Site Inspection Report for Per- and Polyfluoroalkyl Substances at SVAD-067 – Fire Training Area and SVAD-084 – Scrap Wood Open Burn Area

Savanna Army Depot Activity
Savanna, Illinois

Final

Prepared for:

U.S. Army Corps of Engineers
Louisville District
Louisville, Kentucky 40202

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Contract No. W912QR-16-C-0003
Delivery Order No. W912QR18F0137
Leidos CRN 325415

February 2021

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CERTIFICATION 4
CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

Leidos has completed the Site Inspection Report for Per- and Polyfluoroalkyl Substances at SVAD-067 – Fire Training Area and SVAD-084 – Scrap Wood Open Burn Area at Savanna Army Depot Activity, Savanna, Illinois. Notice is hereby given that an independent technical review has been conducted that is appropriate to the level of risk and complexity inherent in the project as defined in the Leidos Quality Assurance Plan. During the independent technical review, compliance with established policy principles and procedures, using justified and valid assumptions, was verified. This included review of assumptions, methods, procedures, and materials used in analyses; the appropriateness of data used and the level of data obtained; and reasonableness of the results, including whether the product meets the customer's needs consistent with the law and existing U.S. Army Corps of Engineers (USACE), Louisville District policies.

Marcy Larriva, P.E., PMP, LRS
Project Manager

February 19, 2021
Date

Rita Schmon-Stasik
QA Manager

February 19, 2021
Date

Matthew Machusick, P.G.
Independent Technical Review Team Leader

February 19, 2021
Date

Significant concerns and explanation of the resolutions are documented within the project file.

As noted above, all concerns resulting from independent technical review of the project have been considered.

Lisa Jones-Bateman, REM, PMP
Senior Program Manager

February 19, 2021
Date

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LIST OF ACRONYMS AND ABBREVIATIONS

%R	Percent Recovery
AFFF	Aqueous Film-Forming Foam
APE	Ammunition Peculiar Equipment
ASD	Assistant Secretary of Defense
BCT	BRAC Cleanup Team
BEC	BRAC Environmental Coordinator
BLS	Below Land Surface
BRAC	Base Realignment and Closure
BTOC	Below Top of Casing
CCB	Continuing Calibration Blank
cis-1,2-DCE	cis-1,2-Dichloroethene
CCV	Continuing Calibration Verification
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CLP	Contract Laboratory Program
CoC	Chain-of-Custody
COC	Chemical of Concern
cPAH	Carcinogenic Polynuclear Aromatic Hydrocarbon
CSM	Conceptual Site Model
DACS	(U.S. Army) Defense Ammunition Center and School
DCQAP	Data Collection Quality Assurance Plan
DERP	Defense Environmental Restoration Program
DGPS	Differential Global Positioning System
DI	Deionized
DL	Detection Limit
DO	Delivery Order
DoD	U.S. Department of Defense
DQA	Data Quality Assessment
DQO	Data Quality Objective
DWEL	Drinking Water Equivalent Level
EBS	Environmental Baseline Survey
FP	Field Procedure
FS	Feasibility Study
FTA	Fire Training Area
FTP	Field Technical Procedure
HA	Health Advisory
HASP	Health and Safety Plan
HQ	Hazard Quotient
I.D.	Identification
ICB	Initial Calibration Blank
IDW	Investigation-Derived Waste
IEPA	Illinois Environmental Protection Agency
IRP	Installation Restoration Program
IS	Internal Standard
ISGS	Illinois State Geological Survey
ISPCS	Illinois State Plane Coordinate System
JULIE	Joint Utility Locating Information for Excavators
K	Hydraulic Conductivity
L&D	Lock and Dam
LCL	Lower Control Limit

LIST OF ACRONYMS AND ABBREVIATIONS (Continued)

LCS	Laboratory Control Sample
LHA	Lifetime Health Advisory
LOD	Limit of Detection
LOQ	Limit of Quantitation
LRA	Local Redevelopment Authority
LRS	Licensed Regulatory Specialist
MCL	Maximum Contaminant Level
MEC	Munitions and Explosives of Concern
MPPEH	Material Potentially Presenting an Explosive Hazard
msl	Mean Sea Level
MS	Matrix Spike
MSD	Matrix Spike Duplicate
NA	Not Applicable
NCDC	National Climatic Data Center
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NOAA	National Oceanic and Atmospheric Administration
NPL	National Priorities List
NTCRA	Non-Time Critical Removal Action
NTU	Nephelometric Turbidity Unit
OASM	(U.S. Army) Ordnance Ammunition, Surveillance, and Maintenance
OSHA	Occupational Safety and Health Administration
P.E.	Professional Engineer
P.G.	Professional Geologist
PAH	Polynuclear Aromatic Hydrocarbon
PARCC	Precision, Accuracy, Representativeness, Comparability, and Completeness
PCB	Polychlorinated Biphenyl
PCE	Tetrachloroethene
PFAS	Per- and Polyfluoroalkyl Substances
PFBS	Perfluorobutane Sulfonate
PFHpA	Perfluoroheptanoic Acid
PFHxS	Perfluorohexane Sulfonate
PFNA	Perfluorononanoic Acid
PFOA	Perfluorooctanoic Acid
PFOS	Perfluorooctane Sulfonate
PMP	Project Management Professional
PPE	Personal Protective Equipment
PVC	Polyvinyl Chloride
QA	Quality Assurance
QC	Quality Control
QSM	Quality Systems Manual
RCRA	Resource Conservation and Recovery Act
REM	Registered Environmental Manager
RfD	Reference Dose
RI	Remedial Investigation
RPD	Relative Percent Difference
RSL	Regional Screening Level
SCS	Soil Conservation Service
SDG	Sample Delivery Group
SDWA	Safe Drinking Water Act

LIST OF ACRONYMS AND ABBREVIATIONS (Continued)

SI	Site Inspection
SOD	Savanna Ordnance Depot
SOP	Standard Operating Procedure
SOW	Statement of Work
SPG	Savanna Proving Grounds
SVDA	Savanna Army Depot Activity
SVOC	Semivolatile Organic Compound
TCE	Trichloroethene
TCLP	Toxicity Characteristic Leaching Procedure
TOC	Top of Casing
UCL	Upper Control Limit
UCMR3	Third Unregulated Contaminant Monitoring Rule
UFP-QAPP	Uniform Federal Policy Quality Assurance Project Plan
UN	United Nations
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
USGS	U.S. Geological Survey
UXO	Unexploded Ordnance
VOC	Volatile Organic Compound

1. INTRODUCTION

This report documents the results of the U.S. Army Base Realignment and Closure Division's (Army's) Site Inspection (SI) for perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA) at the Fire Training Area (SVAD-067) and the Scrap Wood Open Burn Area (SVAD-084) at Savanna Army Depot Activity (SVDA), Savanna, Illinois. Figure 1-1 presents the location of SVDA. The Army conducted this SI in accordance with its authority as the lead agency under Executive Order 12580, which authorizes the U.S. Department of Defense (DoD) to implement environmental response actions in compliance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as amended. This document was prepared by Leidos under Contract No. W912QR-16-D-0003, Delivery Order (DO) No. W912QR18F0137 with the U.S. Army Corps of Engineers (USACE), Louisville District.

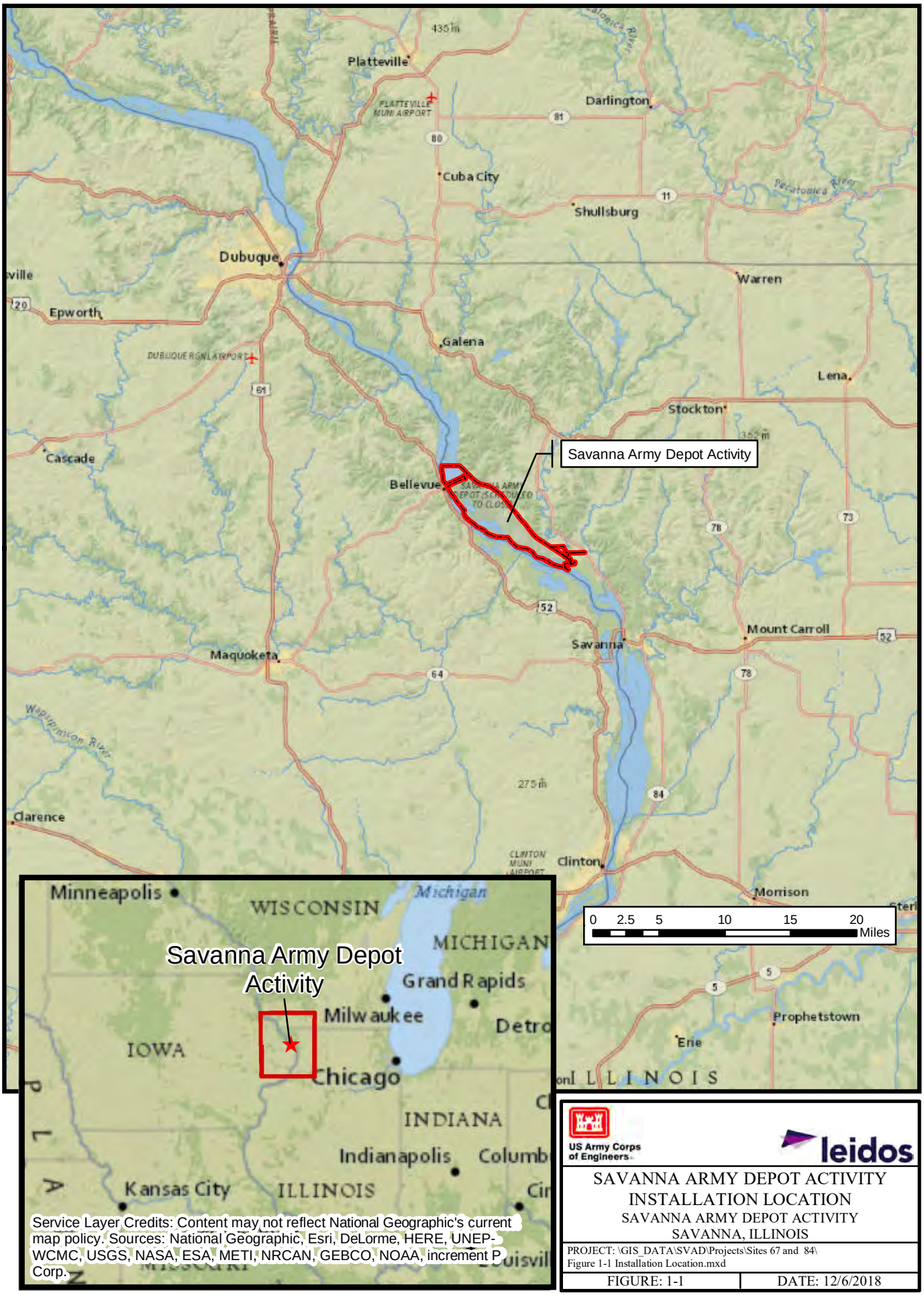
The primary objective of the SI was to determine the presence or absence of PFOS or PFOA in groundwater at SVAD-067 and SVAD-084 at concentrations exceeding the U.S. Environmental Protection Agency (USEPA) drinking water lifetime health advisory (LHA) and the tap water regional screening level (RSL) cited in the October 2019 Assistant Secretary of Defense (ASD) Investigating Per- and Polyfluoroalkyl Substances (PFAS)[1] within the DoD Cleanup Program Memorandum (ASD 2019). This SI was conducted in accordance with CERCLA; the Defense Environmental Restoration Program (DERP); the National Oil and Hazardous Substances Pollution Contingency Plan (NCP); and DoD, Army, and USEPA guidance documents.

In 2012, USEPA, under the Safe Drinking Water Act (SDWA), published the Third Unregulated Contaminant Monitoring Rule (UCMR3), which required public water supplies across the country to sample for a list of 30 unregulated contaminants, including 6 PFAS:

- PFOS
- PFOA
- Perfluorobutane sulfonate (PFBS)
- Perfluorononanoic acid (PFNA)
- Perfluoroheptanoic acid (PFHpA)
- Perfluorohexane sulfonate (PFHxS).

Results of the UCMR3 indicated detections of PFAS at numerous locations, including several near DoD facilities. PFAS have been extensively manufactured and used worldwide for a variety of purposes. PFAS are commonly used as additives to paper, packaging, clothing, carpets, sporting equipment, non-stick cookware, cleaners, pesticides/herbicides, adhesives, paints, varnishes, sealants, hydraulic fluid, and surfactants to enhance product performance. Due to the ubiquitous nature of PFOS/PFOA, its likely use, storage, and incidental releases of other PFOS/PFOA-containing products in small quantities occurred during the operational history of SVDA. However, in general, PFAS detections related to DoD facilities are often linked to the use of aqueous film-forming foam (AFFF), which contains various PFAS. AFFF was used as a firefighting agent to suppress fires involving petroleum hydrocarbons. PFAS are emerging contaminants and historically have not been analyzed during site characterizations; therefore, minimal sampling data exist for most sites.

In 2016, USEPA issued a drinking water health advisory (HA) for PFOS and PFOA. The LHA is 70 nanograms per liter (ng/L) for each compound and the combined total of PFOS and PFOA. When AFFF is released to the environment, PFAS can migrate into soil and groundwater. Once in the environment, the compounds are persistent and may migrate through airborne transport, surface water, groundwater, and/or biologic uptake. The amount of PFAS that enters the environment depends on the type and amount of AFFF used, where and when it was used, the type of soil, and other factors. If private or public wells are located nearby, they could potentially be affected by PFAS. Similarly, surface water features may be impacted and may convey PFAS to downgradient receptors.



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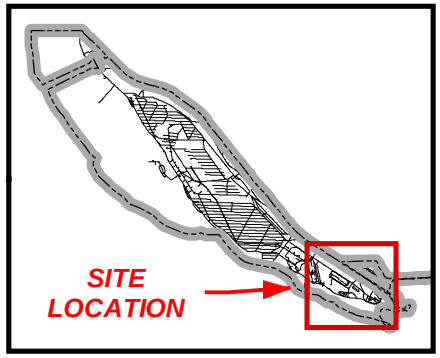
SAVANNA ARMY DEPOT ACTIVITY
INSTALLATION LOCATION
SAVANNA ARMY DEPOT ACTIVITY
SAVANNA, ILLINOIS

PROJECT: \GIS_DATA\SVAD\Projects\Sites 67 and 84\
Figure 1-1 Installation Location.mxd

FIGURE: 1-1	DATE: 12/6/2018

Legend

- INSTALLATION BOUNDARY
- SITES
- BUILDINGS
- RAILROAD
- ROAD



KEY MAP
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SVAD-067 AND SVAD-084
SITE LOCATIONS

SAVANNA ARMY DEPOT ACTIVITY
SAVANNA, ILLINOIS

PROJECT: GIS_DATA\SVAD\Projects\Site 67 and 84\
Figure 1-2 Site Location.mxd

FIGURE: 1-2	DATE: 12/11/2018

In accordance with the June 10, 2016, Department of the Army policy regarding PFOS/PFOA contamination assessment (Department of the Army 2016), the Army sampled the SVDA Lower Post drinking water on September 26, 2016. The groundwater production well provides the sole source of potable water for the Installation. This well, also known as the Lower Post Bedrock Well, is located in Building 107 and is approximately 1,200 feet deep. The six UCMR3 PFAS compounds were analyzed for and not detected (Appendix A).

Although the shallow groundwater at SVDA is not a drinking water source, SVAD-067 and SVAD-084 are under investigation because they were historically used as fire training areas (FTAs) in the Lower Post and Plant Area (Figure 1-2). Based on the timeline for development of AFFF, AFFF-containing PFAS was unlikely to have been used until after 1966. The SVAD-067 FTA was used for approximately 40 years (in use as early as 1947) to train firefighters in various methods of controlling oil-related fires (SAIC 1999a). SVAD-084 was used once a year for an FTA for more than 20 years (Clarke 1996) (use assumed to start in the 1970s). This SI Report presents the results of groundwater investigations at SVAD-067 and SVAD-084 and evaluation for the potential of the six UCMR3 PFAS compounds in groundwater. The scope and objectives for the SI at SVAD-067 and SVAD-084 are defined in Section 1.1. A description of the Installation is provided in Section 1.2, descriptions of SVAD-067 and SVAD-084 are presented in Section 1.3, and the organization of the remainder of the report is summarized in Section 1.4.

1.1 SCOPE AND OBJECTIVES

The SI scope included preparation of project planning documents; field investigations; validation and management of analytical data; comparison of analytical data to screening levels; and documentation of the investigation results. This project was conducted in accordance with the Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) Addendum 2 for the SI at SVAD-067 and SVAD-084 (Leidos 2018a) and the Health and Safety Plan (HASP) Addendum 2 for the SI at SVAD-067 and SVAD-084 (Leidos 2018b). These documents were submitted to the Army, Illinois Environmental Protection Agency (IEPA), and USEPA Region 5 for review and approval prior to the initiation of field activities. Field sampling and laboratory chemical analyses were conducted in accordance with project-specific quality assurance/quality control (QA/QC) and health and safety requirements.

The primary objective of the SI was to determine the presence or absence of PFOS or PFOA in groundwater at SVAD-067 and SVAD-084 at concentrations exceeding the USEPA drinking water LHA and the tap water RSLs that are the residential scenario screening levels calculated using the USEPA RSL calculator and referenced in DoD guidance (ASD 2019). While groundwater samples at SVAD-067 and SVAD-084 were analyzed for the six UCMR3 PFAS compounds, USEPA has calculated LHAs and DWELs for only PFOS and PFOA. Thus, only groundwater sampling results for site concentrations of PFOS and PFOA were compared to the USEPA LHA and DWEL to determine whether the potential exists for human health risk from drinking water.

1.2 INSTALLATION DESCRIPTION

SVDA is located in northwestern Illinois adjacent to the Mississippi River in Jo Daviess and Carroll counties (Figure 1-1). The Installation is in the central lowlands of the interior plains physiographic province, approximately 7 miles north of the city of Savanna, Illinois; 27 miles north of Clinton, Iowa; and approximately 150 miles west of Chicago, Illinois. The Installation occupied 13,062 acres at the time of closure and is bordered by agricultural land to the north and east, the Apple River to the southeast, and the Mississippi River to the south and west.

The U.S. Army purchased the property for the Installation in 1917 for the construction of a proving and test facility for artillery and ammunition. The Installation officially was activated as Savanna Proving Grounds (SPG) on December 26, 1918, and proof testing activities were conducted through approximately August 1919. Ordnance storage facilities were expanded between 1918 and 1921 when the facility began a

transition from proving ground to ordnance depot and was renamed Savanna Ordnance Depot (SOD). Intensive construction of additional magazines, administrative buildings, bomb plants, and shell-loading plants was completed between December 1939 and November 1941.

The Installation was re-designated as a U.S. Army Ordnance Depot in 1959 and received a special weapons mission in January 1961, requiring a special ammunition area for assembly, disassembly, and storage as part of the Installation's operations. The Installation was placed under the jurisdiction of the U.S. Army Supply and Maintenance Command in 1962 and its name was changed to Savanna Army Depot.

Ammunition maintenance and supply operations at SVDA were reduced in 1972 and the special weapons storage and maintenance mission was terminated in 1974. The U.S. Army Ordnance Ammunition, Surveillance, and Maintenance (OASM) School, activated at the Installation in 1950, included the addition of a special weapons workshop in 1970. The school was renamed in 1979 as the U.S. Army Defense Ammunition Center and School (DACS). From 1984 until March 2000, the mission at SVDA was the receipt, storage, issuance, and demilitarization of conventional ammunition and general supplies, which included manufacturing, procurement, and repair of ammunition peculiar equipment (APE) parts for worldwide DoD support and QA of stored ammunition. The QA mission provided ammunition and explosive QA for conventional ammunition, guided missiles, large rockets, ammunition components, explosives, and packing material.

SVDA was placed on the National Priorities List (NPL) in 1984. The CERCLA Installation Restoration Program (IRP) activities have been ongoing at the Installation since 1990. The facility was identified for closure in 1995 under the Base Realignment and Closure (BRAC) process and all industrial activities ceased when SVDA officially closed in March 2000. Currently, the only onsite Army activities are associated with the assessment and remediation of site-related contamination as required under CERCLA and BRAC and the preparation for transferring ownership of various parcels of land to non-DoD entities (SAIC 1999a).

1.3 FIRE TRAINING ACTIVITIES AT SVAD-067 AND SVAD-084

Fire training activities at SVAD-067 and SVAD-084 were determined to have utilized AFFF based on historical records reviews (SAIC 1999a) and recent interviews with a former SVDA Fire Chief. The former Fire Chief was a firefighter during the 1960s and 1970s and was the SVDA Fire Chief from 1987 to 1995. The former Fire Chief indicated that FTA activities at SVAD-067 utilized AFFF mixed with water. The former SVDA employee noted that FTA activities at SVAD-084 were conducted with water and 3M Light Water. 3M Light Water was the brand name for a firefighting foam manufactured by 3M that contained PFOS. Consequently, the groundwater at SVAD-067 and SVAD-084 was evaluated to determine the presence or absence of PFOS or PFOA above the USEPA LHA and the tap water RSLs that were calculated using the USEPA RSL calculator and referenced in DoD guidance (ASD 2019) as a result of DoD activities. SVAD-067 and SVAD-084 site locations are shown in Figure 1-2.

1.4 REGULATORY OVERVIEW AND PROJECT ACTION LIMITS

As discussed in Section 1.0, in 2012, USEPA published the UCMR3, which required public water supplies across the country to sample for a list of 30 unregulated contaminants, including 2 chemicals of concern (COCs) relevant to this SI (PFOS, PFOA). PFAS detections at DoD facilities are often linked to the use of AFFF, which may contain one or more of these chemicals. AFFF is a firefighting agent used to suppress fires involving petroleum hydrocarbons. The USEPA LHA was established as the project action limit in the UFP-QAPP Addendum 2 for the SI at SVAD-067 and SVAD-084 (Leidos 2018a). Subsequent to the establishment of the SVAD-067 and SVAD-084 project actions levels, the Army issued guidance for investigating PFAS within DoD cleanup programs, which calculated tap water RSLs using the USEPA RSL calculator (ASD 2019).

Detected concentrations of PFAS in environmental samples collected during the SI were compared against the USEPA LHAs for PFOS and PFOA and tap water RSLs for PFOS, PFOA, and PFBS, as described below and listed in Table 1-1.

Table 1-1. SI Project Action Limits
Savanna Army Depot Activity, Savanna, Illinois

Parameter	Chemical Abstract Service Number	Tap Water RSL (ng/L) [a]	USEPA Health Advisory[b] (ng/L)
PFOS	1763-23-1	40	70.0[c]
PFOA	335-67-1	40	
PFBS	375-73-5	40,000	N/A

[a] The tap water screening levels of 40 ng/L for PFOS and PFOA and 40,000 ng/L for PFBS are cited in the ASD *Investigating Per- and Polyfluoroalkyl Substances within the Department of Defense Cleanup Program Memorandum* (ASD 2019). These are residential scenario screening levels calculated using the USEPA RSL calculator (HQ=0.1). The screening level of 40 ng/L does not apply to the combined concentrations of PFOS and PFOA.
[b] *Drinking Water Health Advisory for Perfluorooctane Sulfonate* (USEPA 2016a) and *Drinking Water Health Advisory for Perfluorooctanoic Acid* (USEPA 2016b).
[c] When PFOA and PFOS are both present, the combined detected concentrations of the compounds are compared with the 70-ng/L health advisory value.

Currently, no legally enforceable Federal standards, such as maximum contaminant levels (MCLs), exist for PFAS in water. However, under SDWA, USEPA issued a series of Health Advisories (HAs) for PFOS and PFOA, including the most recent in May 2016. To provide Americans, including the most sensitive populations, with a margin of protection from a lifetime of exposure to PFOS and PFOA in drinking water, USEPA established an LHA level for PFOS and PFOA (combined) of 70 ng/L. The LHA of 70 ng/L applies to PFOS and PFOA individually as well as combined. That is, if an individual compound is detected >70 ng/L, the screening level is exceeded. In addition, if individual compounds are <70 ng/L but the sum of the PFOS and PFOA compounds is >70 ng/L, the screening level is exceeded. For example, if PFOS = 50 ng/L and PFOA = 25 ng/L, the screening level is exceeded. USEPA issued the PFAS Action Plan in February 2019. The PFAS Action Plan is the first multi-media, multi-program, national research, management, and risk communication plan to address PFAS and outlines the tools USEPA is developing to address PFAS in drinking water, identify and clean up PFAS contamination, expand monitoring of PFAS manufacturing, increase PFAS scientific research, and promote effective enforcement tools.

ASD issued an Investigating PFAS within the DoD Cleanup Program Memorandum (ASD 2019). RSLs for PFOS, PFOA, and PFBS have been calculated using the established oral reference doses (RfDs) of 2E-05 mg/kg-day (PFOS and PFOA) and 2E-02 mg/kg-day (PFBS). The document further states that when multiple PFAS are encountered at a site, a 0.1 factor is applied to the screening level. The resulting RSLs are provided in Table 1-1. In this document RSLs were used for screening to determine if further investigation is warranted. Therefore, the groundwater data for individual concentrations of PFOS and PFOA also were compared to this screening level of 40 ng/L. Note however, that both the LHA and the tap water RSLs are screening levels for drinking water exposure, and the shallow groundwater at SVDA is not used as a source of drinking water.

1.5 REPORT ORGANIZATION

The contents of this SI Report are summarized below:

- ***Section 2. Environmental Setting***—This section discusses the environmental setting at SVDA. Demographics, land use, geology, hydrogeology, hydrology, soil, and climate are described.

- ***Section 3. Field Investigation Activities and Procedures***—This section provides field procedures followed during the investigations.
- ***Section 4. Laboratory Chemical Analysis Program and Quality Assurance Summary***—This section describes the laboratory chemical analysis program for the investigation. Sample handling procedures, laboratory equipment calibration, laboratory analytical methods, data reporting and validation, and sample data QA/QC are discussed.
- ***Sections 5 (SVAD-067) and 6 (SVAD-084). Site History and Nature of Detected Chemicals***—Sections 5 (SVAD-067) and 6 (SVAD-084) present the site history, field investigation, and site-specific results of the SI activities and includes a discussion of the nature of chemical constituents, and results of data screening.
- ***Section 7. Summary and Conclusions***—This section presents a summary of the SI and presents conclusions for SVAD-067 and SVAD-084.
- ***Section 8***. ***References—***This section lists the references that were used in the preparation of this report.
- ***Appendices***—Appendices A through E include data from field activities or related assessments:
  - Appendix A. SVDA Drinking Water PFAS Data
  - Appendix B. Well Construction, Well Development, and Groundwater Sampling Logs
  - Appendix C. Topographic Survey Results
  - Appendix D. Data Quality Assessment (DQA)
  - Appendix E. Data Presentation Tables
  - Appendix F. Regulatory Comments and Army Responses to Comments.

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2. ENVIRONMENTAL SETTING

The Fire Training Area (SVAD-067) and the Scrap Wood Open Burn Area (SVAD-084) are on the Lower Post and Plant Areas at SVDA. The environmental setting for these areas, including aspects of the facility location, demographics and land use, physiography and topography, climate and meteorology, geology, hydrogeology, surface water hydrology, and soils, is discussed in this section. Descriptions of environmental conditions were compiled from information in the Environmental Baseline Survey (EBS) (SAIC 1999a), from reports and data prepared by the U.S. Geological Survey (USGS), Illinois State Geological Survey (ISGS), Soil Conservation Service (SCS), U.S. Bureau of Census, National Climatic Data Center (NCDC), National Oceanic and Atmospheric Administration (NOAA), and site-specific historical project reports.

2.1 INSTALLATION AND SITE LOCATION

SVDA is in northwestern Illinois adjacent to the Mississippi River in Jo Daviess and Carroll counties, Illinois. The majority of the northern and central portions of the Installation are in Jo Daviess County and the southernmost acreage is in Carroll County. SVAD-067 and SVAD-084 are both in Carroll County.

The Installation occupied 13,062 acres at the time of closure and is approximately 7 miles north of the city of Savanna, Illinois; 27 miles north of Clinton, Iowa; and approximately 150 miles west of Chicago, Illinois. SVDA is bordered by agricultural land to the north and east, the Apple River to the southeast, and the Mississippi River to the west. The Installation is mapped on the Blackhawk, Illinois and Green-Island, Iowa USGS quadrangle maps between coordinates 466,000 feet to 484,000 feet (east) and 2,006,000 feet to 2,017,000 feet (north) in the Illinois (west) State Plane Coordinate System (ISPCS).

2.2 DEMOGRAPHICS AND LAND USE

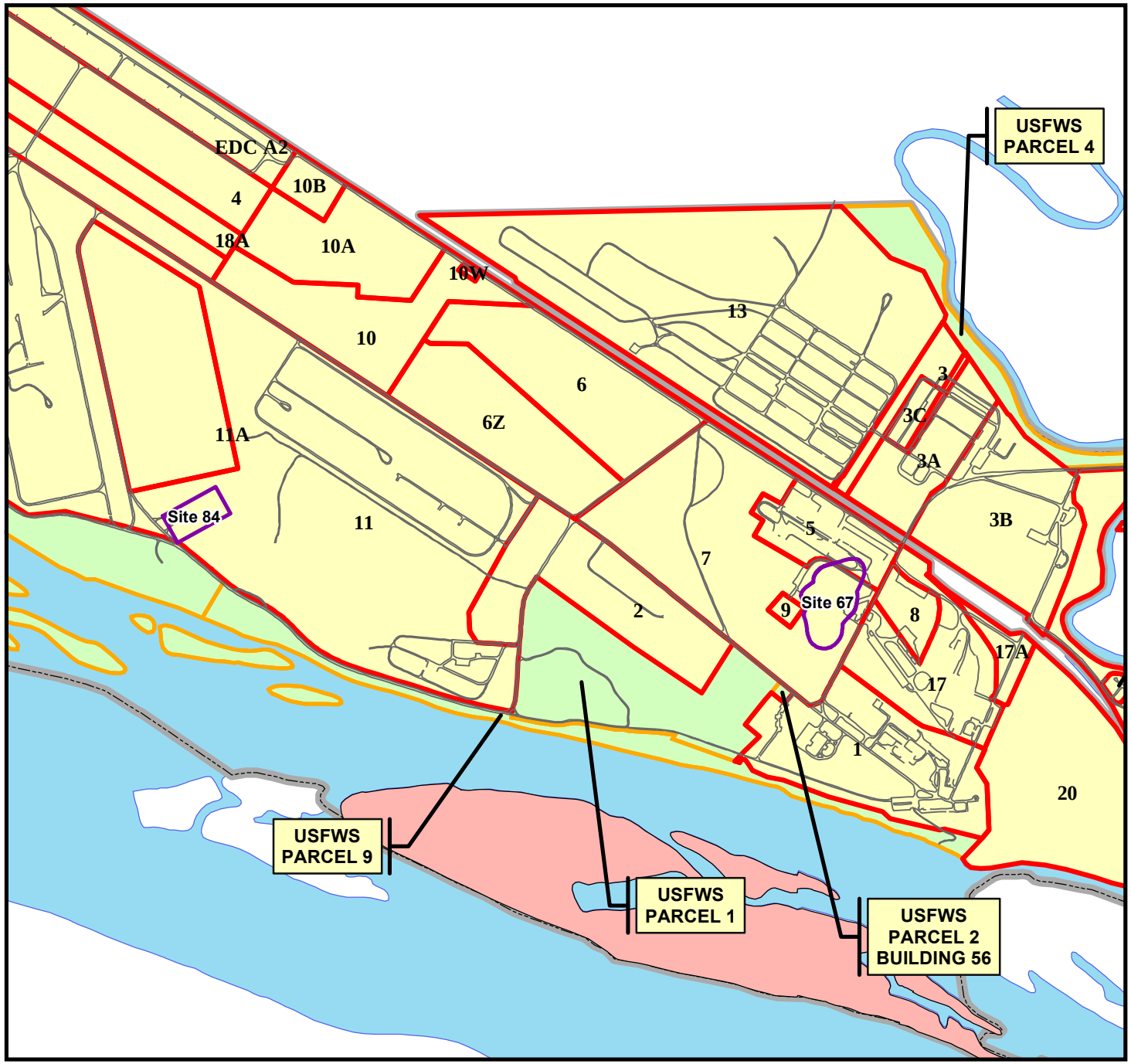
The area immediately surrounding SVDA is sparsely populated with the communities of Bellevue, Iowa (2010 population 2,191); Hanover, Illinois (2010 population 844); and Savanna, Illinois (2010 population 3,729) located within a 7-mile radius. A combined population of 38,065 in Jo Daviess and Carroll counties, Illinois (U.S. Census Bureau 2012). According to the 2010 census, 74 to 77 percent of residents in Jo Daviess and Carroll counties live in rural areas (U.S. Census Bureau 2012). With the closure of SVDA, the current population on the Installation consists of a limited number of U.S. Army civilian personnel, USACE personnel, and Local Redevelopment Authority (LRA) lease holders. No resident populations exist within SVAD-067 or SVAD-084.

The Jo-Carroll LRA has determined that SVAD-067 and SVAD-084 will be re-developed for industrial/commercial land use. The Land Reuse Plan (ERA 1997) and Reuse Plan Map (MSA 1999, revised by Leidos 2018c) is shown in Figure 2-1.

2.3 PHYSIOGRAPHY AND TOPOGRAPHY

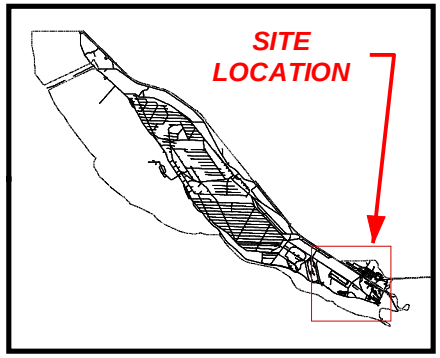
SVDA is located in the central lowlands of the Interior Plains physiographic province of Illinois within the "Driftless Area" of northern Illinois. Primary landforms immediately surrounding the Installation consist of oxbow lakes and broadly sloping surface topography that reflect the impact of historical meandering and flooding by the ancestral Mississippi River and tributaries.

The physiography east and north of the area of historical Mississippi River influence consists of steep upland hills that are heavily dissected by erosion (USGS 1975). Drainage occurring north and northeast of the Installation is through the Apple River and Rush Creek basins, which flow southeastward toward the Mississippi River. The Apple River meanders from the upland area at Hanover toward the Mississippi River and forms the southeastern boundary of the Installation. Ordnance School Lake occurs at the confluence of the Apple and Mississippi Rivers in the southeastern corner of the Installation.



LEGEND

- Installation Boundary
- Sites
- EDC Parcels
- IDNR
- LRA Parcels
- USFWS
- ARMY COE



KEY MAP
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Feet

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LAND REUSE MAP

SAVANNA ARMY DEPOT ACTIVITY
SAVANNA, ILLINOIS

PROJECT: \GIS_DATA\SVAD\Projects\Sites 67 and 84\
Figure 2-1 SVDA LRA Parcel Map 8x11.mxd

FIGURE: 2-1 | **DATE: 12/6/2018**

Surface topography on the central upland areas at SVDA consists of gently rolling hills with elevation from approximately 600 to 660 feet above mean sea level (msl). The Upper Post at SVDA is bordered to the west by an extensive backwater slough complex of the Mississippi River consisting of braided or meandering streams and isolated catchments. The backwater areas are only slightly elevated (588 to 600 feet above msl) above the average stage of the Mississippi River and are subject to flooding. The active Mississippi River channel flows west of the backwater areas and directly borders the southern portion of SVDA.

2.4 CLIMATE AND METEOROLOGY

SVDA is in an area with a typical continental climate that is characterized by cold winters; warm summers; and frequent short-term fluctuations in temperature, humidity, cloudiness, and wind direction. The winds are controlled primarily by storm systems and weather fronts that move eastward and northeastward across the area. Storm systems are prevalent primarily in the winter and spring. Summer thunderstorms are relatively short, and autumn is generally warm, ending abruptly with renewed storm systems in November.

NCDC data for Bellevue, Iowa at Lock and Dam (L&D) #12 for the years between 1951 and 2016 indicate that average monthly temperatures range from 7°F to 80°F (Iowa State University 2017). The average monthly temperature is below 32°F 1 to 5 months per year, commonly occurring between November and March. In contrast, the area experienced a temperature of at least 90°F an average of 12 days each year between 1951 and 2016 principally during the summer months (Iowa State University 2017). The soil freezes to a depth of approximately 2 feet below land surface (BLS) and may remain snow-covered for weeks at a time. Monthly average air temperatures for the period from 1951 to 2016 are shown in Table 2-1.

Table 2-1. Monthly Average Air Temperature for Lock and Dam #12 Station (1951-2016)
Savanna Army Depot Activity, Savanna, Illinois

Month	Maximum Average Temperature (°F)	Minimum Average Temperature (°F)
January	32.5	7.3
February	36.1	10.7
March	51.0	21.7
April	56.0	42.5
May	67.7	52.6
June	74.1	64.4
July	79.8	67.0
August	77.5	63.8
September	69.3	56.0
October	61.9	44.8
November	47.3	29.6
December	36.6	11.3

Source: Iowa Environmental Mesonet, Iowa State University 2017

The average total annual precipitation in Bellevue, Iowa, between 1951 and 2016 was 34.6 inches (Iowa State University 2017) with a maximum of 51.08 inches (2009) and a minimum of 20.4 inches (1988). The driest months are December through February with average rainfall from 1.17 to 1.73 inches per month, and the wet season occurs from April to September with average monthly precipitation between 3.4 to 4.61 inches per month (Iowa State University 2017). Table 2-2 provides a monthly summary of precipitation at Bellevue, Iowa L&D #12 over a 65-year period from 1951 to 2016. The summer months are characterized by short duration, localized showers; however, summer thunderstorms may be severe and are sometimes accompanied by hail or destructive wind. Flooding frequently occurs with the breakup of river ice in late winter and early spring, especially if a thick snow cover has been removed by rain or unseasonably warm temperatures.

Table 2-2. Monthly Precipitation Statistics for Lock and Dam #12 Station (1951-2016) Savanna Army Depot Activity, Savanna, Illinois

Month	Maximum Precipitation (in)	Minimum Precipitation (in)	Average Precipitation (in)
January	4.87	0.08	1.17
February	3.61	0.00	1.24
March	5.29	0.34	2.22
April	8.47	0.85	3.48
May	8.25	0.7	3.77
June	10.76	0.62	4.61
July	9.41	0.3	3.87
August	9.82	0.73	4.05
September	10.69	0.12	3.4
October	8.96	0.00	2.79
November	6.11	0.11	2.35
December	4.96	0.26	1.73

Source: Iowa Environmental Mesonet, Iowa State University 2017

SVDA has experienced snow 6 to 36 times per year between 1951 and 2016 with an average of 17 snowfalls per year (Iowa State University 2017). Average annual snowfall in Bellevue, Iowa from 1951 through 2012 was 31.45 inches (Iowa State University 2013), ranging from 9.1 to 64.6 inches. The highest snowfall totals occur between December and March with lesser amounts in November and April. Snow is relatively lacking between May and October. Heavy snow, greater than 10 inches deep, occurs infrequently, and prevailing winds tend to pile the snow into high drifts. Moderate to heavy ice storms occur annually. Damaging winds may develop into tornadoes at any time of year but are more likely to occur from March through June.

