2018	4/11/2018
Perfluorinated Compounds US EPA Method 537 Rev 1.1 Modified					
Perfluorobutanesulfonate (PFBS)	***400,000***	45	14	13	51
Perfluoroheptanoic acid (PFHpA)	NA	16	2.0 U *	1.9 U *	0.92 U *
Perfluorohexanesulfonate (PFHxS	NA	95	36	29	20
Perfluorononanoic acid (PFNA)	NA	1.9 U	1.8 U	1.9 U	1.8 U
Perfluoro-octanesulfonate (PFOS)	***70***	2.1 U *	1.8 U	1.9 U	1.8 U
Perfluorooctanoic acid (PFOA)	***70***	8.0 U *	3.4 U *	3.0 U *	1.1 U *

		Soil						
Sample ID	PAL[c] (ng/g)	SE-WR-SS01	SE-WR-SB01	SE-WR-SS02	SE-WR-SB02	SE-WR-SS03	SE-WR-SB03	SE-WR-SS04
Sample Date		3/13/2018	3/13/2018	3/13/2018	3/13/2018	1/12/2018	1/12/2018	1/12/2018
Depth (ft bgs)		1	4	1	4	1	4	1
Perfluorinated Compounds US EPA Method 537 Rev 1.1 Modified								
Perfluorobutanesulfonate (PFBS)	***1.26x10^6***	0.52 U	0.50 U	0.71 U	0.68 U	0.65 U	0.65 U	0.58 U
Perfluoroheptanoic acid (PFHpA)	NA	0.40 J	0.18 J	0.30 J	0.68 U	0.27 J	0.65 U	0.23 J
Perfluorohexanesulfonate (PFHxS	NA	0.56	1.7	1.4	0.68 U	2.5	5	2
Perfluorononanoic acid (PFNA)	NA	0.43 J	0.50 U	0.71 U	0.68 U	0.26 J	0.65 U	0.58 U
Perfluoro-octanesulfonate (PFOS)	***1,260***	10	1.5	6.2	0.68 U	110	8.7	5.9
Perfluorooctanoic acid (PFOA)	***1,260***	0.88	0.20 J	0.89	0.68 U	0.96	0.65 U	0.72

Table 5-14. West Ramp (PRL 16) Sample Results (Continued)

		Soil				
Sample ID	PAL[c] (ng/g)	SE-WR-SB04	SE-WR-SS05	SE-WR-SB05	SE-WR-SS06	SE-WR-SB06
Sample Date		1/12/2018	1/12/2018	1/12/2018	1/12/2018	1/12/2018
Depth (ft bgs)		4	1	4	1	4
Perfluorinated Compounds US EPA Method 537 Rev 1.1 Modified						
Perfluorobutanesulfonate (PFBS)	***1.26x10^6***	0.54 U	0.61 U	0.70 U	0.64 U	0.67 U
Perfluoroheptanoic acid (PFHpA)	NA	0.54 U	0.61 U	0.70 U	0.24 J	0.67 U
Perfluorohexanesulfonate (PFHxS	NA	2.8	3	2	4.5 J-	0.44 J
Perfluorononanoic acid (PFNA)	NA	0.54 U	0.61 U	0.70 U	0.32 J	0.67 U
Perfluoro-octanesulfonate (PFOS)	***1260***	0.33 J	23	0.70 U	10	0.24 J
Perfluorooctanoic acid (PFOA)	***1,260***	0.54 U	0.69	0.70 U	0.60 J	0.67 U

PAL = project action level ng/L = nanogram per liter ng/g = nanogram per gram NA = Not applicable D = Duplicate sample

ft = feet bgs = below ground surface

Italicized and bolded value indicates screening criterion used Bold value indicates analyte detected above screening level

* = Reported value changed to non-detect at elevated quantitation limit due to a blank detection

a. United States Environmental Protection Agency (US EPA), May 2016. Drinking Water Health Advisory for PFOS and PFOA. Office of Water (4304T). Health and Ecological Criteria Division, Washington, DC 20460. EPA Document Number: 822-R-16-004 and 822-R-16-005.

b. Michigan Department of Environmental Quality, 2018. Remediation and Redevelopment Division. Environmental Contamination Response Activity Rules. Table 1. Groundwater: Residential and Nonresidential, Part 201 Generic Cleanup Criteria and Screening Levels. Effective 10 January 2018 and updated on 25 June 2018.

c. US EPA Regional Screening Levels (RSLs), May 2018. PFBS groundwater PAL based on RSL for tap water. Soil PALs calculated using the RSL calculator. The RSLs are protective of a residential receptor and a target hazard quotient = 1.0.

Data Qualifiers:

J = Estimated concentration

U = Not detected at concentration shown

J- = Reported value may not be accurate or precise, but the result may be biased low.

Table 5-15. Former Building 33 - Fire Department (PRL 17) Sample Results

		Groundwater
Sample ID	PAL[a,b,c] (ng/L)	SE-33-MW01
Sample Date		5/23/2018
Perfluorinated Compounds US EPA Method 537 Rev 1.1 Modified		
Perfluorobutanesulfonate (PFBS)	***400,000***	220
Perfluoroheptanoic acid (PFHpA)	NA	150
Perfluorohexanesulfonate (PFHxS	NA	2,300
Perfluorononanoic acid (PFNA)	NA	13 U *
Perfluoro-octanesulfonate (PFOS	***70***	**3,200 J+**
Perfluorooctanoic acid (PFOA)	***70***	**400 J+**

		Soil						
Sample ID	PAL[c] (ng/g)	SE-33-SS02	SE-33-SB02	SE-33-SS01	SE-33-SS01D	SE-33-SB01	SE-33-SS03-01	SE-33-SB03-4
Sample Date		12/20/2017	12/20/2017	12/20/2017	12/20/2017	12/20/2017	3/23/2018	3/23/2018
Depth (ft bgs)		1	4	1	1	4	1	4
Perfluorinated Compounds US EPA Method 537 Rev 1.1 Modified								
Perfluorobutanesulfonate (PFBS)	***1.26x10^6***	0.24 J	0.54 U	0.59 U	0.61 U	0.60 U	1.1	1.2
Perfluoroheptanoic acid (PFHpA)	NA	0.55	0.26 J	0.56 J	0.44 J	0.60 U	1.2	0.74 J
Perfluorohexanesulfonate (PFHxS	NA	12	2.8	6.2	6	1.5	29	24
Perfluorononanoic acid (PFNA)	NA	1.2	0.54 U	0.27 J	0.21 J	0.60 U	2	0.74 U
Perfluoro-octanesulfonate (PFOS	***1,260***	180	18	17	14	5.6	140	44
Perfluorooctanoic acid (PFOA)	***1,260***	3.9	0.99	1.3	0.93	0.29 J	13	22

PAL = project action level ng/L = nanogram per liter ng/g = nanogram per gram NA = Not applicable D = Duplicate sample

ft = feet bgs = below ground surface

Italicized and bolded value indicates screening criterion used Bold value indicates analyte detected above screening level

* = Reported value changed to non-detect at elevated quantitation limit due to a blank detection

a. United States Environmental Protection Agency (US EPA), May 2016. Drinking Water Health Advisory for PFOS and PFOA. Office of Water (4304T). Health and Ecological Criteria Division, Washington, DC 20460. EPA Document Number: 822-R-16-004 and 822-R-16-005.

b. Michigan Department of Environmental Quality, 2018. Remediation and Redevelopment Division. Environmental Contamination Response Activity Rules. Table 1. Groundwater: Residential and Nonresidential, Part 201 Generic Cleanup Criteria and Screening Levels. Effective 10 January 2018 and updated on 25 June 2018.

c. US EPA Regional Screening Levels (RSLs), May 2018. PFBS groundwater PAL based on RSL for tap water. Soil PALs calculated using the RSL calculator. The RSLs are protective of a residential receptor and a target hazard quotient = 1.0.

Data Qualifiers:

J = Estimated concentration

U = Not detected at concentration shown

J+ = Reported value may not be accurate or precise, but the result may be biased high.

Table 5-16. Former Building 176 - Vehicle Maintenance (PRL 18) Sample Results

		Groundwater
Sample ID	PAL[a,b,c] (ng/L)	SE-176-MW01
Sample Date		4/9/2018
Perfluorinated Compounds US EPA Method 537 Rev 1.1 Modified		
Perfluorobutanesulfonate (PFBS)	***400,000***	24
Perfluoroheptanoic acid (PFHpA)	NA	25
Perfluorohexanesulfonate (PFHxS	NA	52
Perfluorononanoic acid (PFNA)	NA	1.8 U *
Perfluoro-octanesulfonate (PFOS)	***70***	5.1 U *
Perfluorooctanoic acid (PFOA)	***70***	13

		Soil					
Sample ID	PAL[c] (ng/g)	SE-176-SS01	SE-176-SB01	SE-176-SS02	SE-176-SB02	SE-176-SS03	SE-176-SB03
Sample Date		12/20/2017	12/20/2017	12/21/2017	12/21/2017	12/20/2017	12/20/2017
Depth (ft bgs)		1	4	1	4	1	4
Perfluorinated Compounds US EPA Method 537 Rev 1.1 Modified							
Perfluorobutanesulfonate (PFBS)	***1.26x10^6***	1.9	2.7	0.59 U	0.54 U	0.21 J	0.59 J
Perfluoroheptanoic acid (PFHpA)	NA	0.78	0.82	0.23 J	0.54 U	0.30 J	0.45 J
Perfluorohexanesulfonate (PFHxS	NA	31	19	1.9	1.7	5.6	20
Perfluorononanoic acid (PFNA)	NA	0.75 J+	0.71 U	0.20 J+	0.54 U	0.30 J	0.92 J+
Perfluoro-octanesulfonate (PFOS)	***1,260***	77 J+	57 J+	12 J+	18 J+	36	170 J+
Perfluorooctanoic acid (PFOA)	***1,260***	5.1	3.4	0.61	0.68	0.75	1.7

PAL = project action level ng/L = nanogram per liter ng/g = nanogram per gram NA = Not applicable

ft = feet bgs = below ground surface

Italicized and bolded value indicates screening criterion used Bold value indicates analyte detected above screening level

* = Reported value changed to non-detect at elevated quantitation limit due to a blank detection

a. United States Environmental Protection Agency (US EPA), May 2016. Drinking Water Health Advisory for PFOS and PFOA. Office of Water (4304T). Health and Ecological Criteria Division, Washington, DC 20460. EPA Document Number: 822-R-16-004 and 822-R-16-005.

b. Michigan Department of Environmental Quality, 2018. Remediation and Redevelopment Division. Environmental Contamination Response Activity Rules. Table 1. Groundwater: Residential and Nonresidential, Part 201 Generic Cleanup Criteria and Screening Levels. Effective 10 January 2018 and updated on 25 June 2018.

c. US EPA Regional Screening Levels (RSLs), May 2018. PFBS groundwater PAL based on RSL for tap water. Soil PALs calculated using the RSL calculator. The RSLs are protective of a residential receptor and a target hazard quotient = 1.0.

Data Qualifiers:

J = Estimated concentration

U = Not detected at concentration shown

J+ = Inorganic analyte present. Reported value may not be accurate or precise, but the result may be biased high.

Table 5-17. Wet Well/Drainage Basin 340 (PRL 20) Sample Results

		Surface Water
Sample ID	PAL[a,b] (ng/L)	SE-DB340-SW01
Sample Date		2/8/2018
Perfluorinated Compounds US EPA Method 537 Rev 1.1 modified		
Perfluorobutanesulfonate (PFBS)	***400,000***	12 U
Perfluoroheptanoic acid (PFHpA)	NA	11 U
Perfluorohexanesulfonate (PFHxS	NA	120
Perfluorononanoic acid (PFNA)	NA	20 U
Perfluoro-octanesulfonate (PFOS)	***11***	**170**
Perfluorooctanoic acid (PFOA)	***420***	29 U

		Sediment
Sample ID	PAL[b] (ng/g)	SE-SD340
Sample Date		5/2/2018
Depth (ft bgs)		NA
Perfluorinated Compounds US EPA Method 537 Rev 1.1 Modified		
Perfluorobutanesulfonate (PFBS)	***1.26x10^6***	0.86 U
Perfluoroheptanoic acid (PFHpA)	NA	0.97 U
Perfluorohexanesulfonate (PFHxS	NA	0.91 U
Perfluorononanoic acid (PFNA)	NA	0.97 U
Perfluoro-octanesulfonate (PFOS)	***1,260***	1.8
Perfluorooctanoic acid (PFOA)	***1,260***	0.97 U

PAL = project action level ng/L = nanogram per liter ng/g = nanogram per gram NA = Not applicable

ft = feet bgs = below ground surface

Italicized and bolded value indicates screening criterion used Bold value indicates analyte detected above screening level

a. Michigan Department of Environmental Quality, 2016. Rule 57 Water Quality Values. Surface Water Assessment Section. 21 October 2016. Values are protective of drinking water.

b. US EPA Regional Screening Levels (RSLs), May 2018. PFBS groundwater PAL based on RSL for tap water. Soil PALs calculated using the RSL calculator. The RSLs are protective of a residential receptor and a target hazard quotient = 1.0.

Data Qualifiers:

U = Not detected at concentration shown

Table 5-18. Wet Well/Drainage Basin 507 (PRL 21) Sample Results

		Surface Water
Sample ID	PAL[a,b] (ng/L)	SE-DB507-SW01
Sample Date		2/8/2018
Perfluorinated Compounds US EPA Method 537 Rev 1.1 modified		
Perfluorobutanesulfonate (PFBS)	***400,000***	140
Perfluoroheptanoic acid (PFHpA)	NA	140
Perfluorohexanesulfonate (PFHxS	NA	2,000
Perfluorononanoic acid (PFNA)	NA	39
Perfluoro-octanesulfonate (PFOS)	***11***	**2,400**
Perfluorooctanoic acid (PFOA)	***420***	290

		Sediment
Sample ID	PAL[b] (ng/g)	SE-DB507-SD01
Sample Date		4/27/2018
Depth (ft bgs)		NA
Perfluorinated Compounds US EPA Method 537 Rev 1.1 Modified		
Perfluorobutanesulfonate (PFBS)	***1.26x10^6***	2.2 U
Perfluoroheptanoic acid (PFHpA)	NA	2.5 U
Perfluorohexanesulfonate (PFHxS	NA	2.4 U
Perfluorononanoic acid (PFNA)	NA	2.5 U
Perfluoro-octanesulfonate (PFOS)	***1,260***	24
Perfluorooctanoic acid (PFOA)	***1,260***	2.5 U

PAL = project action level ng/L = nanogram per liter ng/g = nanogram per gram NA = Not applicable

ft = feet bgs = below ground surface

Italicized and bolded value indicates screening criterion used Bold value indicates analyte detected above screening level

a. Michigan Department of Environmental Quality, 2016. Rule 57 Water Quality Values. Surface Water Assessment Section. 21 October 2016. Values are protective of drinking water.

b. US EPA Regional Screening Levels (RSLs), May 2018. PFBS groundwater PAL based on RSL for tap water. Soil PALs calculated using the RSL calculator. The RSLs are protective of a residential receptor and a target hazard quotient = 1.0.