2.5 SURFACE WATER HYDROLOGY

Surface water features affecting the hydrology at SVDA consist of rivers and streams draining areas to the north of SVDA, Mississippi River backwater areas to the southeast, and changes in Mississippi River stage. Surface water runoff from the elevated bluffs northeast of SVDA is drained onto the northern and central portions of the facility predominantly through intermittent streams along the northeastern Installation boundary. Surface drainage from the developed Installation areas is predominantly radial from the plateau areas toward the surrounding lower-lying areas. No surface water features are located on SVAD-067 or SVAD-084. The nearest water body is the Mississippi River, which is approximately 2,000 feet south of SVAD-067 and 1,000 feet south of SVAD-084.

2.6 SVDA GEOLOGY AND HYDROGEOLOGY

Regional geology at SVDA is characterized by Wisconsinan-aged glacial deposits and recent alluvium underlain by Paleozoic bedrock. The Parkland Sand and Henry Formation are the uppermost units encountered beneath the Installation and consist of sand deposits extending to a maximum depth of approximately 170 feet BLS (Dames & Moore 1994). The Parkland Sand consists of wind-blown, fine- to medium-grained sand deposited as dunes or sheet-like units. The Parkland Sand grades to more coarse deposits of the Henry Formation at approximately 110 feet BLS. The Henry Formation consists of moderately to poorly sorted, glacially derived sand and gravel and medium- to coarse-grained sandy outwash deposits that contain occasional silt lenses. The glacial deposits are overlain in portions of the SVDA facility by recent sediments associated with migration or episodic flooding of the Mississippi and

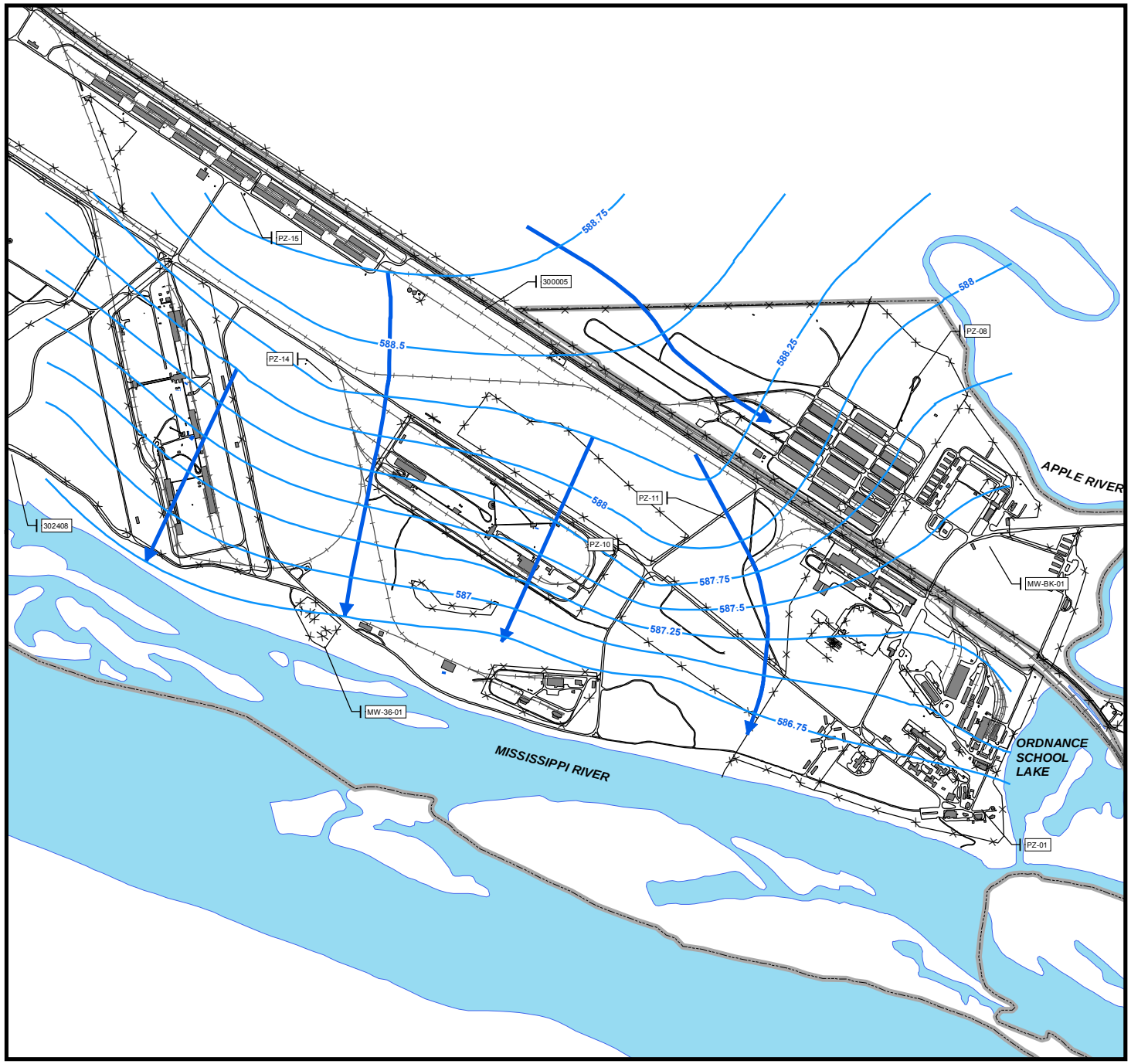
Apple Rivers. Bedrock ranges in elevation from 611 feet above msl in the northern portion of the Installation to 448 feet above msl in the southern portion. The bedrock surface forms an elongated trough extending northwest to southeast across SVDA from the Upper Post to the Lower Post (Dames & Moore 1994).

Alluvium and wind-blown sand aquifers underlying the Upper Post comprise the initial source of shallow groundwater. Hydrogeologic conditions in the shallow aquifer have been investigated through measurements of groundwater elevation in monitoring wells, aquifer tests, and assessment of groundwater flow direction. Hydraulic conductivity in the glacial aquifer underlying the Upper Post ranged from 5.9×10^{-4} to 1.2×10^{-1} cm/sec with a geometric average hydraulic conductivity of 1.52×10^{-2} cm/sec (Dames & Moore 1994) and the hydraulic conductivity in the overburden material on the Lower Post ranged from 1.6×10^{-4} to 9.4×10^{-2} cm/sec with a geometric average hydraulic conductivity of 1.93×10^{-2} cm/sec.

2.6.1 Geology/Hydrogeology at SVAD-067

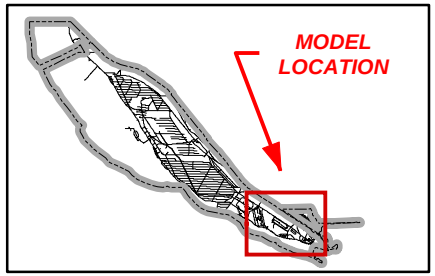
As documented in the final Lower Post Remedial Investigation (RI) (SAIC 2004), geologic and hydrogeologic conditions at SVAD-067 have been characterized using information obtained during monitoring well installations at the sites and information from previous investigations at adjacent sites on the Lower Post. Glacial geology underlying SVAD-067 consists of yellowish brown to reddish brown to brown fine- to medium-grained sand extending to a depth of 151 feet BLS. Bedrock was encountered beneath the site at monitoring wells MW-67-06 and 306706 and at the location of a deep pumping test boring at depths of 139.5 to 151 feet BLS (elevation 452 to 466 feet above msl, respectively). Groundwater underlying SVAD-067 occurs under unconfined conditions at depths ranging from 4.2 to 27.8 feet BLS with an average depth of 16.6 feet BLS from measurements obtained at monitoring wells between December 1998 and September 2003. Groundwater elevation measurements from December 1998 through September 2003 ranged from 580.49 to 593.04 feet above msl. Aquifer hydraulic conductivity (K) underlying the Lower Post ranges from 1.6×10^{-4} to 9.4×10^{-2} cm/sec with a geometric average hydraulic conductivity of 1.93×10^{-2} cm/sec based on 35 slug test results (Dames & Moore 1994). Hydraulic conductivity near SVAD-067 ranged from 3.5×10^{-4} to 8.5×10^{-2} cm/sec with a geometric average of 2.2×10^{-2} cm/sec. The results of a pumping test conducted west of SVAD-067 indicate horizontal aquifer hydraulic conductivity at 1.3×10^{-1} cm/sec.

The continuous groundwater monitoring on the Lower Post and Plant Areas over a 27-month period indicates that the groundwater flow in this area is predominantly directed toward the Mississippi River. Episodic rises in river stage in response to precipitation events temporarily reverse groundwater flow directions for short periods of time. Groundwater flow maps for the Lower Post and Plant Areas during periods of normal flow and reversed flow conditions are provided in Figures 2-2 and 2-3, respectively. Groundwater information collected from the new groundwater monitoring wells installed during the Leidos SI field activities are provided in Table 2-1. Although the groundwater information collected during the 2018 SI field activities indicated a relatively flat gradient through the site, the groundwater elevation measurements confirmed a southern flow of shallow groundwater at SVAD-067. Groundwater levels collected during the SI from the monitoring wells indicate the depth to shallow groundwater ranged from 11.52 feet BLS in MW-67PFAS-03 to 16.96 feet BLS in MW-67PFAS-02. Groundwater elevations were 591.29 feet above msl in MW-67PFAS-03 and 591.37 feet above msl in MW-67PFAS-01. The depths to groundwater and groundwater elevations were consistent with historical data.



Legend

- INSTALLATION BOUNDARY
- BUILDINGS
- RAILROAD
- ROADS
- FENCES
- RIVER or LAKE
- GROUNDWATER ELEVATION CONTOUR
- GROUNDWATER FLOW DIRECTION
- MONITORING WELL or PIEZOMETER



KEY MAP
NOT TO SCALE

N

1,000 500 0 1,000 2,000
Feet

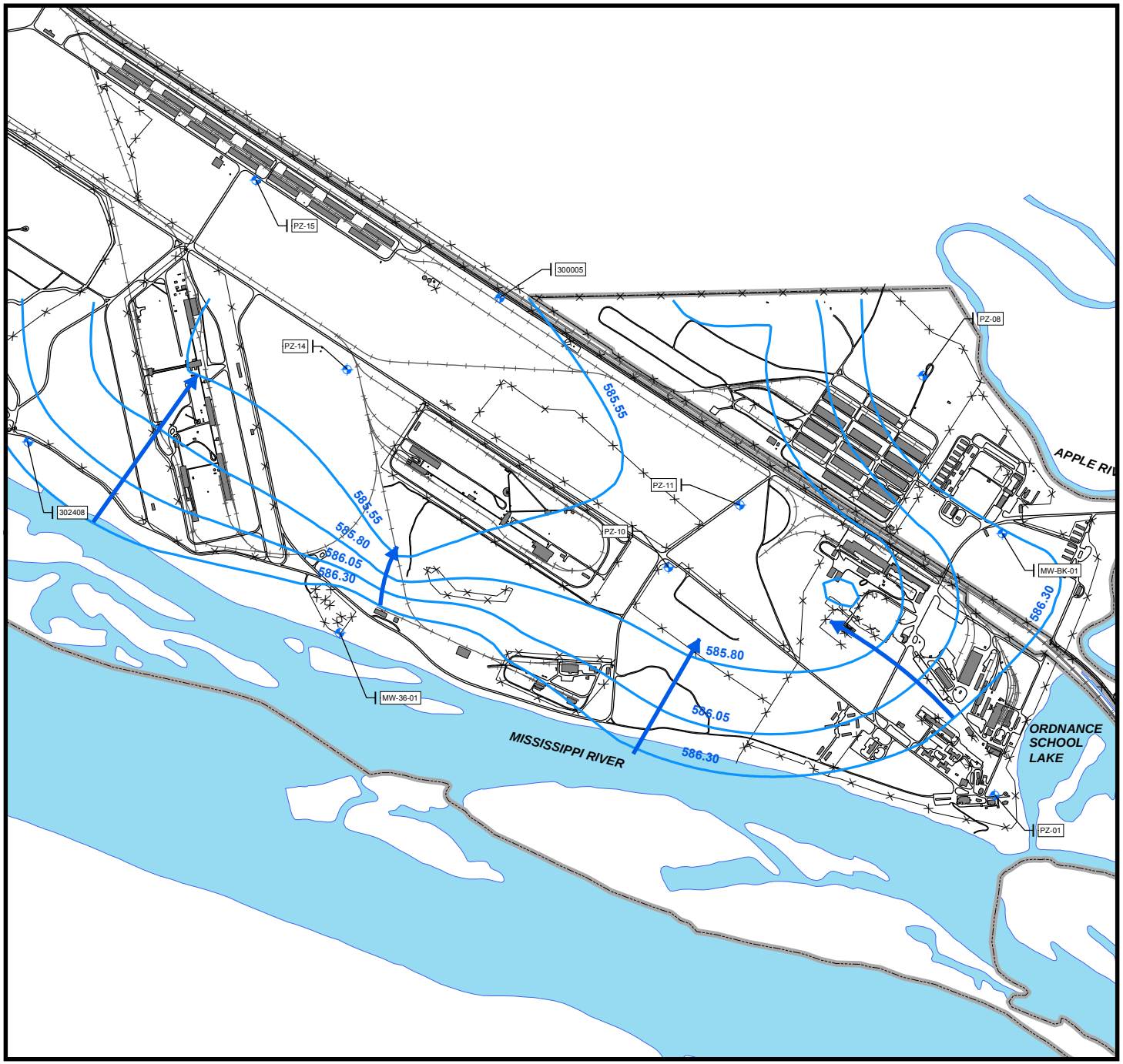
US Army Corps of Engineers

leidos

LOWER POST AREA GROUNDWATER ELEVATION NORMAL FLOW CONDITIONS – JULY 1999
SAVANNA ARMY DEPOT ACTIVITY
SAVANNA, ILLINOIS

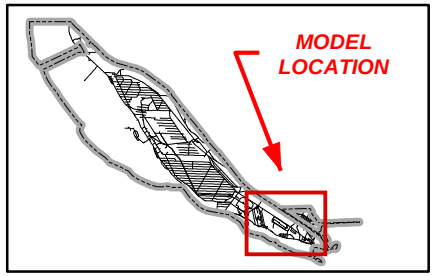
PROJECT:\GIS_DATA\SVAD\Projects\Sites 67 and 84\
Figure 1-9 SV LP GW Normal Flow 8x11.mxd

FIGURE: 2-2 | **DATE: 12/11/2018**



Legend

- INSTALLATION BOUNDARY
- BUILDINGS
- RAILROAD
- ROADS
- FENCES
- RIVER or LAKE
- GROUNDWATER ELEVATION CONTOUR
- GROUNDWATER FLOW DIRECTION
- MONITORING WELL or PIEZOMETER



KEY MAP
NOT TO SCALE

1,000 500 0 1,000 2,000
Feet

US Army Corps of Engineers

leidos

LOWER POST AREA GROUNDWATER ELEVATION REVERSED FLOW CONDITIONS – JUNE 2000

SAVANNA ARMY DEPOT ACTIVITY
SAVANNA, ILLINOIS

PROJECT: \GIS_DATA\SVAD\Projects\Sites 67 and 84\
Figure 2-3 SV LP GW Rev 8x11.MXD

FIGURE: 2-3	DATE: 5/21/2019

2.6.2 Geology/Hydrogeology at SVAD-084

As documented in the Sites 46, 76CS, 84, and 184 RI Report (SAIC 2007), the geologic conditions underlying SVAD-084 have been characterized through drilling data obtained during the 2000 and 2003 investigations at the site. The soil at SVAD-084 is fine- to coarse-grained, moderately sorted, sub-rounded to well-rounded, loose sand with varying amounts of silt and gravel. The aquifer underlying the site consists of yellow-brown to brown, well- to poorly sorted, medium-grained sand that extends to bedrock at approximately 205 feet BLS (Dames & Moore 1994).

Groundwater monitoring wells had not been installed at SVAD-084 prior to this SI. Groundwater elevation in the vicinity of SVAD-084 was previously characterized through monitoring associated with adjacent SVAD-047 and SVAD-036 located 400 feet east and 300 feet south of SVAD-084, respectively. Groundwater level measurement was conducted at wells 303601, 303602, MW-36-01, MW-47-01, and MW-47-02 between October 2001 and September 2003 with groundwater elevation ranging from 582.93 to 587.21 feet above msl and an average elevation of 584.64 feet above msl. The depth to groundwater ranged from 41.52 to 65.34 feet BLS. Based on groundwater measurements in the wells surrounding SVAD-084, groundwater flow beneath the site is predominantly directed to the south and southwest toward the Mississippi River.

The continuous groundwater monitoring on the Lower Post and Plant Areas over a 27-month period indicates that the groundwater flow in this area is predominantly directed toward the Mississippi River. Episodic rises in river stage in response to precipitation events temporarily reverse groundwater flow directions for short periods of time. Groundwater flow maps for the Lower Post and Plant Areas during periods of normal flow and reversed flow conditions are provided in Figures 2-2 and 2-3, respectively. Groundwater information collected from the new groundwater monitoring wells installed during the 2018 SI field activities are provided in Table 2-3. Although the groundwater information collected during the 2018 SI field activities indicated a relatively flat gradient through the site, the groundwater elevation measurements confirmed a south-southeast flow of shallow groundwater at SVAD-084. Groundwater levels collected during the SI from the monitoring wells indicate the depth to shallow groundwater ranged from 39.28 feet BLS in MW-84PFAS-03 to 42.96 feet BLS in MW-84PFAS-01. Groundwater elevations were 589.17 feet above msl in MW-84PFAS-03 and 589.33 feet above msl in MW-84PFAS-01. The depths to groundwater and groundwater elevations were consistent with historical data.

Table 2-3. 2018 SI Water Level Measurements
Savanna Army Depot Activity, Savanna, Illinois

Monitoring Well	TOC Elevation (ft above msl)	Screened Interval	October 2018	
			Depth to Water (ft BTOC)	Groundwater Elevation (ft above msl)
MW-67PFAS-01	607.46	11.43-21.48	16.09	591.37
MW-67PFAS-02	608.32	13.00-23.05	16.96	591.36
MW-67PFAS-03	602.81	14.15-24.20	11.52	591.29
MW-84PFAS-01	632.29	37.30-47.35	42.96	589.33
MW-84PFAS-02	631.94	38.96-49.01	42.54	589.40
MW-84PFAS-03	628.45	33.55-43.60	39.28	589.17

Note: TOC elevation and ground surface elevation data are from the monitoring well survey conducted in October 2018, by Central Illinois Consulting, Inc. (see Appendix C). Screened intervals shown in this table for the new wells were obtained from the well construction diagrams provided in Appendix B. Depth to water information was obtained from the groundwater sampling logs in Appendix B.

3. FIELD INVESTIGATION ACTIVITIES AND PROCEDURES

The principal guidance document for planning and implementing the SVAD-067 and SVAD-084 investigation includes the June 10, 2016, Department of the Army policy regarding perfluorinated compound contamination assessment (Department of the Army 2016) to determine the presence or absence of PFOS and PFOA in groundwater as a result of DoD activities. Subsequent to the establishment of the SVAD-067 and SVAD-084 investigation activities and procedures, the Army issued Guidance for Addressing Releases of PFAS (Department of the Army 2018). The investigation activities and procedures utilized for the SVAD-067 and SVAD-084 SI were consistent with the requirements presented in this Guidance.

The objectives of the DQO process were to define the problem at the sites, identify the necessary decisions, specify decision-making rules and the level of confidence necessary to resolve the problem, identify the number of samples necessary to support the decision, and obtain agreement from the decision makers (i.e., the BRAC Cleanup Team [BCT]) before the sampling program was initiated. The SVAD-067 and SVAD-084 sampling points were determined by locating sampling points in the areas with the highest potential for identifying COCs or at known release points. The BCT concurred that selected sampling schemes would be representative of site conditions prior to initiation of field investigation activities (Leidos 2018a). The field investigations at SVAD-067 and SVAD-084 were conducted in accordance with UFP-QAPP Addendum 2 (Leidos 2018a) and HASP Addendum 2 (Leidos 2018b).

Fire training activities at SVAD-067 and SVAD-084 were determined to have utilized AFFF based on historical records reviews (SAIC 1999a) and recent interviews with the former SVDA Fire Chief. The former SVDA Fire Chief was a firefighter during the 1960s and 1970s and was the SVDA Fire Chief from 1987 to 1995. The former SVDA Fire Chief indicated that FTA activities at SVAD-067 utilized AFFF mixed with water. The former SVDA Fire Chief noted that FTA activities at SVAD-084 were conducted with water and 3M Light Water. 3M Light Water was the brand name for a firefighting foam manufactured by 3M that contained PFOS. Consequently, the groundwater at SVAD-067 and SVAD-084 was evaluated to determine the presence or absence of PFOS and PFOA at concentrations exceeding the USEPA LHA and tap water screening levels (ASD 2019) as a result of DoD activities.

3.1 FIELD INVESTIGATION ACTIVITIES

Under this SI, sampling activities at SVAD-067 and SVAD-084 included installing three permanent groundwater monitoring wells at each site and conducting one round of groundwater sampling. Samples were analyzed for the six UCMR3 PFAS compounds to determine the presence or absence of PFAS in groundwater. The groundwater samples were collected at and downgradient from the source areas at SVAD-067 and SVAD-084 and analyzed in accordance with USEPA protocols for PFAS investigations and respective laboratory reporting requirements.

3.2 FIELD PROCEDURES

The following sections describe the field procedures for sampling, sample handling and custody, decontamination, and investigation-derived waste (IDW) handling used during the SI field activities at SVAD-067 and SVAD-084.

3.2.1 Field Sampling Methods

The following sections describe the field inspection, munitions and explosives of concern (MEC) clearance, and sampling methods used during the SI field activities at SVAD-067 and SVAD-084. The SI sampling locations were selected during the work plan development. The sampling locations were based on potential PFAS release areas, as well as upgradient of and downgradient from the potential release areas.

The purpose of the SI sampling was to determine the presence or absence of PFOS and PFOA constituents at concentrations exceeding the USEPA LHA established in the work plan (Leidos 2018a) and the tap water RSLs (ASD 2019).

Because many materials routinely used in the course of environmental investigation can potentially contain PFAS, the field crew conducted the groundwater monitoring well installation and sample collection in accordance with the PFAS sampling standard operating procedure (SOP) included in the UFP-QAPP Addendum 2 (Leidos 2018a) and HASP Addendum 2 (Leidos 2018b).

3.2.1.1 Visual Inspections

A visual inspection was conducted at the SVAD-067 and SVAD-084 areas prior to initiating drilling activities for monitoring well installation. During this visual inspection, site characteristics, including topography, surface water drainage patterns, buildings and structures (e.g., location or potential release pathways), visible surface stains, damaged concrete or structures, stressed vegetation, exposed soil, and utility locations, were evaluated prior to locating intrusive sampling points.

3.2.1.2 Utilities Clearance

Prior to initiating any intrusive activities during the fieldwork, the investigation area was cleared of underground utilities by state, facility, and Leidos personnel. During the mobilization stage, pre-determined sample locations were provided to the Illinois Joint Utility Locating Information for Excavators (JULIE) organization (i.e., the Illinois One-Call System), who later marked the area for underground public utilities (e.g., electricity, telephone, fiber optic, water, gas) based on the quarter section number. Consistent with State of Illinois requirements, contact with JULIE and acquisition of the necessary clearance was completed by the firm actually performing the intrusive work (in this case both Leidos and Mateco Drilling).

As-built underground utility maps also were provided by SVDA representatives and reviewed by Leidos personnel prior to intrusive work to verify the location of utilities. Once onsite, Leidos sampling personnel used best professional judgment to verify that there was no obvious evidence of utilities in the sampling area.

3.2.1.3 MEC Avoidance

Prior to initiating intrusive activities, the investigation areas were verified to be free of MEC, material potentially presenting an explosive hazard (MPPEH), or other metallic objects by a Leidos unexploded ordnance (UXO) technician. This individual cleared all proposed monitoring well locations using a Schonstedt® GA-52CX magnetometer, first at the surface and then incrementally with depth as necessary. No metallic anomalies were detected at SVAD-067 and SVAD-084.

3.2.1.4 Groundwater Monitoring Well Installation

Groundwater monitoring well installation was conducted in accordance with the SOPs provided on Worksheet #21a and Appendix C of the UFP-QAPP Addendum 2 (Leidos 2018a). Specific construction parameters, such as the exact depth of screen settings, were determined in the field based on information obtained during the well drilling process (e.g., depth to water). All new monitoring wells were installed using hollow-stem auger drilling. The new monitoring wells were constructed of Schedule 40, 2-inch diameter, flush-threaded, polyvinyl chloride (PVC) riser and 0.010-inch slotted screen. The screens were installed to extend approximately 7 feet below the top of the water table. All wells installed during the investigation were constructed with 10-foot screens. Table 3-1 provides monitoring well construction details. Well construction logs are provided in Appendix B.

Table 3-1. Monitoring Well Construction Information
Savanna Army Depot Activity, Savanna, Illinois

Monitoring Well	Top of Casing Elevation (ft above msl)	Ground Elevation (ft above msl)	Screened Interval (ft BGS)	Total Well Depth (ft BTOC)	Well Diameter (in)	Casing
SVAD-067						
MW-67PFAS-01	607.46	605.08	11.43-21.48	23	2	PVC
MW-67PFAS-02	608.32	605.95	13.00-23.05	23.3	2	PVC
MW-67PFAS-03	602.81	600.73	14.15-24.20	27.6	2	PVC
SVAD-084						
MW-84PFAS-01	632.29	630.13	37.30-47.35	48	2	PVC
MW-84PFAS-02	631.94	629.78	38.96-49.01	49.3	2	PVC
MW-84PFAS-03	628.45	626.13	33.55-43.60	48	2	PVC

Note: TOC elevation and ground surface elevation data are from the monitoring well survey conducted in October 2018, by Central Illinois Consulting, Inc. (see Appendix C). Screened intervals shown in this table for the new wells were obtained from the well construction diagrams provided in Appendix B. Depth to water information was obtained from the groundwater sampling logs in Appendix B.

Following advancement of the augers to the target depth, well installation activities began with the placement of the well screen and casing into the augers. After the well screen and casing were placed into the augers, the granular filter pack was placed into the annulus between the well (i.e., well screen and casing) and the hollow-stem augers. The augers were incrementally removed from the borehole as the sand was poured to the desired height. The filter pack consisted of IES Drilling Supplies, Inc. (10/20) silica, manufactured for this purpose. Granular filter pack was added until the sand was approximately 2 to 3 feet above the top of the screen. The Leidos geologist measured the final depth to the top of the granular filter pack using a weighted tape. The data were recorded on the monitoring well construction forms and recorded in the field logbook.

After the well screen was in place and the sand pack had been installed, at least 1 foot of Black Hills Bentonite, 3/8-inch bentonite chips were placed inside the augers, over the sand pack, and hydrated with approximately 5 to 10 gallons of potable water. The potable water used for hydration and decontamination activities was sampled during the event. The potable water was analyzed prior to use, and analytical results are presented in Appendix E. The Leidos geologist measured the top of the bentonite using the weighted tape. The data were recorded on the monitoring well construction form and in the field logbook and preparation was made to initiate grouting.

Grout consisting of Type I Portland cement, Baroid Quick-Gel High Yield bentonite powder, and potable water was mixed and emplaced via tremmie pipe through the hollow-stem augers, over the bentonite seal. After the grout was brought to the ground surface, the remaining hollow-stem augers were removed from the borehole and a steel protective casing was placed over the well and suspended into the grout. As needed, additional grout was placed in the borehole to bring the level back to the ground surface.

The construction of each well was completed by filling the annulus between the well casing and the protective casing with mortar to a height above the eventual top of the well pads. Well pads were formed by pouring concrete within 3- by 3-foot square, 5 ½-inch-tall wooden forms centered around the protective casing. Following pad placement, weep holes were drilled into the protective casing, directly above the height of the mortar collar. Four, 6-foot-tall, steel protective posts (bollards) were driven approximately 2 feet below the ground surface, at each corner of each well pad, filled with sand, and capped with concrete. Each protective casing and all posts were primed and then painted safety-orange. Well identification (I.D.) numbers were stenciled onto each protective casing using a paint pen. Keyed-alike locks were placed on each protective casing.

Borehole cuttings, decontamination fluids and solids, and groundwater removed during development and pre-sample purging were containerized and disposed of as IDW. Information pertaining to the handling of IDW is contained in Section 3.5.

3.2.1.5 Groundwater Monitoring Well Development and Sampling

Each new monitoring well was developed in accordance with the UFP-QAPP Addendum 2 (Leidos 2018a). Development was completed by first bailing and surging the wells using new, disposable, polyethylene bailers and cotton, PFAS-free rope. Bailing was conducted to remove any gross accumulation of sediment. Following bailing, the wells were pumped using (PFAS-free) Monsoon submersible pumps equipped with new polyethylene tubing. Wells were first pumped at the highest possible rate to continue removal of gross sediment. During the removal of the first well volumes, the pump was raised and lowered throughout the screened interval and turned on and off several times to provide additional surging action. After the groundwater turbidity began clearing, the pump was set at the approximate mid-point of the water column and pumping was continued until water quality parameters stabilized. Development was considered complete after a minimum of 5 volumes were removed, pH readings were within 0.1 standard units, conductivity was +/- 10 mS/cm, and temperature was within 0.5°F in three consecutive readings. In addition, development was continued until the water appeared clear. At each well, turbidity was reduced to readings of 10 Nephelometric Turbidity Units (NTUs) or less. Tens of well volumes were removed from each well.

All groundwater samples were collected in accordance with the procedures outlined in the following sections. QC samples, including potable and deionized (DI) source water blanks, a reagent blank, one duplicate, and one matrix spike/matrix spike duplicate (MS/MSD) also were collected. The potable water source blank and the reagent blank were collected in Trizma-preserved containers.

Monitoring Well Purging and Groundwater Sampling—Each new monitoring well was purged before sampling. Purging was conducted using the low-flow methods described in SOP field procedure (FP) 5-6A, which is provided in Appendix D of the Data Collection Quality Assurance Plan (DCQAP) (SAIC 1999b). The purpose of the low-flow purging and sampling procedure was to obtain groundwater samples that are representative of the source from which they are collected and to minimize sampler exposure to groundwater contaminants. To be useful and accurate, the groundwater sample must be representative of the particular saturated zone of the substrate being sampled. The physical, chemical, and bacteriological integrity of the sample must be maintained from the time of sampling to the time of testing in order to keep any changes in water quality parameters to a minimum. Each well was purged at a rate of 1 liter per minute or less depending on the rate of recharge so as not to lower the water level within the well. During purging, pH, specific conductance, turbidity, dissolved oxygen, oxidation-reduction potential, and temperature were measured from purged water, using the instruments described in Section 4.14 of the DCQAP (SAIC 1999b). Purging was considered complete when all parameters stabilized for three successive readings and turbidity was lowered to below 10 NTUs. Section 8 of SOP FP 5-6A, which is provided in Appendix D of the DCQAP (SAIC 1999b), details the minimum criteria for stabilization of purge water.

Following the completion of purging, samples were collected without pause in pumping, directly from the discharge tubing (not from the discharge of the flow-through cell). Samples were collected in laboratory-supplied, certified-clean, plastic containers. Monitoring well development and sampling logs are presented in Appendix B.

3.2.1.6 Topographic Surveying

The monitoring well locations were predetermined during work plan development. These locations were preloaded into the differential global positioning system (DGPS) unit with sub-meter accuracy. Once in the field, the DGPS unit with sub-meter accuracy was used to navigate to the predetermined locations,

which were then marked with a wooden stake and visible flagging for easy recognition by sampling personnel. Following sampling, the actual locations (i.e., horizontal coordinates) and ground and top of casing elevations of each monitoring well were surveyed by a licensed surveyor (Central Illinois Consulting, Inc.). Survey coordinates are provided in Appendix C.

3.3 SAMPLE IDENTIFICATION AND FIELD CUSTODY PROCEDURES

The sample I.D. system discussed in UFP-QAPP Addendum 2 (Leidos 2018a) was used to uniquely identify each environmental and field QC sample obtained during the SI. This system allowed information about each sample or sample location to be easily and accurately tracked from collection to reporting and ensured unique sample nomenclature. The first two letters in the sample I.D. number represent the sample type (e.g., MW for monitoring well). The next two numbers designate the site. Each site designation was appended with 'PFAS' to distinguish the sample location from previous monitoring wells installed at the sites. The last two digits represent the individual location number (e.g., "03" for well 003). In addition, samples also include a field sample number. The field sample number is a unique, sequential designation assigned to each environmental sample and field QC sample collected. It is an alphanumeric code that indicates the sequential sample number for a corresponding sample I.D. number. A complete example of the format for a typical sample name is as follows:

Sample I.D.	Sample Description
MW-67PFAS-03-LDOS01	Monitoring Well (MW) at SVAD-067 for PFAS investigation (67PFAS) sample location number 3, first sample collected by Leidos (LDOS01)

Duplicate and Field QC Blanks—The following QC test and flagging codes were used to identify duplicate environmental and field QC blank samples:

- "D" entered in the flagging code field was used to identify all field duplicates collected in the field
- "R" entered in the QC test code field was used to identify all equipment rinsate blanks collected in the field
- "N" and "ND" entered in the flagging code field was used to identify all MS and MSDs in the field.

Sample labels were completed at the time of sampling and were attached to each container. The label was completed in indelible ink and contained the following information:

- Date and time sample collected
- Media type
- Site I.D. and field sample number
- Depth
- Preservative used (if any)
- Initials of sample collector.

Procedures for transporting environmental samples and field QC samples from SVDA to the laboratory are summarized below:

- Sample collection points, depth increments, and sampling devices documented in the field logbooks were verified with the information written on the sample label and chain-of-custody (CoC) form.
- Logbook entries, field record sheets, and CoCs with sample identification, locations, date, time, and names or initials of all persons handling the sample in the field were completed.

- Samples were placed into re-sealable plastic bags.
- Samples were packaged in thermally insulated, rigid coolers along with ice and coolant blanks. After a cooler was filled, the completed CoC form was placed inside a re-sealable plastic bag and taped to the inside lid of the cooler
- Custody seals were attached in two separate locations on the outside of each cooler.

All samples were kept on ice in a cooler after sample collection. Sample preparation and packaging was completed at the end of each day that samples were collected. Sample coolers were shipped to the analytical laboratory by overnight delivery.

3.4 DECONTAMINATION PROCEDURES

All nondisposable sampling equipment (e.g., pumps, pump cords, flow cell) that came in contact with groundwater were decontaminated prior to and after each use. The purpose of decontamination was to prevent the introduction of extraneous material or chemicals into the samples and to prevent cross-contamination between samples. Decontamination of field equipment was conducted in accordance with SOP field technical procedure (FTP)-400, which is provided in Appendix C of the UFP-QAPP Addendum 2 (Leidos 2018a).

The decontamination process included an initial scrub with DI water and a laboratory-grade, phosphate-free, biodegradable detergent (e.g., Liquinox®) to remove particulate matter and surface film. Following this scrub, the equipment was then rinsed twice in separate bins containing DI water Decontaminated sampling equipment was kept in the final decontamination bin to prevent recontamination during down time or transit.

Drilling equipment was decontaminated by steam cleaning, using water from a source sampled during the investigation. All equipment, including augers, rods, tools, and measuring tapes, were decontaminated before and after each use. Decontamination activities were conducted within an established area that used a trough to primarily collect decontamination wastewater and which was underlain by bermed plastic sheeting to collect overspray.

Rinse water generated during the decontamination process was containerized as liquid IDW. This material was first placed in temporary storage containers (e.g., 5-gallon buckets or carboys) before being ultimately transferred into 55-gallon drums for storage, transport, and disposal. Solids generated from decontamination of drilling equipment were contained in 55-gallon drums, which also were used to contain drill cuttings.

DI water used in each rinse was provided by the analytical laboratory and certified clean. DI water used in the decontamination process was sampled and analyzed for the same COCs as the primary environmental samples (i.e., PFAS).

3.5 DISPOSITION OF FIELD INVESTIGATION-DERIVED WASTE

The IDW generated during the SI at SVAD-067 and SVAD-084 included soil (solid), development and purged groundwater, and decontamination rinse water (liquid). These materials were managed in accordance with the specific IDW Management Plans provided in the DCQAP (SAIC 1999b).

All IDW generated at SVAD-067 and SVAD-084 was ultimately placed in United Nations (UN)-approved, 55-gallon drums for storage, transport, and disposal, although this material may have been stored transiently in other containers (e.g., 5-gallon buckets or carboys) when small volumes were generated. All containers used to hold any amount of IDW (including intermediate containers) were properly labeled as soon as they were filled according to applicable Leidos procedures and Occupational Safety and Health Administration (OSHA) regulations. Permanent labels for the drums included a unique

container number, a description of the contents (i.e., soil or wastewater), the fill date, the source location (i.e., SVAD-067 or SVAD-084), the generator's name (i.e., SVDA), and a telephone number for the generator's point of contact (i.e., the SVDA BRAC Environmental Coordinator [BEC]). Each bucket or carboy used to temporarily store liquid IDW before it was transferred to a 55-gallon drum was marked "Nonpotable Water" or "Decontamination Waste" to comply with Leidos and OSHA hazard communication standards.

The contents of the IDW drums were sampled for characterization. A waste soil sample was collected during drilling by collecting aliquots from each 5-foot interval of each boring and combining and homogenizing them in a zip-seal bag to form a composite. For drums containing liquid IDW (i.e., wastewater), a composite sample was collected by extracting contents through the bung hole of each drum using a disposable bailer. The waste hauler (Veolia) was contacted prior to sampling to determine parameters required for disposal of waste potentially containing PFOS/PFOA. Veolia advised Leidos to analyze for suspected contaminants based on site history and previous investigations. It was determined that toxicity characteristic leaching procedure (TCLP) pesticides and TCLP, herbicides would be of no concern and the potential did exist for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs) and metals. Therefore, both solid IDW and liquid IDW were analyzed for TCLP VOCs, TCLP SVOCs, and TCLP metals. In addition, Veolia required the analysis of polychlorinated biphenyls (PCBs), pH, flashpoint, cyanide, sulfide, and paint filter test (solid IDW only). Results were then used to determine proper waste disposal.