Data Qualifiers:

U = Not detected at concentration shown

Table 5-19. Wet Well/Drainage Basin 508 (PRL 22) Sample Results

		Surface Water
Sample ID	PAL[a,b] (ng/L)	SE-DB508-SW01
Sample Date		2/8/2018
Perfluorinated Compounds US EPA Method 537 Rev 1.1 modified		
Perfluorobutanesulfonate (PFBS)	***400,000***	240
Perfluoroheptanoic acid (PFHpA)	NA	110
Perfluorohexanesulfonate (PFHxS	NA	2,200
Perfluorononanoic acid (PFNA)	NA	31
Perfluoro-octanesulfonate (PFOS)	***11***	**2,000**
Perfluorooctanoic acid (PFOA)	***420***	190

		Sediment
Sample ID	PAL[b] (ng/g)	SE-DB508-SD01
Sample Date		3/23/2018
Depth (ft bgs)		NA
Perfluorinated Compounds US EPA Method 537 Rev 1.1 Modified		
Perfluorobutanesulfonate (PFBS)	***1.26x10^6***	0.57 U
Perfluoroheptanoic acid (PFHpA)	NA	0.57 U
Perfluorohexanesulfonate (PFHxS	NA	0.25 J
Perfluorononanoic acid (PFNA)	NA	0.57 U
Perfluoro-octanesulfonate (PFOS)	***1,260***	2.6
Perfluorooctanoic acid (PFOA)	***1,260***	0.25 J

PAL = project action level ng/L = nanogram per liter ng/g = nanogram per gram NA = Not applicable

ft = feet bgs = below ground surface

Italicized and bolded value indicates screening criterion used Bold value indicates analyte detected above screening level

a. Michigan Department of Environmental Quality, 2016. Rule 57 Water Quality Values. Surface Water Assessment Section. 21 October 2016. Values are protective of drinking water.

b. US EPA Regional Screening Levels (RSLs), May 2018. PFBS groundwater PAL based on RSL for tap water. Soil PALs calculated using the RSL calculator. The RSLs are protective of a residential receptor and a target hazard quotient = 1.0.

Data Qualifiers:

J = Estimated concentration

U = Not detected at concentration shown

Table 5-20. Wet Well/Drainage Basin 980 (PRL 23) Sample Results

		Surface Water
Sample ID	PAL[a,b] (ng/L)	SE-DB980-SW01
Sample Date		2/8/2018
Perfluorinated Compounds US EPA Method 537 Rev 1.1 modified		
Perfluorobutanesulfonate (PFBS)	***400,000***	9 J+
Perfluoroheptanoic acid (PFHpA)	NA	3 U
Perfluorohexanesulfonate (PFHxS	NA	29
Perfluorononanoic acid (PFNA)	NA	0.5 U
Perfluoro-octanesulfonate (PFOS)	***11***	**33**
Perfluorooctanoic acid (PFOA)	***420***	6 U

		Sediment
Sample ID	PAL[b] (ng/g)	SE-DB980-SD01
Sample Date		3/23/2018
Depth (ft bgs)		NA
Perfluorinated Compounds US EPA Method 537 Rev 1.1 Modified		
Perfluorobutanesulfonate (PFBS)	***1.26x10^6***	0.92 U
Perfluoroheptanoic acid (PFHpA)	NA	0.92 U
Perfluorohexanesulfonate (PFHxS	NA	0.92 U
Perfluorononanoic acid (PFNA)	NA	0.92 U
Perfluoro-octanesulfonate (PFOS)	***1,260***	0.95
Perfluorooctanoic acid (PFOA)	***1,260***	0.92 U

PAL = project action level ng/L = nanogram per liter ng/g = nanogram per gram NA = Not applicable

ft = feet bgs = below ground surface

Italicized and bolded value indicates screening criterion used Bold value indicates analyte detected above screening level

a. Michigan Department of Environmental Quality, 2016. Rule 57 Water Quality Values. Surface Water Assessment Section. 21 October 2016. Values are protective of drinking water.

b. US EPA Regional Screening Levels (RSLs), May 2018. PFBS groundwater PAL based on RSL for tap water. Soil PALs calculated using the RSL calculator. The RSLs are protective of a residential receptor and a target hazard quotient = 1.0.

Data Qualifiers:

J+ = Reported value may not be accurate or precise, but the result may be biased high.

U = Not detected at concentration shown

Table 5-21. Wet Well/Drainage Basin 990 (PRL 24) Sample Results

		Surface Water
Sample ID	PAL[a,b] (ng/L)	SE-DB990-SW01
Sample Date		2/8/2018
Perfluorinated Compounds US EPA Method 537 Rev 1.1 modified		
Perfluorobutanesulfonate (PFBS)	***400,000***	53
Perfluoroheptanoic acid (PFHpA)	NA	17 U
Perfluorohexanesulfonate (PFHxS)	NA	340
Perfluorononanoic acid (PFNA)	NA	20 U
Perfluoro-octanesulfonate (PFOS)	***11***	**490**
Perfluorooctanoic acid (PFOA)	***420***	27 U

		Sediment
Sample ID	PAL[b] (ng/g)	SE-DB990-SD01
Sample Date		3/23/2018
Depth (ft bgs)		NA
Perfluorinated Compounds US EPA Method 537 Rev 1.1 Modified		
Perfluorobutanesulfonate (PFBS)	***1.26x10^6***	0.67 U
Perfluoroheptanoic acid (PFHpA)	NA	0.67 U
Perfluorohexanesulfonate (PFHxS)	NA	0.67 U
Perfluorononanoic acid (PFNA)	NA	0.67 U
Perfluoro-octanesulfonate (PFOS)	***1,260***	3.6
Perfluorooctanoic acid (PFOA)	***1,260***	0.67 U

PAL = project action level ng/L = nanogram per liter ng/g = nanogram per gram NA = Not applicable

ft = feet bgs = below ground surface

Italicized and bolded value indicates screening criterion used Bold value indicates analyte detected above screening level

a. Michigan Department of Environmental Quality, 2016. Rule 57 Water Quality Values. Surface Water Assessment Section. 21 October 2016. Values are protective of drinking water.

b. US EPA Regional Screening Levels (RSLs), May 2018. PFBS groundwater PAL based on RSL for tap water. Soil PALs calculated using the RSL calculator. The RSLs are protective of a residential receptor and a target hazard quotient = 1.0.

Data Qualifiers:

U = Not detected at concentration shown

Table 5-22. Aircraft Crash Sites (PRL 25) Sample Results

		Groundwater						
Sample ID	PAL[a,b,c] (ng/L)	SE-AC-MW01	SE-AC-MW02	SE-AC-MW03	SE-AC-MW03D	SE-AC-MW04	SE-AC-MW05	SE-AC-MW06
Sample Date		5/20/2018	5/20/2018	5/20/2018	5/20/2018	5/20/2018	5/20/2018	5/20/2018
Perfluorinated Compounds US EPA Method 537 Rev 1.1 Modified								
Perfluorobutanesulfonate (PFBS)	***400,000***	30	0.98 U	0.97 U	0.97 U	0.98 U *	31	3.5
Perfluoroheptanoic acid (PFHpA)	NA	1.7 U *	1.1 U *	1.1 U *	1.1 U *	1.1 U *	1.4 U *	1.2 U *
Perfluorohexanesulfonate (PFHxS)	NA	22	0.98 U	0.97 U	0.97 U *	0.98 U *	110	28
Perfluorononanoic acid (PFNA)	NA	1.1 U	1.1 U	1.1 U	1.1 U *	1.1 U	1.1 U	1.1 U *
Perfluoro-octanesulfonate (PFOS)	***70***	2.1 U *	2.0 U	2.0 U	9.4 U *	2.1 U	10 U *	25
Perfluorooctanoic acid (PFOA)	***70***	1.7 U *	1.1 U *	1.1 U *	1.1 U *	1.2 U *	3.0 U *	5.4 U *

		Soil							
Sample ID	PAL[c] (ng/g)	SE-AC-SS01-01	SE-AC-SS01-01D	SE-AC-SB01-4	SE-AC-SS02-01	SE-AC-SB02-4	SE-AC-SS03-01	SE-AC-SB03-4	SE-AC-SS04-01
Sample Date		3/25/2018	3/25/2018	3/25/2018	3/25/2018	3/25/2018	3/24/2018	3/24/2018	3/24/2018
Depth (ft bgs)		1	1	4	1	4	1	4	1
Perfluorinated Compounds US EPA Method 537 Rev 1.1 Modified									
Perfluorobutanesulfonate (PFBS)	***1.26x10^6***	0.72 U	0.73 U	0.70 U	0.79 U	0.72 U	0.70 U	0.78 U	0.72 U
Perfluoroheptanoic acid (PFHpA)	NA	0.72 U	0.73 U	0.70 U	0.79 U	0.72 U	0.70 U	0.78 U	0.72 U
Perfluorohexanesulfonate (PFHxS)	NA	0.72 U	0.73 U	0.70 U	0.79 U	0.72 U	0.70 U	0.78 U	0.72 U
Perfluorononanoic acid (PFNA)	NA	0.72 U	0.73 U	0.70 U	0.79 U	0.72 U	0.70 U	0.78 U	0.72 U
Perfluoro-octanesulfonate (PFOS)	***1,260***	0.72 U	0.73 U	0.70 U	0.79 U	0.72 U	0.70 U	0.78 U	0.30 J
Perfluorooctanoic acid (PFOA)	***1,260***	0.72 U	0.73 U	0.70 U	0.79 U	0.72 U	0.70 U	0.78 U	0.72 U

Table 5-22. Aircraft Crash Sites (PRL 25) Sample Results (Continued)

		Soil							
Sample ID	PAL[c] (ng/g)	SE-AC-SS04-01D	SE-AC-SB04-4	SE-AC-SS05-01	SE-AC-SS05-01D	SE-AC-SB05-4	SE-AC-SS06-01	SE-AC-SS06-01D	SE-AC-SB06-4
Sample Date		3/24/2018	3/24/2018	3/20/2018	3/20/2018	3/20/2018	3/19/2018	3/19/2018	3/19/2018
Depth (ft bgs)		1	4	1	1	4	1	1	4
Perfluorinated Compounds US EPA Method 537 Rev 1.1 Modified									
Perfluorobutanesulfonate (PFBS)	***1.26x10^6***	0.68 U	0.72 U	0.74 U	0.82 U	0.53 U	0.69 U	0.78 U	0.73 U
Perfluoroheptanoic acid (PFHpA)	NA	0.68 U	0.72 U	0.74 U	0.82 U	0.53 U	0.69 U	0.78 U	0.73 U
Perfluorohexanesulfonate (PFHxS)	NA	0.68 U	0.72 U	0.30 J	0.31 J	0.64	0.69 U	0.78 U	0.30 J
Perfluorononanoic acid (PFNA)	NA	0.68 U	0.72 U	0.74 U	0.82 U	0.53 U	0.69 U	0.78 U	0.73 U
Perfluoro-octanesulfonate (PFOS)	***1,260***	0.64 J	0.72 U	0.55 J	1.1	0.24 J	7.3	7.5	0.40 J
Perfluorooctanoic acid (PFOA)	***1,260***	0.68 U	0.72 U	0.74 U	0.82 U	0.53 U	0.69 U	0.27 J	0.73 U

PAL = project action level ng/L = nanogram per liter ng/g = nanogram per gram NA = Not applicable D = Duplicate sample

ft = feet bgs = below ground surface

Bold value indicates analyte detected above screening level Italicized and bolded value indicates screening criterion used

* = Reported value changed to non-detect at elevated quantitation limit due to a blank detection

a. United States Environmental Protection Agency (US EPA), May 2016. Drinking Water Health Advisory for PFOS and PFOA. Office of Water (4304T). Health and Ecological Criteria Division, Washington, DC 20460. EPA Document Number: 822-R-16-004 and 822-R-16-005.

b. Michigan Department of Environmental Quality, 2018. Remediation and Redevelopment Division. Environmental Contamination Response Activity Rules. Table 1. Groundwater: Residential and Nonresidential, Part 201 Generic Cleanup Criteria and Screening Levels. Effective 10 January 2018 and updated on 25 June 2018.

c. US EPA Regional Screening Levels (RSLs), May 2018. PFBS groundwater PAL based on RSL for tap water. Soil PALs calculated using the RSL calculator. The RSLs are protective of a residential receptor and a target hazard quotient = 1.0.

Data Qualifiers: J = Estimated concentration

U = Not detected at concentration shown

Table 5-23. Drainage Basin 1420/Outfall 006A (PRL 26) Sample Results

		Surface Water		
Sample ID	PAL[a,b] (ng/L)	SE-OF006A-SW01	SE-OF006A-SW02	SE-OF006A-SW03
Sample Date		4/13/2018	4/13/2018	4/13/2018
Perfluorinated Compounds US EPA Method 537 Rev 1.1 Modified				
Perfluorobutanesulfonate (PFBS)	***400,000***	9.3	14	4.6 J
Perfluoroheptanoic acid (PFHpA)	NA	4.7 U *	9.5	6.2
Perfluorohexanesulfonate (PFHxS)	NA	16	100	38
Perfluorononanoic acid (PFNA)	NA	9.4 U	7.4 J	2.4 J
Perfluoro-octanesulfonate (PFOS)	***11***	26	**970**	**180**
Perfluorooctanoic acid (PFOA)	***420***	4.7 U *	65	11

		Sediment		
Sample ID	PAL[b] (ng/g)	SE-OF006A-SD01	SE-OF006A-SD02	SE-OF006A-SD03
Sample Date		4/27/2018	4/27/2018	4/27/2018
Depth (ft bgs)		NA	NA	NA
Perfluorinated Compounds US EPA Method 537 Rev 1.1 Modified				
Perfluorobutanesulfonate (PFBS)	***1.26x10^6***	1.8 U	1.4 U	1.0 U
Perfluoroheptanoic acid (PFHpA)	NA	2.1 U	1.6 U	1.2 U
Perfluorohexanesulfonate (PFHxS)	NA	2.0 U	1.5 U	1.1 U
Perfluorononanoic acid (PFNA)	NA	2.1 U	1.6 U	1.2 U
Perfluoro-octanesulfonate (PFOS)	***1,260***	4.1	4.7	4
Perfluorooctanoic acid (PFOA)	***1,260***	2.1 U	1.6 U	1.2 U

PAL = project action level ng/L = nanogram per liter ng/g = nanogram per gram NA = Not applicable

ft = feet bgs = below ground surface

Bold value indicates analyte detected above screening level Italicized and bolded value indicates screening criterion used

* = Reported value changed to non-detect at elevated quantitation limit due to a blank detection

a. Michigan Department of Environmental Quality, 2016. Rule 57 Water Quality Values. Surface Water Assessment Section. 21 October 2016. Values are protective of drinking water.

b. US EPA Regional Screening Levels (RSLs), May 2018. PFBS groundwater PAL based on RSL for tap water. Soil PALs calculated using the RSL calculator. The RSLs are protective of a residential receptor and a target hazard quotient = 1.0.