No IDW from SVAD-067 or SVAD-084 was characterized as hazardous. Containerized waste was disposed of in accordance with applicable state and Federal Resource Conservation and Recovery Act (RCRA) regulations. The licensed and certified waste hauler (Veolia) removed the drums containing IDW waste from SVDA for disposal on April 18, 2019. The drums containing IDW were disposed of at Covanta Environmental Solution (5625 Old Porter Road, Portage, Indiana 46368). Soiled personal protective equipment (PPE) was bagged and disposed of as municipal waste.

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4. LABORATORY CHEMICAL ANALYSIS PROGRAM AND QUALITY ASSURANCE SUMMARY

This section summarizes the laboratory chemical analysis program implemented as part of the SVAD-067 and SVAD-084 field investigations conducted in October 2018 at SVDA. Sections 4.1 through 4.5 summarize sample handling procedures, equipment calibration, analytical methods, data reporting and validation, and sample QA/QC. Additional information on these guidelines is presented in the UFP-QAPP (Leidos 2014) and UFP-QAPP Addendum 2 (Leidos 2018a), which was followed during the laboratory chemical analysis program. Test America, located in Arvada, Colorado, was the analytical laboratory under contract for the analysis of PFAS and Eurofins, located in Lancaster, Pennsylvania, was the split QC analytical laboratory for PFAS during the SVAD-067 and SVAD-084 field investigations.

A QA summary of the analytical data is presented in Section 4.6. Appendix D provides additional information on the QA assessment. Appendix D (Table D-1) summarizes the groundwater samples collected for PFAS analysis, in addition to the field QC samples collected and selected laboratory QC (i.e., MS/MSDs and laboratory duplicates) samples.

4.1 SAMPLE HANDLING PROCEDURES

A critical aspect of sample collection and analysis protocols is the maintenance of strict CoC procedures, which include tracking and documentation during sample collection, shipment, and laboratory processing. The Sample Manager was responsible for sample custody until the samples were properly packaged, documented, and released to FedEx. The laboratory was responsible for sample custody thereafter in accordance with approved procedures.

4.1.1 Establishment of Sample Delivery Groups

All samples collected at SVAD-067 and SVAD-084 were reported by sample delivery groups (SDGs) at the analytical laboratory. Analytical batch size is determined as the maximum number of samples up to 20, including QC samples, which can be analyzed using the most time-consuming activity in the analysis, which frequently is the extraction or digestion process. Analysis of samples within an SDG was as continuous as possible. All samples were processed as defined in USEPA Method 537 Version 1.1 (USEPA 2009), the DoD QSM Version 5.1 (DoD 2017), and the laboratory SOP.

4.1.2 Laboratory Sample Receipt

All samples received by the Laboratory Sample Custodian or designee were checked for proper preservation (e.g., pH, temperature of coolant blank above 2°C or below 6°C); integrity (e.g., leaking, broken bottles); and proper, complete, and accurate documentation and ID of the samples. The temperature of the coolant blank was noted. No insufficiencies and/or discrepancies were noted.

Samples received at the laboratory were logged into the laboratory computer database. Initial entries included field sample number, date of receipt, and analyses required. As samples were received, they were assigned a laboratory sample ID number. The sample custodian labeled each container with its sample ID number, and the samples then were transferred to their designated storage areas.

4.1.3 Chain-of-Custody Record

CoC forms were used to document the traceability and integrity of all samples from the point of collection to the laboratory by maintaining a record of sample collection, transfer between personnel, shipment, and receipt by the laboratory. A CoC form was filled out and was signed and dated by each sample custodian.

Shipping containers were sealed with custody tape. Sealed coolers were transported to Federal Express for overnight delivery to the laboratory. The air bill number, written on the CoC form, acted as the custody documentation while the coolers were in the possession of Federal Express. The CoC form was placed in a resealable plastic bag and taped to the inside lid of the cooler.

When the possession of samples was transferred, the individual relinquishing the samples and the individual receiving the samples signed, dated, and noted the time of transferal on the CoC document. This record represents the official documentation for all transferal of sample custody until the samples arrived at the laboratory.

Samples received by the laboratory were considered to be physical evidence and were handled according to USEPA procedural safeguards. In addition, all data generated from the sample analyses, including all associated calibrations, method blanks, and other supporting QC analyses, were identified with the project name, project number, and SDG designation. All data were maintained under the proper custody. The laboratory provided complete security for samples, analyses, and data.

4.2 LABORATORY ANALYTICAL METHODS

The chemical analysis program for SVAD-067 and SVAD-084 field investigations conforms to the analytical requirements presented in the UFP-QAPP (Leidos 2014) and UFP-QAPP Addendum 2 (Leidos 2018a) for the chemical analysis of groundwater samples. All samples were analyzed for PFAS using modified USEPA Method 537 Version 1.1 (USEPA 2009), the DoD QSM Version 5.1, and the laboratory SOP during the October 2018 sampling event.

4.3 LABORATORY EQUIPMENT CALIBRATION

To ensure that daily variances had not adversely affected the operation of each instrument, a series of calibration standards was analyzed according to specific methodologies before any samples were analyzed. The laboratories satisfied all calibration requirements, as stated in USEPA Method 537 Version 1.1 (USEPA 2009). All calibration requirements were met for these methods with the exceptions summarized in Section 4.6.2 and Appendix D. The UFP-QAPP (Leidos 2014) and UFP-QAPP Addendum 2 (Leidos 2018a) contain the laboratory-specific method SOPs and calibration procedures specific to each analytical method.

4.4 DATA REPORTING AND VALIDATION

The Leidos QA Manager or designee initiated a validation of the analytical data packages. One hundred percent of the data were validated using the USEPA Contract Laboratory Program (CLP) *National Functional Guidelines for Organic Data Review* (USEPA 1999), modified to accommodate the DoD QSM, Version 5.1 (DoD 2017), and Louisville QSM Supplement (USACE 2002) criteria. The *National Functional Guidelines for Organic Data Review* (USEPA 1999) was used to validate the data.

During the data validation, a modified USEPA CLP National Functional Guidelines validation occurred. As such, CLP Forms 1 through 14 were reviewed to ensure that the QC results fell within appropriate QC limits for holding times, blank contamination, internal standards (ISs), surrogate recoveries, calibrations, MS/MSDs, laboratory control samples (LCSs), cleanup checks, detection limits (DLs), and any other required QC data. Laboratory QC forms were reviewed to ensure that the QC results fell within the appropriate QC limits. Any resulting data validation qualifiers were applied and a data validation report, as previously described, was prepared.

In addition, 10 percent of the data were recalculated by a third-party validator from the raw data to verify that the algorithms were used and that data transcription was correct. Analytical results were checked and recalculated from raw data. If a significant problem was found in any analytical protocol or matrix type

(e.g., consistent failure to meet calibration requirements or poor spike recoveries), 100 percent of the data generated by that particular method were fully validated to determine if a serious systemic problem exists in the data set. No problems were encountered by the third-party validator during calculation verification.

Individual reagent blanks, equipment rinse blanks, and field blanks were associated with the corresponding environmental samples. These field blanks were evaluated following the same criteria as method blanks, and the associated environmental samples were appropriately qualified. After all of the data validation for the project was completed, a project DQA was prepared (see Appendix D).

4.5 SAMPLE DATA QUALITY ASSURANCE/QUALITY CONTROL

This section presents the QA/QC procedures applied during the laboratory analysis and field investigation. This discussion includes laboratory QA/QC procedures (Section 4.5.1) and field QA/QC (Section 4.5.2). Details on the results of the QC samples (field and laboratory) are presented in the DQA included as Appendix D.

4.5.1 Laboratory Quality Assurance/Quality Control

The most current versions of the USEPA method requirements were followed for all samples collected. Samples were analyzed for PFAS. The method requirements pertain to holding times, method blanks, calibration standards, ISs, surrogate standards, LCSs, MS/MSDs, and DLs. The acceptance criteria and method SOPs are provided in the UFP-QAPP (Leidos 2014) and UFP-QAPP Addendum 2 (Leidos 2018a).

Method Blanks—Method blanks were used to monitor the possibility of laboratory-induced contamination by running a volume of approved reagent water through the entire analytical scheme (i.e., digestion, extraction, concentration, analysis). USEPA blank requirements are specified in the respective statements of work (SOWs) and the analytical method.

Matrix Spike/Matrix Spike Duplicates—MS/MSDs were analyzed on water samples to evaluate the accuracy and precision of the analysis and matrix effect of the sample on the analytical methodology. This evaluation was accomplished by analyzing three sample aliquots of equal weight. One aliquot was analyzed routinely. A known amount of selected compounds at known concentrations was added to each of the two remaining sample aliquots. The spiked samples and unspiked samples were analyzed in the same manner. Accuracy was expressed as the percent recovery (%R) of each added compound. Precision was expressed as the relative percent difference (RPD) of MS and MSD compounds. A pair of MS/MSD samples was analyzed for every 20 samples of similar matrix received at the laboratory and analyzed by USEPA methods.

Laboratory Control Samples—LCSs were analyzed to evaluate the accuracy of the analysis and matrix effect of the sample on the analytical methodology. A known amount of selected compounds at known concentrations was added to the LCS. The spiked samples were analyzed in the same manner as the environmental samples. Accuracy was expressed as the %R of each added compound. An LCS was analyzed with each SDG.

4.5.2 Field Quality Assurance/Quality Control

Table 4-1 summarizes the frequency of field QC samples that were collected during this investigation. A discussion of field QC is presented on Worksheet #20 of the UFP-QAPP (Leidos 2014) and UFP-QAPP Addendum 2 (Leidos 2018a).

Table 4-1. Frequency of Field QC Samples for SVDA-067 and SVAD-084 Field Investigations
Savanna Army Depot Activity, Savanna, Illinois

QC Sample	Water
Field Blank	1 per DI water 1 per tap water
Equipment Rinsate Blank	1 for every 10 or fewer investigative samples
Field Duplicate	1 for every 10 or fewer investigative samples
Reagent Blank	1 per sampling event

4.5.3 Quality Assurance Split Sample Analysis

One field sample was split from the primary samples and sent to a third-party independent laboratory referred to as the QA laboratory. The QA laboratory for the SVAD-067 and SVAD-084 SI was Eurofins of Lancaster, Pennsylvania. The analysis of QA split samples provides an overall measure of field and laboratory accuracy and precision. Primary and QA laboratory data were assessed using guidelines provided in the Louisville QSM Supplement (USACE 2007). Appendix D, Table D-4 provides a comparison of the primary and QA split results.

Sample results that were detected above the reporting limit by both the primary laboratory and the QA laboratory were all in good agreement according to Louisville QSM Supplement guidelines (USACE 2007). No sample results were in disagreement. The reproducibility between the primary and QA split sample are considered acceptable. A full discussion is included in Appendix D.

4.5.4 Third-Party Data Validation

Third-party full data validation was required on 10 percent of the SVAD-067 and SVAD-084 sample results. Third-party data validation was performed by EcoChem, Inc. of Seattle, Washington. Full validation consisted of validating the data using the QC data reported by the laboratory against required precision and accuracy limits established in the DoD QSM (2017) and against QC requirements outlined in the Louisville QSM Supplement (USACE 2007), UFP-QAPP (Leidos 2014), and UFP-QAPP Addendum 2 (Leidos 2018a).

Appendix D, Table D-5 provides a comparison of Leidos data verification applied qualifiers and EcoChem's data validation applied qualifiers. Some discrepancies existed due to differences in professional judgment used during the verification or validation process as well as fundamental differences between the verification process and the validation process (i.e., the verification process does not involve examining raw data and the validation process requires examining and recalculating raw data). A full discussion is included in Appendix D.

Overall, the differences between the Leidos verification qualifiers and the Ecochem validation qualifiers have no impact on the final usability of the data. In instances where the discrepancies were based on professional judgment or where EcoChem's validation protocol differed from the DoD QSM (DoD 2017) protocol or the UFP-QAPP (Leidos 2014) and/or UFP-QAPP Addendum 2 (Leidos 2018a), no changes were made to Leidos-applied qualifiers.

4.6 QUALITY ASSURANCE SUMMARY

This section summarizes the results of the DQA conducted for the analytical data resulting from this investigation. A comparison of the analytical results to project DQOs, as defined in the UFP-QAPP (Leidos 2014) and UFP-QAPP Addendum 2 (Leidos 2018a), formed the basis for evaluating the quality of the analytical data. Data verification and validation were conducted on 100 percent of the resulting

analytical data packages to ensure that the laboratory produced an acceptable quality level for results. One hundred percent of the data were evaluated for contamination due to field activities by evaluating all field QC blanks (i.e., reagent blank, equipment rinsate blanks, field blanks).

The following sections summarize the DQOs for the precision, accuracy, representativeness, comparability, and completeness (PARCC) and sensitivity parameters obtained during the SVAD-067 and SVAD-084 SI. A detailed project DQA is presented in Appendix D. A summary of the samples collected, the parameters of interest, and the related field QC samples (i.e., reagent blank, equipment rinsate blanks, field blanks) are presented in Appendix D, Table D-1. All data validation qualifiers applied to the data are presented in Appendix D, Table D-2.

4.6.1 Precision

Precision was evaluated based on the analysis of two different types of QC samples: MS/MSDs and field duplicate samples.

The first type of QC sample used to assess the precision of the data quality was the RPDs of the MS/MSDs. All MS/MSD RPDs were within the control limits specified on Worksheet #12 of the UFP-QAPP (Leidos 2014) and UFP-QAPP Addendum 2 (Leidos 2018a).

The second type of QC sample used to monitor field precision was field duplicate samples. Duplicate sample pairs were collected to ascertain the contribution of variability (i.e., precision) due to environmental media and sampling precision techniques. Field duplicate RPDs were reviewed to identify any percentages that were suspicious. Data have not been qualified based on the results of field duplicates, since the USEPA *CLP National Functional Guidelines for Organic Data Review* (USEPA 1999) do not include control limits for field duplicate RPDs. No specific control limits for field duplicates were established in part because the natural heterogeneity of the environmental media was much greater than the variability imparted by field and laboratory activities. Although data were not qualified due to field duplicate RPDs, field duplicate RPDs were calculated and compared to the maximum RPD limit of 30 percent or an absolute difference of three times the sample-specific limit of quantitation (LOQ) when the results are less than five times the sample-specific LOQ, as specified in the UFP-QAPP (Leidos 2014) and UFP-QAPP Addendum 2 (Leidos 2018a) for all field duplicates collected and listed in Appendix D, Table D-1 (field duplicate sample IDs end in a "D"). In instances where both the primary and field duplicate result were nondetect, the RPD was not calculated. Calculated RPDs are provided in Appendix D, Table D-3. Field duplicate comparisons were acceptable, as discussed in Appendix D.

As a result, the laboratory DQO for precision has been fulfilled. A comprehensive discussion of MS/MSD and duplicate results is presented in Appendix D.

4.6.2 Accuracy

Analytical accuracy is defined in the UFP-QAPP (Leidos 2014) and UFP-QAPP Addendum 2 (Leidos 2018a) and measured through the use of LCS %Rs, MS/MSD %Rs, ISs, surrogate recoveries, initial and continuing instrument calibration, calibration blanks, method blanks, and field QC blanks (i.e., reagent blanks, field blanks, equipment rinsates).

MS/MSD recoveries above the upper control limit (UCL) indicate a potential high bias in the corresponding native sample detects. MS/MSD recoveries below the lower control limit (LCL) indicate a potential low bias in the corresponding native sample nondetects and detects. Nondetected organic sample results were qualified as rejected (R) if the associated recoveries were below 10 percent. All MS/MSD results were within control limits and no results were qualified.

The LCS was the second QC type used to assess analytical accuracy. Based on an evaluation of the data, criteria were within the control limits specified in the UFP-QAPP (Leidos 2014) and UFP-QAPP Addendum 2 (Leidos 2018a). No data were qualified due to LCS results.

The QC method used to assess the accuracy of the data was the surrogate percent recoveries for PFAS. Sample results were qualified as estimated (J/UJ) if the associated surrogates were below the LCL. Detected PFAS sample results were qualified as estimated (J) if the associated surrogates were above the UCL. Nondetected PFAS sample results were qualified as rejected (R) if the associated surrogates were below 10 percent. All surrogates were within control limits and no data were qualified.

ISs were added in all calibration standards, environmental samples, and QC blanks in accordance with USEPA Method 537 rev 1.1 for PFAS. IS results above retention time and/or above percent area recoveries are qualified as estimated (J) for associated analytes. IS results below retention time and/or below $\pm$50 percent area recoveries but above 25 percent are qualified as estimated (J/UJ) for associated analytes. No ISs were below +25 percent and no data were rejected. Sample results qualified due to IS performance are summarized in Appendix D, Table D-2 with reason code K01.

All supporting QC information cited above also was qualitatively evaluated with respect to the analytical accuracy DQO. Based on the evaluation of the MS/MSD and LCS results and the associated laboratory QC results summarized in Appendix D, the laboratory accuracy was determined to be acceptable for all analyses. The analytical DQO for accuracy has been met, except where noted.

Method blank analysis was conducted with each analytical batch of environmental samples analyzed, and the results evaluated for interferents that might potentially interfere with accurate quantitation of a target compound. No results were qualified due to method blank contamination.

Initial calibration blanks (ICBs) and continuing calibration blanks (CCBs) were analyzed with each batch of PFAS analyses. Any analyte detected in the ICBs and/or CCBs were below the allowable levels as defined by the analytical method. Appendix D, Table D-2 lists the sample results that were qualified due to ICB/CCB contamination with reason code F06.

Field blanks (i.e., reagent blanks, equipment rinsate blanks and field blanks [i.e., source tap water and source DI water used in the equipment decontamination process]) were collected to determine the degree of cross-contamination or ensure successful decontamination procedures. The data validation qualifier "U" was applied to field sample detections at concentrations below the action level in the associated equipment blank. No sample results were qualified based on field blank contamination.

Results were qualified as estimated (J) when the associated with continuing calibration verification (CCV) recoveries were above the UCL. Results were qualified as estimated (J/UJ) when the associated CCV recoveries are below the LCL. Data points qualified as "UJ" or "J" are considered to be acceptable, but estimates. No results were qualified based on CCV discrepancies.

Based on an evaluation of the compounds and elements detected in the blanks and calibration results, the overall accuracy was determined to be acceptable for all analyses. The analytical DQO for accuracy has been met, except where noted. A comprehensive discussion of the method and field QC blank results are presented in Appendix D.

4.6.3 Representativeness

Based on an evaluation of sample precision and accuracy, the samples collected during the SVAD-067 and SVAD-084 SI are considered to be representative of the environmental conditions.

4.6.4 Comparability

Based on the precision and accuracy assessment presented above, the data collected during the SVAD-067 and SVAD-084 field investigations are considered to be comparable with the data collected during previous investigations. The analytical methods, contract required quantitation limits, and contract required detection limits were the same from task to task.

4.6.5 Completeness

Completeness measures the amount of valid data obtained from the laboratory analysis process and sampling. For data to be considered valid, they must have met all acceptance criteria, including accuracy and precision, as well as any other criteria specified by the analytical methods used.

Results that have been qualified with a "U," "UJ," or "J" for various reasons encountered minor analytical problems with limited impact on the data quality. No results were rejected (R).

DQOs for the SVAD-067 and SVAD-084 SI were set at 90 percent for field sampling and laboratory completeness. Based on the evaluation of the field and laboratory QC results presented in Appendix D, 100 percent of the total environmental sample data collected were used as the basis for all recommendations presented in this report.

4.6.6 Sensitivity

All sample results were reported using the latest DoD QSM guidance (DoD 2017). The DL, limit of detection (LOD), and LOQ criteria specified in the UFP-QAPP (Leidos 2014) and UFP-QAPP Appendix 2 (Leidos 2018a) were met except in instances where dilutions were required. In instances where dilutions were required, lesser diluted analyses were used wherever possible.

4.6.7 Data Usability Assessment

All analytical data, data validation qualifiers, and QC results were evaluated to determine the confidence with which the results could be used in the decision-making process. An evaluation of the data quality indicator (PARCC and sensitivity) results in the preceding sections were used to determine the overall data usability. No data points were rejected during the data validation process. As a result, data completeness was excellent at 100 percent complete. Seventy-eight of the planned 78 data points are considered fully usable for decision making. Three results were qualified as nondetect (U) due to continuing calibration blank contamination, and three results were qualified as estimated (J) due to IS area counts that were slightly above (7 percent) the UCL. Results that were qualified as "U," "UJ," or "J" for various reasons encountered minor analytical problems, but are considered fully usable for decision-making.

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5. SVAD-067 SITE HISTORY AND NATURE OF DETECTED CHEMICALS

This section presents the site history and analytical results of the SI groundwater sampling conducted at SVAD-067.

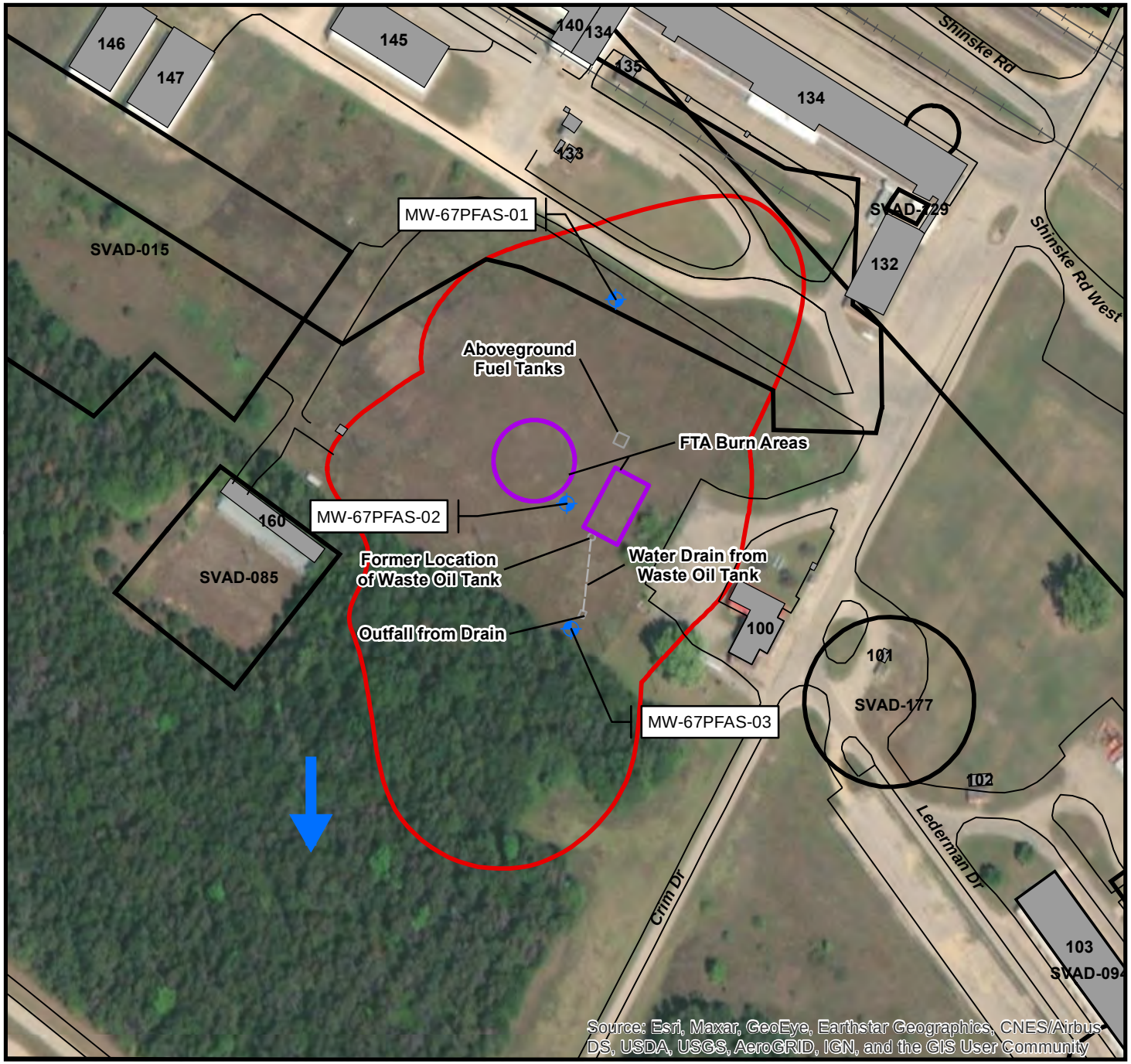
5.1 SITE HISTORY

SVAD-067 is the FTA located in the central portion of the Lower Post facilities, west of Crim Drive and north of McIntyre Road. The site encompasses approximately 8.6 acres behind the Fire Station, Building 100. The SVAD-067 FTA was used for approximately 40 years to train fire fighters in various methods of controlling oil-related fires (SAIC 1999a). Waste oil and other flammable materials were released to a bermed shallow pit area and set afire, to be quenched by Fire Department personnel. Historical aerial photographs of SVDA indicated that a burn area possibly was used as early as 1947. A waste oil tank was used to store waste oil for use during fire training exercises and was located adjacent to the burn area. The tank was removed after 1988. By 1952, a well-defined circular, bermed burn area with a diameter of approximately 90 feet was present. The burn area was still clearly present, with a similar configuration, in 1964. By 1970, the circular burn area had been replaced by a smaller square burn area (roughly 40 by 40 feet), slightly off-center toward the east relative to the preceding circular area (SAIC 1999a). Figure 5-1 depicts the SVAD-067 site features.

SVAD-067 was recommended for investigation in 1988 by the U.S. Army Environmental Hygiene Agency after evidence of spilled oil and burned residue indicated a potential environmental impact from the past usage of the FTA (SAIC 1999a). The FTA was subdivided into two potential source areas: Site 67A, the tank that was used to store waste oil for use during fire training exercises, and Site 67B, the fire training pit where oil was burned on the ground. Other site features included the area where water associated with the waste oil tank was discharged to the ground surface, aboveground metal trays used to support fire training exercises, and two 500-gallon fuel aboveground storage tanks used to supply fuel to the metal trays for training.

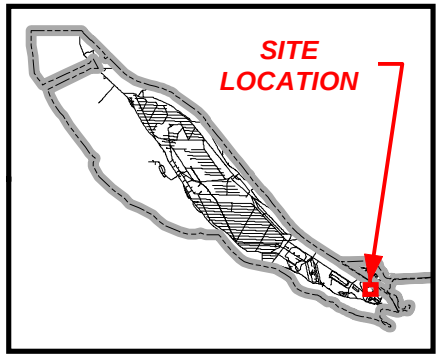
Past activities at this site impacted the soil and groundwater. Historical investigations indicated the chemicals in soil and groundwater include VOCs (primarily trichloroethene [TCE] and tetrachloroethene [PCE]) and petroleum constituents, including polynuclear aromatic hydrocarbons (PAHs). Soils were determined to be characteristic hazardous wastes under RCRA based on TCE and PCE concentrations. A remedial action, which addressed soils only, eliminated the source of continuing VOC and PAH groundwater contamination. Remediation of contaminated soil was initiated in 1993 and consisted of the excavation of 20,345 cubic yards of soil followed by treatment using low-temperature thermal desorption. Approximately 40 to 45 percent of the thermally treated soil required subsequent treatment with lime to stabilize high concentrations of lead. All treated and stabilized soil was returned to the excavation area as backfill and regraded (Four Seasons 1998). The remedial action successfully eliminated the primary source (VOC- and PAH-contaminated soil) of groundwater contamination in the area; however, subsequent groundwater sampling indicated that groundwater quality near SVAD-067 had been adversely affected.

In the fall of 1998 and fall of 1999, Phase I and II sampling activities were conducted at SVAD-067 to delineate the extent of groundwater contamination. Sampling data indicated that elevated VOC concentrations in groundwater were localized. TCE and cis-1,2-dichloroethene (cis-1,2-DCE) were detected primarily in the shallow groundwater samples with the exception of TCE being detected in a mid-depth well at 75 feet BLS. Additional rounds of groundwater sampling were conducted in 2003, 2007, and 2008. During the four consecutive quarters of monitoring in addition to the two quarters of monitoring in January and April 2007, TCE was the only COC detected in the groundwater at SVAD-067. TCE was not detected at concentrations exceeding the residential human health screening level (2.6 micrograms per liter [µg/L]) and were detected only in one shallow well that was bound by wells with nondetects for TCE.



Legend

- BUILDINGS
- RAILROAD
- ROADS
- SITES
- SVAD-067
- POTENTIAL SOURCE AREAS
- MONITORING WELLS
- GROUNDWATER FLOW DIRECTION



KEY MAP
NOT TO SCALE

N

100 50 0 100 200 300
Feet

US Army Corps of Engineers

leidos

SVAD-067
FIRE TRAINING AREA

SAVANNA ARMY DEPOT ACTIVITY
SAVANNA, ILLINOIS

PROJECT: \GIS_DATA\SVAD\Projects\Sites 67 and 84\
Figure 5-1 Site 67 Site Features.mxd

FIGURE: 5-1 | **DATE: 11/11/2020**

Based on the groundwater sampling, it was determined that human health risks from SVAD-67 were acceptable due to remediation of the soil and decrease of COC concentrations in groundwater below risk-based screening levels.

PFAS constituents were not analyzed for during the historical soil and groundwater sampling activities. Based on historical records reviews (SAIC 1999a) and recent interviews with the former SVDA Fire Chief, fire training activities at SVAD-067 may have utilized AFFF. As a result, the Army determined that an SI for potential PFOS and PFOA was necessary at SVAD-067.

5.2 CONCEPTUAL SITE MODEL

A preliminary conceptual site model (CSM) is provided in Figure 5-2. The primary release mechanism of PFAS to the environment at SVAD-067 is from the use of AFFF products to extinguish fires during firefighting training activities. During the fire training exercises, contaminants released onto the soil subsequently would have migrated to groundwater. The primary potential route of transport of PFAS constituents at SVAD-067 is to groundwater via leaching and percolation.

As discussed in Section 5.1, 20,345 cubic yards of soil were excavated and thermally treated using low-temperature thermal desorption to address TCE and PCE concentrations at SVAD-067. All treated and stabilized soil was returned to the excavation area as backfill and regraded (Four Seasons 1998). The temperatures used to achieve thermal desorption for TCE and PCE were unlikely to have reduced PFAS concentrations in soil.

Currently, SVAD-067 is inactive and visited infrequently. The planned future land use is specified in the Local Redevelopment Plan (ERA 1997) and Reuse Plan Map (MSA 1999, revised by SAIC 2018). According to this plan, the planned future land use for SVAD-067 is industrial/commercial.

5.3 SI SAMPLING AND RESULTS

The SVAD-067 SI was conducted in the fall of 2018. SI activities included the installation and sampling of three groundwater monitoring wells (MW-67PFAS-01, MW-67PFAS-02, MW-67PFAS-03). Groundwater samples were analyzed for the six UCMR3. The results for site concentrations were then compared to the USEPA LHA and the USEPA tap water RSLs. The monitoring well locations and analytical results are shown in Figure 5-3.

The three monitoring wells at SVAD-067 were placed at the potential release area (MW-67PFAS-02), as well as upgradient of (MW-67PFAS-01) and downgradient from (MW-67PFAS-03) the potential release area. The SVAD-067 potential release area was assumed to be co-located with the historical highest concentrations of soil and groundwater contaminants (i.e., TCE) and adjacent to the fire training pit. The predominant groundwater flow direction at SVAD-067 is south and was determined using data from continuous groundwater monitoring over a 12-month period (January through December 1999). The groundwater sample from the northernmost well established whether the periods of groundwater flow reversal have impacted groundwater in the typically upgradient direction from the source area. Four groundwater samples (including one field duplicate at MW-67PFAS-02) were collected at SVAD-067 and analyzed for the six UCMR3 PFAS chemicals.

All six PFAS compounds were detected in groundwater from each of the three monitoring wells (with the exception of PFHpA at MW-67PFAS-01). PFBS concentrations did not exceed the RSL of 40,000 ng/L. Individual PFOS and PFOA concentrations exceeded both the USEPA RSL of 40 ng/L and the USEPA drinking water LHA of 70 ng/L (USEPA 2016a and 2016b) at MW-67PFAS-02 and MW-67PFAS-03. At MW-67PFAS-01 (the upgradient well), PFOS was detected at 33 ng/L; therefore, it did not exceed the screening values. However, PFOA did exceed both the USEPA RSL of 40 ng/L and the USEPA drinking water LHA of 70 ng/L (USEPA 2016b). The combined PFOS and PFOA concentrations exceeded the USEPA drinking water LHA at all three monitoring wells. No screening criteria are available for PFHxS,

PFHpA, or PFNA. The analytical results are presented in Table 5-1. Data presentation tables are provided in Appendix E.

Based on the results of the SI groundwater sampling, PFOS/PFOA chemicals at levels exceeding the screening criteria are present at SVAD-067. Each of the three SVAD-067 wells contained exceedances of PFOS and/or PFOA, but the highest combined PFOS and PFOA concentration occurred in the downgradient well (MW-67PFAS-03). The presence of PFOA at concentrations exceeding the LHA in the upgradient well (MW-67PFAS-01) is indicative that the groundwater flow reversal has likely impacted groundwater in the typically upgradient direction from the source area.

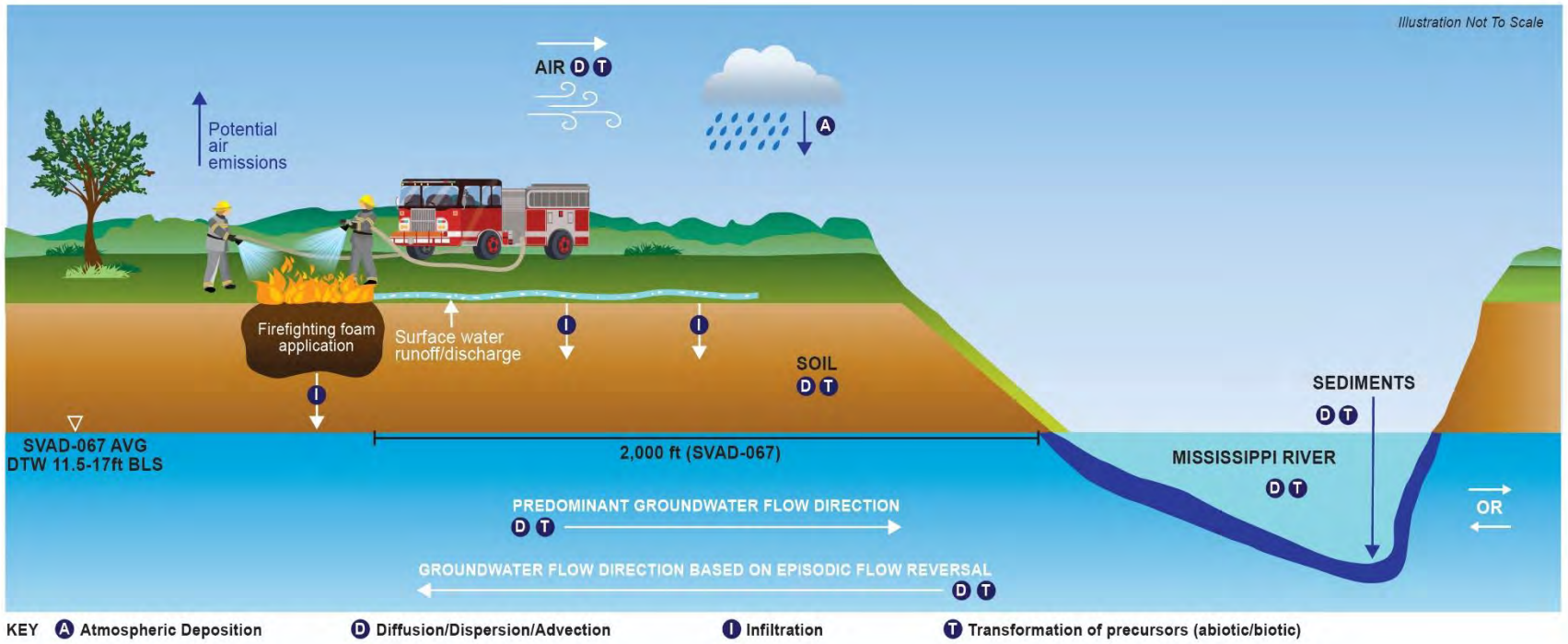


Figure 5-2. SVAD-067 Fire Training Area Preliminary Site Conceptual Model

Table 5-1. PFAS Analytical Results at SVAD-067
Savanna Army Depot Activity, Savanna, Illinois

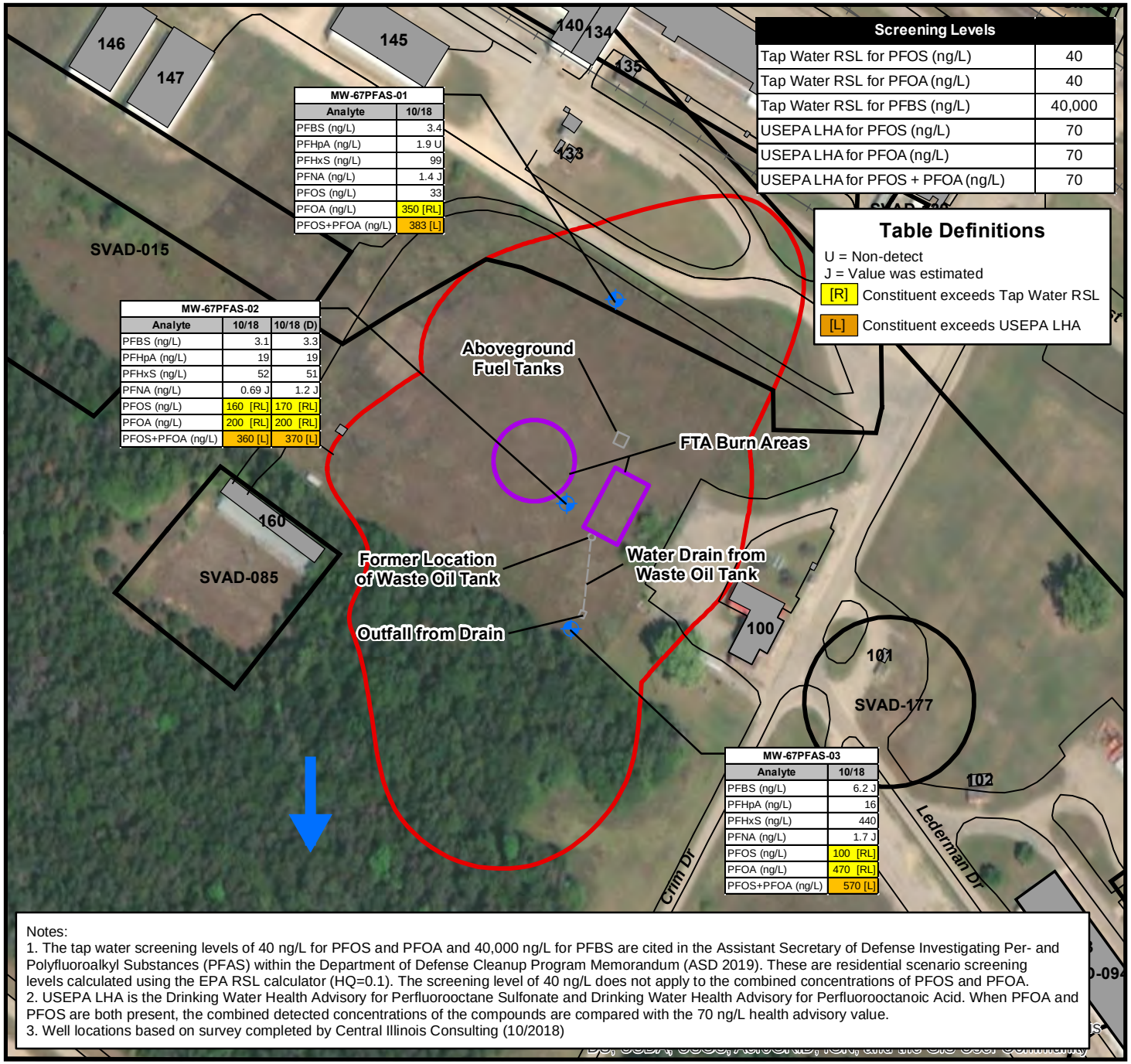
Parameter / Location ID / Sample ID / Sample Type / Depth (ft) / Sample Date	Units	Project Action Limit [P]	Tap Water RSL [T]	MW-67PFAS-01 LDOS01 WELL 17.62 10/02/2018	MW-67PFAS-02 LDOS01 WELL 17.63 10/02/2018	MW-67PFAS-02 LDOS01D WELL 17.63 10/02/2018	MW-67PFAS-03 LDOS01 WELL 19.92 10/02/2018
PFAS							
Perfluorobutane sulfonate (PFBS)	ng/L	**400000**	**40000**	**3.4**	**3.1**	**3.3**	**6.2 J**
Perfluoroheptanoic acid (PFHpA)	ng/L	N/A	N/A	1.9 U	**19**	**19**	**16**
Perfluorohexane sulfonate (PFHxS)	ng/L	N/A	N/A	**99**	**52**	**51**	**440**
Perfluorononanoic acid (PFNA)	ng/L	N/A	N/A	**1.4 J**	**0.69 J**	**1.2 J**	**1.7 J**
Perfluorooctane sulfonate (PFOS)	ng/L	**70**	**40**	**33**	**160 [P] [T]**	**170 [P] [T]**	**100 [P] [T]**
Perfluorooctanoic acid (PFOA)	ng/L	**70**	**40**	**350 [P]**	**200 [P] [T]**	**200 [P] [T]**	**470 [P][T]**
PFOS + PFOA	ng/L	**70**	**-**	**383 [P]**	**360 [P]**	**370 [P]**	**570 [P]**

Data Qualifiers:

J = Estimated concentration.
U = Chemical not detected above the laboratory detection limit.

[a] The USEPA LHA for groundwater is a drinking water advisory, as updated in 2016. When both PFOS and PFOA are detected in water, the combined concentrations of PFOS and PFOA should be compared to the 70-ng/L LHA.
[b] The tap water screening levels of 40 ng/L for PFOS and PFOA and 40,000 ng/L for PFBS are cited in the ASD *Investigating Per- and Polyfluoroalkyl Substances* within *the Department of Defense Cleanup Program* Memorandum (ASD 2019). These are residential scenario screening levels calculated using the USEPA RSL calculator (HQ=0.1). The screening level of 40 ng/L does not apply to the combined concentrations of PFOS and PFOA.

Bold values denote detected concentrations.
[P] = Concentration exceeds the USEPA LHA.
[T] = Concentration exceeds the Tap Water Screening Level.
N/A = No PAL or screening level available.



MW-67PFAS-01	
Analyte	10/18
PFBS (ng/L)	3.4
PFHpA (ng/L)	1.9 U
PFHxS (ng/L)	99
PFNA (ng/L)	1.4 J
PFOS (ng/L)	33
PFOA (ng/L)	350 [RL]
PFOS+PFOA (ng/L)	383 [L]

MW-67PFAS-02		
Analyte	10/18	10/18 (D)
PFBS (ng/L)	3.1	3.3
PFHpA (ng/L)	19	19
PFHxS (ng/L)	52	51
PFNA (ng/L)	0.69 J	1.2 J
PFOS (ng/L)	160 [RL]	170 [RL]
PFOA (ng/L)	200 [RL]	200 [RL]
PFOS+PFOA (ng/L)	360 [L]	370 [L]

MW-67PFAS-03	
Analyte	10/18
PFBS (ng/L)	6.2 J
PFHpA (ng/L)	16
PFHxS (ng/L)	440
PFNA (ng/L)	1.7 J
PFOS (ng/L)	100 [RL]
PFOA (ng/L)	470 [RL]
PFOS+PFOA (ng/L)	570 [L]

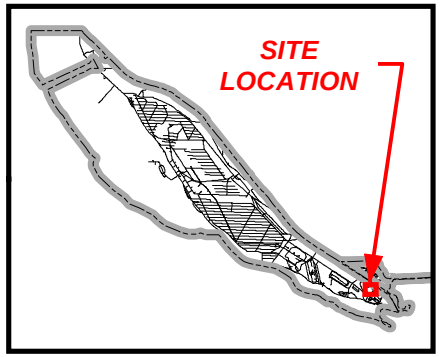
Screening Levels	
Tap Water RSL for PFOS (ng/L)	40
Tap Water RSL for PFOA (ng/L)	40
Tap Water RSL for PFBS (ng/L)	40,000
USEPA LHA for PFOS (ng/L)	70
USEPA LHA for PFOA (ng/L)	70
USEPA LHA for PFOS + PFOA (ng/L)	70

Table Definitions

U = Non-detect
J = Value was estimated
[R] Constituent exceeds Tap Water RSL
[L] Constituent exceeds USEPA LHA

Legend

- BUILDINGS
- RAILROAD
- ROADS
- SITES
- SVAD-067
- POTENTIAL SOURCE AREAS
- MONITORING WELLS
- GROUNDWATER FLOW DIRECTION



KEY MAP
NOT TO SCALE

N

100 50 0 100 200 300 Feet

Notes:
1. The tap water screening levels of 40 ng/L for PFOS and PFOA and 40,000 ng/L for PFBS are cited in the Assistant Secretary of Defense Investigating Per- and Polyfluoroalkyl Substances (PFAS) within the Department of Defense Cleanup Program Memorandum (ASD 2019). These are residential scenario screening levels calculated using the EPA RSL calculator (HQ=0.1). The screening level of 40 ng/L does not apply to the combined concentrations of PFOS and PFOA.
2. USEPA LHA is the Drinking Water Health Advisory for Perfluorooctane Sulfonate and Drinking Water Health Advisory for Perfluorooctanoic Acid. When PFOA and PFOS are both present, the combined detected concentrations of the compounds are compared with the 70 ng/L health advisory value.
3. Well locations based on survey completed by Central Illinois Consulting (10/2018)

US Army Corps of Engineers

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SVAD-067
FIRE TRAINING AREA
ANALYTICAL RESULTS

SAVANNA ARMY DEPOT ACTIVITY
SAVANNA, ILLINOIS

PROJECT: \GIS_DATA\SVAD\Projects\Sites 67 and 84\
Figure 5-3 Site 67 GW Results.mxd

FIGURE: 5-3	DATE: 11/11/2020

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6. SVAD-084 SITE HISTORY AND NATURE OF DETECTED CHEMICALS

This section presents the analytical results of the SI groundwater sampling conducted at SVAD-084.

6.1 SITE HISTORY

SVAD-084 is the Scrap Wood Open Burn Area located along West Road north of the Industrial Sewage Plant (SVAD-036) and southwest of the Chromium Ore Open Storage Area (SVAD-047). SVAD-084 is approximately 4.3 acres. The site was used to train firefighters by burning scrap wood. Wood collected from the shop areas was stockpiled at the site, covered with diesel fuel, and ignited (SAIC 1999a). In addition, two trailer structures and various other materials reportedly were burned in this area. SVDA personnel have indicated that SVAD-084 was used for more than 20 years, but open burning was limited to approximately once each year (SAIC 1999a). A strong petroleum odor was noted during the 1999 EBS visual inspection (SAIC 1999a). Open burning ended in early 2000. Figure 6-1 depicts the SVAD-084 site features.

Multiple field investigations were conducted from 1998 through 2003 to determine if chemical constituents from the Scrap Wood Open Burn Area were present. Soil gas, soil, and limited groundwater sampling was conducted at SVAD-084. Based on the results of the RI and human health risk assessment, arsenic, carcinogenic polynuclear aromatic hydrocarbons (cPAHs), dioxins, and furans in the soil were identified as COCs at SVAD-084. Although originally identified in the RI as human health risk drivers, cPAHs, dioxins, and furans were not retained as COCs in the Feasibility Study (FS) (Leidos 2015) after additional evaluation. No COCs were identified for the planned future use (i.e., worker scenario). However, the soil COC associated with unrestricted land use at SVAD-084 was arsenic. In the FS (Leidos 2015), excavation and offsite disposal were recommended as the preferred alternative for SVAD-084. An Interim Removal Action was completed in 2016. A total of approximately 3,232 tons of nonhazardous soil and debris were excavated and disposed of offsite. After removal activities were completed, confirmation soil samples were collected and ensured that the remaining soils did not contain concentrations above the remedial goal. SVAD-084 achieved the unrestricted use criteria with the successful completion of the non-time critical removal action (NTCRA) (Leidos 2017).

Based on historical records reviews (SAIC 1999a) and recent interviews with the former SVDA Fire Chief, fire training activities at SVAD-084 may have utilized AFFF. Therefore, the potential exists that either PFOS or PFOA was released at SVAD-084. As a result, the Army determined that an SI for potential PFOS and PFOA was necessary at SVAD-084.

6.2 CONCEPTUAL SITE MODEL

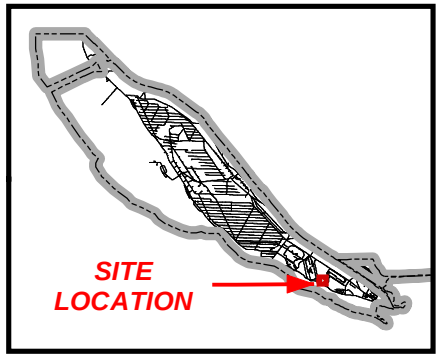
A preliminary CSM is provided in Figure 6-2. The primary release mechanism of PFAS to the environment at SVAD-084 is from the use of AFFF products to extinguish burning scrap wood fires during firefighting training activities. During the fire training exercises, contaminants released onto the soil subsequently would have migrated to groundwater. The primary potential route of transport of PFAS constituents at SVAD-084 is to groundwater via leaching and percolation.

As noted in Section 6.1, an interim removal action was completed, and approximately 3,232 tons of nonhazardous soil and debris were excavated and disposed of offsite to address arsenic concentrations. The excavation depth was approximately 1.5 feet BLS and backfilled with clean backfill. PFAS from site activities are not expected to be present within the 0- to 1.5-foot interval but may be present in the soil deeper than 1.5 feet BLS.

Currently, SVAD-084 is inactive and visited infrequently. The planned future land use is specified in the Local Redevelopment Plan (ERA 1997) and Reuse Plan Map (MSA 1999, revised by Leidos 2018c). According to this plan, the planned future land use for SVAD-084 is industrial/commercial.

Legend

- FENCES
- BURN PILE/POTENTIAL SOURCE AREA
- SITES
- SVAD-084
- IRA ACTUAL REMEDIATION AREA
- MONITORING WELLS
- GROUNDWATER FLOW DIRECTION



KEY MAP
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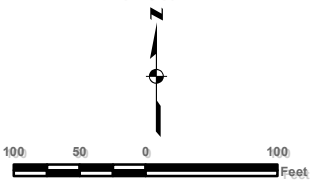

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SVAD-084
SCRAP WOOD OPEN BURN AREA

SAVANNA ARMY DEPOT
SAVANNA, ILLINOIS

PROJECT: \GIS_DATA\SVAD\Projects\
Sites 67 and 84\Figure 6-1 Site 84 Site Features.mxd

FIGURE: 6-1 | DATE: 11/11/2020

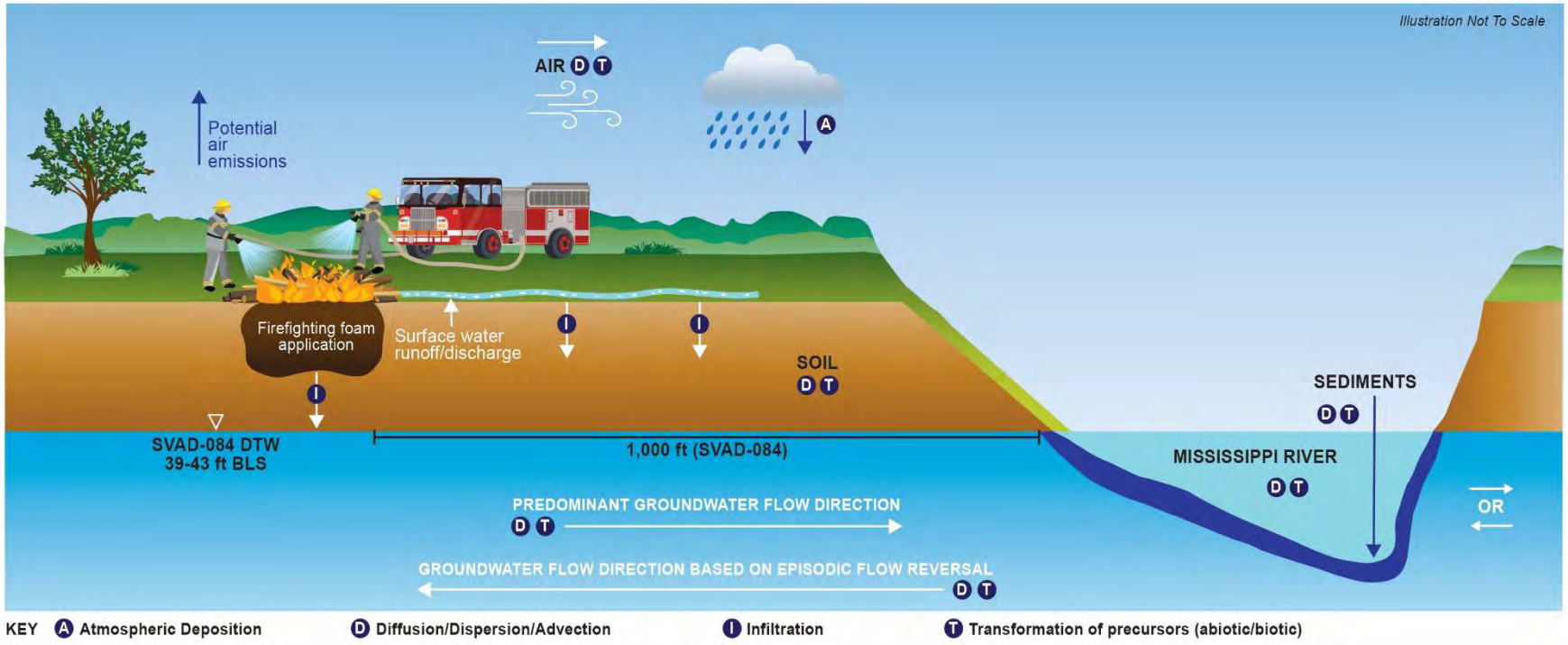


Figure 6-2. SVAD-084 Scrap Wood Open Burn Area Preliminary Site Conceptual Model

6.3 SI SAMPLING AND RESULTS

The SVAD-084 SI was conducted in the fall of 2018. SI activities included the installation and sampling of three groundwater monitoring wells (MW-84PFAS-01, MW-84PFAS-02, MW-84PFAS-03). The groundwater samples were analyzed for the six UCMR3 PFAS chemicals. The results for site concentrations of PFAS were then compared to the USEPA LHA and the tap water screening levels. The monitoring wells and the analytical results are shown in Figure 6-3.

The three monitoring wells at SVAD-084 were placed at the potential release area (MW-84PFAS-02), as well as upgradient of (MW-84PFAS-01) and downgradient from (MW-84PFAS-03) the potential release area. The SVAD-084 potential source area was defined by the area of the historical burn pile and the removal action area. The predominant groundwater flow direction at SVAD-084 is south/southwest and was determined using data from continuous groundwater monitoring over a 12-month period (January through December 1999). The groundwater sample from the northernmost well (MW-84PFAS-01) established whether the periods of groundwater flow reversal have impacted groundwater in the typically upgradient direction from the potential source area. Three groundwater samples were collected at SVAD-084 and analyzed for the six UCMR3 PFAS chemicals.

PFBS was the only PFAS compound detected in all three monitoring wells; however, PFBS concentrations did not exceed the RSL of 40,000 ng/L in any of the wells. With the exception of PFBS, no other PFAS compounds were detected in upgradient well MW-84PFAS-01.

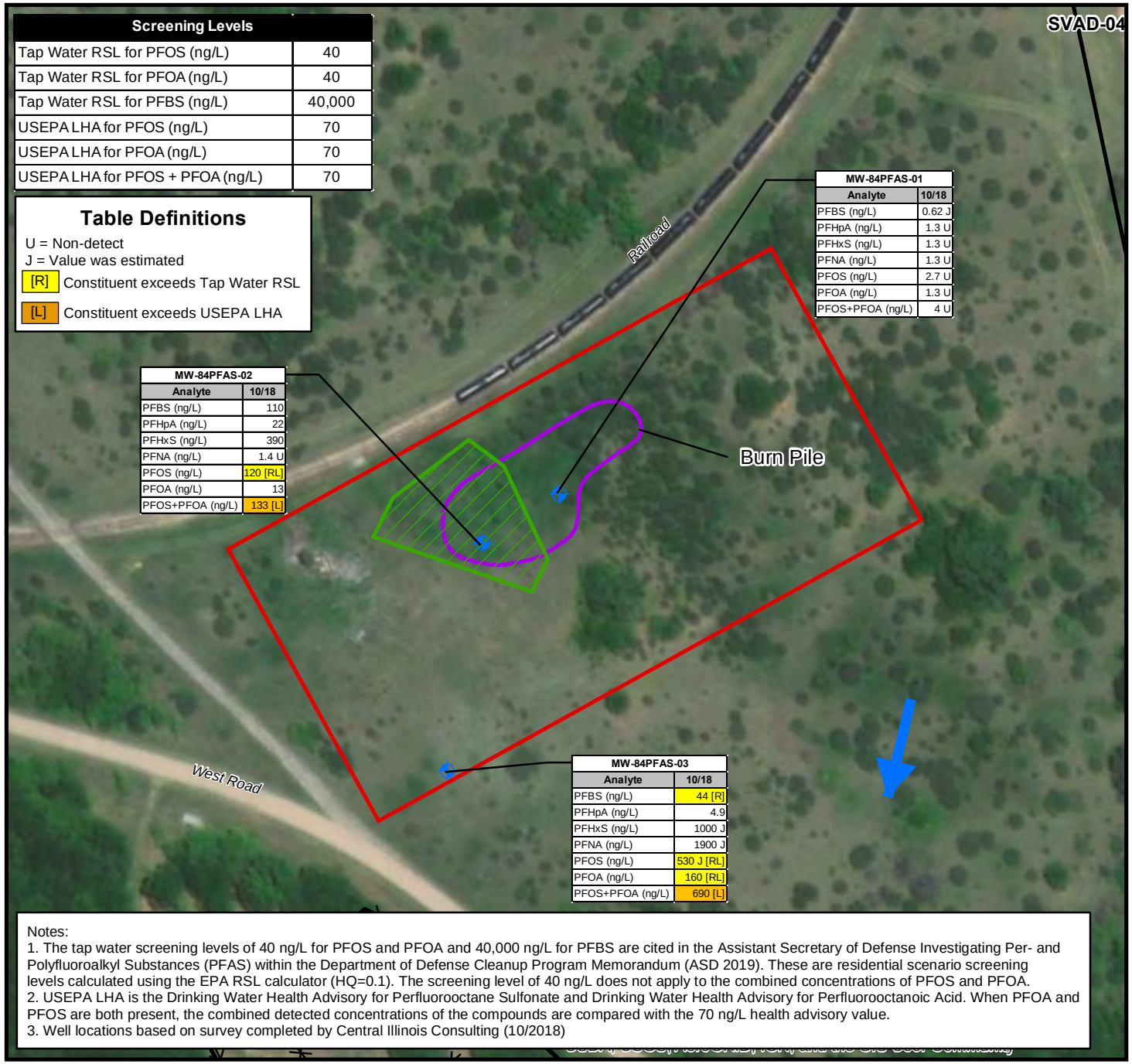
Five of the six PFAS compounds (PFNA was not detected) were detected in groundwater from source area well MW-84PFAS-02. No screening criteria are available for PFHxS, PFHpA, or PFNA. The individual PFOS concentration exceeded both the USEPA RSL of 40 ng/L (ASD 2019) and the USEPA drinking water LHA of 70 ng/L (USEPA 2016a) at MW-84PFAS-02; however, the PFOA concentration at MW-84PFAS-02 did not exceed the screening values. The combined PFOS and PFOA concentrations exceeded the USEPA drinking water LHA at source area well MW-84PFAS-02.

All six PFAS compounds were detected in groundwater from downgradient well MW-84PFAS-03. The individual PFOS and PFOA concentrations exceeded both the USEPA RSL of 40 ng/L (ASD 2019) and the EPA drinking water LHA of 70 ng/L (USEPA 2016a and 2016b), and the combined PFOS and PFOA concentrations exceeded the 70-ng/L USEPA drinking water LHA (USEPA 2016a and 2016b) at MW-84PFAS-03. Analytical results for SVAD-084 are presented in Table 6-1.

Screening Levels	
Tap Water RSL for PFOS (ng/L)	40
Tap Water RSL for PFOA (ng/L)	40
Tap Water RSL for PFBS (ng/L)	40,000
USEPA LHA for PFOS (ng/L)	70
USEPA LHA for PFOA (ng/L)	70
USEPA LHA for PFOS + PFOA (ng/L)	70

Table Definitions

U = Non-detect
J = Value was estimated
[R] Constituent exceeds Tap Water RSL
[L] Constituent exceeds USEPA LHA



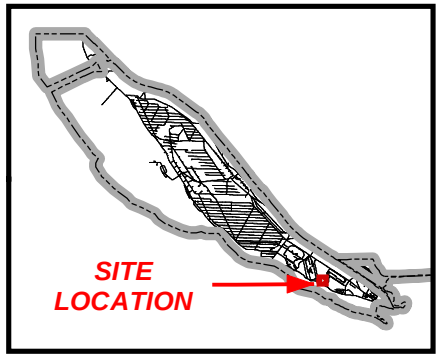
MW-84PFAS-01	
Analyte	10/18
PFBS (ng/L)	0.62 J
PFHpA (ng/L)	1.3 U
PFHxS (ng/L)	1.3 U
PFNA (ng/L)	1.3 U
PFOS (ng/L)	2.7 U
PFOA (ng/L)	1.3 U
PFOS+PFOA (ng/L)	4 U

MW-84PFAS-02	
Analyte	10/18
PFBS (ng/L)	110
PFHpA (ng/L)	22
PFHxS (ng/L)	390
PFNA (ng/L)	1.4 U
PFOS (ng/L)	120 [RL]
PFOA (ng/L)	13
PFOS+PFOA (ng/L)	133 [L]

MW-84PFAS-03	
Analyte	10/18
PFBS (ng/L)	44 [R]
PFHpA (ng/L)	4.9
PFHxS (ng/L)	1000 J
PFNA (ng/L)	1900 J
PFOS (ng/L)	530 J [RL]
PFOA (ng/L)	160 [RL]
PFOS+PFOA (ng/L)	690 [L]

Legend

- FENCES
- BURN PILE/POTENTIAL SOURCE AREA
- SITES
- SVAD-084
- IRA ACTUAL REMEDIATION AREA
- MONITORING WELLS
- GROUNDWATER FLOW DIRECTION



KEY MAP
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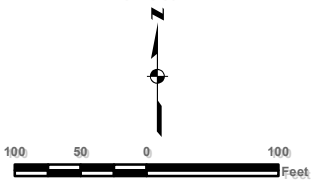

Notes:
1. The tap water screening levels of 40 ng/L for PFOS and PFOA and 40,000 ng/L for PFBS are cited in the Assistant Secretary of Defense Investigating Per- and Polyfluoroalkyl Substances (PFAS) within the Department of Defense Cleanup Program Memorandum (ASD 2019). These are residential scenario screening levels calculated using the EPA RSL calculator (HQ=0.1). The screening level of 40 ng/L does not apply to the combined concentrations of PFOS and PFOA.
2. USEPA LHA is the Drinking Water Health Advisory for Perfluorooctane Sulfonate and Drinking Water Health Advisory for Perfluorooctanoic Acid. When PFOA and PFOS are both present, the combined detected concentrations of the compounds are compared with the 70 ng/L health advisory value.
3. Well locations based on survey completed by Central Illinois Consulting (10/2018)

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SVAD-084
SCRAP WOOD OPEN BURN AREA
ANALYTICAL RESULTS
SAVANNA ARMY DEPOT
SAVANNA, ILLINOIS

PROJECT: \GIS_DATA\SVAD\Projects\
Sites 67 and 84\Figure 6-3 Site 84 GW Results.mxd

FIGURE: 6-3 | DATE: 11/11/2020

Table 6-1. PFAS Analytical Results at SVAD-084
Savanna Army Depot Activity, Savanna, Illinois

Parameter	Location ID Sample ID Sample Type Depth (ft) Sample Date	Units	Project Action Limit [P]	Tap Water RSL [T][b]	MW-84PFAS-01 LDOS01 WELL 42.84 10/03/2018	MW-84PFAS-02 LDOS01 WELL 43.84 10/03/2018	MW-84PFAS-03 LDOS01 WELL 41.18 10/02/2018
PFAS							
Perfluorobutane sulfonate (PFBS)		ng/L	N/A	**40000**	**0.62 J**	**110**	**44**
Perfluoroheptanoic acid (PFHpA)		ng/L	N/A	N/A	1.3 U	**22**	**4.9**
Perfluorohexane sulfonate (PFHxS)		ng/L	N/A	N/A	1.3 U	**390**	**1000 J**
Perfluorononanoic acid (PFNA)		ng/L	N/A	N/A	1.3 U	1.4 U	**1900 J**
Perfluorooctane sulfonate (PFOS)		ng/L	**70**	40	2.7 U	**120 [P][T]**	**530 J [P][T]**
Perfluorooctanoic acid (PFOA)		ng/L	**70**	40	1.3 U	**13**	**160 [P][T]**
PFOS + PFOA		ng/L	**70**	**-**	**4.0 U**	**133 [P]**	**690 [P]**

Data Qualifiers:

J = Estimated concentration.
U = Chemical not detected above the laboratory detection limit.

[a] The USEPA LHAs for groundwater is a drinking water advisory, as updated in 2016. When both PFOS and PFOA are detected in water, the combined concentrations of PFOS and PFOA should be compared to the 70-ng/L LHA.
[b] The tap water screening levels of 40 ng/L for PFOS and PFOA and 40,000 ng/L for PFBS are cited in the ASD *Investigating Per- and Polyfluoroalkyl Substances within the Department of Defense Cleanup Program* Memorandum (ASD 2019). These are residential scenario screening levels calculated using the USEPA RSL calculator (HQ=0.1). The screening level of 40 ng/L does not apply to the combined concentrations of PFOS and PFOA.

Bold values denote detected concentrations.
[P] = Concentration exceeds the USEPA LHA.
[T] = Concentration exceeds the Tap Water Screening Level.
N/A = No Project Action Limit or screening level available.

Based on the results of the SI groundwater sampling, PFOS and PFOA at levels exceeding the screening criteria are present at SVAD-084. The highest concentrations of PFOS and PFOA were detected in the downgradient well (MW-84PFAS-03). Given the presence and magnitude of PFOS and PFOA at the SVAD-084 site boundary, it is likely that the contamination is migrating downgradient with potential to impact SVAD-036.

7. SUMMARY AND CONCLUSIONS

In accordance with the June 10, 2016, Department of the Army policy regarding PFAS contamination assessment (Department of the Army 2016), the Army sampled the SVDA Lower Post drinking water on September 26, 2016. The groundwater production well provides the sole source of potable water for the Installation. This well, also known as the Lower Post Bedrock Well, is located in Building 107 and is approximately 1,200 feet deep. The six UCMR3 PFAS compounds were analyzed for and not detected.

Fire training activities at SVAD-067 and SVAD-084 were determined to have utilized AFFF based on historical records reviews (SAIC 1999a) and recent interviews with the former SVDA Fire Chief. The former SVDA Fire Chief was a firefighter during the 1960s and 1970s and was the SVDA Fire Chief from 1987 to 1995. The former SVDA Fire Chief indicated that FTA activities at SVAD-067 utilized AFFF mixed with water and FTA activities at SVAD-084 utilized water and 3M Light Water. 3M Light Water was the brand name for a firefighting foam manufactured by 3M that contained PFOS. As a result, the groundwater at SVAD-067 and SVAD-084 were evaluated for PFOS/PFOA in this SI.

The principal objective of the SI was to gather sufficient information to determine if PFOS/PFOA constituents are present at the sites at concentrations exceeding the USEPA LHA and the tap water screening levels that were calculated using the USEPA RSL calculator and referenced in DoD guidance (ASD 2019). Three monitoring wells were installed, sampled, and analyzed for the six UCMR3 PFAS compounds at each site. PFOS and PFOA concentrations were compared to the USEPA LHA and the tap water screening level.

The SI groundwater sampling results indicate PFOS/PFOA chemicals are present at levels exceeding both the USEPA LHA and the groundwater screening level at SVAD-067 and SVAD-084. The combined PFOS and PFOA concentrations exceeded the LHA at all three monitoring wells at SVAD-067 and at two of the three wells at SVAD-084. A single concentration of PFOS or PFOA exceeded the tap water screening level of 40 ng/L at each site.

It is important to note that the drinking water source at SVDA (i.e., the bedrock production well) was sampled and the six UCMR3 PFAS compounds were not detected. In addition, the contaminated shallow groundwater at issue at SVAD-067 and SVAD-084 is not a source of drinking water. However, more information is needed at this time to determine the risk to human health and the environment at SVAD-067 and SVAD-084 based on the current or planned future land use at SVDA (industrial/commercial).

SVAD-067 is one of several sites that are in the FS stage of the CERCLA process (SVAD-015, SVAD-033, SVAD-067, SVAD-223, and SVAD-006-R-01). The Army intends to proceed with the FS that is currently underway but expand the FS to include a focused RI for PFAS at SVAD-067. The focused RI/FS would define the nature and extent of PFAS at SVAD-067. SVAD-084 is at the Proposed Plan stage of the CERCLA process. The Army intends to pause the Proposed Plan in order to complete a Focused RI and FS for PFAS at SVAD-084. The focused RI would define the nature and extent of PFAS at SVAD-084. The results of the focused RI/FS will be incorporated into the Proposed Plan for SVAD-084.

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APPENDIX A

SVDA DRINKING WATER PFAS DATA

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NORTHERN LAKE SERVICE, INC.
Analytical Laboratory and Environmental Services
400 North Lake Avenue - Crandon, WI 54520
Ph: (715)-478-2777 Fax: (715)-478-3060

ANALYTICAL REPORT

WDNR Laboratory ID No. 721026460
WDATCP Laboratory Certification No. 105-330
EPA Laboratory ID No. WI00034

Client: Savanna Army Depot/JoCarroll Depot LRA
Attn: Tim Schoenig
2000 Portland Avenue
Savannah, IL 61074

NLS Project: 268235
NLS Customer: 108541
Phone: 815 238 1490

Project: Perfluorinated Compounds

3159 Crain Dr NLS ID: 948928

Matrix: DW
Collected: 09/26/16 08:00 Received: 09/27/16

Parameter	Result	Units	Dilution	MRL	Analyzed	Method	Lab
Perfluorinated Chemicals by EPA Method 537	see attached				10/01/16	EPA 537	721026460
Solid Phase Extraction by EPA Method 537	yes				09/29/16	EPA 537	721026460

Field Blank NLS ID: 948929

Matrix: FB
Collected: 09/26/16 08:00 Received: 09/27/16

Parameter	Result	Units	Dilution	MRL	Analyzed	Method	Lab
Perfluorinated Chemicals by EPA Method 537	not analyzed				10/01/16	EPA 537	721026460
Solid Phase Extraction by EPA Method 537	not analyzed				10/01/16	EPA 537	721026460

Values in brackets represent results greater than or equal to the LOD but less than the LOQ and are within a region of "Less-Certain Quantitation". Results greater than or equal to the LOQ are considered to be in the region of "Certain Quantitation". LOD and/or LOQ tagged with an asterisk(*) are considered Reporting Limits. All LOD/LOQs adjusted to reflect dilution and/or solids content.

ND = Not Detected (< LOD) LOD = Limit of Detection LOQ = Limit of Quantitation NA = Not Applicable
DWB = Dry Weight Basis %DWB = (mg/kg DWB) / 10000 1000 ug/L = 1 mg/L
MCL = Maximum Contaminant Levels for Drinking Water Samples. Shaded results indicate >MCL.

Reviewed by:

Authorized by:
R. T. Krueger
President

ANALYTICAL RESULTS: Perfluorinated Chemicals by EPA 537 UCMR3 Safe Drinking Water Analysis

Customer: Savanna Army Depot/JoCarroll Depot LRA NLS Project: 268235

Project Description: Perfluorinated Compounds

Project Title: Template: 537PPT Printed: 10/03/2016 14:40

Sample: 948928 3159 Crain Dr Collected: 09/26/16 Analyzed: 10/01/16 - Analytes: 6

ANALYTE NAME	RESULT	UNITS	WWB	DIL	MRL	MCL	Note
perfluorobutanesulfonic acid (PFBS)	ND	ppt		1	90		
perfluoroheptanoic acid (PFHpA)	ND	ppt		1	10		
perfluorohexanesulfonic acid (PFHxS)	ND	ppt		1	30		
perfluorooctanoic acid (PFOA)	ND	ppt		1	20		
perfluorononanoic acid (PFNA)	ND	ppt		1	20		
perfluorooctanesulfonic acid (PFOS)	ND	ppt		1	40		
C13-PFHxA (SURR)	95.519%						S
C13-PFDA (SURR)	99.117%						S

NOTES APPLICABLE TO THIS ANALYSIS:

S = This compound is a surrogate used to evaluate the quality control of a method.