Data Qualifiers: J = Estimated concentration

U = Not detected at concentration shown

Table 5-24. Sludge Drying Beds (PRL 27) Sample Results

		Groundwater
Sample ID	PAL[a,b,c] (ng/L)	SE-SDB-MW01
Sample Date		4/6/2018
Perfluorinated Compounds US EPA Method 537 Rev 1.1 Modified		
Perfluorobutanesulfonate (PFBS)	***400,000***	4.5
Perfluoroheptanoic acid (PFHpA)	NA	0.92 U *
Perfluorohexanesulfonate (PFHxS)	NA	8.9
Perfluorononanoic acid (PFNA)	NA	1.8 U
Perfluoro-octanesulfonate (PFOS)	***70***	2.6 U *
Perfluorooctanoic acid (PFOA)	***70***	1.0 U *

		Soil					
Sample ID	PAL[c] (ng/g)	SE-SDB-SS01	SE-SDB-SB01	SE-SDB-SS02	SE-SDB-SB02	SE-SDB-SS03	SE-SDB-SB03
Sample Date		12/18/2017	12/18/2017	12/18/2017	12/18/2017	12/18/2017	12/18/2017
Depth (ft bgs)		1	4	1	4	1	4
Perfluorinated Compounds US EPA Method 537 Rev 1.1 Modified							
Perfluorobutanesulfonate (PFBS)	***1.26x10^6***	0.59 U	0.66 U	0.51 U	0.64 U	0.59 U	0.58 U
Perfluoroheptanoic acid (PFHpA)	NA	0.59 U	0.66 U	0.51 U	0.64 U	0.59 U	0.58 U
Perfluorohexanesulfonate (PFHxS)	NA	0.59 U	0.71	0.37 J	0.64 U	0.59 U	0.58 U
Perfluorononanoic acid (PFNA)	NA	0.59 U	0.66 U	0.51 U	0.64 U	0.59 U	0.58 U
Perfluoro-octanesulfonate (PFOS)	***1,260***	1.3	0.66 U	2.1	0.64 U	7.1	0.97
Perfluorooctanoic acid (PFOA)	***1,260***	0.37 J	0.66 U	0.33 J	0.64 U	0.52 J	0.58 U

PAL = project action level ng/L = nanogram per liter ng/g = nanogram per gram NA = Not applicable

ft = feet bgs = below ground surface

Italicized and bolded value indicates screening criterion used Bold value indicates analyte detected above screening level

* = Reported value changed to non-detect at elevated quantitation limit due to a blank detection

a. United States Environmental Protection Agency (US EPA), May 2016. Drinking Water Health Advisory for PFOS and PFOA. Office of Water (4304T). Health and Ecological Criteria Division, Washington, DC 20460. EPA Document Number: 822-R-16-004 and 822-R-16-005.

b. Michigan Department of Environmental Quality, 2018. Remediation and Redevelopment Division. Environmental Contamination Response Activity Rules. Table 1. Groundwater: Residential and Nonresidential, Part 201 Generic Cleanup Criteria and Screening Levels. Effective 10 January 2018 and updated on 25 June 2018.

c. US EPA Regional Screening Levels (RSLs), May 2018. PFBS groundwater PAL based on RSL for tap water. Soil PALs calculated using the RSL calculator. The RSLs are protective of a residential receptor and a target hazard quotient = 1.0.

Data Qualifiers:

J = Estimated concentration

U = Not detected at concentration shown

Table 5-25. IRP Site 9 - Sludge Application Area (PRL 28) Sample Results

		Groundwater				
Sample ID	PAL[a,b,c] (ng/L)	SE-IRP9-MW01	SE-IRP9-MW02	SE-IRP9-MW03	SE-IRP9-MW04	SE-IRP9-MW04D
Sample Date		5/22/2018	4/13/2018	5/22/2018	4/10/2018	4/10/2018
Perfluorinated Compounds US EPA Method 537 Rev 1.1 Modified						
Perfluorobutanesulfonate (PFBS)	***400,000***	2.6	3.4	4.8	0.91 U *	0.96 U *
Perfluoroheptanoic acid (PFHpA)	NA	1.1 U *	0.92 U	3.1 U *	0.91 U	0.96 U
Perfluorohexanesulfonate (PFHxS)	NA	5.1	53	49	1.8 U	1.9 U
Perfluorononanoic acid (PFNA)	NA	1.1 U	1.8 U	1.1 U	1.8 U	1.9 U
Perfluoro-octanesulfonate (PFOS)	***70***	2.1 U *	1.8 U *	7.0 U *	1.8 U	1.9 U
Perfluorooctanoic acid (PFOA)	***70***	1.8 U *	0.92 U	9.1 J+	0.91 U	0.96 U

		Soil						
Sample ID	PAL[c] (ng/g)	SE-IRP9-SS01-01	SE-IRP9-SB01-4	SE-IRP9-SS02-01	SE-IRP9-SB02-4	SE-IRP9-SS03-01	SE-IRP9-SB03-4	SE-IRP-SS04-01
Sample Date		3/19/2018	3/19/2018	3/19/2018	3/19/2018	3/19/2018	3/19/2018	3/15/2018
Depth (ft bgs)		1	4	1	4	1	4	1
Perfluorinated Compounds US EPA Method 537 Rev 1.1 Modified								
Perfluorobutanesulfonate (PFBS)	***1.26x10^6***	0.72 U	0.69 U	0.68 U	0.74 U	0.75 U	0.70 U	0.59 U
Perfluoroheptanoic acid (PFHpA)	NA	0.72 U	0.69 U	0.68 U	0.74 U	0.75 U	0.70 U	0.59 U
Perfluorohexanesulfonate (PFHxS)	NA	0.72 U	0.69 U	1	0.36 J	0.75 U	0.42 J	0.59 U
Perfluorononanoic acid (PFNA)	NA	0.72 U	0.69 U	0.68 U	0.74 U	0.75 U	0.70 U	0.59 U
Perfluoro-octanesulfonate (PFOS)	***1,260***	2.6	0.69 U	3	0.74 U	0.75 U	3.1	2.9
Perfluorooctanoic acid (PFOA)	***1,260***	0.38 J	0.69 U	0.34 J	0.28 J	0.75 U	0.46 J	0.59 U

Table 5-25. IRP Site 9 - Sludge Application Area (PRL 28) Sample Results (Continued)

		Soil						
Sample ID	PAL[c] (ng/g)	SE-IRP-SB04-4	SE-IRP9-SS05-01	SE-IRP9-SB05-4	SE-IRP-SS06-01	SE-IRP-SB06-4	SE-IRP9-SS07-01	SE-IRP9-SB07-4
Sample Date		3/15/2018	3/20/2018	3/20/2018	3/15/2018	3/15/2018	3/19/2018	3/19/2018
Depth (ft bgs)		4	1	4	1	4	1	4
Perfluorinated Compounds US EPA Method 537 Rev 1.1 Modified								
Perfluorobutanesulfonate (PFBS)	***1.26x10^6***	0.60 U	0.75 U	0.70 U	0.66 U	0.77 U	0.72 U	0.77 U
Perfluoroheptanoic acid (PFHpA)	NA	0.60 U	0.75 U	0.70 U	0.66 U	0.77 U	1.3	0.29 J
Perfluorohexanesulfonate (PFHxS)	NA	0.60 U	0.75 U	0.70 U	0.76	0.77 U	19	1.1
Perfluorononanoic acid (PFNA)	NA	0.60 U	0.75 U	0.70 U	0.66 U	0.77 U	1.5	0.77 U
Perfluoro-octanesulfonate (PFOS)	***1260***	0.65	2.2	0.70 U	2	0.77 U	130	0.59 J
Perfluorooctanoic acid (PFOA)	***1,260***	0.24 J	0.48 J	0.70 U	0.66 U	0.77 U	5.4	0.77 U

		Soil						
Sample ID	PAL[b] (ng/g)	SE-IRP9-SS08-01	SE-IRP9-SB08-4	SE-IRP9-SB08-4D	SE-IRP9-SS09-01	SE-IRP9-SB09-4	SE-IRP9-SS10-01	SE-IRP9-SB10-4
Sample Date		3/19/2018	3/19/2018	3/19/2018	3/19/2018	3/19/2018	3/19/2018	3/19/2018
Depth (ft bgs)		1	4	4	1	4	1	4
Perfluorinated Compounds US EPA Method 537 Rev 1.1 Modified								
Perfluorobutanesulfonate (PFBS)	***1.26x10^6***	0.71 U	0.80 U	0.72 U	0.78 U	0.84 U	0.72 U	0.88 U
Perfluoroheptanoic acid (PFHpA)	NA	0.71 U	0.80 U	0.72 U	0.78 U	0.84 U	0.72 U	0.88 U
Perfluorohexanesulfonate (PFHxS)	NA	0.71 U	0.80 U	0.72 U	0.27 J	0.84 U	0.72 U	0.88 U
Perfluorononanoic acid (PFNA)	NA	0.71 U	0.80 U	0.72 U	0.78 U	0.84 U	0.72 U	0.88 U
Perfluoro-octanesulfonate (PFOS)	***1260***	0.71 U	0.80 U	0.72 U	1.7	0.84 U	0.87	0.88 U
Perfluorooctanoic acid (PFOA)	***1,260***	0.71 U	0.80 U	0.72 U	0.37 J	0.84 U	0.72 U	0.88 U

Table 5-25. IRP Site 9 - Sludge Application Area (PRL 28) (Continued)

		Soil			
Sample ID	PAL[c] (ng/g)	SE-1RP9-SS11	SE-1RP9-SB11	SE-1RP9-SS12	SE-1RP9-SB12
Sample Date		1/10/2018	1/10/2018	1/10/2018	1/10/2018
Depth (ft bgs)		1	4	1	4
Perfluorinated Compounds US EPA Method 537 Rev 1.1 Modified					
Perfluorobutanesulfonate (PFBS)	***1.26x10^6***	0.59 U	0.55 U	0.68 U	0.72 U
Perfluoroheptanoic acid (PFHpA)	NA	0.59 U	0.55 U	0.68 U	0.72 U
Perfluorohexanesulfonate (PFHxS)	NA	0.59 U	0.6	0.68 U	0.72 U
Perfluorononanoic acid (PFNA)	NA	0.59 U	0.55 U	0.68 U	0.72 U
Perfluoro-octanesulfonate (PFOS)	***1260***	0.92	0.55	0.68 U	0.72 U
Perfluorooctanoic acid (PFOA)	***1,260***	0.23 J	0.41 J	0.68 U	0.72 U

PAL = project action level ng/L = nanogram per liter ng/g = nanogram per gram NA = Not applicable D = Duplicate sample

ft = feet bgs = below ground surface

Italicized and bolded value indicates screening criterion used Bold value indicates analyte detected above screening level

* = Reported value changed to non-detect at elevated quantitation limit due to a blank detection

a. United States Environmental Protection Agency (US EPA), May 2016. Drinking Water Health Advisory for PFOS and PFOA. Office of Water (4304T). Health and Ecological Criteria Division, Washington, DC 20460. EPA Document Number: 822-R-16-004 and 822-R-16-005.

b. Michigan Department of Environmental Quality, 2018. Remediation and Redevelopment Division. Environmental Contamination Response Activity Rules. Table 1. Groundwater: Residential and Nonresidential, Part 201 Generic Cleanup Criteria and Screening Levels. Effective 10 January 2018 and updated on 25 June 2018.

c. US EPA Regional Screening Levels (RSLs), May 2018. PFBS groundwater PAL based on RSL for tap water. Soil PALs calculated using the RSL calculator. The RSLs are protective of a residential receptor and a target hazard quotient = 1.0.

Data Qualifiers:

J = Estimated concentration

U = Not detected at concentration shown

Table 5-26. Base Boundary Wells Sample Results

		Groundwater					
Sample ID	PAL[a,b,c] (ng/L)	SE-BKGW-102	SE-BKGW-103	SE-BKGW-104	SE-BKGW-106	SE-BKGW-107	SE-BKGW-108
Sample Date		5/22/2018	5/23/2018	5/23/2018	5/23/2018	5/22/2018	5/23/2018
Perfluorinated Compounds US EPA Method 537 Rev 1.1 Modified							
Perfluorobutanesulfonate (PFBS)	***400,000***	14 J+	1.5 U *	5.4 J+	1 U *	1.1 U *	1.5 J
Perfluoroheptanoic acid (PFHpA)	NA	1.7 U *	1.1 U *	1.1 U *	1.1 U	1.1 U	0.32 J
Perfluorohexanesulfonate (PFHxS)	NA	16	1.1 U *	12	1.0 U	0.99 U *	1.1 J
Perfluorononanoic acid (PFNA)	NA	1.1 U *	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U
Perfluoro-octanesulfonate (PFOS)	***70***	8.5 U *	2.1 U *	2.1 U *	2.1 U	2.1 U	0.66 J
Perfluorooctanoic acid (PFOA)	***70***	7.8 U *	1.1 U *	2.3 U *	1.1 U	1.1 U *	0.33 J

PAL = project action level ng/L = nanogram per liter NA = Not applicable

Bold value indicates analyte detected above screening level Italicized and bolded value indicates screening criterion used

* = Reported value changed to non-detect at elevated quantitation limit due to a blank detection

a. United States Environmental Protection Agency (US EPA), May 2016. Drinking Water Health Advisory for PFOS and PFOA. Office of Water (4304T). Health and Ecological Criteria Division, Washington, DC 20460. EPA Document Number: 822-R-16-004 and 822-R-16-005.

b. Michigan Department of Environmental Quality, 2018. Remediation and Redevelopment Division. Environmental Contamination Response Activity Rules. Table 1. Groundwater: Residential and Nonresidential, Part 201 Generic Cleanup Criteria and Screening Levels. Effective 10 January 2018 and updated on 25 June 2018.

c. US EPA Regional Screening Levels (RSLs), May 2018. PFBS groundwater PAL based on RSL for tap water. Soil PALs calculated using the RSL calculator. The RSLs are protective of a residential receptor and a target hazard quotient = 1.0.

Data Qualifiers: J+ = Reported value may not be accurate or precise, but the result may be biased high.