APPENDIX B

WELL CONSTRUCTION, WELL DEVELOPMENT, AND GROUNDWATER SAMPLING LOGS

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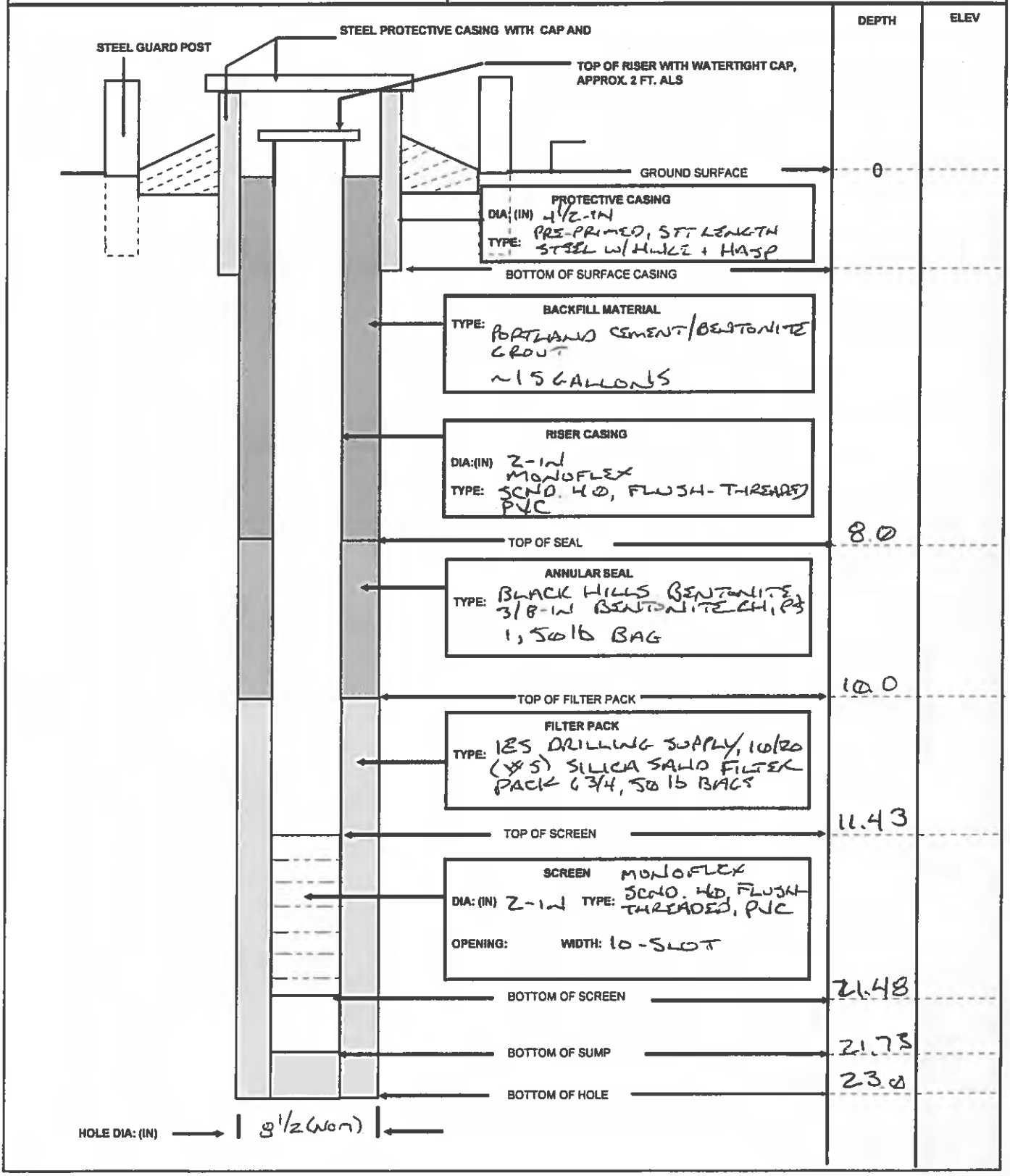
MONITORING WELL (STICK-UP)

PROJECT NAME: SWAB PFAS SI **DELIVERY ORDER NO:**

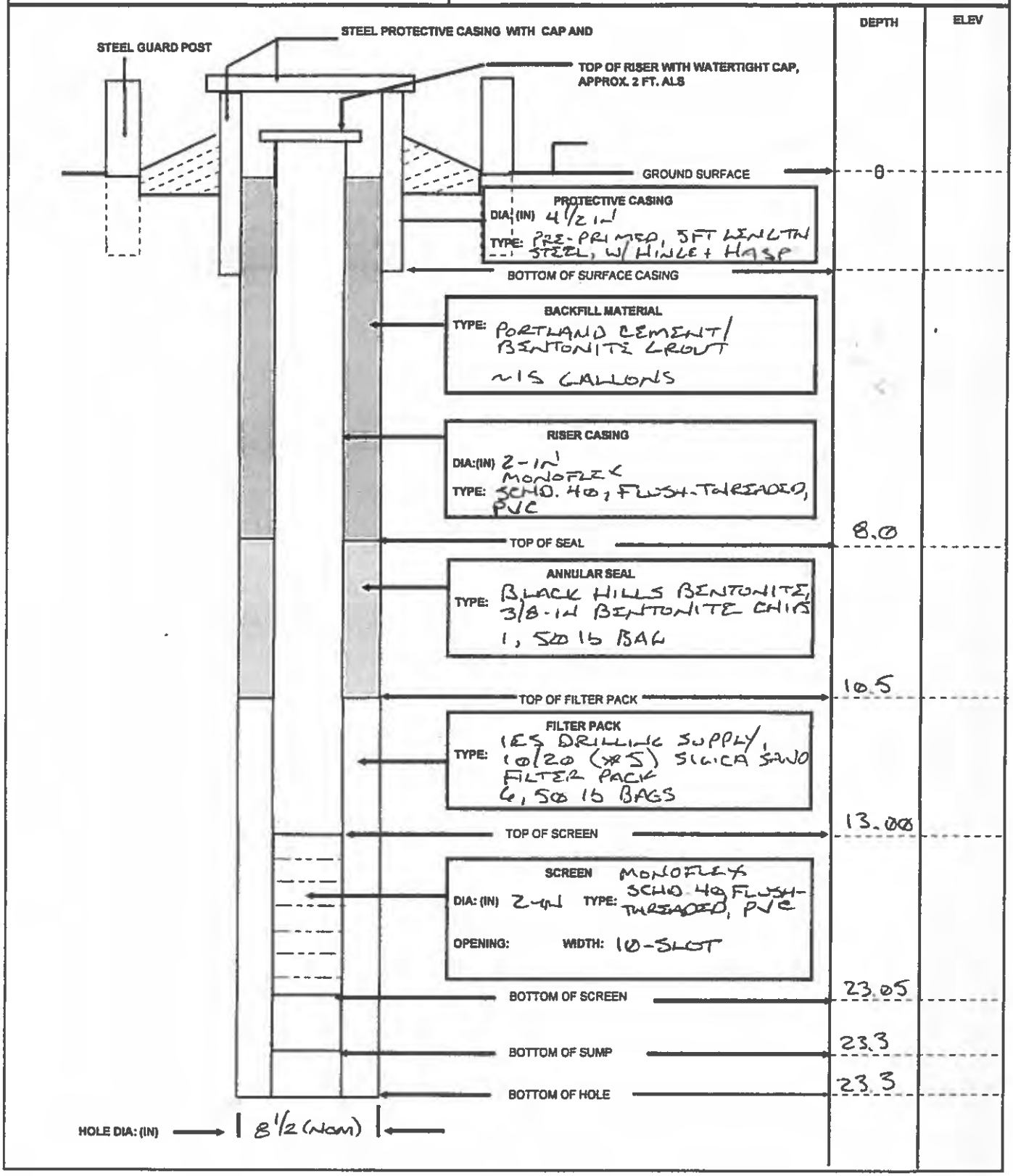
WELL NUMBER: MW-67PFAS-01	BEGIN: 9/6/18	END: 9/10/18
COORDINATES: N: E:	REFERENCE POINT:	ELEVATION: MSL



MONITORING WELL (STICK-UP)

PROJECT NAME: SWAO PFAS SI **DELIVERY ORDER NO:**

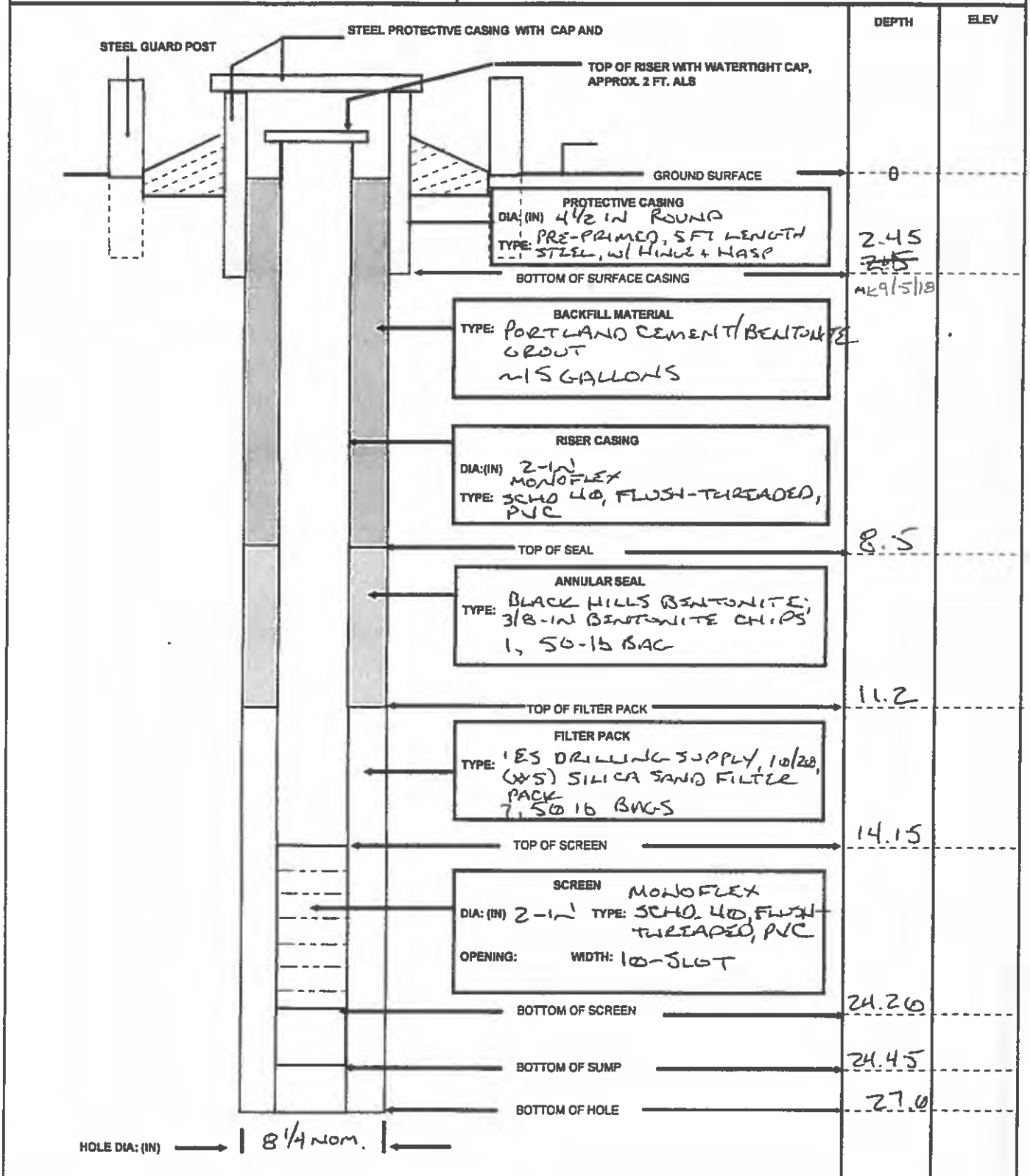
WELL NUMBER: MW-67PFAS-02	BEGIN: 9/6/18	END: 9/10/18
COORDINATES: N: E:	REFERENCE POINT:	ELEVATION: MSL



MONITORING WELL (STICK-UP)

PROJECT NAME: SVAD PFAS SI **DELIVERY ORDER NO:**

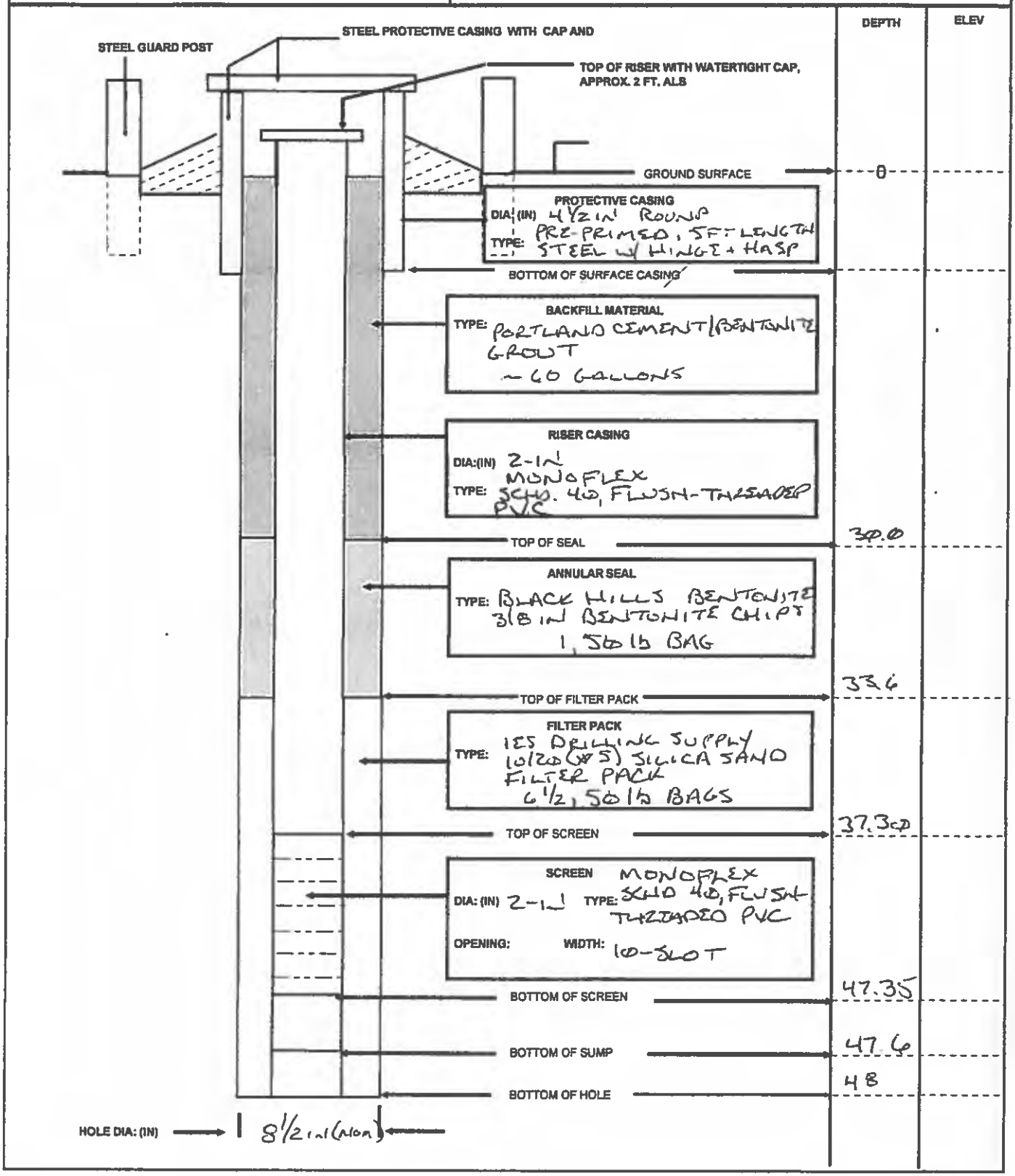
WELL NUMBER: MW-67PFAS-03	BEGIN: 9/5/18	END: 9/10/18
COORDINATES: N: E:	REFERENCE POINT:	ELEVATION: MSL



MONITORING WELL (STICK-UP)

PROJECT NAME: SWAD PFAS SI **DELIVERY ORDER NO:**

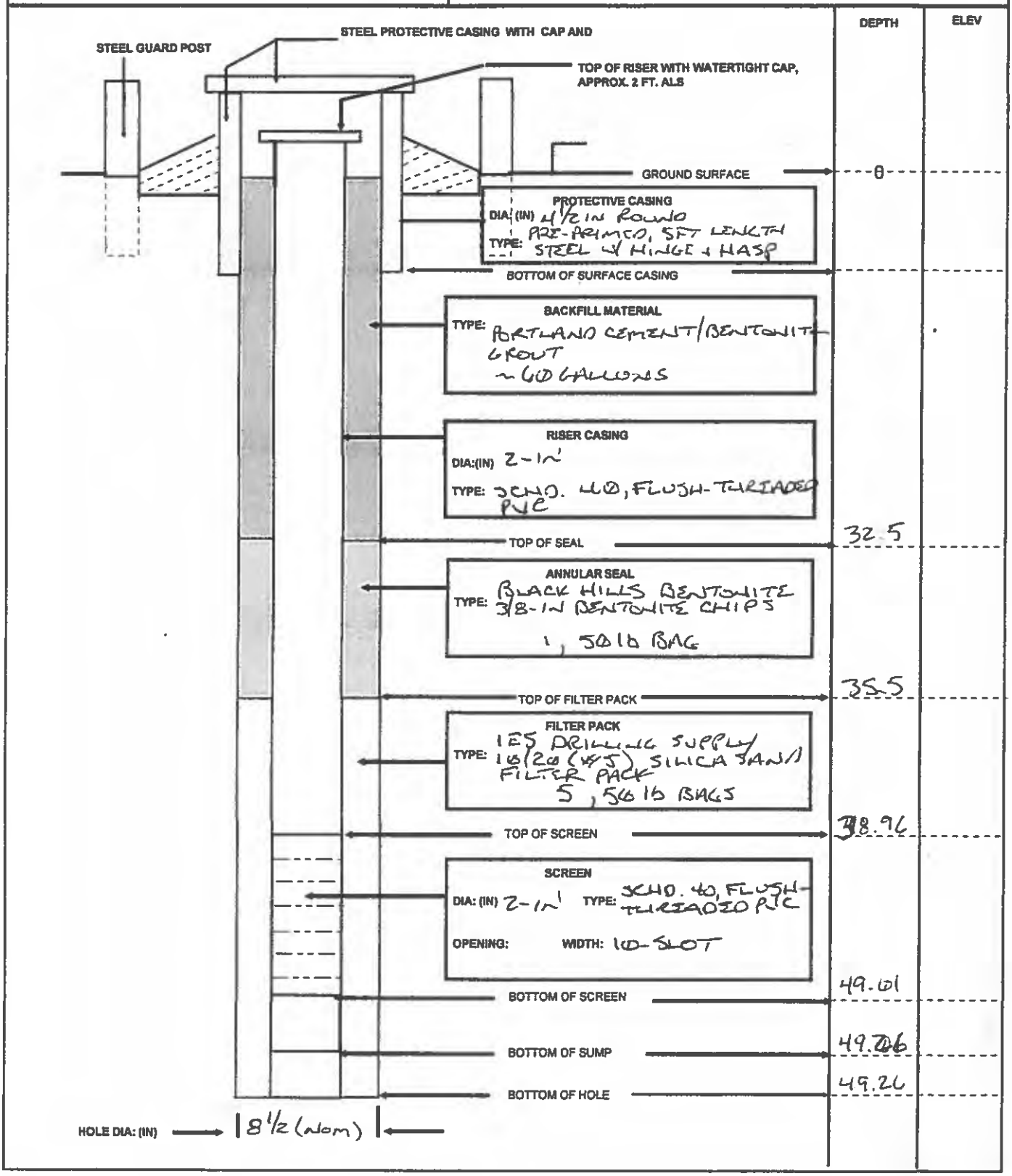
WELL NUMBER: MW-84PFAS-01	**BEGIN:** 9/7/18	**END:** 9/10/18
COORDINATES: N: E:	**REFERENCE POINT:**	**ELEVATION:** MSL



MONITORING WELL (STICK-UP)

PROJECT NAME: SVAO PFAS SI **DELIVERY ORDER NO:**

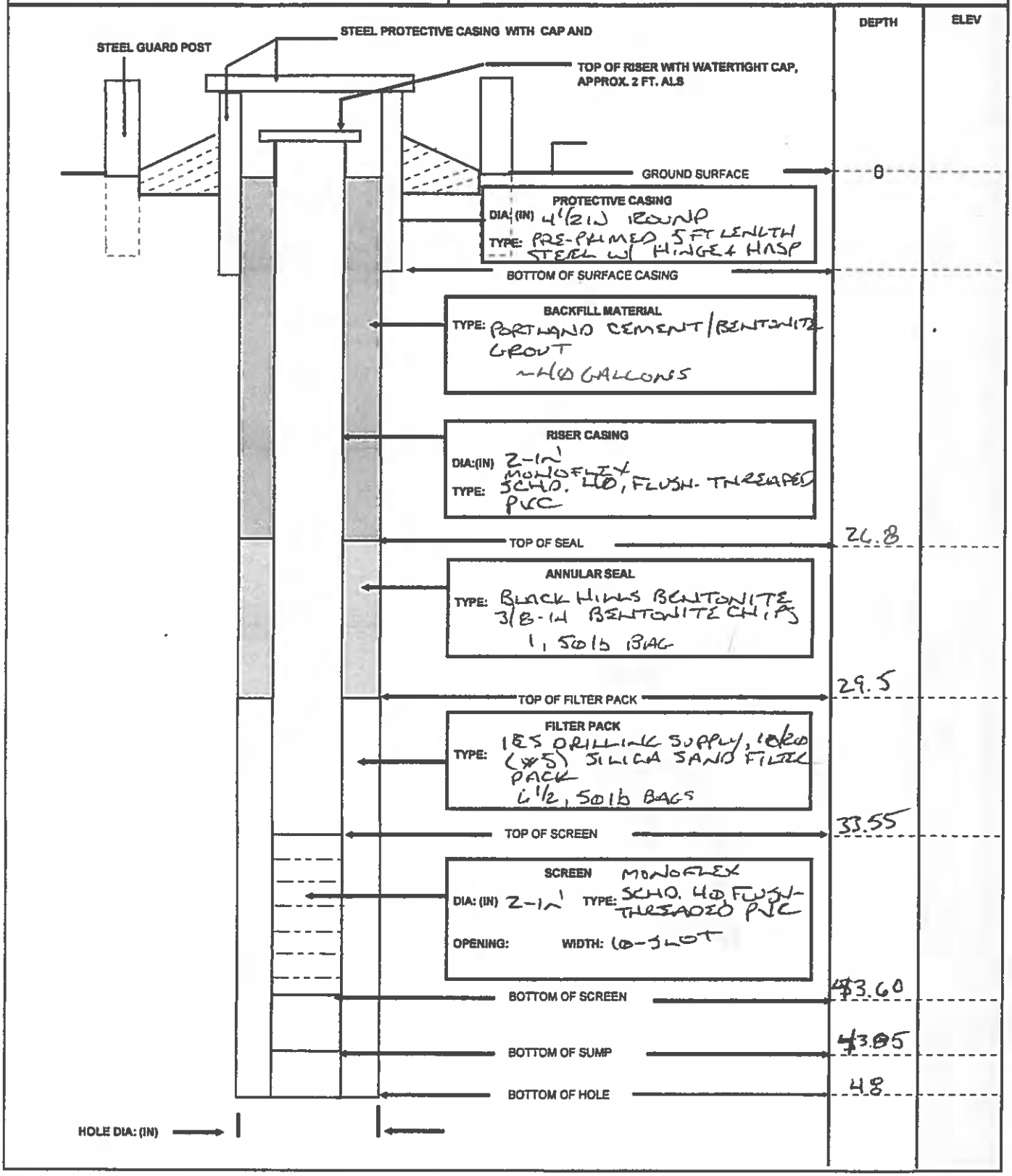
WELL NUMBER: MW-84PFAS-02	**BEGIN:** 9/7/18	**END:** 9/10/18
COORDINATES: N: E:	**REFERENCE POINT:**	**ELEVATION:** MSL



MONITORING WELL (STICK-UP)

PROJECT NAME: SVAD PFAS SI **DELIVERY ORDER NO:**

WELL NUMBER: MW-84PFAS-03	**BEGIN:**	**END:** 9/10/18
COORDINATES: N: E:	**REFERENCE POINT:**	**ELEVATION:** MSL



WELL DEVELOPMENT FORM

PROJECT NAME: SVAD PFAS SI **DELIVERY ORDER NO:**

Date: 9/9/18 Time: 1430

Well Number and Location: MW-67PFAS-01 SVAD SITE 67

Comments : WATER INITIALLY BAILED AND PUMPED WAS VERY TURBID; APPEARANCE OF COFFEE.

MK 9/9/18

Water Levels / Time: Initial: 17.20 / 12:12 Pumping: 17.20 / VARIOUS

Final: 17.20 / 14:30

Total Well Depth: Initial: 25.62 FT BTOC Final: 25.62 FT BTOC

Date and Time: Begin: 9/9/18 / 12:12 Completed: 9/9/18 / 14:30

Development Method(S): BAIL/SUCK W/ DISPOSABLE BAILER. PUMP W/ MONSOON SUBMERSIBLE PUM

Total Quantity of Water Removed: 54 gals

FIELD MEASUREMENT	SERIAL NUMBER	DATE OF LAST CALIBRATION
Temperature	QED-MP-20	9/9/18
Specific Conductivity		
pH		
Turbidity		N/A
DO	—	—
ORP	—	—

WELL DEVELOPMENT SUMMARY

PROJECT NAME: SVAO PFAS SI **DELIVERY ORDER NO:**

WELL NUMBER: MW-67PFAS-01

DATE	BEGINNING TIME	GALLONS REMOVED	TEMP (C)	SPECIFIC CONDUCTIVITY ~~(µMHOS/CM)~~ mS/cm	pH (STANDARD UNITS)	TURBIDITY (NTU)	TOTAL GALLONS REMOVED	WELL VOLUMES REMOVED	WL (FT BTOC)	COMMENTS
9/9/18	1330	30	15.26	0.343	5.74	98.3	30	21.4	17.20	PUMPING AT 840 mL/MIN
	1340	~4	13.53	0.291	6.08	63.7	34	24.3	17.20	
	1350	~4	13.37	0.297	6.10	19.3	38	27.1	17.20	
	1400	~4	13.32	0.294	6.09	20.0	42	30.0	17.20	
	1410	~4	13.54	0.293	6.09	22.1	46	32.9	17.20	
	1420	~4	13.41	0.290	6.10	26.3	50	35.7	17.20	
	1425	~2	13.38	0.289	6.13	2.5	52	37.1	17.20	
	1430	~2	13.41	0.290	6.13	3.1	54	38.6	17.20	
			DEVELOPMENT COMPLETED							
										1 CASING VOLUME = 1.4 GALLONS

mk 9/9/18

RECORDED BY: [signature] 9/9/18 QA CHECKED BY: [signature] 9/10/18

WELL DEVELOPMENT FORM

PROJECT NAME: SVAO PFAS SI **DELIVERY ORDER NO:**

Date: 9/9/18 Time: 1215

Well Number and Location: MW-67PFAS-02 SVAO SITE 67

Comments : WATER INITIALLY PUMP BAILED / PUMPED WAS TURBID; mk 9/9/18
APPEARANCE OF COFFEE. TURBIDITY DECLINED
RAPIDLY AFTER ~15 GALLONS REMOVED.
— MK 9/9/18 —

Water Levels / Time: Initial: 17.98 / ~~17.98~~ 10:35 Pumping: 18.01 / VARIOUS
mk 9/9/18
Final: 18.01 / 1215

Total Well Depth: Initial: 25.71 FT BTOC Final: 25.71 FT BTOC

Date and Time: Begin: 9/9/18 / 1035 Completed: 9/9/18 / 12:15

Development Method(S): BAIL/SURGE W/ NEW DISPOSABLE BAILER, PUMP W/
SUBMERSIBLE PUMP.

Total Quantity of Water Removed: 37 gals

FIELD MEASUREMENT	SERIAL NUMBER	DATE OF LAST CALIBRATION
Temperature	QED MP-20 EE&S NO: 14369	9/9/18
Specific Conductivity	↓	↓
pH	↓	↓
Turbidity	↓	N/A
DO	—	—
ORP	—	—

WELL DEVELOPMENT SUMMARY

PROJECT NAME: SWAD PFAS SJ **DELIVERY ORDER NO:**

WELL NUMBER: MW-67PFAS-02

DATE	BEGINNING TIME	GALLONS REMOVED	TEMP (C)	SPECIFIC CONDUCTIVITY ~~(uMHOS/CM)~~ mS/cm AC 9/18	pH (STANDARD UNITS)	TURBIDITY (NTU)	TOTAL GALLONS REMOVED	WELL VOLUMES REMOVED	WL (FT BTOC)	COMMENTS
9/9/18	1135	25	13.57	0.458	5.90	94.0	25	19.8	18.01	
	1145	~3	13.51	0.465	6.69	9.5	28	22.2	18.01	
	1155	~3	14.12	0.467	6.84	4.3	31	24.6	18.01	
	1205	~3	13.66	0.467	6.88	4.1	34	27.0	18.01	
	1215	~3	14.00	0.468	6.90	3.4	37	29.4	18.01	
			DEVELOPMENT		COMPLETED					

AC 9/9/18

1 well volume = 1.26 gallons

RECORDED BY: [signature] 9/9/18

QA CHECKED BY: [signature] 9/10/18

WELL DEVELOPMENT FORM

PROJECT NAME: SWAD PFAS SI **DELIVERY ORDER NO:**

Date: 9/9/18 Time: 10:10

Well Number and Location: MW-67PFAS-03 SWMU SITE 67

Comments : WATER VERY TURBID THROUGH FIRST 20 GALLONS REMOVED, THEN CLEARED RAPIDLY

MK 9/9/18

Water Levels / Time: Initial: 12.55 / 0740 Pumping: 12.58 / ~~12.5~~ VARIOUS

MK 9/9/18

Final: 12.58 / 1010

Total Well Depth: Initial: 26.58 FT BTOC Final: 26.60 FT BTOC

Date and Time: Begin: 9/9/18 / 07:40 Completed: 9/9/18 / 10:10

Development Method(S): BAIL/SURGE W/ DISPOSABLE BAILEE. PUMP W/ SUBMERSIBLE PUMP

Total Quantity of Water Removed: 53 gals

FIELD MEASUREMENT	SERIAL NUMBER	DATE OF LAST CALIBRATION
Temperature	QED MP-20 EERS NO: 16369	9/9/18
Specific Conductivity	↓	↓
pH	↓	↓
Turbidity	↓	N/A
DO	—	N/A
ORP	—	N/A

WELL DEVELOPMENT SUMMARY

PROJECT NAME: SVAO PFAS SI **DELIVERY ORDER NO:**

WELL NUMBER: MW-67PFAS-03

DATE	BEGINNING TIME	GALLONS REMOVED	TEMP (C)	SPECIFIC CONDUCTIVITY ~~(UMHOS/CM)~~ MS/cm 9/9/18	pH (STANDARD UNITS)	TURBIDITY (NTU)	TOTAL GALLONS REMOVED	WELL VOLUMES REMOVED	COMMENTS WL (FT BTOC)
9/9/18	0849	29	12.38	0.120	5.53	647	29	12.6	12.58
	0900	3	12.39	0.119	5.83	254	32	13.9	12.58 WL STABLE PUMPING AT 720 mL/MIN
	0910	3	12.55	0.118	5.87	180	35	15.2	12.58
	0920	3	12.62	0.118	5.89	115	38	16.5	12.58
	0930	3	12.46	0.116	5.91	76.1	41	17.8	12.58 920 mL/MIN
	0940	3	12.45	0.117	5.92	51.6	44	19.1	12.58
	0950	3	12.48	0.117	5.93	19.5	47	20.4	12.58
	1000	3	12.54	0.116	5.94	10.7	50	21.7	12.58
	1005	~1.5	12.58	0.116	5.94	11.4	51.5	22.4	12.58
	1010	~1.5	12.58	0.116	5.95	10.6	53	23.0	12.58
		DEVELOPMENT		COMPLETED					
									CASING VOLUME = 2.3 GALLONS

MK 9/9/18

RECORDED BY: [signature] 9/9/18 QA CHECKED BY: [signature] 9/10/18

WELL DEVELOPMENT SUMMARY

PROJECT NAME: SVAD PFAS SI **DELIVERY ORDER NO:**

WELL NUMBER: MW-84PFAS-01

DATE	BEGINNING TIME	GALLONS REMOVED	TEMP (C)	SPECIFIC CONDUCTIVITY (µMHOS/CM)	pH (STANDARD UNITS)	TURBIDITY (NTU)	TOTAL GALLONS REMOVED	WELL VOLUMES REMOVED	WL fx. BTOC COMMENTS
9/10/18	1010	27	13.04	0.279	6.51	302	27		43.23
	1020	~3	13.12	0.282	7.08	22.3	30		43.23
	1030	~3	13.27	0.281	7.25	11.5	33		43.23
	1040	~3	13.01	0.283	7.34	8.0	36		43.23
↓	1050	~3	13.18	0.278	7.28	7.9	39		43.23
				DEVELOPMENT COMPLETED					

MV 9/10/18

RECORDED BY: Clh 9/10/18 QA CHECKED BY:

WELL DEVELOPMENT FORM

PROJECT NAME: SVAO PFAS SI **DELIVERY ORDER NO:**

Date: 9/10/18 Time: 12:35

Well Number and Location: MW-84PFAS-03

Comments : FIRST BAILED/PUMPED WATER TURBID, APPEARANCE OF COFFEE. CLEARED RAPIDLY AFTER ~15 GALLONS REMOVED. MK 9/10/18

Water Levels / Time: Initial: 42.72 / 10:35 Pumping: 42.75 / VARIOUS

Final: 42.75 / 12:35

Total Well Depth: Initial: 51.60 FT BTOC Final: 51.36 FT BTOC

Date and Time: Begin: 9/10/18 / 1035 Completed: 9/10/18 / 1235

Development Method(S): SURGE/BAIL W/ DISPOSABLE BAILER; PUMP WITH SUBMERSIBLE PUMP

Total Quantity of Water Removed: 32 gals

FIELD MEASUREMENT	SERIAL NUMBER	DATE OF LAST CALIBRATION
Temperature	OED MP-20 ESES-16369	9/10/18
Specific Conductivity	↓	↓
pH	↓	↓
Turbidity	↓	N/A
DO	N/A	N/A
ORP	N/A	N/A

WELL DEVELOPMENT SUMMARY

PROJECT NAME: **DELIVERY ORDER NO:**

WELL NUMBER: MW-84 PFAS-02

DATE	BEGINNING TIME	GALLONS REMOVED	TEMP (C)	SPECIFIC CONDUCTIVITY (µMHOS/CM)	pH (STANDARD UNITS)	TURBIDITY (NTU)	TOTAL GALLONS REMOVED	WELL VOLUMES REMOVED	WL Fr. BTOC COMMENTS
9/10/18	1155	20	12.45	0.228	6.52	135	20		42.75
	1205	~3	12.26	0.228	7.80	10.4	23		42.75
	1215	~3	12.34	0.229	8.07	5.4	26		42.75
	1225	~3	12.30	0.228	8.14	3.9	29		42.75
	1235	~3	12.35	0.228	8.16	3.7	32		42.75
			DEVELOPMENT COMPLETED						

MW 9/10/18

RECORDED BY: 9/10/18 QA CHECKED BY:

WELL DEVELOPMENT FORM

PROJECT NAME: SVAD PFAS SI **DELIVERY ORDER NO:**

Date: 9/10/18 Time: 09:05

Well Number and Location: MW-84PFAS-03 SVAD SITE 84

Comments : WATER TRANSLUCENT EVEN AFTER SURGING/ BAILING. MK 9/10/18

Water Levels / Time: Initial: 38.97 / 07:15 Pumping: 38.98 / VARIOUS

Final: 38.98 / 09:05

Total Well Depth: Initial: 46.20 FT BTOC Final: 46.17 FT BTOC

Date and Time: Begin: 9/10/18 / 0715 Completed: 9/10/18 / 0905

Development Method(S): SURGE/BAIL W/ DISPOSABLE BAILER, PUMP W/ SUBMERSIBLE PUMP.

Total Quantity of Water Removed: 43 gals

FIELD MEASUREMENT	SERIAL NUMBER	DATE OF LAST CALIBRATION
Temperature	QED MP-20 EQUIP NO: 16369	9/10/18
Specific Conductivity	↓	↓
pH	↓	↓
Turbidity	↓	N/A
DO	N/A	N/A
ORP	N/A	N/A

WELL DEVELOPMENT SUMMARY

PROJECT NAME: SVAO PFAS SI **DELIVERY ORDER NO:**

WELL NUMBER: MW-84PFAS-03

DATE	BEGINNING TIME	GALLONS REMOVED	TEMP (C)	SPECIFIC CONDUCTIVITY ~~(µMHOS/CM)~~ mS/cm µS/cm	pH (STANDARD UNITS)	TURBIDITY (NTU)	TOTAL GALLONS REMOVED	WELL VOLUMES REMOVED	WL (FT BTOC) COMMENTS
9/10/18	0805	25	13.33	0.333	5.60	380	25		38.98
	0815	~3	12.38	0.312	7.85	38.6	28		38.98
	0825	~3	12.35	0.308	8.13	14.0	31		38.98
	0835	~3	12.37	0.307	8.18	7.3	34		38.98
	0845	~3	12.50	0.308	8.17	5.7	37		38.98
	0855	~3	12.68	0.308	8.16	5.3	40		38.98
	0905	~3	12.75	0.308	8.16	4.4	43		38.98
			DEVELOPMENT COMPLETED						

MK 9/10/18

RECORDED BY: [signature] 9/10/18

QA CHECKED BY: [signature] 9/10/18

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: SVAD PFAS SI **DELIVERY ORDER NO:**

Date (mm/dd/yy): 9/5/18 Su M Tu (W) Th F Sa PAGE 1 OF 7

Task Team Members:

M. KLIDZEJS - LEIDOS, P.G. GARY SWIFT - MATECO, DRILLER

CHARLES SPUAR - LEIDOS, GEOL JEFF CROEL - MATECO, HELPER

DANA WINSLOW - LEIDOS, SUXOS — MK 9/5/18

Narrative (include time and location):

0656 CREWS ARRIVE AT SITE 67 OF SVAA.

0700 HOLD PRE-ENTRY BRIEFING AND GO THROUGH "FIELD CHECKLIST FOR PFC SAMPLE COLLECTION" (SEE FIELD FORMS).

~0740 MEET W/ TODD KNUTH (USACE). GET APPROVAL TO UNLOAD DRILLER'S SUPPLIES IN LOT AT NORTH END OF OLD FIRE STATION (BLDG 1000).

~0750 SPEAK W/ TIM SCHOENG (VIA PHONE) REGARDING WATER SOURCE. HE ADVISES THAT WE CAN USE THE FIRE HYDRANT AT THE INTERSECTION OF CN AND MCINTYRE ROADS. LATER, AFTER SPEAKING AGAIN W/ CATHY COLLINS AND TODD KNUTH, WILL CALL TIM BACK W/ BILLING INFO FOR WATER.

~0800 MATECO'S VENDOR UNLOADS DRILLING AND WELL INSTALLATION MATERIALS.

Daily Weather Conditions: A.M. (0800) MOSTLY CLOUDY, TEMP 75, WIND SSW AT ~10.

P.M. (1100) CLOUDY, RAIN, TEMP 78, WIND WSW ~10MPH

Recorded By [signature] 9/5/18 QA Checked By [signature] 9/6/18

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: SVAO PFAS SI **DELIVERY ORDER NO:**

Date (mm/dd/yy): 9/5/18 Su M Tu (W) Th F Sa PAGE 2 OF 7

Task Team Members:

SEE PG. 1 OF 7

Narrative (include time and location):

~0800 DANA AND CHARLES BEGIN CLEARING FOR UXO ON PATHS TO, AND AT, DRILLING SITES AT G7.
0824 DANA AND CHARLES OFF TO CLEAR FOR UXO AT SITE 84. DRILL CREW EMPTIES THEIR TWO POTABLE WATER TANKS, THEN FILLS TANKS FROM HYDRANT. (500 GALLONS).
0900 COLLECT POTABLE SOURCE WATER BLANK (FIELD BLANK FROM HYDRANT, BACK-FLOW PREVENTER AND HOSE (2, 250-ML, TRIZMA PRESERVED CONTAINERS). SAMPLE ID: MW-67PFAS-03 LDOSEBO1
0920 RETURN TO SITE G7. DRILL CREW SETS UP DECON PAD. DECON AUGERS AND TOOLING
INVENTORY WELL MATERIALS + DRILLING SUPPLIES: BENTONITE CHIPS - BLACK HILLS BENTONITE, BENTONITE PLUG, 3/8-IN CHIPS

Daily Weather Conditions: A.M. MK 9/5/18

P.M.

Recorded By 9/5/18 QA Checked By 9/6/18

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: SVAD PFAS SI **DELIVERY ORDER NO:**

Date (mm/dd/yy): 9/5/18 Su M Tu (W) Th F Sa PAGE 3 OF 7

Task Team Members:

SEE PAGE 10F 7

Narrative (include time and location):

BENTONITE (BAROID QUIK-GEL, HIGH YIELD BENTONITE, CEMENT - ST. MARY'S CEMENT INC, TYPE I PORTLAND. SAND - IES DRILLING SUPPLY, 10/20 (#5) SILICA SAND WELL FILTER PACK (1.0 MM) SiO_2 99% 50LB BAGS

RISER - MONOFLEX, SCHD 40, 2" x 10', FLUSH-THREAD

SCREEN - MONOFLEX, SCHD 40, 2" x 10', FLUSH-THREAD

PROTECTIVE CASING, 4 1/2-IN DIAM, 5-FT LENGTH, PRE-PRIMED STEEL, W/ HINGE + LOCKING HASP.

POSTS - 6 FT LENGTH, 3-IN DIAM, FIRE-FLO, 300 PSI ASTM 135/A795-E, STEEL

HSAs - 6 1/2-IN OD, 4 1/2-IN ID, 5-FT

BIT - 8 1/4-IN OD, 4 1/2-IN ID, 4-IN LENGTH BULLET BI

RIG = CME 55, TRACK MOUNTED, REMOTE-CONTROLLED

— MK 9/5/18 —

Daily Weather Conditions: A.M. MK 9/5/18

P.M.

Recorded By 9/5/18 QA Checked By 9/6/18

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: SVAO PFAS SI **DELIVERY ORDER NO:**

Date (mm/dd/yy): 9/5/18 Su M Tu (W) Th F Sa PAGE 4 OF 7

Task Team Members:

SEE PG 1 FOR

Narrative (include time and location):

0950 BEGIN SETTING UP ON MW-67PFAS-03 LOCATION

NOTE: ALTHOUGH A UTILITY LOCATE HAS BEEN REQUESTED, FIND NO MARKINGS IN AREA. UNDERGROUND ELECTRICAL IS APPARENT FROM BOXES. DRILLER TO CALL TOOO J (AT MATTCO) TO GET LINES MARKED.

NOTE: REVIEWED UTILITY DRAWINGS W/ DANA. WE AGREE TO THE LIKELY LOCATIONS OF ELECTRICAL IN AREA.

HEAVY RAIN BEGINS AROUND 10:00. STAND BY

NOTE: JAMIE JOHNSON ALSO CALLS JULIE TO REQUEST RE-MARK OR ALL CLEAR

1109 USIC REP ON SITE; BUT NOT THE ONE WHO MARKS ELECTRICAL

1113 VANGUARD ELECTRICAL ON SITE. MARKS ELECTRICAL WHICH WAS W/IN 10FT OF -03 SITE

Daily Weather Conditions: A.M. MK 9/5/18

P.M.

Recorded By 9/5/18 QA Checked By 9/6/18

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: JVAD PFAS SI **DELIVERY ORDER NO:**

Date (mm/dd/yy): 9/5/18 Su M Tu (W) Th F Sa PAGE 5 OF 7

Task Team Members:

SEE PG 1 OF

Narrative (include time and location):

1140 BEGIN HAND AUGERING TO CLEAR UTILITIES.
~~BEGIN HOLLOW-STEM AUGER (HSA) DRILLING.~~ MK 9/5/18

1150 HEAVY RAIN STARTS AGAIN. DRILL CREW BREAKS FOR LUNCH. NOTE: OANA CLEARED HOLE FOR UXO AFTER HAND AUGERING

1155 DRILL CREW OFF SITE.

1250 DRILL CREW RETURNS TO SITE.

1302 BEGIN DRILLING

1330 END DRILLING AT 22 FT BGS. FIRST WET SAND RECOVERED AT ~22 FT DRILLING. KNOCK PLUG OUT. MEASURE WATER LEVEL (WL) AT 15.5 FT BGS

WELL MATERIALS: BOTTOM CAP = 0.25 FT, SCREEN = 10.05 FT; RISERS = 2, BOTH 10.05 FT. STICK LENGTH = 30.40 FT

1404 7 BAGS SAND POURED INSIDE AUGERS TO

Daily Weather Conditions: A.M. MK 9/5/18

P.M.

Recorded By [signature] 9/5/18 QA Checked By [signature] 9/6/18

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: SVAD PFAS SZ **DELIVERY ORDER NO:**

Date (mm/dd/yy): 9/5/18 Su M Tu (W) Th F Sa PAGE 6 OF 7

Task Team Members:

SEE PG 1 OF 7

Narrative (include time and location):

11.2 FT BGS

1415 1 BAG BENTONITE POURED TO 8.5 FT.

HYDRATE BENTONITE W/ ~5 GALLONS POTABLE WATER

1440 MIX BATCH OF GROUT CONSISTING OF 1 BAG PORTLAND, ~1/4 BAG BENTONITE POWDER, ~40 GALLONS WATER. PUMP INSIDE AUGERS & PULL AUGERS

~1530 TIM SCHOENG COMES OUT TO SITE AFTER TODD JOHANNSEN (MATECO) CALLED HIM ABOUT WATER LINE THAT EXTENDS N FROM BLDG 100. TIM + KLIDJIS FIND VALVES THAT DEFINE THE WATER LINE. PLANNED LOCATION OF MW-67PFAS-02 IS W/IN ~10FT OF THE WATER LINE. TIM ASKS THAT WE MOVE THE BORING ~10 FT WEST. MK 9/5/18

Daily Weather Conditions: A.M. PM (1445) CLOUDY, RAIN, TEMP 73, WIND NW ~5 MPH

P.M. —MK 9/5/18—

Recorded By MK 9/5/18 QA Checked By 9/6/18

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: SVAD PFAS SI **DELIVERY ORDER NO:**

Date (mm/dd/yy): 9/5/18 Su M Tu (W) Th F Sa PAGE 7 OF 7

Task Team Members:

SEE PG 1 OF 7

Narrative (include time and location):

~1630 TIM LEAVES SITE AFTER CALLING TODD, ADVISING HIM OF THE PIPES LOCATION.

~1640 ALL OTHER TEAM MEMBERS LEAVE SITE.

NOTE: WHILE WE WERE SEARCHING FOR THE WATER LINE, THE MATECO CREW INSTALLED THE PROTECTIVE CASING AND MORTAR COLLAR AROUND MK 9/5/18 AT THE WELL INSTALLED TODAY.

1650 M. KLIDZEJS OFF SITE FOR PAY.

MK 9/5/18

Daily Weather Conditions: A.M. MK 9/5/18

P.M. (1650) CLOUDY, RAIN, TEMP 71, WIND N AT 5-10MPH

Recorded By 9/5/18 QA Checked By 9/6/18

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: SWAD PFAS SI **DELIVERY ORDER NO:**

Date (mm/dd/yy): _____ Su M Tu W Th F Sa PAGE_____ OF _____

Task Team Members:

_____ _____

_____ _____

_____ _____

Narrative (include time and location):

MK 9/5/17

Daily Weather Conditions: A.M. _____

P.M. _____

Recorded By _____ QA Checked By _____

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: SEAD PFAS SI **DELIVERY ORDER NO:**

Date (mm/dd/yy): 9/6/18 Su M Tu W (Th) F Sa PAGE 1 OF 7

Task Team Members:

M. KLIDZEJS - LEIDOS, P.G. — G. SWIFT - MATECO, DRILLER

C. SPURR LEIDOS, GEOL — J. CROEL - MATECO, HELPER

D. WINSLOW - LEIDOS, SUXOS — — MC 9/6/18 —

Narrative (include time and location):

0635 M. KLIDZEJS ON SITE.

INSPECT MW-67PFAS-03. TOP OF PROTECTIVE CASING AT 2.55FT AGS, TOP OF WELL CASING AT 2.23 FT AGS. MEASURE WL AT 11.3 FT BELOW GROUND SURFACE (BGS) NOTE: GROUND HERE IS ~4-5 FT LOWER THAN OTHER 2 PLANNED WELLS AT THIS SITE. ORIGINAL STICK-UP OF ORIGINAL RISER (NOW CUT) WAS 5.95 FT

~0650 REST OF LEIDOS CREW AND MATECO ON SITE

0710 HOLD TAILGATE SAFETY BRIEFING

0730 BEGIN MOVING EQUIPMENT AND RIG ONTO MW-67PFAS-

EARLIER, DALIA CLEARED PATH IN AND FOUND LIKELY LOCATION OF WATER LINE. BORING HAS BEEN MOVED TO POINT ~15FT WEST OF ORIGINALLY PLANNED LOCATION.

Daily Weather Conditions: A.M. (0645) CLOUDY, DRIZZLE, TEMP 66, WIND NE~10MP

P.M. — ML 9/6/18 —

Recorded By [signature] 9/6/18 QA Checked By [signature] 9/7/18

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: SWAD PFAS SI **DELIVERY ORDER NO:**

Date (mm/dd/yy): 9/6/18 Su M Tu W TH F Sa PAGE 2 OF 7

Task Team Members:

SEE PG 1 OF 2

Narrative (include time and location):

0743 BEGIN HAND AUGERING TO CLEAR UTILITIES.

0756 HOLE HAND AUGERED TO 6FT. BANA SCANS HOLE FOR UXO.

0803 BEGIN HSA DRILLING

0815 TD HSA AT 23FT.

WELL MATERIALS: BOTTOM CAP = 0.25FT; SCREEN = 10.05FT

RISERS (2), EACH 10.05 FT. STRING LENGTH = 30.35 FT

0834 INSERT WELL STRING. MEASURE WL AT 16.4 FT BGS.

0842 BEGIN POURING SAND INSIDE AUGERS. NOTE: ORIGINAL

STICK-UP OF STRING = 6.9 FT AGS. CUT 2.9H FT OFF

RISER. CHARGE AUGERS W/ ~20 GALLONS OF POTABLE

WATER. HAD BEEN HAVING DIFFICULTY RAISING AUGERS.

CUT AN ADDITIONAL 1.68 FT OFF RISER. FINAL STRING

LENGTH = ~~26.23~~ 25.73 FT MK 9/6/18

0925 6 BAGS SAND POURED TO 10.5 FT.

0940 1 BAG BENTONITE POURED TO 8.0 FT BGS. HYDRATE

Daily Weather Conditions: A.M. (0800) CLOUDY, TEMP 70, WIND SE ~5 MPH

—MK 9/6/18—

P.M.

Recorded By [signature] 9/6/18 QA Checked By [signature] 9/7/18

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: SVAD PFAS SI **DELIVERY ORDER NO:**

Date (mm/dd/yy): 9/6/18 Su M Tu W (Th) F Sa PAGE 3 OF 7

Task Team Members:

SEE PG 1 OF 2

Narrative (include time and location):

WITH ~10 GALLONS POTABLE WATER
MIX BATCH OF GROUT CONSISTING OF ~8 GALLONS
POTABLE WATER 1,94 lb BAG PORTLAND, ~15 lbs
BENTONITE POWDER.
FINAL STICK-UP OF WELL = 2.43 FT
1013 PUMP GROUT INSIDE AUGERS TO ~2 FT BGS
MOVE EQUIPMENT OFF WELL SITE.
1025 BEGIN MOVING ONTO MW-67PFAS-01
1035 BEGIN DRILLING. NOTE: DANA + CHARLES HAND
AUGERED THIS HOLE AND CLEARED FOR UXO EARLIER
1045 TD HSA AT 23 FT
WELL MATERIALS: BOTTOM CAP = 0.25, SCREEN = 10.05
1ST RISER = 10.04, 2ND RISER 10.07 FT. STRAW LENGTH = 30.4
1118 MEASURE WL AT 15.5 FT BGS
CUT 4.5 FT OFF RISER. INSERT STICK INSIDE AUGERS

Daily Weather Conditions: A.M. MC 9/6/18

P.M.

Recorded By [signature] 9/6/18 QA Checked By [signature] 9/7/18

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: SVAD PFAS SI **DELIVERY ORDER NO:**

Date (mm/dd/yy): 9/6/18 Su M Tu W (Th) F Sa PAGE 4 OF 7

Task Team Members:

SEE PG 1 OF 7

Narrative (include time and location):

1120 BEGIN POURING SAND.

1150 SAND POURED TO ~~10.5~~ 10.0 FT USING 6 3/4 BAGS.

TAPE GOT HUNG AT 7.5 FT

1200 BENTONITE POURED TO 8.0 FT. USING 1 BAG.

H/DRATE USING ~10 GALLONS POTABLE WATER.

MIX BATCH OF GROUT USING 1 BAG PORTLAND, ~10 GALLONS WATER, 1/4 BAG BENTONITE. ADDITIONAL 1.68 FT CUT OFF RISER.

POUR BENTONITE INSIDE AUGERS TO ~2 FT BGS.

MOVE EQUIPMENT OFF SITE TO DECON. FINAL TD OF WELL STRING = 2.50 FT. TAPE RECOVERED W/ LAST AUGER.

~1235 DRILL CREW BREAKS FOR LUNCH.

1319 DRILL CREW RETURNS TO SITE.

INSPECT MW-67PFAS-03. GROUT AT GROUND SURFACE (UNSURE WHEN DRILLERS TOPPED HOLE OFF). MORTAR IN PROTECTIVE CASING AT 0.30 FT AGS

Daily Weather Conditions: A.M. MK 9/6/18

P.M.

Recorded By 9/6/18 QA Checked By 9/7/18

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: SVAP PFAS SI **DELIVERY ORDER NO:**

Date (mm/dd/yy): 9/6/18 Su M Tu W (Th) F Sa PAGE 5 OF 7

Task Team Members:

SEE PG 1 OF 2

Narrative (include time and location):

1330 DRILLERS BEGIN DECON.

1410 BEGIN MOVING EQUIPMENT AND SUPPLIES TO SITE 084

1520 BEGIN SETTING UP ON MW-84PFAS-03. NOTE:
EARLIER IN THE DAY, DANA CLEARED THE AREA
AND DANA AND CHARLES HAND AUGERED FOR
UTILITY AND UXO CLEARANCE.

1537 BEGN DRILLING

1610 REACH 45 FT. HAVE WATER IN AUGERS, RISING
SLOWLY. HAD NO MEASUREABLE WATER AFTER
REACHING 30 AND 40 FT BGS.

1630 WATER LEVEL FAIRLY STABLE ~42 FT BGS

1632 ADVANCE BORING TO 47 FT BGS. MEASURE WL
AT 43.8 FT BGS. RISING SLOWLY

1646 ADVANCE BORING TO 48 FT BGS. PUSH PLUG OUT.
WL NEARLY STABLE AT 37.5 FT BGS

Daily Weather Conditions: ~~A.M.~~ PM (1335) MOSTLY CLOUDY, TEMP 71, WIND NE ~10 MPH
— MK 9/6/18 —
P.M.

Recorded By [signature] 9/6/18 QA Checked By [signature] 9/7/18

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: SWAO PFAS SI **DELIVERY ORDER NO:**

Date (mm/dd/yy): 9/6/18 Su M Tu W (Th) F Sa PAGE 6 OF 7

Task Team Members:

SEE PL 1 OF 2

Narrative (include time and location):

1710 SET WELL STRIK W/ BOTTOM NEAR 43 FT BGS
1707 CHARLES OFF SITE FOR DAY AND TO GET DEVELOPMENT AND SHIPPING SUPPLIES FROM WALMART
~10 GALLONS POTABLE WATER ADDED INSIDE AUGERS TO CHASE SAND
1730 SAND POURED TO 29.5 FT USING 6 1/2 BAGS
1740 BENTONITE POURED 26.8 FT USING 1 BAG. HYDRATED W/ ~10 GALLONS
1755 RICHEJS + MATECO CREW OFF WELL SITE AFTER SECURING.
1802 ARRIVE AT MW-GTPFAS-02. MEASURE TOP OF SEMI-HARDENED GROUT AT 2.0 FT BGS. MATECO CREW SETS PROTECTIVE CASING AND FILLS W/ MORTAR TO ~1.2 FT AGS

Daily Weather Conditions: A.M. MLC 9/6/18

P.M.

Recorded By 9/6/18 QA Checked By 9/7/18

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: SWAO PFAS SI **DELIVERY ORDER NO:**

Date (mm/dd/yy): 9/6/18 Su M Tu W (Th) F Sa PAGE 7 OF 7

Task Team Members:

SEE PL (OF)

Narrative (include time and location):

1820 MATECO CREW OFF WELL SITE TO GET MORE WATER FROM TANK.

1835 AT MW-67PFAS-01. MEASURE TOP OF SEMI-HARD GROUT AT 1.6 FT. MATECO CREW SETS PROTECTIVE CASING AND FILLS TO 1.4 FT AGS W/ MORTAR.

1850 CREWS LEAVE SITE FOR DAY. NOTE: DANA LEFT SITE, AT THE END OF HIS WORK, AROUND MID-DAY

MK 9/6/18

Daily Weather Conditions: A.M. — MK 9/6/18

P.M. (1830) MOSTLY CLOUDY, TEMP 71, WIND ENE ~5MPH

Recorded By [signature] 9/6/18 QA Checked By [signature] 9/7/18

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: SV40 PFAS SI **DELIVERY ORDER NO:**

Date (mm/dd/yy): ________ Su M Tu W Th F Sa PAGE_____ OF _____

Task Team Members:

_______________________ _______________________

_______________________ _______________________

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Narrative (include time and location):

MJL 9/6/18

Daily Weather Conditions: A.M. ______________________________

P.M. ______________________________

Recorded By ______________________ QA Checked By ______________________

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: SWAO PFAS SI **DELIVERY ORDER NO:**

Date (mm/dd/yy): 9/6/18 Su M Tu W (Th) F Sa PAGE 1 OF 1

Task Team Members:

Charles Spurr

Dana Winslow

CS 9/6/18

CS 9/6/18

Narrative (include time and location):

0820 MW-84PFAS-02 cleared to 6' bgs w/ hand auger. * Hole moved 12" NW due to EM anomaly in original location. No anomalies down hole

0840 MW-84PFAS-01 cleared to 6' bgs w/ hand auger. No anomalies down hole.

0915 MW-84PFAS-03 cleared to 6' bgs w/ hand auger. No anomalies down hole.

1000 MW-67PFAS-01 cleared to 6' bgs w hand auger. No anomalies down hole.

CS 9/6/18

Daily Weather Conditions: A.M. Mostly Cloudy

P.M. CS 9/6/18

Recorded By Charles Spurr 9/6/18 QA Checked By [signature] 9/7/18

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: SVAO PFAS SI **DELIVERY ORDER NO:**

Date (mm/dd/yy): _____ Su M Tu W Th F Sa PAGE_____ OF _____

Task Team Members:

_____ _____

_____ _____

_____ _____

Narrative (include time and location):

9/9/18

MV

Daily Weather Conditions: A.M. _____

P.M. _____

Recorded By _____ QA Checked By _____

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: SWAO PFAS SI **DELIVERY ORDER NO:**

Date (mm/dd/yy): 9/7/18 Su M Tu W Th (F) Sa PAGE 1 OF 4

Task Team Members:

M. KLIDZEJS - LEIDOS, P.G.
C. SPURR - LEIDOS, GEOL.
G. SWIFT - MATECO, DRILLER
J. CROEL - MATECO, HELPER

MK 9/7/18

Narrative (include time and location):

0700 M. KLIDZEJS ON SITE. MATECO CREW ON SITE BUT CALLING INTO A ~~MANDATORY~~, MATECO, MONTHLY H&S TELECONFERENCE.

~0730 CHARLES ON SITE

~0745 MATECO'S MEETING ENDS. GO TO MW-8H PFAS-03

DRILLERS PREPARE TO MIX GROUT

0836 GROUT ~~POURED~~ TREMIED INSIDE AUGERS TO ~ 2FT BGS MK 9/7/18 USING ~ 40 GALLONS, MIXED IN TWO BATCHES, EACH USING 1 BAG PORTLAND, ~ 1/4 BAG BENTONITE, AND ~ 10 GALLONS WATER

MEASURE STICK-UP OF ORIGINAL WELL STRINK AT 4.6 FT AGS

0910 MEASURE WL AT 37.31 FT BGS

MATECO CREW HAS BEGUN SETTING UP TO DRILL ON MW-84PFAS-01, WHICH WAS HAND AUGERED

Daily Weather Conditions: A.M. (0700) CLOUDY, TEMP 59, WIND NE ~ 5-10 MPH

P.M. (1110) CLOUDY TEMP 68, WIND NE ~ 10 MPH

Recorded By 9/7/18 QA Checked By 9/10/18

37.31 ✓

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: SJAD PFAS SI **DELIVERY ORDER NO:**

Date (mm/dd/yy): 9/7/18 Su M Tu W Th F Sa PAGE 2 OF 4

Task Team Members:

_____ _____

_____ See Pg 1 of 4 _____

_____ _____

Narrative (include time and location):

TO 5 FT AND CLEARED OF UXO YESTERDAY.
0916 BEGIN DRILLING MW-84PFAS-01
0945 TO HSAs AT 44.5FT BGS.
DRILL CREW LEAVES WELL SITE FOR SUPPLIES.
1005 SET WELL STRING CONSISTING OF 0.25FT BOTTOM CAP, 10.0 FT SCREEN, AND 4, 10.0 FT RISERS. STRING LENGTH = 50.5 FT
1025 MEASURE WL AT 41.7 FT BGS; SEEMINGLY STABLE.
CUT 2.2FT OFF RISERS NEW STRING LENGTH 48.3 FT MK 9/7/18
AQUARIUS BOPING TO 48. MEASURE WL AT 41.7 FT
REMOVE CUT RISER AND REPLACE W/ NEW SECTION
1100 BEGIN POURING SAND PACK
1130 SAND POURED TO ~~33.6~~ 33.4 FT USING 6 1/2 BAGS MK 9/7/18
1141 1 BAG BENTONITE POURED TO 30.0 FT, HYDRATED W/ ~10 GALLONS WATER. RISER STICK UP = 2.9 FT AGS

Daily Weather Conditions: A.M. MK 9/7/18

P.M.

Recorded By ML Kelly 9/7/18 QA Checked By Celia Lam 9/10/18

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: SVAD PFAS SI **DELIVERY ORDER NO:**

Date (mm/dd/yy): 9/7/18 Su M Tu W Th (F) Sa PAGE 3 OF 4

Task Team Members:

JER PE, OF

Narrative (include time and location):

1145 DRILL CREW BREAKS FOR LUNCH

1309 DRILL CREW RETURNS TO SITE. BEGIN MIXING GROUT

~1330 DRILL CREW OFF SITE TO GET WATER AND DECON AUGERS.

1424 DRILL CREW RETURNS TO SITE.

1435 BEGIN MIXING 2ND BATCH OF GROUT.

1441 GROUT PUMPED TO 1.8 FT BGS. TOTAL OF ~60 GALLONS OF GROUT USED

1450 MOVE RIG ONTO MW-84PFAS-02

1455 BEGIN DRILLING. MEASURE WL IN MW-84PFAS-01 AT 41.66 FT BGS.

1518 TD HSA AT 49 FT

SET WELL STRING W/ 0.25 FT BOTTOM CAP, 10.05 FT SCREEN AND 4, 10.05 FT RISERS STRING LENGTH= 50.5 FT

Daily Weather Conditions: A.M. MK 9/7/18

P.M.

Recorded By 9/7/18 QA Checked By 9/10/18

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: SVAP PFAS SI **DELIVERY ORDER NO:**

Date (mm/dd/yy): 9/7/18 Su M Tu W Th (F) Sa PAGE 4 OF 4

Task Team Members:

SEE PG 1 OF 4

Narrative (include time and location):

KNOCK OUT PLUG. MEASURE WL AT 41.1 FT BGS.

1555 SAND POURED TO 35.5 FT BGS USING 5 BAGS

1607 1 BAG BENTONITE POURED TO 32.5 FT BGS AND HYDRATED W/ 10 GALLONS POTABLE.

1620 CREWS MOVE TO MW-84PFAS-03, TAG TOP OF SEMI-HARDENED GROUT AT ~~2T~~ 2.1 FT BGS. SET PROTECTIVE CASING IN MORTAR. MK 9/7/18

1630 CREWS MOVE TO MW-84PFAS-01. CUT 0.82 FT OFF RISER TO STICK-UP OF 2.26 FT, TAG TOP OF SEMI-HARDENED GROUT AT ~3FT. SET PROTECTIVE CASING IN MORTAR.

1705 CREWS LEAVE SITE 0854 FOR END OF DAY

MK 9/7/18

Daily Weather Conditions: A.M. CS 9/10/18

P.M.

Recorded By MK 9/7/18 QA Checked By 9/10/18

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: SVAO PFAS SI **DELIVERY ORDER NO:**

Date (mm/dd/yy): 9/8/18 Su M Tu W Th F (Sa) PAGE 1 OF 3

Task Team Members:

M. KLIDZEJS - LEIDOS, P.G.

G. SWIFT - MATECO, DRILLER

J. CROEL - MATECO, HELPER

MK 9/8/18

Narrative (include time and location):

0645 KLIDZEJS ON SITE. NOTE: CHARLES TO STAY AT HOTEL UNTIL DEVELOPMENT EQUIPMENT ARRIVES FROM ENVIRONMENTAL EQUIPMENT & SUPPLY (EE&S) VIA UPS. EQUIPMENT WAS SUPPOSED TO BE SHIPPED TO ARRIVE YESTERDAY.

0650 MATECO CREW ON SITE

0700 CREWS ARRIVE AT MW-PFAS-02

0730 BEGIN MIXING GROUT

0744 FIRST BATCH TRIMMED. PULL 30 FT OF AUGERS MIX 2ND BATCH

0810 HOLE GROUTED TO ~ 2 FT USING TOTAL OF ~ 60 GALLONS

ADD RISER SECTION TO BRING HEIGHT TO 2.4 FT AGS

0824 DRILL CREW LEAVES SITE TO PICK UP FORMS FOR WELL PADS FROM HARDWARE STORE IN SAVANNA.

BEGIN PREPARING FOR DEVELOPMENT. AT FIRE HYDRANT DESIGNATED FOR OUR USE. DECON 3 NEW, 5-GALLON HDPE

Daily Weather Conditions: A.M. (0710) CLOUDY, TEMP 59, WIND NE ~ 10 MPH

P.M. (0940) OVERCAST, TEMP 64, WIND NE @ 10-15 MPH

Recorded By [signature] 9/8/18 QA Checked By [signature] 9/10/18

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: SWAD PFAS SI **DELIVERY ORDER NO:**

Date (mm/dd/yy): 9/8/18 Su M Tu W Th F (Sa) PAGE 2 OF 3

Task Team Members:

SEE PL 1 OF 3

Narrative (include time and location):

BUCKETS AND HOS TO USE FOR DECON. WILL DECON PUMP, PUMP CORD, WLI, AND FLOW CELL IN BUCKETS FILLED W/: 1) LIQUINOX AND POTABLE WATER, 2) DEIONIZED (DI WATER, AND 3) DI WATER. DI WATER PROVIDED BY TEST AMERICA.

0925 DRILL CREW RETURNS TO SITE. BEGINS MOVING + LOADING EQUIPMENT. NOTE THE WELL FORMS ARE 3 FT x 3 FT x 5 1/2 IN TALL

1020 GROUT LEVEL IN MW-84PFAS02 HAD FALLEN TO 12 FT BGS. TOP OFF W/ ~10 GALLONS GROUT. DRILL CREW BEGINS AWARDING FILLED DRUMS

1210 CREWS GET SITE FOR LUNCH

1245 M. KLIDZETS RETURNS TO SITE.

1310 MATECO CREW RETURNS.

1320 ARRIVE AT MW-84PFAS02 TO SET PROTECTIVE

Daily Weather Conditions: A.M. MK 9/8/18

P.M.

Recorded By 9/8/18 QA Checked By 9/10/18

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: SVAD AFFAS SI **DELIVERY ORDER NO:**

Date (mm/dd/yy): 9/8/18 Su M Tu W Th F (Sa) PAGE 3 OF 3

Task Team Members:

SEE PG 1 OF 3

Narrative (include time and location):

CASING AND MORTAR COLLAR

1335 OFF WELL SITE. DRILL CREW TO CONTINUE PICKING U/ FILLED DRUMS AND TRANSFERING TO H-AREA

1610 DRILLERS REPORT THEY ARE DONE SETTING WELL PAD FORMS AND ARE LEAVING FOR THE DAY.

1710 KRIDZESS OFF SITE AFTER FINISHING PAINTING OF PROTECTIVE CASINGS

MK 9/8/18

Daily Weather Conditions: A.M. MK 9/8/18

P.M.

Recorded By 9/8/18 QA Checked By 9/10/18

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: SVAO PFAS SI **DELIVERY ORDER NO:**

Date (mm/dd/yy): _____ Su M Tu W Th F Sa PAGE_____ OF _____

Task Team Members:

_____ _____

_____ _____

_____ _____

Narrative (include time and location):

MW-2 7/8/18

Daily Weather Conditions: A.M. _____

P.M. _____

Recorded By _____ QA Checked By _____

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: SVAD PFAS SI **DELIVERY ORDER NO:**

Date (mm/dd/yy): 9/9/18 (Su) M Tu W Th F Sa PAGE 1 OF 5

Task Team Members:

M. KLUDZEJS - LEIDOS, P.G. J. CROEL - MATECO, HELPER

C. SPURR - LEIDOS, GEOL

G. SWIFT - MATECO, DRILLER

MK 9/9/18

Narrative (include time and location):

0640 M. KLUDZEJS ON SITE

0655 MATECO CREW ON SITE, CHARLES ON SITE

0705 ARRIVE AT MW-67PFAS-03, CALIBRATE MP-20. DECON PUMP + WLI.

0740 OPEN WELL. PID AT TOC = 1.5(MAX) PPM, SUSTAINED AT 0.9 PPM. BZ = 0.0 PPM

MEASURE WL AT 12.55FT BTOC. MEASURE TD AT 26.58 FT BTOC (SORT). WATER COLUMN = 14.03 x 0.163 (GAL/FT FOR 2-IN WELL) = 2.3 GALLONS

0746 BEGIN BAILING/SURGING USING NEW DISPOSABLE BAILER AND PFAS-FREE COTTON ROPE (FROM RESCS)

0801 END BAILING AFTER REMOVING 15 LITERS

INSERT ~~POW~~ MONSOON PUMP W/ NEW TUBING

MK 9/9/18

Daily Weather Conditions: A.M. (0650) CLEAR, TEMP 66, WIND LIGHT & VARIABLE

P.M. (0905) CLEAR, TEMP 80, WIND NE AT 10-15MPH

Recorded By [signature] 9/9/18 QA Checked By [signature] 9/9/18

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: SVAO PFAS SI **DELIVERY ORDER NO:**

Date (mm/dd/yy): 9/9/18 (Su) M Tu W Th F Sa PAGE 2 OF 5

Task Team Members:

~~SEE PG 1 OF 5~~

Narrative (include time and location):

MEASURE WL AT 12.52 FT BTOC

0810 BEGIN PUMPING AT HIGHEST RATE

0820 STOP PUMPING AFTER REMOVING 29 GALLONS

LEAVE WELL SITE TO TRANSFER PURGE WATER TO DRUM

0837 RETURN TO SITE. SET PUMP ~ 2 FT OFF WELL BOTTOM

MEASURE WL AT 12.53 FT

RESUME PUMPING (SEE DEVELOPMENT LOG FORMS)

NOTE: DURING REMOVAL OF FIRST 29 GALLONS RAISED AND LOWERED PUMP THROUGHOUT THE WATER COLUMN AND TURNED THE PUMP OFF AND ON SEVERAL TIMES. WATER WAS ~~VERY~~ TURBID ~~ONE~~ (LIKE CHOCOLATE MILK) UNTIL ~ 20 GALLONS REMOVED. AFTER 20 GALLONS WATER JUST APPEARED HEAVILY STAINED.

MK 9/9/18

Daily Weather Conditions: A.M. _____

P.M. _____

Recorded By MK 9/9/18 QA Checked By [illegible] 9/9/18

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: JVAD PFAS SI **DELIVERY ORDER NO:**

Date (mm/dd/yy): 9/9/18 (Su) M Tu W Th F Sa PAGE 3 OF 5

Task Team Members:

SEE PG 1 OF 5

Narrative (include time and location):

1040 DEVELOPMENT COMPLETED PARAMETERS STABLE. WATER IS CLEAR. TURBIDITY STABLE AROUND 10 NTUs PULL WLT AND PUMP. DECON WLT AND FLOW CELL. DISCARD TUBING. FINAL TD = 26.60 FT BTOC

1630 OFF WELL SITE. TRANSFER PURGE WATER TO DRUM.

1035 ARRIVE AT MW-67PFASE02

OPEN WELL PID AT TOC = 0.3 - 0.5 ppm. BZ = 0.0 ppm

MEASURE WL AT 17.98 FT BTOC. MEASURE TD AT 25.71 FT BTOC. H/C = 7.73 FT x 0.163

MK 9/9/18

1055 ~~BEGIN PUMPING USING MONSOON PUMP AND NEW TUBING~~

MK 9/9/18

~~SET AT ~1 FT ABOVE BOT~~ BEGIN BAILING/SURGING USING NEW BAILER AND COTTON ROPE

1105 END BAILING AFTER REMOVING 5 GALLONS. DECON PUMP.

1112 ~~BEGIN~~ BEGIN PUMPING AT HIGHEST POSSIBLE RATE

MK 9/9/18

Daily Weather Conditions: A.M. _____

P.M. _____

MK 9/9/18

Recorded By MK 9/9/18 QA Checked By 9/10/18

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: SVAO PFAS SI **DELIVERY ORDER NO:**

Date (mm/dd/yy): 9/9/18 (Su) M Tu W Th F Sa PAGE 4 OF 5

Task Team Members:

SEE PG 1 OF 5

Narrative (include time and location):

1130 STOP PUMPING AFTER REMOVING ANOTHER 20 GALLONS
EMPTY WATER INTO DRUMS.
1135 RESUME PUMPING AT SLOWER RATE W/ PUMP SET
AT ~5 FT ABOVE WELL BOTTOM.
NOTE: DURING INITIAL PUMPING, RAISED + LOWERED AND TURNED
PUMP OFF + ON SEVERAL TIMES.
1205 MSH 9/9/18 KHDEES ARRIVES AT MW-67PFAS-01. C. SPURR
REMAINS AT MW-67PFAS-02, CONTINUING
DEVELOPMENT TASKS.
1212 OPEN WELL. PID AT TOC = 1.2ppm MAX, SUSTAINED
NEAR 0.8 ppm. BZ=0.0 ppm. MEASURE WL AT 17.20
FT BTOC. MEASURE TD AT 25.62. WC = 8.42 x 0.163 =
1.4 GALLONS (CASING VOLUME).
1228 BEGIN BAILING W/ NEW DISPOSABLE BAILER AND
COTTON & ROPE

Daily Weather Conditions: A.M. — CS 9/10/18 —

P.M. (1200) CLEAR, TEMP 70, WIND NE ~10MPH

Recorded By [signature] 9/9/18 QA Checked By [signature] 9/10/18

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: SVAD PFAS SI **DELIVERY ORDER NO:**

Date (mm/dd/yy): 9/9/18 (Su) M Tu W Th F Sa PAGE 5 OF 5

Task Team Members:

SEE PG 1 OF 5

Narrative (include time and location):

1243 END BAILING AFTER REMOVING 5 GALLONS. WATER IS VERY TURBID; APPEARANCE OF COFFEE.

1302 1253 MK 9/9/18 BEGIN PUMPING AT HIGH RATE

1315 STOP PUMPING TO TRANSFER WATER TO DRUMS

1330 RESUME PUMPING. WL PRIOR TO PUMP = 17.20

1430 DEVELOPMENT COMPLETED. PARAMETERS STABLE, TURBIDITY CLEAR (3.1 NTUs). PULL WLI AND PUMP. DECON PUMP, WLI, AND FLOW CELL.

1500 OFF WELL SITE.

AT STAGING AREA TRANSFER PURGE WATER AND DECON WATER TO DRUMS

1530 CREWS OFF SITE FOR DAY. KLIDZEJS GETS FRESH POTABLE WATER FOR DECON.

1545 KLIDZEJS OFF SITE.

— MK 9/9/18 —

Daily Weather Conditions: A.M. — MK 9/9/18 —

P.M. (1245) CLEAR, TEMP 71, WIND NE AT 10 MPH

Recorded By MK 9/9/18 QA Checked By 9/10/18

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: SWMU 8 PFAS SI **DELIVERY ORDER NO:**

Date (mm/dd/yy): _____ Su M Tu W Th F Sa PAGE_____ OF _____

Task Team Members:

_____ _____

_____ _____

_____ _____

Narrative (include time and location):

MK 8/9/18

Daily Weather Conditions: A.M. _____

P.M. _____

Recorded By _____ QA Checked By _____

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: SVAD PFAS SI **DELIVERY ORDER NO:**

Date (mm/dd/yy): 9/10/18 Su (M) Tu W Th F Sa PAGE 1 OF 4

Task Team Members:

M. KLIDZEJS - LEIDOS, P.G. J CROEL - MATECO, HELPER

C. SPURR - LEIDOS, GEO

G. SWIFT - MATECO, DRILLER

MK 9/10/18

Narrative (include time and location):

0630 M. KLIDZEJS ON SITE

0647 C. SPURR ON SITE. 0700 MATECO CREW ON SITE. DISCUSS DAY'S ACTIVITIES.

0710 ARRIVE AT MW-8HPFAS-03 TO DEVELOP WELL

0715 OPEN WELL, PID AT TOC = ~~0.0~~ 1.3 ppm (MAX), SUSTAINED AROUND 0.7 ppm. BZ = 0.0 ppm

MV 9/10/18

MEASURE WL AT 38.97 FT BTOC. MEASURE TD AT 46.20 FT. WC = 7.23 x 0.163 = 1.2 GALLONS

0722 BEGIN BAILING/SURGING W/ NEW DISPOSABLE BAILER AND COTTON ROPE

0737 END BAILING AFTER REMOVING 5 GALLONS

INSERT MONSOON PUMP W/ NEW PROACTIVE TUBING IN WELL. MEASURE WL AT 38.96 FT BTOC

0750 BEGIN PUMPING AT MAX RATE OF PUMP.

0805 STOP PUMPING AFTER REMOVING ANOTHER 20

Daily Weather Conditions: A.M. (0640) CLEAR, TEMP 48, WIND N ~5 MPH

P.M. (0825) CLEAR, TEMP 55, WIND N AT <5 MPH

Recorded By M Klidzejs 9/10/18 QA Checked By

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: SVAO PFAS SI **DELIVERY ORDER NO:**

Date (mm/dd/yy): 9/10/18 Su (M) Tu W Th F Sa PAGE 2 OF 4

Task Team Members:

SEE PG 1 OF 4

Narrative (include time and location):

GALLONS. CONNECT TUBING TO FLOW CELL

0805 RESUME PUMPING AT SLOWER RATE AND W/ PUMP SET AT ~MID-POINT OF WC. (SEE DEVELOPMENT RECORD FORMS). NOTE: DURING PUMPING OF 1ST 25 GALLONS, MOVED PUMP THROUGHOUT THE WATER COLUMN AND TURNED THE PUMP OFF & ON SEVERAL TIMES TO DISLODGE LOOSE WELL TO GO TO MW-84PFAS-01

0848 OPEN WELL MW-84PFAS-01. PID AT TOC = 1.1 ppm (MAX) SUSTAINED ~0.8 ppm, BZ = 0.0 PPM.

0850 MEASURE WL AT 43.21 FT BTOC. MEASURE TD AT 49.43 FT BTOC. WC = 6.22 FT × 0.163 = 1.0 GALLON (CASING VOLUME)

0900 0859 BEGIN BAILING/SURGING W/ NEW DISPOSABLE BAILER + COTTON ROPE MK 9/10/18

0917 END BAILING AFTER REMOVING 5 GALLONS

INSERT MONSOON PUMP W/ NEW TUBING IN

Daily Weather Conditions: A.M. MK 9/10/18

P.M.

Recorded By NL Kapp 9/10/18 QA Checked By

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: SVAD PFAS SI **DELIVERY ORDER NO:**

Date (mm/dd/yy): 9/10/18 Su (M) Tu W Th F Sa PAGE 3 OF 4

Task Team Members:

SEE PG 1 OF 4

Narrative (include time and location):

WELL

MEASURE WL AT ~~MW~~ WL 9/10/18 43.22 FT BTOC.