U = Not detected at concentration shown

Table 6-1. Relevant Data Quality Objectives

PRL No.	PRL Description	Compounds Above PALs	Sampling Recommendation(s) and Objectives
1	IRP Site 2 (Fire Training Area #2)	Groundwater: PFOS, PFOA	Groundwater: Determine the nature and extent both vertically and horizontally through the sampling of existing and additional new monitoring wells. Soil: Although PALs were not exceeded, PFAS were detected in soil samples. Therefore, additional surface and subsurface soil samples are proposed to determine if an unidentified source exists and if so, to determine the nature and extent in the vertical and horizontal directions given the potential for soil to groundwater migration.
4	Building 154 – Fuel System Repair	Groundwater: Combined PFOS + PFOA[1]	
5	Building 1401 – USCG Hangar	None[2]	Groundwater: Although PALs for the individual compounds were not exceeded, PFAS were detected in some groundwater samples. Therefore, additional groundwater sampling is proposed to better define potential groundwater impacts both vertically and horizontally through the sampling of existing and additional new monitoring wells. Soil: Although PALs were not exceeded, PFAS were detected in soil samples. Therefore, additional surface and subsurface soil samples are proposed to determine if an unidentified source exists and if so, to determine the nature and extent in the vertical and horizontal directions given the potential for soil to groundwater migration.
6	Building 1461 – USCG Hangar	None[2]	
7	Building 1416 – Army National Guard Hangar	None[2]	
8	Building 1422 – DHS Hangar	Groundwater: PFOS, PFOA	Groundwater: Determine the nature and extent both vertically and horizontally through the sampling of existing and additional new monitoring wells. Soil: Although PALs were not exceeded, PFAS were detected in soil samples. Therefore, additional surface and subsurface soil samples are proposed to determine if an unidentified source exists and if so, to determine the nature and extent in the vertical and horizontal directions given the potential for soil to groundwater migration.
9	Building 1436 – DHS Hangar	None[2]	Groundwater: Although PALs were not exceeded, PFAS were detected in the groundwater sample. Therefore, additional groundwater sampling is proposed to better define potential groundwater impacts both vertically and horizontally through the sampling of existing and additional new monitoring wells. Soil: Although PALs were not exceeded, PFAS were detected in soil samples. Therefore, additional surface and subsurface soil samples are proposed to determine if an unidentified source exists and if so, to determine the nature and extent in the vertical and horizontal directions given the potential for soil to groundwater migration.
10	Building 859 – Fire Department	Groundwater: PFOS, PFOA	Groundwater: Determine the nature and extent both vertically and horizontally through the sampling of existing and additional new monitoring wells. Soil: Although PALs were not exceeded, PFAS were detected in soil samples. Therefore, additional surface and subsurface soil samples are proposed to determine if an unidentified source exists and if so, to determine the nature and extent in the vertical and horizontal directions given the potential for soil to groundwater migration.
11	Building 501 – Former Wastewater Treatment Plant	None[2]	Groundwater: Although PALs were not exceeded, additional groundwater sampling is proposed to better define potential groundwater impacts both vertically and horizontally through the sampling of existing and additional new monitoring wells. Soil: Although PALs were not exceeded, additional PFAS were detected in soil samples. Therefore, surface and subsurface soil samples are proposed to determine if an unidentified source exists and if so, to determine the nature and extent in the vertical and horizontal directions given the potential for soil to groundwater migration.

PRL No.	PRL Description	Compounds Above PALs	Sampling Recommendation(s) and Objectives
12	Nozzle Testing Area	Groundwater: PFOS Soil: PFOS	Groundwater: Determine the nature and extent both vertically and horizontally through the sampling of existing and additional new monitoring wells. Soil: Additional surface and subsurface soil samples is proposed to determine the nature and extent in the vertical and horizontal directions given the potential for a fire department to have soil impacts in a spatial direction.
13	C16 – AOC	Groundwater: PFOS, PFOA Soil: PFOS	
14	CRF – AOC	None[2]	Groundwater: Although PALs were not exceeded, additional groundwater sampling is proposed to better define potential groundwater impacts both vertically and horizontally through the sampling of existing and additional new monitoring wells. Soil: Although PALs were not exceeded, PFAS were detected in two soil samples. Therefore, additional surface and subsurface soil samples are proposed to determine if an unidentified source exists and if so, to determine the nature and extent in the vertical and horizontal directions given the potential for soil to groundwater migration.
15	East Ramp	Groundwater: PFOS + PFOA	Groundwater: Determine the nature and extent both vertically and horizontally through the sampling of existing and additional new monitoring wells. Soil: Although PALs were not exceeded, PFAS were detected in soil samples. Therefore, additional surface and subsurface soil samples are proposed to determine if an unidentified source exists and if so, to determine the nature and extent in the vertical and horizontal directions given the potential for soil to groundwater migration.
16	West Ramp	None[2]	Groundwater: Although PALs were not exceeded, PFAS were detected in groundwater samples. Therefore, additional groundwater sampling is proposed to better define potential groundwater impacts both vertically and horizontally through the sampling of existing and additional new monitoring wells. Soil: Although PALs were not exceeded, PFAS were detected in soil samples. Therefore, additional surface and subsurface soil samples are proposed to determine if an unidentified source exists and if so, to determine the nature and extent in the vertical and horizontal directions given the potential for soil to groundwater migration.
17	Former Building 33 – Fire Department	Groundwater: PFOS, PFOA	Groundwater: Determine the nature and extent both vertically and horizontally through the sampling of existing and additional new monitoring wells. Soil: Although PALs were not exceeded, PFAS were detected in soil samples. Therefore, additional surface and subsurface soil samples are proposed to determine if an unidentified source exists and if so, to determine the nature and extent in the vertical and horizontal directions given the potential for soil to groundwater migration.
18	Former Building 176 – Vehicle Maintenance	None[2]	Groundwater: Although PALs were not exceeded, PFAS were detected in the groundwater sample. Therefore, additional groundwater sampling is proposed to better define potential groundwater impacts both vertically and horizontally through the sampling of existing and additional new monitoring wells. Soil: Although PALs were not exceeded, PFAS were detected in soil samples. Therefore, additional surface and subsurface soil samples are proposed to determine if an unidentified source exists and if so, to determine the nature and extent in the vertical and horizontal directions given the potential for soil to groundwater migration.

PRL No.	PRL Description	Compounds Above PALs	Sampling Recommendation(s) and Objectives
20	Wet Well/Drainage Basin 340	Surface Water: PFOS	Surface Water and Sediment: Complete a short-term storm water characterization study in compliance with the MDEQ NOV. Conduct additional sampling of surface water and sediment downstream beyond the base boundary to determine the extent of surface water and sediment impacts and support the evaluation of whether there are unacceptable risks to ecological or human health receptors.
21	Wet Well/Drainage Basin 507	Surface Water: PFOS	
22	Wet Well/Drainage Basin 508	Surface Water: PFOS	
23	Wet Well/Drainage Basin 980	Surface Water: PFOS	
24	Wet Well/Drainage Basin 990	Surface Water: PFOS	
25	Aircraft Crash Sites	None[2]	Groundwater: Although PALs were not exceeded, PFAS were detected in groundwater samples. Therefore, additional groundwater sampling is proposed to better define potential groundwater impacts both vertically and horizontally through the sampling of existing and additional new monitoring wells. Soil: Although PALs were not exceeded, PFAS were detected in soil samples. Therefore, additional surface and subsurface soil samples are proposed to determine if an unidentified source exists and if so, to determine the nature and extent in the vertical and horizontal directions given the potential for soil to groundwater migration.
26	Drainage Basin 1420/Outfall 006A	Surface Water: PFOS	Surface Water and Sediment: PFAS were detected in surface water and sediment samples, but PALs were not exceeded in sediment samples. Additional sampling of surface water and sediment downstream beyond the base boundary is proposed to determine the extent of surface water and sediment impacts and support the evaluation of whether there are unacceptable risks to ecological or human health receptors.
27	Sludge Drying Beds	None[2]	Groundwater: Although PALs were not exceeded, PFAS were detected in the groundwater. Therefore, additional groundwater sampling is proposed to better define potential groundwater impacts both vertically and horizontally through the sampling of existing and additional new monitoring wells. Soil: Although PALs were not exceeded, PFAS were detected in soil samples. Therefore, additional surface and subsurface soil samples are proposed to determine if an unidentified source exists and if so, to determine the nature and extent in the vertical and horizontal directions given the potential for soil to groundwater migration.
28	IRP Site 9-Sludge Application Area	None[2]	
General			Groundwater: (1) Collect additional groundwater samples in upgradient locations to quantify potential impacts from upgradient sources; (2) collect additional groundwater samples off-base from a limited number of new monitoring wells to determine if PFAS impacts beyond the base boundary are increasing or decreasing.