0945 BEGIN PUMPING AT MAX RATE.

1002 STOP PUMPING AFTER REMOVING 27 GALLONS.

CONNECT TUBING TO FLOW CELL. WL = 43.22 FT BTOC

1004 RESUME PUMPING AT SLOWER RATE

1033 KLUDZEJS LEAVES WELL SITE TO GO TO MW-84PFAS-02

1035 OPEN WELL. PID AT TOC = 0.6 ppm (MAX). SUSTAINED AT

0.1-0.2 ppm. BZ = 0.0 ppm.

MEASURE WL AT 42.72 FT BTOC. MEASURE TD AT 51.60 FT BTOC

WC = 8.88 FT x 0.163 = 1.4 GALLONS

1104 BEGIN BAILING/SURGING USING NEW DISPOSABLE BAILER + COTTON ROPE

1124 END BAILING AFTER REMOVING 5 GALLONS

SET MONSOON PUMP W/ NEW TUBING IN WELL

MEASURE WL AT 42.72 FT BTOC

Daily Weather Conditions: A.M. SEE B-51

P.M.

Recorded By [signature] 9/10/18 QA Checked By

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: SVAD PFAS SI **DELIVERY ORDER NO:**

Date (mm/dd/yy): 9/10/18 Su M Tu W Th F Sa PAGE 4 OF 4

Task Team Members:

SEE PG 1 OF 4

Narrative (include time and location):

1135 BEGIN PUMPING AT MAX RATE

1144 STOP PUMPING AFTER REMOVING 15 ADDITIONAL GALLONS, CONNECT FLOW CELL

1155 ~~1155~~ RESUME PUMPING

1200 COLLECT SOLID IDW CHARACTERIZATION SAMPLE. SAMPLE WAS FORMED AS GRABS FROM EACH 5FT INTERVAL OF EACH MON. WELL BORING. SAMPLE ID: IDW-SO-PFAS LDOS001

1235 DEVELOPMENT OF MW-BHPAS-02 COMPLETED. PARAMETERS STABLE. WATER IS CLEAR

1715 M. KLIDZEJS OFF SITE FOR DAY AFTER PLACING LOCKS ON WELLS, INSPECTING WELLSITES, CHECKING INVENTORY OF DRUMS NOW ALL STAGED IN H-AREA, MOVING EQUIPMENT AND COOLERS TO USACE'S BLDG. NOTE: CHARLES BROUGHT SAMPLES COLLECTED TO ~~DATE~~ DATE TO FEDEX.

mid 9/10/18

Daily Weather Conditions: A.M. ~~—~~ one 9/10/18

P.M. (1305) CLEAR, TEMP 72, WIND NW ~5MPH

Recorded By [signature] 9/10/18 QA Checked By _____

HTRW DRILLING LOG

	DISTRICT: LOUISVILLE	HOLE NUMBER MW-84PFAS-01
1. COMPANY NAME: Leidos	2. DRILL SUBCONTRACTOR: MATECO	SHEET 1 OF 6

3. PROJECT: SVAO PFAS SI	4. LOCATION: SVAO SITE 084
5. NAME OF DRILLER: GARY SWIFT	6. MANUFACTURERS DESIGNATION OF DRILL: CME 55
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: -6 1/2 IN OD, 4 1/2 IN ID, 5 FT LENGTH HSAs -8 1/4 IN OD, 4 1/2 IN ID, 4-IN LENGTH BULLET BIT W/ WOODEN PLUG	8. HOLE LOCATION:
	9. SURFACE ELEVATION:
	10. DATE STARTED: 9/7/18 — 11. DATE COMPLETED: 9/7/18
12. OVERBURDEN THICKNESS: >48 FT	15. DEPTH GROUNDWATER ENCOUNTERED: 41.7 FT BGS
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: —
14. TOTAL DEPTH OF HOLE: 48 FT	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): —

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES: N/A

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY: N/A
	—	—	—	—	—	

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
	—	X	—	

LOCATION SKETCH/COMMENTS — SCALE:

HTRW DRILLING LOG

HOLE NUMBER MW-8HPFAS

PROJECT: SWAO PFAS SI | INSPECTOR M. Kidzeis | SHEET 2 OF 4

ELEV. (A)	DEPTH (B)	DESCRIPTION OF MATERIALS (C)	HEADSPACE SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX	ANALYTICAL SAMPLE NO. (F)	REMARKS (G)
	0	0.0 – 4Ft:				HAND HOLE TO 5FT TO CLEAR UTILITIES + UXO
	1	SAND (SP). FINE GRAINED, WELL SORTED, LOOSE DARK YELLOWISH BROWN (10YR 4/6) SC. MOIST				HSA DRILLING
	2					
	3					
	4					
	5					
	6					
	7					
	8		PID over cuttings = 0.0 ppm			
	9					
	10					

PROJECT: SWAO PFAS SI | HOLE NUMBER MW-8HPFAS-01

HTRW DRILLING LOG

HOLE NUMBER MW-84PFAS

PROJECT: SWAD PFAS SI | INSPECTOR M. KIDZEJS | SHEET 3 OF 6

ELEV. (A)	DEPTH (B)	DESCRIPTION OF MATERIALS (C)	HEADSPACE SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX	ANALYTICAL SAMPLE NO. (F)	REMARKS (G)
	11					
	12					
	13					
	14	SAME AS ABOVE				
	15					
	16					
	17		PID OVER CUTTINGS = 0.0 PPM			
	18					
	19					
	20					

PROJECT: SWAD PFAS SI | HOLE NUMBER MW-84PFAS-01

HTRW DRILLING LOG

HOLE NUMBER MW-84 PFAS

PROJECT: SWAD PFAS SI. | INSPECTOR M. KUIDZEJS | SHEET 4 OF 6

ELEV. (A)	DEPTH (B)	DESCRIPTION OF MATERIALS (C)	HEADSPACE SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX	ANALYTICAL SAMPLE NO. (F)	REMARKS (G)
	21					
	22					
	23					
	24					
	25	SAME AS ABOVE				
	26					
	27		AD OVER CUTTINGS = 0.0 ppm			
	28					
	29					

PROJECT: SWAD PFAS SI | HOLE NUMBER MW-84PFAS-01

HTRW DRILLING LOG

HOLE NUMBER MW-84PAS-

PROJECT: SWMU PFAS SI. | INSPECTOR M. KLIDZEJS | SHEET 5 OF 6

ELEV. (A)	DEPTH (B)	DESCRIPTION OF MATERIALS (C)	HEADSPACE SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX	ANALYTICAL SAMPLE NO. (F)	REMARKS (G)
	31					
	32					
	33					
	34					
	35	SAME AS ABOVE				
	36					
	37					
	38					
	39					

PROJECT: SWMU PFAS SI | HOLE NUMBER MW-84PFAS-01

HTRW DRILLING LOG

HOLE NUMBER MW84PFAS

PROJECT: SVAD PFAS SI

INSPECTOR M. KLIDZEJS

SHEET 6 OF 6

ELEV. (A)	DEPTH (B)	DESCRIPTION OF MATERIALS (C)	HEADSPACE SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX	ANALYTICAL SAMPLE NO. (F)	REMARKS (G)
	41					
	42					DRILL RIG CHATTERS DRILLING AT 42 FT
	43					
	44					~~TD AT 44.5 FT BGS~~ MK 9/7/18
	45					ADVANCE BORING TO 48 FT. WL WAS STABLE AT 41.7 FT
	46					
	47					
	48					TD = 48 FT
	49					

PROJECT: SVAD PFAS SI

HOLE NUMBER MW84PFAS-0

HTRW DRILLING LOG

1. COMPANY NAME: LEIDOS	2. DRILL SUBCONTRACTOR: MATECO	HOLE NUMBER MW-84PFAS-02
3. PROJECT: SVAD PFAS SI	4. LOCATION: SVAD SITE 084	SHEET 1 OF 6
5. NAME OF DRILLER: GARY SWIFT	6. MANUFACTURERS DESIGNATION OF DRILL: CME 55	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: -6 1/2 IN OD 4 1/2 IN ID, 5FT LENGTH HSAs; -8 1/4 IN OD, 4 1/2 IN ID BULLET BIT W/ WOODEN PLUG	8. HOLE LOCATION:	
	9. SURFACE ELEVATION:	
	10. DATE STARTED: 9/7/18	11. DATE COMPLETED: 9/7/18
12. OVERBURDEN THICKNESS: >49 FT	15. DEPTH GROUNDWATER ENCOUNTERED: ~~N/A~~ 41.1 FT BGS	
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: —	
14. TOTAL DEPTH OF HOLE: 49.3 FT	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): —	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES: N/A			
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY: N/A
	—	—	—	—	—	
22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR		
	—	X	—			

LOCATION SKETCH/COMMENTS — SCALE:

HTRW DRILLING LOG

HOLE NUMBER MW-84PFAS

PROJECT: SVAO PFAS SI . | INSPECTOR M. KLIDZEJS | SHEET 2 OF 4

ELEV. (A)	DEPTH (B)	DESCRIPTION OF MATERIALS (C)	HEADSPACE SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX	ANALYTICAL SAMPLE NO. (F)	REMARKS (G)
		0.0-4FT: SAND (SP). FINE GRAINED, WELL SORTED, LOOSE, YELLOWISH BROWN (10YR 5/4) DAMP	P.I.D OVER CUTTINGS = 0.0PPM			

PROJECT: SVAO PFAS SI | HOLE NUMBER MW-84PFAS-02

HTRW DRILLING LOG

HOLE NUMBER MW-84PFAS

PROJECT: SWAD PFAS SI

INSPECTOR M. KIDZEJS

SHEET 3 OF 6

ELEV. (A)	DEPTH (B)	DESCRIPTION OF MATERIALS (C)	HEADSPACE SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX	ANALYTICAL SAMPLE NO. (F)	REMARKS (G)
	11					
	12					
	13	SAME AS ABOVE				
	14		PID OVER CUTTINGS = 0.0 ppm			
	15					
	16					
	17					
	18					
	19					

PROJECT: SWAD PFAS SI

HOLE NUMBER MW-84PFAS-0

HTRW DRILLING LOG

HOLE NUMBER MW-84PFAS-0

PROJECT: SWAD PFAS SI. | INSPECTOR M. KLIDZEJS | SHEET 4 OF 6

ELEV. (A)	DEPTH (B)	DESCRIPTION OF MATERIALS (C)	HEADSPACE SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX	ANALYTICAL SAMPLE NO. (F)	REMARKS (G)
	21					
	22					
	23					
	24	SAME AS ABOVE	PID OVER CUTTINGS = 0.0 ppm			
	25					
	26					
	27					
	28					
	29					
	30					

PROJECT: SWAD PFAS SI | HOLE NUMBER MW-84PFAS-02

HTRW DRILLING LOG

HOLE NUMBER MW-84PFAS

PROJECT:

INSPECTOR M. Kidzeis

SHEET 5 OF 6

ELEV. (A)	DEPTH (B)	DESCRIPTION OF MATERIALS (C)	HEADSPACE SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX	ANALYTICAL SAMPLE NO. (F)	REMARKS (G)
	31					
	32					
	33					
	34	SAME AS ABOVE MOIST	PID OVER CUTTINGS = 0.0 PPM			
	35					
	36					
	37					
	38					
	39					

PROJECT: SVAD PFAS SI

HOLE NUMBER MW-84PFAS-02

HTRW DRILLING LOG

HOLE NUMBER MW-84PFAS

PROJECT: SVAO PFAS SI. | INSPECTOR M. Kidzeis | SHEET 6 OF 6

ELEV. (A)	DEPTH (B)	DESCRIPTION OF MATERIALS (C)	HEADSPACE SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX	ANALYTICAL SAMPLE NO. (F)	REMARKS (G)
	41					
	42					~~HARD~~ MK 9/7/18 DRILL RIG CHATTERS DRILLING AT 42 FT
	43					
	44	SAME AS ABOVE	PID OVER CUTTINGS = 0.0 ppm			MK 9/7/18 ~~TD = 44.5 FT~~ BGS
	45	CUTTINGS FROM LAST OF DRILLING WET				
	46					
	47					
	48					
	49					TD = 49 FT
	50					

PROJECT: SVAO PFAS SI | HOLE NUMBER MW-84PFAS-02

HTRW DRILLING LOG

DISTRICT: LOUISVILLE		HOLE NUMBER: MW-84PFAS-03
1. COMPANY NAME: LEIDOS	2. DRILL SUBCONTRACTOR: MATECO	SHEET 1 OF 4
3. PROJECT: SVAD PFAS SI	4. LOCATION: SVAD SITE 084	
5. NAME OF DRILLER: GARY SWIFT	6. MANUFACTURERS DESIGNATION OF DRILL: CME 55	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: -6 1/2 IN OD, 4 1/2 IN ID 5FT LENGTH HSAs; -8 1/4 IN OD, 4 1/2 IN ID, 4-IN LENGTH BULLET BIT W/ WOODEN PLUG	8. HOLE LOCATION:	
	9. SURFACE ELEVATION:	
	10. DATE STARTED: 9/6/18	11. DATE COMPLETED: 9/6/18
12. OVERBURDEN THICKNESS: > 48 FT	15. DEPTH GROUNDWATER ENCOUNTERED: SEE LOG	
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: —	
14. TOTAL DEPTH OF HOLE: 48 FT	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): —	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES: N/A		
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)
	—	—	—	—	—
22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR	21. TOTAL CORE RECOVERY: N/A
	—	X	—		

LOCATION SKETCH/COMMENTS — SCALE:

PROJECT: SVAD PFAS SI — HOLE NUMBER: MW-84PFAS-03

HTRW DRILLING LOG

HOLE NUMBER MW-84PFAS

PROJECT: SVAO PFAS SI | INSPECTOR M. KLIDZEJS | SHEET 2 OF 6

ELEV. (A)	DEPTH (B)	DESCRIPTION OF MATERIALS (C)	HEADSPACE SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX	ANALYTICAL SAMPLE NO. (F)	REMARKS (G)
		0.0 – 4.8FT: SAND (SP). FINE GRAINED (PREDOM) W/ SOME MEDGRAINS MOD. WELL SORTED. LOOSE. DARK YELLOWISH BROWN (10YR 4/6). V. MOIST	PID OVER CUTTINGS = 0.0 ppm			HAND AUGER TO 5.0 FT FOR UTILITY CLEARANCE. DRILL USING HSA

PROJECT: SVAO PFAS SI | HOLE NUMBER MW-84PFAS-03

HTRW DRILLING LOG

HOLE NUMBER MW-84PFAS-

PROJECT: SVAO PFAS SI | INSPECTOR M. KLIDZEJS | SHEET 3 OF 6

ELEV. (A)	DEPTH (B)	DESCRIPTION OF MATERIALS (C)	HEADSPACE SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX	ANALYTICAL SAMPLE NO. (F)	REMARKS (G)
	14	SAME AS ABOVE	PID OVER CUTTINGS = 0.0 ppm			

PROJECT: SVAO PFAS SI | HOLE NUMBER MW-84PFAS-03

HTRW DRILLING LOG

HOLE NUMBER MW-84PFAS-

PROJECT: SVAD PFAS SI. | INSPECTOR M. KidzEJS | SHEET 4 OF 6

ELEV. (A)	DEPTH (B)	DESCRIPTION OF MATERIALS (C)	HEADSPACE SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX	ANALYTICAL SAMPLE NO. (F)	REMARKS (G)
	21					
	22					
	23					
	24					
	25	SAME AS ABOVE				
	26					
	27					
	28					
	29					AFTER REACHING 30 FT. WELL MEASURED DRY

PROJECT: SVAD PFAS SI | HOLE NUMBER MW-84PFAS-6

HTRW DRILLING LOG

HOLE NUMBER MW-84PFA

PROJECT: SVAD PFAS SI. | INSPECTOR M. Kidzeiss | SHEET 5 OF 6

ELEV. (A)	DEPTH (B)	DESCRIPTION OF MATERIALS (C)	HEADSPACE SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX	ANALYTICAL SAMPLE NO. (F)	REMARKS (G)
	31					
	32					
	33		PID OVER CUTTINGS = 0.0ppm			
	34	SAME AS ABOVE SL. MOIST				
	35					
	36					
	37					
	38					
	39					WELL MEASURED DRY AFTER REACHING 40ft ADVANCE BORING TO 45FT

PROJECT: | HOLE NUMBER MW-84PFAS-03

HTRW DRILLING LOG

HOLE NUMBER MW-84PFAS-

PROJECT: SVAD PFAS SI . | INSPECTOR M. KLIDZEIS | SHEET 6 OF 6

ELEV. (A)	DEPTH (B)	DESCRIPTION OF MATERIALS (C)	HEADSPACE SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX	ANALYTICAL SAMPLE NO. (F)	REMARKS (G)
	41					
	42	SAME AS ABOVE V. MOIST 40.4 FT				
	43					
	44					
	45					AFTER ADVANCING TO 45, MEASURE WL AT 42 FT.
	46					ADVANCE BORING TO 47 FT MEASURE WL AT 43.8 FT, RISING SLOWLY
	47					ADVANCE BORING TO 48 FT PUSH OUT PLUG MEASURE WL AT 37.5 FT BGS
	48					TD = 48 FT
	49					

PROJECT: SVAD PFAS SI | HOLE NUMBER MW-84PFAS-03

HTRW DRILLING LOG

DISTRICT: LOUISVILLE		HOLE NUMBER MW-67PFAS-01
1. COMPANY NAME: LEIDOS	2. DRILL SUBCONTRACTOR: MATECO	SHEET 1 OF 4
3. PROJECT: SVAD PFAS SI	4. LOCATION: SVAD SITE 067	
5. NAME OF DRILLER: GARY SWIFT	6. MANUFACTURERS DESIGNATION OF DRILL: CME 55	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: -6 1/2 IN OD, 4 1/2 IN ID, 5FT LENGTH HSAs -8 1/4 IN OD, 4 1/2 IN ID, 4-IN LENGTH BULLET BIT W/ WOODEN PLUG	8. HOLE LOCATION:	
	9. SURFACE ELEVATION:	
	10. DATE STARTED: 9/6/18	11. DATE COMPLETED: 9/6/18
12. OVERBURDEN THICKNESS: >23FT	15. DEPTH GROUNDWATER ENCOUNTERED: N/A	
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: 15.5 FT BGS 33 MIN	
14. TOTAL DEPTH OF HOLE: 23FT	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): —	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES: N/A			
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY N/A
	—	—	—	—	—	
22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR		
	—	X	—			

LOCATION SKETCH/COMMENTS SCALE:

PROJECT: SVAD PFAS SI HOLE NUMBER MW-67PFAS-01

HTRW DRILLING LOG

HOLE NUMBER MW-67PFAS

PROJECT: SVAD PFAS SI

INSPECTOR M. KLIDZEJS

SHEET 2 OF 4

ELEV. (A)	DEPTH (B)	DESCRIPTION OF MATERIALS (C)	HEADSPACE SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX	ANALYTICAL SAMPLE NO. (F)	REMARKS (G)
	0	0.0 - 23FT: SAND (SP), TRACES FINES. FINE-GRAINED, WELL SORTED LOOSE, DARK GRAY (10YR) MOIST				HAND AUGER TO CLEAR UTILITIES HSA DRILLING
	6	GRADES TO BROWN (10YR 4/3) BY ~ 6FT				
	7		PID OVER CUTTINGS = 0.0PPM			

PROJECT: SVAD PFAS SI

HOLE NUMBER MW-67PFAS-0201

HTRW DRILLING LOG

HOLE NUMBER MW-67PFAS

PROJECT: SVAO PFAS SI | INSPECTOR M. KLIDZESS | SHEET 3 OF 4

ELEV. (A)	DEPTH (B)	DESCRIPTION OF MATERIALS (C)	HEADSPACE SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX	ANALYTICAL SAMPLE NO. (F)	REMARKS (G)
	11					
	12					
	13					
	14					
	15	GRADES TO YELLOWISH BROWN (10YR 5/4) ~15FT	PID OVER CUTTINGS = 0.0ppm			
	16					
	17					
	18					
	19					

PROJECT: SVAO PFAS SI | HOLE NUMBER MW-67PFAS-02 01

HTRW DRILLING LOG

HOLE NUMBER MW-67 PFA

PROJECT: SVAO PFAS SI. | INSPECTOR M. KLIDZEJS | SHEET 4 OF 4

ELEV. (A)	DEPTH (B)	DESCRIPTION OF MATERIALS (C)	HEADSPACE SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX	ANALYTICAL SAMPLE NO. (F)	REMARKS (G)
	21	SAME AS ABOVE				
	22					
	23					TD = 23 FT
	24					
	25					
	26					
	27					
	28					
	29					

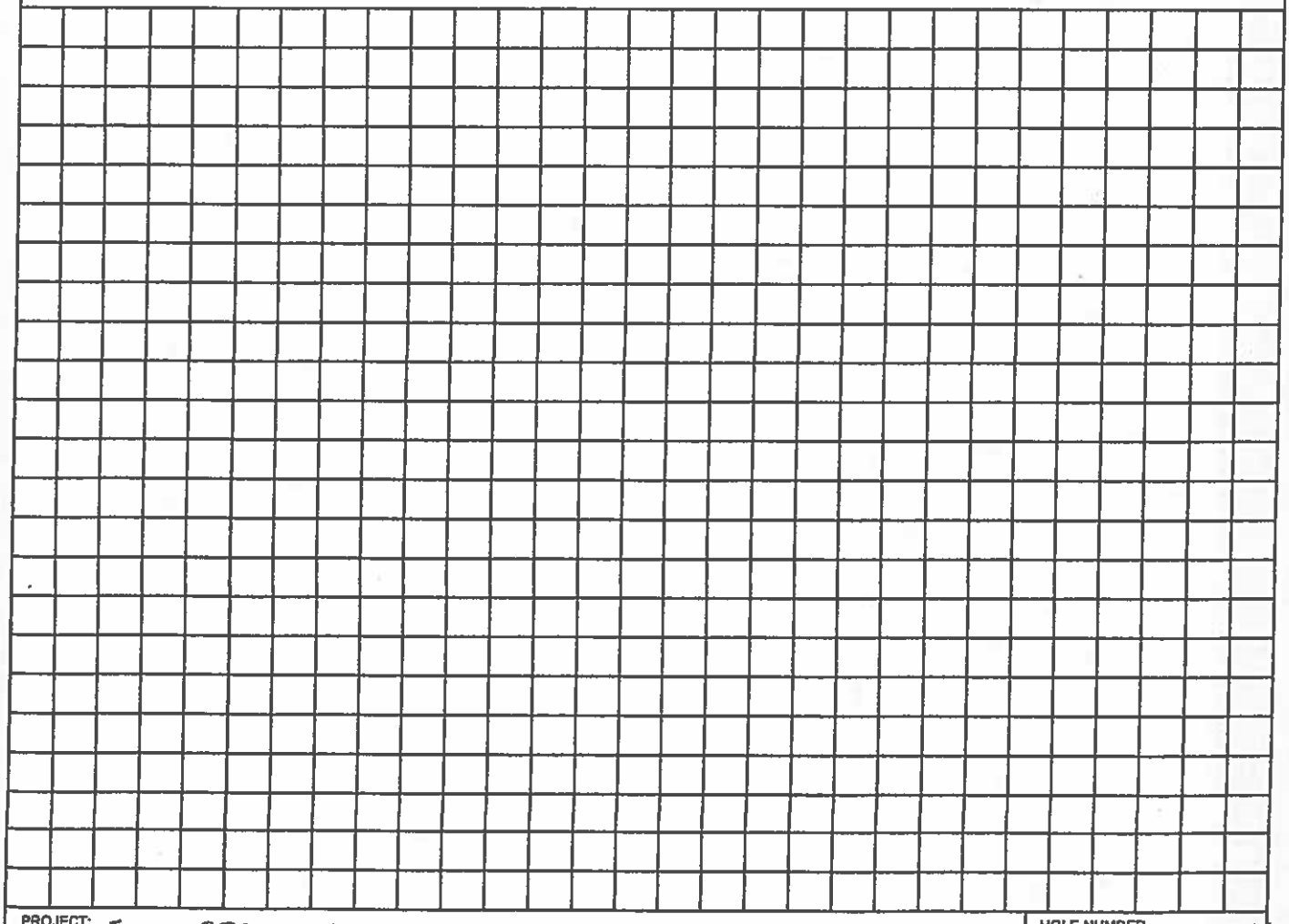
PROJECT: | HOLE NUMBER MW-67PFAS-02-01

HTRW DRILLING LOG

DISTRICT: LOUISVILLE		HOLE NUMBER MW-67PFAS-02
1. COMPANY NAME: Leidos	2. DRILL SUBCONTRACTOR: MATECO	SHEET 1 OF 4
3. PROJECT: SVAD PFAS SI	4. LOCATION: SVAD SITE 067	
5. NAME OF DRILLER: GARY SWIFT	6. MANUFACTURERS DESIGNATION OF DRILL: CME 55	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: -6 1/2 IN OD, 4 1/2 IN ID, 5FT LENGTH HSAs, -5 7/8 IN OD, 4 1/2 IN ID, 4-IN LENGTH BULLET DIT W/ WOODEN PLUG	8. HOLE LOCATION:	
	9. SURFACE ELEVATION:	
	10. DATE STARTED: 9/6/18	11. DATE COMPLETED: 9/6/18
12. OVERBURDEN THICKNESS: > 23.3 FT	15. DEPTH GROUNDWATER ENCOUNTERED: N/A	
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: 16.4 FT 19 MIN	
14. TOTAL DEPTH OF HOLE: 23.3 FT	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): —	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES: N/A			
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY: N/A
—	—	—	—	—	—	
22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR		
	—	X	—			

LOCATION SKETCH/COMMENTS — SCALE:



PROJECT: SVAD PFAS SI — HOLE NUMBER MW-67PFAS-02

HTRW DRILLING LOG

HOLE NUMBER MW-67 PFAS

PROJECT: SVAD PFAS SI

INSPECTOR M. KLIDZEJS

SHEET 2 OF 4

ELEV. (A)	DEPTH (B)	DESCRIPTION OF MATERIALS (C)	HEADSPACE SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX	ANALYTICAL SAMPLE NO. (F)	REMARKS (G)
	0	0.0 - 23~~6~~ FT: SAND (SP) FINE GRAINED, WELL SORTED, LOOSE, VERY DARK GRAY (10YR 3/1) MOIST.	PID IN HOLE = 0.0 ppm			LITHOLOGY LOGGED FROM AUGER CUTTINGS HAND AUGER TO 6 FT TO CLEAR UTILITIES
	7		PID OVER CUTTINGS = 0.0 ppm			

PROJECT: SVAD PFAS SI

HOLE NUMBER MW-67PFAS-002

HTRW DRILLING LOG

HOLE NUMBER MW-67PFAS

PROJECT: SWAO PFAS SI. | INSPECTOR M. KUDZEJS | SHEET 3 OF 4

ELEV. (A)	DEPTH (B)	DESCRIPTION OF MATERIALS (C)	HEADSPACE SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX	ANALYTICAL SAMPLE NO. (F)	REMARKS (G)
	11					
	12					
	13					
	14					
	15	COLOR GRADES TO BROWN (10YR 4/3) BY 15FT MOIST				
	16					
	17		PID OVER CUTTINGS = 0.0 PPM			
	18					
	19					

PROJECT: SWAO PFAS SI | HOLE NUMBER MW-67PFAS-OR

HTRW DRILLING LOG

HOLE NUMBER MW-67PFAS

PROJECT: SWAO PFAS SI . INSPECTOR M. Kidzeis SHEET 4 OF 4

ELEV. (A)	DEPTH (B)	DESCRIPTION OF MATERIALS (C)	HEADSPACE SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX	ANALYTICAL SAMPLE NO. (F)	REMARKS (G)
	21	SAME AS ABOVE				
	22					
	23					TD = 23.3FT
	24					
	25					
	26					
	27					
	28					
	29					
	30					

PROJECT: SWAO PFAS SI HOLE NUMBER MW-67PFAS-002

HTRW DRILLING LOG

DISTRICT: LOUISVILLE		HOLE NUMBER MW-67PFAS-03
1. COMPANY NAME: LEIDOS	2. DRILL SUBCONTRACTOR: MATECO	SHEET 1 OF 4
3. PROJECT: SVAD PFAS SI	4. LOCATION: SVAD SITE 067	
5. NAME OF DRILLER: GARY SWIFT	6. MANUFACTURERS DESIGNATION OF DRILL: CME 55	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: - 6 1/2 IN OD, 4 1/2 IN ID, 5 FT LENGTH HSA - 8 1/4 IN OD, 4 1/2 IN ID, 4 IN LENGTH BULLET BIT W/ WOODEN PLUG	8. HOLE LOCATION:	
	9. SURFACE ELEVATION:	
	10. DATE STARTED: 9/5/18	11. DATE COMPLETED: 9/5/18
12. OVERBURDEN THICKNESS: > 27	15. DEPTH GROUNDWATER ENCOUNTERED: FIRST WET CUTTINGS AT ~22 FT BGS	
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: —	
14. TOTAL DEPTH OF HOLE: 27 FT	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY):	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES: N/A		
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)
	—	—	—	—	—

21. TOTAL CORE RECOVERY	22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
N/A		—	X	—	

LOCATION SKETCH/COMMENTS — SCALE:

HTRW DRILLING LOG

HOLE NUMBER MW-67PFAS

PROJECT: SVAD PFAS SI | INSPECTOR M. Kidzeis | SHEET 2 OF 4

ELEV. (A)	DEPTH (B)	DESCRIPTION OF MATERIALS (C)	HEADSPACE SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX	ANALYTICAL SAMPLE NO. (F)	REMARKS (G)
	1	0.0 - 27 FT:				HAND AUGER TO 5FT TO CLEAR UTILITIES
	2	SAND (SP) SOME FINES, FINE GRAINED, WELL SORTED LOOSE, BLACK (10YR 2/1) MOIST	CUTTINGS 0.0PPM			LITHOLOGY LOGGED FROM AUGER CUTTINGS.
	3					
	4					
	5	GRADES TO DARK GRAYISH BROWN (10YR 3/2)				HSA DRILLING
	6					
	7		CUTTINGS = 0.0 PPM			
	8					
	9					
	10					

PROJECT: SVAD PFAS SI | HOLE NUMBER MW-67PFAS-03

HTRW DRILLING LOG

HOLE NUMBER MW-67 PFAS

PROJECT: SVAD PFAS SI | INSPECTOR M. KLIDZEJS | SHEET 3 OF 4

ELEV. (A)	DEPTH (B)	DESCRIPTION OF MATERIALS (C)	HEADSPACE SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX	ANALYTICAL SAMPLE NO. (F)	REMARKS (G)
	11					
	12					
	13	COLOR GRADES TO BROWN (10YR 5/3)				
	14	OTHERWISE, SAME AS ABOVE.				
	15		CUTTINGS = 0.0 ppm			
	16					
	17					
	18					
	19					

PROJECT: SVAD PFAS SI | HOLE NUMBER MW-67PFAS-03

HTRW DRILLING LOG

HOLE NUMBER MW-67PFAS

PROJECT: SVAO PFAS SI

INSPECTOR M. KIDZEJS

SHEET 4 OF 4

ELEV. (A)	DEPTH (B)	DESCRIPTION OF MATERIALS (C)	HEADSPACE SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX	ANALYTICAL SAMPLE NO. (F)	REMARKS (G)
	21	SAME AS ABOVE				
	22		CUTTINGS = 0.0 PPM			FIRST WET CUTTINGS RETURNED DRILLING AT 22 FT BGS
	23					
	24					
	25					
	26					
	27					TD = 27 FT
	28					
	29					

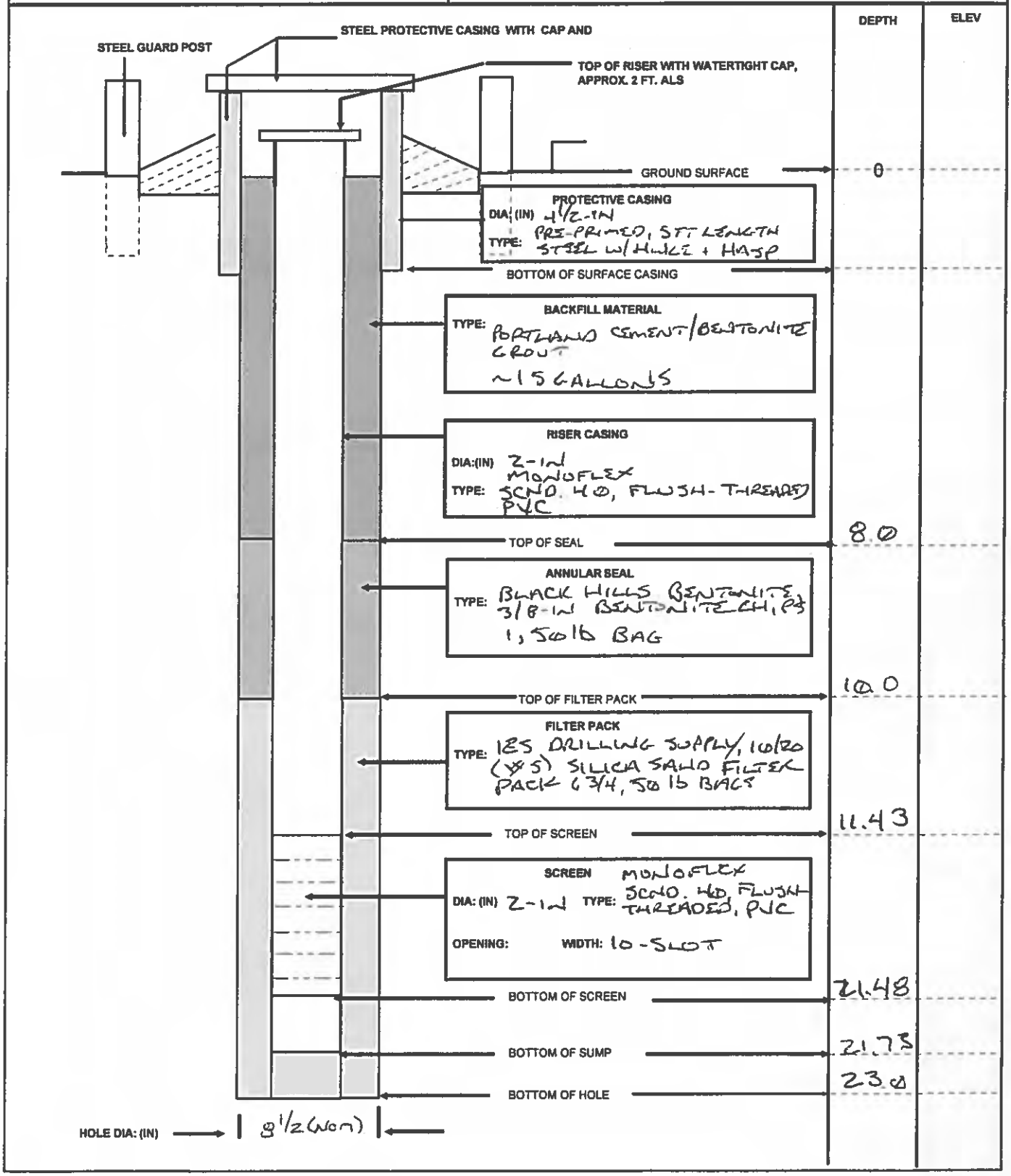
PROJECT: SVAO PFAS SI

HOLE NUMBER MW-67PFAS-03

MONITORING WELL (STICK-UP)

PROJECT NAME: SWAB PFAS SI **DELIVERY ORDER NO:**

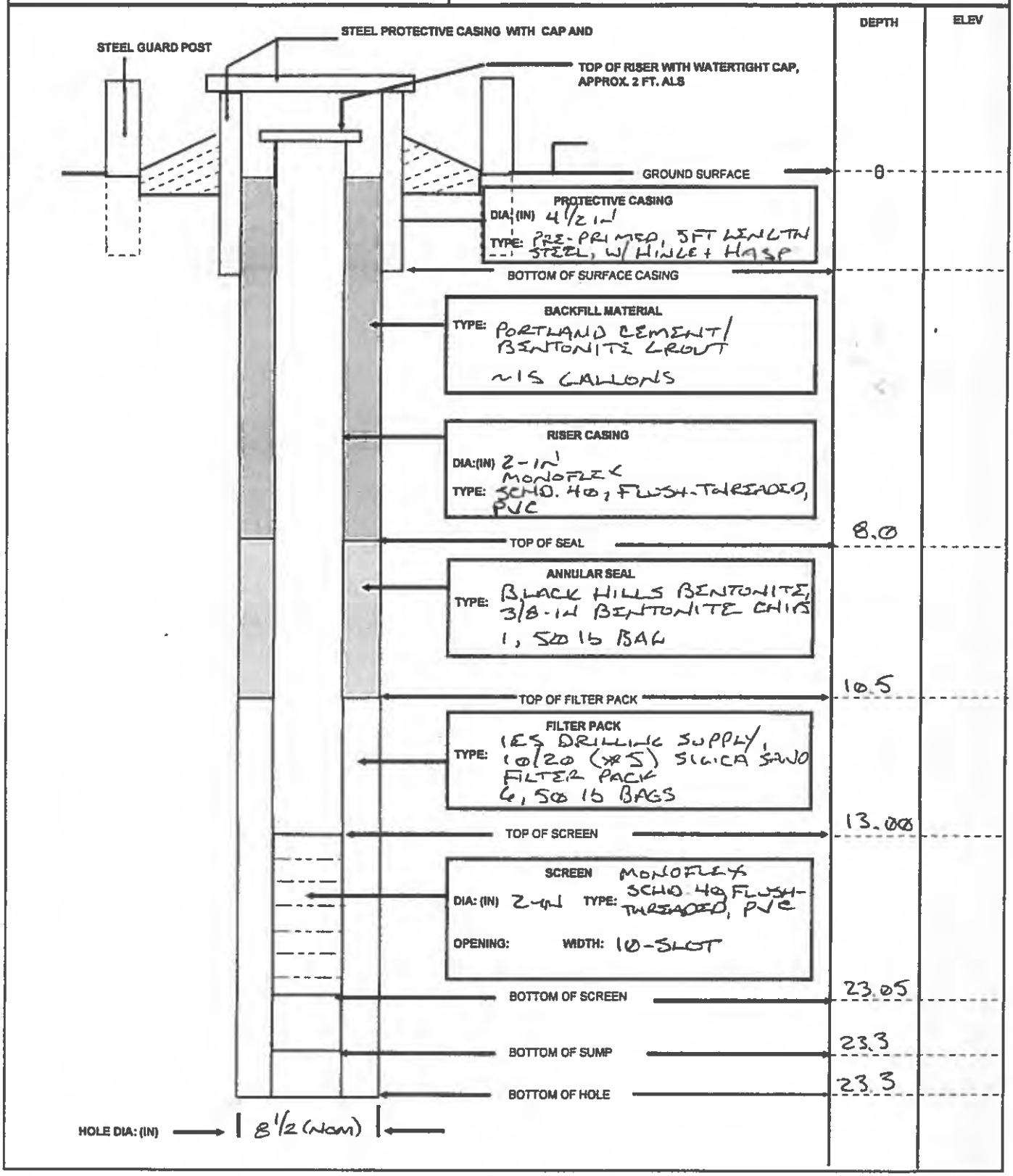
WELL NUMBER: MW-67PFAS-01	BEGIN: 9/6/18	END: 9/10/18
COORDINATES: N: E:	REFERENCE POINT:	ELEVATION: MSL