Note:

1 PFOS and PFOA were not detected at the PRL; however, the analytical results were above the screening criteria and the combined value of the non-detect reported value for PFOS + PFOA was above the PAL.

2 The combined value of PFOS + PFOA was less than the PAL.

Table 7-1. Summary of Maximum SI Sampling Results Exceeding PALs

PRL Number	PRL Name	Media	Result Exceeding PAL[a, b, c]		
			PFOS	PFOA	PFBS
1	**IRP Site 2 (Fire Training Area #2)**	**Groundwater**	**17,000 ng/L**	**5,500 ng/L**	--
		Soil	--	--	--
4	**Building 154 – Fuel System Repair**	**Groundwater**	**Combined total exceeded the PAL (116 U ng/L)[d]**		--
		Soil	--	--	--
5	Building 1401 – USCG Hangar	Groundwater	Combined total does not exceed the PAL		--
		Soil	--	-	--
6	Building 1461 – USCG Hangar	Groundwater	Combined total does not exceed the PAL		--
		Soil	--	--	--
7	Building 1416 – Army National Guard Hangar	Groundwater	Combined total does not exceed the PAL		--
		Soil	--	--	--
8	**Building 1422 – DHS Hangar**	**Groundwater**	**11,000 ng/L**	**850 ng/L**	--
		Soil	--	--	--
9	Building 1436 – DHS Hangar	Groundwater	Combined total does not exceed the PAL		--
		Soil	--	--	--
10	**Building 859 – Fire Department**	**Groundwater**	**530 ng/L**	**890 ng/L**	--
		Soil	--	--	--
11	Building 501 – Former Wastewater Treatment Plant	Groundwater	Combined total does not exceed the PAL		--
		Soil	--	--	--
12	**Nozzle Testing Area**	**Groundwater**	**84 J+ ng/L**	--	--
		Soil	**1,900 ng/g**	--	--
13	**C16 – AOC**	**Groundwater**	**84 U* ng/L**	**370 ng/L**	--
		Soil	**1,700 ng/g**	--	--
14	CRF – AOC	Groundwater	Combined total does not exceed the PAL		--
		Soil	--	--	--
15	**East Ramp**	**Groundwater**	**Combined PFOS + PFOA exceeds the PAL (80 J+ ng/L)[d]**		--
		Soil	--	--	--
16	West Ramp	Groundwater	Combined total does not exceed the PAL		--
		Soil	--	--	--
17	**Former Building 33 – Fire Department**	**Groundwater**	**3,200 J+ ng/L**	**400 J+ ng/L**	--
		Soil	--	--	--
18	Former Building 176 – Vehicle Maintenance	Groundwater	Combined total does not exceed the PAL		--
		Soil	--	--	--
20	**Wet Well/Drainage Basin 340**	**Surface Water**	**170 ng/L**	--	--
		Sediment	--	--	--
21	**Wet Well/Drainage Basin 507**	**Surface Water**	**2,400 ng/L**	--	--
		Sediment	--	--	--
22	**Wet Well/Drainage Basin 508**	**Surface Water**	**2,000 ng/L**	--	--
		Sediment	--	--	--
23	**Wet Well/Drainage Basin 980**	**Surface Water**	**33 ng/L**	--	--
		Sediment	--	--	--
24	**Wet Well/Drainage Basin 990**	**Surface Water**	**490 ng/L**	--	--
		Sediment	--	--	--

PRL Number	PRL Name	Media	Result Exceeding PAL[a, b, c, d]		
			PFOS	PFOA	PFBS
25	Aircraft Crash Sites	Groundwater	Combined total does not exceed the PAL		--
		Soil	--	--	--
26	**Drainage Basin 1420/Outfall 006A**	**Surface Water**	**970 ng/L**	--	--
		Sediment	--	--	--
27	Sludge Drying Beds	Groundwater	Combined total does not exceed the PAL		--
		Soil	--	--	--
28	IRP Site 9- Sludge Application Area	Groundwater	Combined total does not exceed the PAL		--
		Soil	--	--	--
NA	Base Boundary Wells	Groundwater	Combined total does not exceed the PAL		--

Note: PRL 2 - IRP Site 3 (Fire Training Area #1), PRL 3 - IRP Site 15 (Fire Training Area #3) and Building 105 - Supply were recommended for NFA and are not included in the table (BB&E, 2016).

(e) MDEQ, 2018a. Remediation and Redevelopment Division. Environmental Contamination Response Activity Rules. Table 1. Groundwater: Residential and Nonresidential, Part 201 Generic Cleanup Criteria and Screening Levels. Effective 10 January 2018 and updated on 25 June 2018.

(f) US EPA, 2018. RSLs, May 2018. PFBS groundwater PAL based on RSL for tap water. Soil PALs were calculated using the RSL calculator. The RSLs are protective of a residential receptor and a THQ equal to 1.0.

(g) MDEQ, 2018b. Rule 57 Water Quality Values. Surface Water Assessment Section.15 March 2018. Values are protective of drinking water.

(h) While both PFOS and PFOA were not detected, combined (PFOS + PFOA) groundwater concentration exceeded the PAL.

Table ES-1 lists the compounds that exceed the following PALs. Compounds without PALs are included in the **Section 5** Tables.

Summary of the Screening Criteria

Analyte	Groundwater (ng/L)	Soil and Sediment (ng/g)	Surface Water (ng/L)
PFOS	70	1,260	11
PFOA	70	1,260	420
PFOA+PFOS	70	NA	NA
PFBS	400,000	1.26×10^6	400,000

Bolded value indicates that the analyte was detected above the PAL.

-- indicates that the analyte was not detected above the PAL.

AOC = Area of Concern

DHS = Department of Homeland Security

FTA = Fire Training Area

IRP = Installation Restoration Program

J+ = Reported value may not be accurate or precise, and the result may be biased high.

NA = Not Applicable

NFA = no further action

ng/L = nanograms per liter

ng/g = nanograms per gram

PFBS = Perfluorobutanesulfonate

PFOA = Perfluorooctanoic acid

PFOS = Perfluoro-octanesulfonate

PRL = potential release location

THQ = target hazard quotient

U* = Positive value reported by laboratory was changed during data validation to non-detect at elevated quantitation limit due to blank detection but is still considered to be a positive detect-See Section 5.1.

USCG = United States Coast Guard