MONITORING WELL (STICK-UP)

PROJECT NAME: SWAO PFAS SI **DELIVERY ORDER NO:**

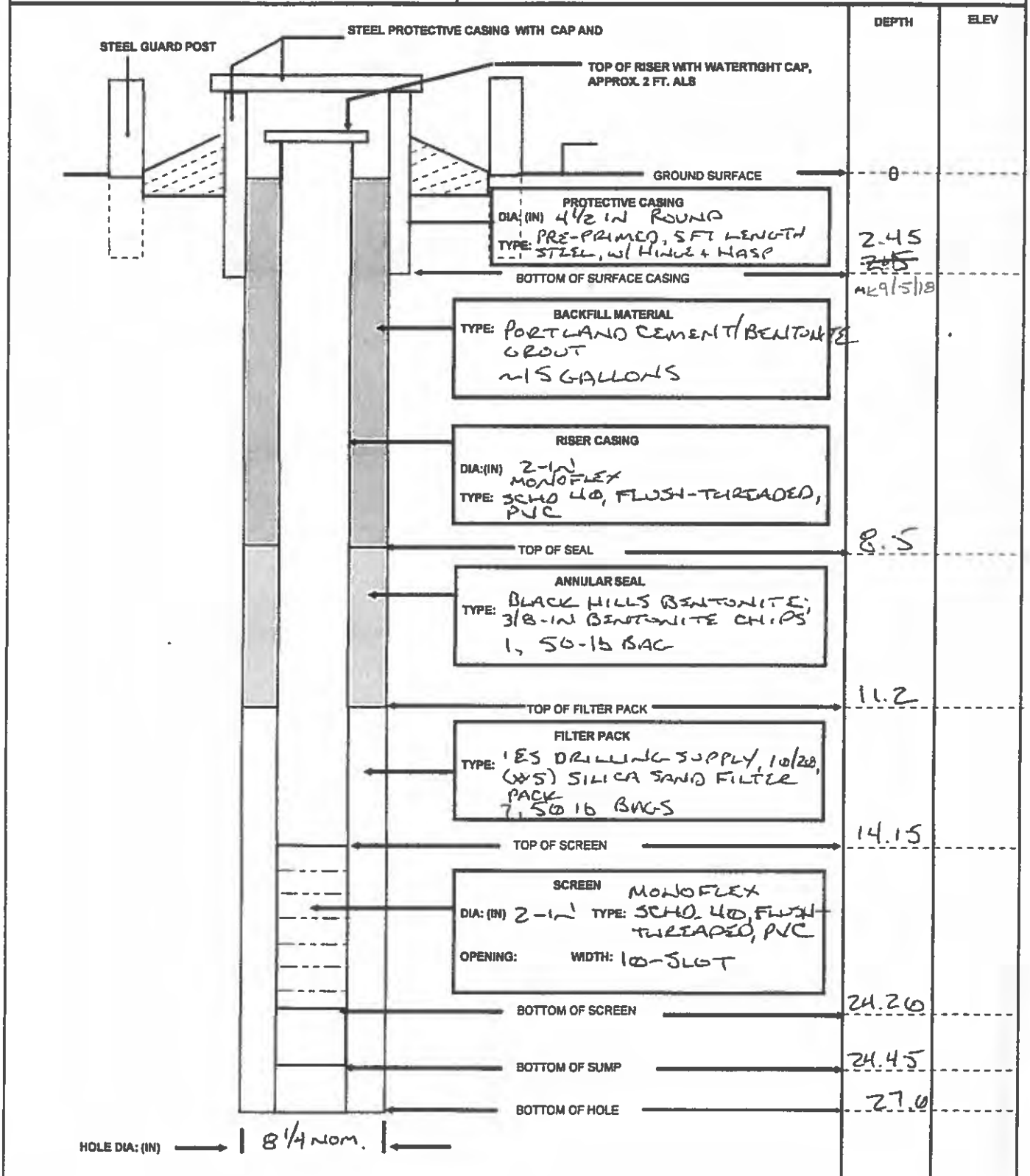
WELL NUMBER: MW-67PFAS-02	BEGIN: 9/6/18	END: 9/10/18
COORDINATES: N: E:	REFERENCE POINT:	ELEVATION: MSL



MONITORING WELL (STICK-UP)

PROJECT NAME: SVAD PFAS SI **DELIVERY ORDER NO:**

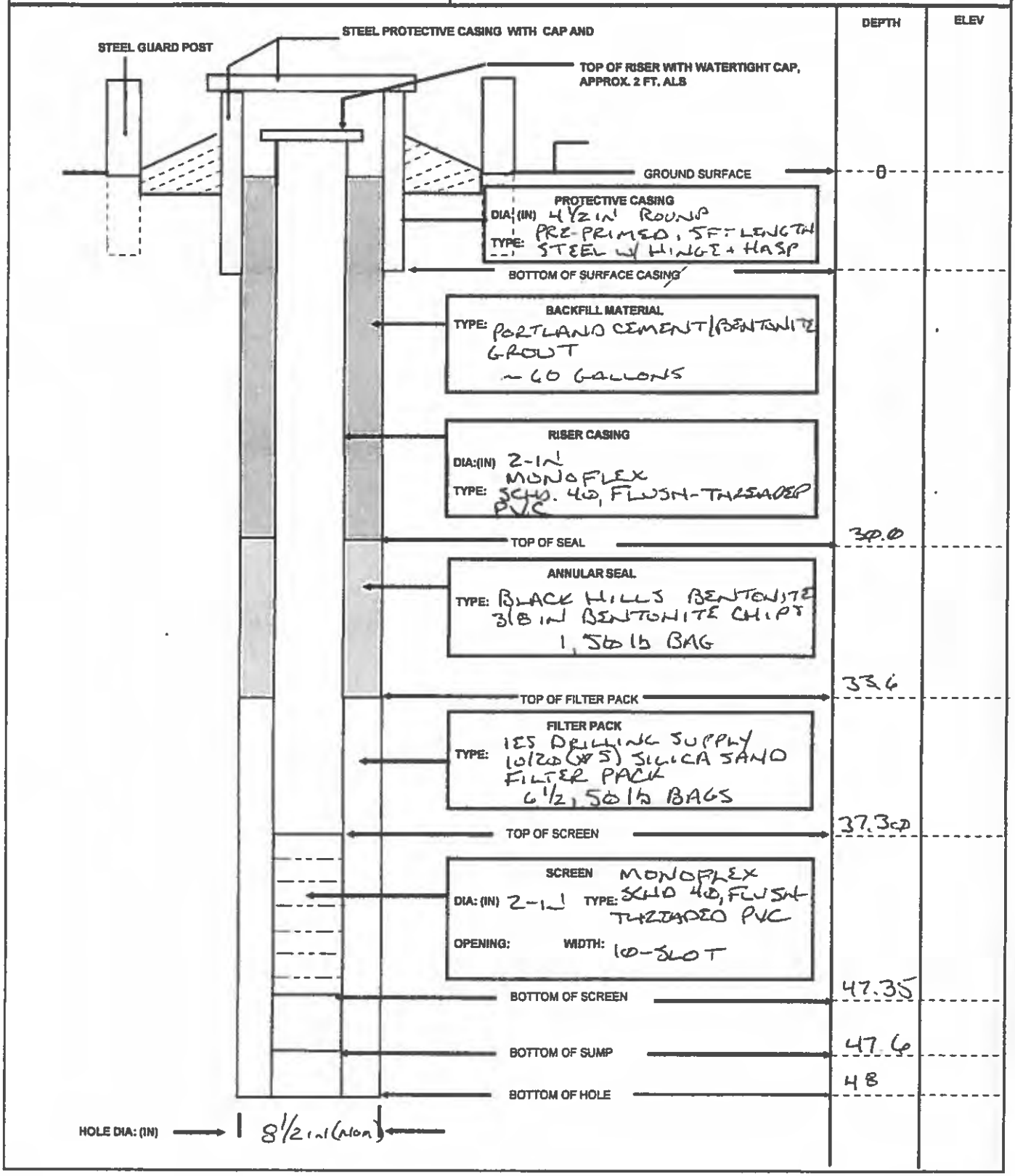
WELL NUMBER: MW-67PFAS-03	BEGIN: 9/5/18	END: 9/10/18
COORDINATES: N: E:	REFERENCE POINT:	ELEVATION: MSL



MONITORING WELL (STICK-UP)

PROJECT NAME: SCAD PFAS SI **DELIVERY ORDER NO:**

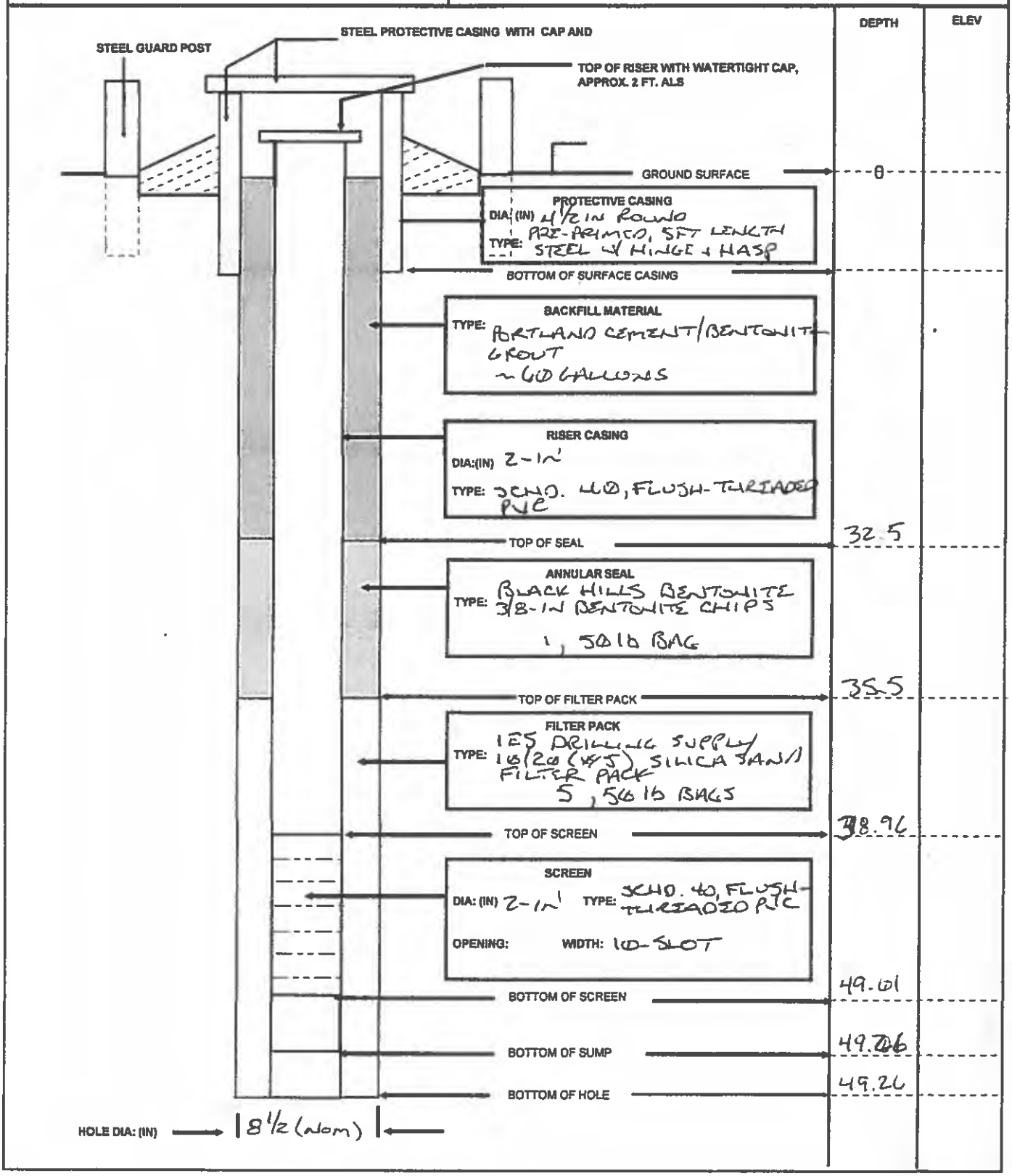
WELL NUMBER: MW-84PFAS-01	**BEGIN:** 9/7/18	**END:** 9/10/18
COORDINATES: N: E:	**REFERENCE POINT:**	**ELEVATION:** MSL



MONITORING WELL (STICK-UP)

PROJECT NAME: SVAO PFAS SI **DELIVERY ORDER NO:**

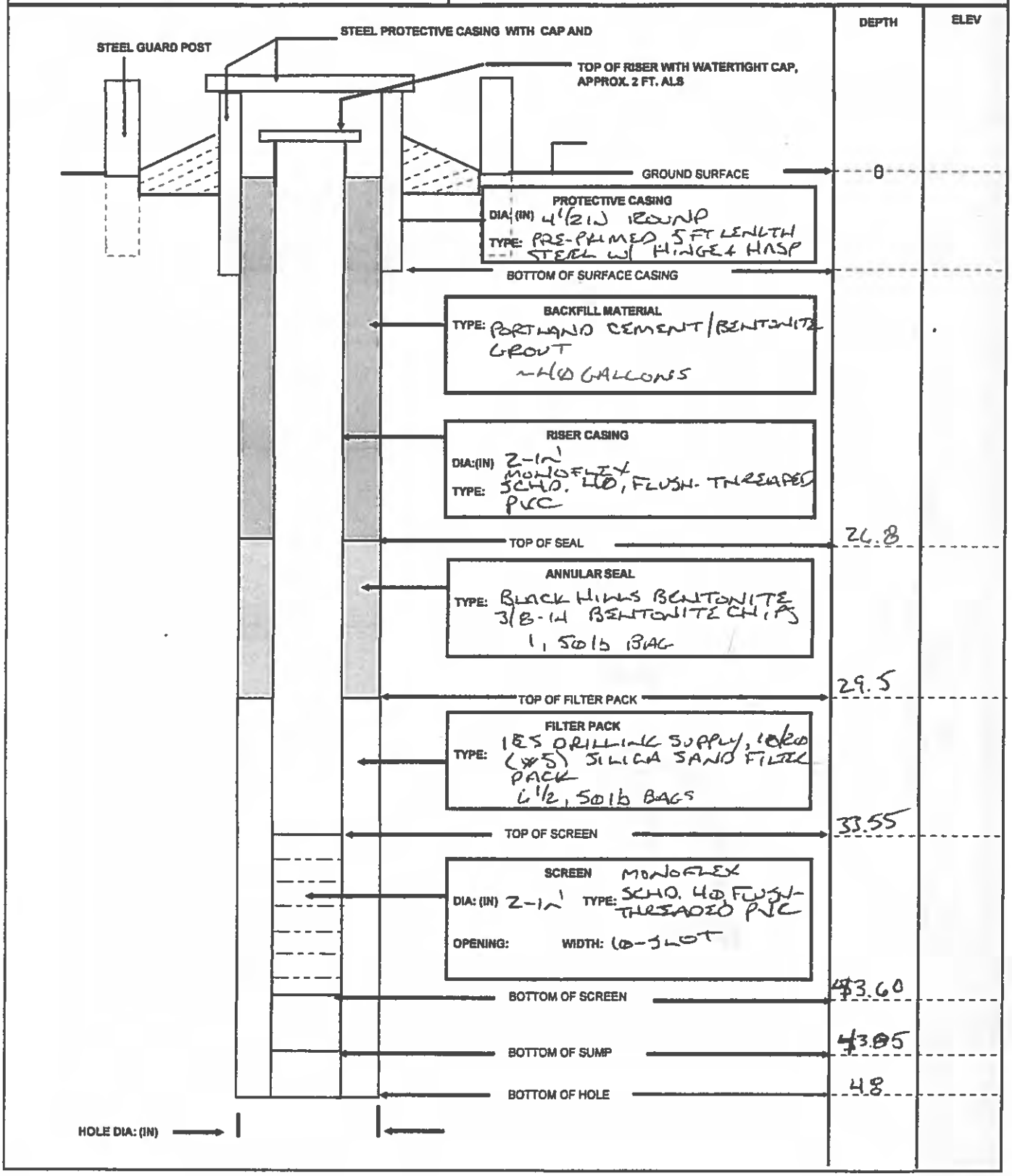
WELL NUMBER: MW-84PFAS-02	**BEGIN:** 9/7/18	**END:** 9/10/18
COORDINATES: N: E:	**REFERENCE POINT:**	**ELEVATION:** MSL



MONITORING WELL (STICK-UP)

PROJECT NAME: SVAD PFAS SI **DELIVERY ORDER NO:**

WELL NUMBER: MW-84PFAS-03	**BEGIN:**	**END:** 9/10/18
COORDINATES: N: E:	**REFERENCE POINT:**	**ELEVATION:** MSL



WELL DEVELOPMENT FORM

PROJECT NAME: SVAD PFAS SI **DELIVERY ORDER NO:**

Date: 9/9/18 Time: 1430

Well Number and Location: MW-67PFAS-01 SVAD SITE 67

Comments : WATER INITIALLY BAILED AND PUMPED WAS VERY TURBID; APPEARANCE OF COFFEE.

MK 9/9/18

Water Levels / Time: Initial: 17.20 / 12:12 Pumping: 17.20 / VARIOUS

Final: 17.20 / 14:30

Total Well Depth: Initial: 25.62 FT BTOC Final: 25.62 FT BTOC

Date and Time: Begin: 9/9/18 / 12:12 Completed: 9/9/18 / 14:30

Development Method(S): BAIL/SUCK W/ DISPOSABLE BAILER. PUMP W/ MONSOON SUBMERSIBLE PUM

Total Quantity of Water Removed: 54 gals

FIELD MEASUREMENT	SERIAL NUMBER	DATE OF LAST CALIBRATION
Temperature	QED-MP-20	9/9/18
Specific Conductivity		
pH		
Turbidity		N/A
DO	—	—
ORP	—	—

WELL DEVELOPMENT SUMMARY

PROJECT NAME: SWAO PFAS SI **DELIVERY ORDER NO:**

WELL NUMBER: MW-67PFAS-01

DATE	BEGINNING TIME	GALLONS REMOVED	TEMP (C)	SPECIFIC CONDUCTIVITY ~~(µMHOS/CM)~~ mS/cm	pH (STANDARD UNITS)	TURBIDITY (NTU)	TOTAL GALLONS REMOVED	WELL VOLUMES REMOVED	WL (FT BTOC)	COMMENTS
9/9/18	1330	30	15.26	0.343	5.74	98.3	30	21.4	17.20	PUMPING AT 840 mL/MIN
	1340	~4	13.53	0.291	6.08	63.7	34	24.3	17.20	
	1350	~4	13.37	0.297	6.10	19.3	38	27.1	17.20	
	1400	~4	13.32	0.294	6.09	20.0	42	30.0	17.20	
	1410	~4	13.54	0.293	6.09	22.1	46	32.9	17.20	
	1420	~4	13.41	0.290	6.10	26.3	50	35.7	17.20	
	1425	~2	13.38	0.289	6.13	2.5	52	37.1	17.20	
	1430	~2	13.41	0.290	6.13	3.1	54	38.6	17.20	
			DEVELOPMENT COMPLETED							
										1 CASING VOLUME = 1.4 GALLONS

MK 9/9/18

RECORDED BY: [signature] 9/9/18 QA CHECKED BY: [signature] 9/10/18

WELL DEVELOPMENT FORM

PROJECT NAME: SVAO PFAS SI **DELIVERY ORDER NO:**

Date: 9/9/18 Time: 1215

Well Number and Location: MW-67PFAS-02 SVAO SITE 67

Comments : WATER INITIALLY PUMP BAILED / PUMPED WAS TURBID; mk 9/9/18
APPEARANCE OF COFFEE. TURBIDITY DECLINED
RAPIDLY AFTER ~15 GALLONS REMOVED.
— MK 9/9/18 —

Water Levels / Time: Initial: 17.98 / ~~17.98~~ 10:35 Pumping: 18.01 / VARIOUS
mk 9/9/18
Final: 18.01 / 1215

Total Well Depth: Initial: 25.71 FT BTOC Final: 25.71 FT BTOC

Date and Time: Begin: 9/9/18 / 1035 Completed: 9/9/18 / 12:15

Development Method(S): BAIL/SURGE W/ NEW DISPOSABLE BAILER, PUMP W/
SUBMERSIBLE PUMP.

Total Quantity of Water Removed: 37 gals

FIELD MEASUREMENT	SERIAL NUMBER	DATE OF LAST CALIBRATION
Temperature	QED MP-20 EE&S NO: 14369	9/9/18
Specific Conductivity	↓	↓
pH	↓	↓
Turbidity	↓	N/A
DO	—	—
ORP	—	—

WELL DEVELOPMENT SUMMARY

PROJECT NAME: SWAD PFAS SJ **DELIVERY ORDER NO:**

WELL NUMBER: MW-67PFAS-02

DATE	BEGINNING TIME	GALLONS REMOVED	TEMP (C)	SPECIFIC CONDUCTIVITY ~~(uMHOS/CM)~~ mS/cm per 9/5/18	pH (STANDARD UNITS)	TURBIDITY (NTU)	TOTAL GALLONS REMOVED	WELL VOLUMES REMOVED	WL (FT BTOC)	COMMENTS
9/9/18	1135	25	13.57	0.458	5.90	94.0	25	19.8	18.01	
	1145	~3	13.51	0.465	6.69	9.5	28	22.2	18.01	
	1155	~3	14.12	0.467	6.84	4.3	31	24.6	18.01	
	1205	~3	13.66	0.467	6.88	4.1	34	27.0	18.01	
	1215	~3	14.00	0.468	6.90	3.4	37	29.4	18.01	
			DEVELOPMENT		COMPLETED					

per 9/9/18

1 well volume = 1.26 gallons

RECORDED BY: [signature] 9/9/18 QA CHECKED BY: [signature] 9/10/18

WELL DEVELOPMENT FORM

PROJECT NAME: SWAD PFAS SI **DELIVERY ORDER NO:**

Date: 9/9/18 Time: 10:10

Well Number and Location: MW-67PFAS-03 SWMU SITE 67

Comments : WATER VERY TURBID THROUGH FIRST 20 GALLONS REMOVED, THEN CLEARED RAPIDLY

MK 9/9/18

Water Levels / Time: Initial: 12.55 / 0740 Pumping: 12.58 / ~~12.5~~ VARIOUS

MK 9/9/18

Final: 12.58 / 1010

Total Well Depth: Initial: 26.58 FT BTOC Final: 26.60 FT BTOC

Date and Time: Begin: 9/9/18 / 07:40 Completed: 9/9/18 / 10:10

Development Method(S): BAIL/SURGE W/ DISPOSABLE BAILEE. PUMP W/ SUBMERSIBLE PUMP

Total Quantity of Water Removed: 53 gals

FIELD MEASUREMENT	SERIAL NUMBER	DATE OF LAST CALIBRATION
Temperature	QED MP-20 EERS NO: 16369	9/9/18
Specific Conductivity	↓	↓
pH	↓	↓
Turbidity	↓	N/A
DO	—	N/A
ORP	—	N/A

WELL DEVELOPMENT SUMMARY

PROJECT NAME: SVAO PFAS SI **DELIVERY ORDER NO:**

WELL NUMBER: MW-67PFAS-03

DATE	BEGINNING TIME	GALLONS REMOVED	TEMP (C)	SPECIFIC CONDUCTIVITY ~~(UMHOS/CM)~~ MS/cm ML 9/9/18	pH (STANDARD UNITS)	TURBIDITY (NTU)	TOTAL GALLONS REMOVED	WELL VOLUMES REMOVED	COMMENTS WL (FT BTOC)
9/9/18	0849	29	12.38	0.120	5.53	647	29	12.6	12.58
	0900	3	12.39	0.119	5.83	254	32	13.9	12.58 WL STABLE PUMPING AT 720 mL/MIN
	0910	3	12.55	0.118	5.87	180	35	15.2	12.58
	0920	3	12.62	0.118	5.89	115	38	16.5	12.58
	0930	3	12.46	0.116	5.91	76.1	41	17.8	12.58 920 mL/MIN
	0940	3	12.45	0.117	5.92	51.6	44	19.1	12.58
	0950	3	12.48	0.117	5.93	19.5	47	20.4	12.58
	1000	3	12.54	0.116	5.94	10.7	50	21.7	12.58
	1005	~1.5	12.58	0.116	5.94	11.4	51.5	22.4	12.58
	1010	~1.5	12.58	0.116	5.95	10.6	53	23.0	12.58
		DEVELOPMENT		COMPLETED					
								ML 9/9/18	
									CASING VOLUME = 2.3 GALLONS

RECORDED BY: [signature] 9/9/18 QA CHECKED BY: [signature] 9/10/18

WELL DEVELOPMENT SUMMARY

PROJECT NAME: SVAD PFAS SI **DELIVERY ORDER NO:**

WELL NUMBER: MW-84PFAS-01

DATE	BEGINNING TIME	GALLONS REMOVED	TEMP (C)	SPECIFIC CONDUCTIVITY (µMHOS/CM)	pH (STANDARD UNITS)	TURBIDITY (NTU)	TOTAL GALLONS REMOVED	WELL VOLUMES REMOVED	WL fx. BTOC COMMENTS
9/10/18	1010	27	13.04	0.279	6.51	302	27		43.23
	1020	~3	13.12	0.282	7.08	22.3	30		43.23
	1030	~3	13.27	0.281	7.25	11.5	33		43.23
	1040	~3	13.01	0.283	7.34	8.0	36		43.23
↓	1050	~3	13.18	0.278	7.28	7.9	39		43.23
				DEVELOPMENT COMPLETED					

MV 9/10/18

RECORDED BY: Clh 9/10/18 QA CHECKED BY:

WELL DEVELOPMENT FORM

PROJECT NAME: SVAO PFAS SI **DELIVERY ORDER NO:**

Date: 9/10/18 Time: 12:35

Well Number and Location: MW-84PFAS-03

Comments : FIRST BAILED/PUMPED WATER TURBID, APPEARANCE OF COFFEE. CLEARED RAPIDLY AFTER ~15 GALLONS REMOVED. MK 9/10/18

Water Levels / Time: Initial: 42.72 / 10:35 Pumping: 42.75 / VARIOUS

Final: 42.75 / 12:35

Total Well Depth: Initial: 51.60 FT BTOC Final: 51.36 FT BTOC

Date and Time: Begin: 9/10/18 1035 Completed: 9/10/18 1235

Development Method(S): SURGE/BAIL W/ DISPOSABLE BAILER; PUMP WITH SUBMERSIBLE PUMP

Total Quantity of Water Removed: 32 gals

FIELD MEASUREMENT	SERIAL NUMBER	DATE OF LAST CALIBRATION
Temperature	OED MP-20 EE&S - 16369	9/10/18
Specific Conductivity	↓	↓
pH	↓	↓
Turbidity	↓	N/A
DO	N/A	N/A
ORP	N/A	N/A

WELL DEVELOPMENT SUMMARY

PROJECT NAME: **DELIVERY ORDER NO:**

WELL NUMBER: MW-84 PFAS-02

DATE	BEGINNING TIME	GALLONS REMOVED	TEMP (C)	SPECIFIC CONDUCTIVITY (µMHOS/CM)	pH (STANDARD UNITS)	TURBIDITY (NTU)	TOTAL GALLONS REMOVED	WELL VOLUMES REMOVED	WL Fr. BTOC COMMENTS
9/10/18	1155	20	12.45	0.228	6.52	135	20		42.75
	1205	~3	12.26	0.228	7.80	10.4	23		42.75
	1215	~3	12.34	0.229	8.07	5.4	26		42.75
	1225	~3	12.30	0.228	8.14	3.9	29		42.75
	1235	~3	12.35	0.228	8.16	3.7	32		42.75
			DEVELOPMENT COMPLETED						

MW 9/10/18

RECORDED BY: 9/10/18 QA CHECKED BY:

WELL DEVELOPMENT FORM

PROJECT NAME: SVAD PFAS SI **DELIVERY ORDER NO:**

Date: 9/10/18 Time: 09:05

Well Number and Location: MW-84PFAS-03 SVAD SITE 84

Comments : WATER TRANSLUCENT EVEN AFTER SURGING/ BAILING. MK 9/10/18

Water Levels / Time: Initial: 38.97 / 07:15 Pumping: 38.98 / VARIOUS

Final: 38.98 / 09:05

Total Well Depth: Initial: 46.20 FT BTOC Final: 46.17 FT BTOC

Date and Time: Begin: 9/10/18 / 0715 Completed: 9/10/18 / 0905

Development Method(S): SURGE/BAIL W/ DISPOSABLE BAILER, PUMP W/ SUBMERSIBLE PUMP.

Total Quantity of Water Removed: 43 gals

FIELD MEASUREMENT	SERIAL NUMBER	DATE OF LAST CALIBRATION
Temperature	QED MP-20 EQUIP NO: 16369	9/10/18
Specific Conductivity	↓	↓
pH	↓	↓
Turbidity	↓	N/A
DO	N/A	N/A
ORP	N/A	N/A

WELL DEVELOPMENT SUMMARY

PROJECT NAME: SVAO PFAS SI **DELIVERY ORDER NO:**

WELL NUMBER: MW-84PFAS-03

DATE	BEGINNING TIME	GALLONS REMOVED	TEMP (C)	SPECIFIC CONDUCTIVITY ~~(µMHOS/CM)~~ mS/cm µS/cm	pH (STANDARD UNITS)	TURBIDITY (NTU)	TOTAL GALLONS REMOVED	WELL VOLUMES REMOVED	WL (FT BTOC) COMMENTS
9/10/18	0805	25	13.33	0.333	5.60	380	25		38.98
	0815	~3	12.38	0.312	7.85	38.6	28		38.98
	0825	~3	12.35	0.308	8.13	14.0	31		38.98
	0835	~3	12.37	0.307	8.18	7.3	34		38.98
	0845	~3	12.50	0.308	8.17	5.7	37		38.98
	0855	~3	12.68	0.308	8.16	5.3	40		38.98
	0905	~3	12.75	0.308	8.16	4.4	43		38.98
			DEVELOPMENT COMPLETED						

MK 9/10/18

RECORDED BY: [signature] 9/10/18

QA CHECKED BY: [signature] 9/10/18

PRE-ENTRY SAFETY & HEALTH TRAINING RECORD

PROJECT NAME: SVAD PFAS SI **DELIVERY ORDER NO:**

PAGE 1 OF 1

DATE: 9/5/18 TIME: 07:00

MEETING LOCATION: SVAD SITE 67

SITE SAFETY & HEALTH OFFICER: MIKE KLIDZEJS

SUMMARY OF MEETING ACTIVITIES: SITE/JOB HAZARDS: 1) WORK AROUND AUGER RIG (ENTANGLEMENT, PINCH, FALLING AUGERS/TOOLING); 2) BIOLOGICAL HAZARDS (TICKS, SNAKES, HORNETS); 3) UTILITIES; 4) DRIVING; 5) UNAUTHORIZED PERSONS ENTERING WORK ZONE; 6) INCLEMENT WEATHER; 7) HEAT STRESS; 8) NOISE; 9) SITE CONTAMINANTS (PFAS, POL); 10) CHEMICAL TOOLS (SILICA-CONTAINING MATERIALS; ISOBUTYLENE; 11) SLIPS, TRIPS, FALLS HAZARD CONTROLS: 1) ONLY NECESSARY PERSONS AROUND RIG; 2) AWARENESS OF HAZARDS; 3) SITE INSPECTIONS; 4) EXCLUSION ZONE; 5) TAKE BREAKS AS NEEDED; 6) BUDDY SYSTEM; 7) STOP-WORK AUTHORITY; 8) PPE; 9) SOS LOCATION; 10) EMERGENCY CONTACTS AND SUPPLIES; 11) TRAINING REQUIREMENTS.
OTHER DISCUSSION POINTS: 1) PFAS PROHIBITIONS, 2) DRILLING AND WELL INSTALLATION; 3) DECON; 4) DRUM LABELLING AND HANDLING.

THE FOLLOWING INDIVIDUALS ATTENDED THE PRE-ENTRY SAFETY & HEALTH TRAINING MEETING:

NAME	SIGNATURE	COMPANY
GRYSWET		MATRIX DRILLING
JEFF CROEL		MATRIX DRILLING
Charles Spurr		Leidos
Dana Winsko		Leidos
	MK 9/5/18	

RECORDED BY: _____ QA CHECK BY: _____
(Signature and Date) (Signature and Date)

FIELD CHECKLIST FOR PFC SAMPLE COLLECTION

PROJECT: SVAD PFAS SI
SITE: 67 AND 84

Reviewed with the Following Field Staff: CHARLES SPURR, DANA WINSLOW, GARY SWIFT (MATECO), JEFF CROEL (MATECO)

Date: 9/5/18
Conditions: NORMAL

MATERIALS TO AVOID: SAMPLING ACTIVITIES	
Verified:	**Sampling Equipment:**
✓	NO Teflon (or other fluoropolymers)
✓	NO aluminium foil
✓	Only HDPE/LDPE/silicone in use
✓	Only nitrile gloves (changed often)
Verified:	**Sample Bottles:**
✓	NO glass or LDPE bottles
✓	NO Teflon lined caps
✓	NO chemical ice packs/NO blue ice
✓	Only HDPE bottle with poly/HDPE caps (bottles will be preserved with Trizma if residual chlorine expected)
✓	Only regular ice in Zip-loc bags
Verified:	**Field Documentation**
✓	NO waterproof/treated paper of field books
✓	NO Rite-in-the-Rain notebooks
✓	NO plastic clipboards
✓	NO Post-it notes or other adhesive papers
✓	NO Sharpies
✓	Only loose, plain paper
✓	Only metal clipboards
✓	Only ballpoint pens
Verified:	**Decontamination Procedures**
✓	NO Decon 90 (or other flouro-containing detergents
✓	Only Alconox or Liquinox
MATERIALS TO AVOID: FIELD STAFF CLOTHING/PERSONAL CARE	
Verified:	**Clothing Worn by Field Crew**
✓	NO clothing or boots with Gore-Tex or other synthetic, resistant fabrics (e.g., Tyvek)
✓	NO clothing with stain-resistant materials or treatments (e.g., Scotch-Guard)
✓	NO clothing washed with fabric softener
✓	Only cotton clothing (laundered multiple times w/out fabric softener)
✓	Only rain gear made from polyurethane or wax coated material
✓	Only polyurethane/PVC boots or untreated leather boots
Verified:	**Personal Care Products Used by Field Crew**
✓	NO cosmetics, moisturizers, lotions, etc
✓	Only APPROVED sunscreen: See Table 1 of SOP
✓	Only APPROVED insect repellant: See Table 1 of SOP

FIELD CHECKLIST FOR PFC SAMPLE COLLECTION

PROJECT:

MATERIALS TO AVOID: FIELD STAFF CLOTHING/PERSONAL CARE (continued)	
Verified:	**Food/Beverage**
✓	NO food/beverages on-site with the exception of water/hydration fuids
✓	AVOID pre-packaged food, fast food wrappers/containers
✓	Wash hands after eating
~	

Detail below any items which cannot be verified:

N/A

MK 9/5/18

Provide details of corrective action(s) taken in response to above items:

N/A

MK 9/5/18

Field manager (print): Mike Knidzejs

Field Mgr Signature:

Date / Time: 9/5/18 0700

TAILGATE SAFETY MEETING LOG FORM

PROJECT NAME: **DELIVERY ORDER NO:**

DATE: 9/6/18 Su M Tu W (Th) F Sa TIME: 0710

WEATHER: CLOUDY, LIGHT DRIZZLE, TEMP IN 70s WIND ~ 10MPH

WORKING CONDITIONS: WET

REQUIRED PPE: LEVEL D

NOTES:
- MOSQUITOS; INSECT REPELLANT
- POISON IVY
- TICKS
- COVER WELL CASINGS WHEN POURING MORTAR
MK 9/6/18

The following individuals attended the daily "tailgate safety meeting": (signatures)		
Charles Spurr		9/6/18
DANA WINSTON		KCIDOS
JEFF Cook		MATCO
GARY SLIKER		MATCO
	MK 9/6/18	

9/6/18
SITE HEALTH & SAFETY OFFICER (Signature and Date)

TAILGATE SAFETY MEETING LOG FORM

PROJECT NAME: **DELIVERY ORDER NO:**

DATE: _____ Su M Tu W Th F Sa TIME: _____

WEATHER:

WORKING CONDITIONS:

_____

REQUIRED PPE: _____

_____

NOTES:

The following individuals attended the daily "tailgate safety meeting": (signatures)		

_____

SITE HEALTH & SAFETY OFFICER (Signature and Date)

PROJECT:

DAILY SAFETY INSPECTION

Date										
9/4/18	9/5/18	9/6/18	9/7/18	9/8/18	9/9/18	9/10/18				
Response (Use Y, N, or NA)										ITEM
N	Y	Y	N	N	N	N				Daily safety briefing conducted?
Y	Y	Y	Y	Y	Y	Y				Emergency numbers and route to hospital posted?
Y	Y	Y	Y	Y	Y	Y				SSHP on-site, available to employees, and complete?
Y	Y	Y	Y	Y	Y	Y				Required exposure monitoring conducted and documented?
Y	Y	Y	Y	Y	Y	Y				Calibration of monitoring instruments (PID, OVA, CGI) checked (and documented) daily against known standard?
Y	Y	Y	Y	Y	Y	Y				First aid kit available and inspected weekly?
Y	Y	Y	Y	Y	Y	Y				Personnel wearing PPE required by SSHP for fieldwork (at least safety shoes or boots, safety glasses with side shields, and nitrile or similar gloves to handle potentially contaminated material)?
Y	Y	Y	Y	Y	Y	Y				Personnel using buddy system (maintaining visual or verbal contact and able to render aid)?
Y	Y	Y	Y	Y	Y	Y				If temperature ≥70°F: heat stress training, cool fluids, other controls in SSHP being followed?
N/A	N/A	N/A	N/A	N/A	N/A	N/A				If temperature ≤40°F: cold stress training conducted, controls in SSHP implemented?
Y	Y	Y	Y	Y	Y	Y				Personnel using appropriate biological hazard controls (see SSHP)?
Y	Y	Y	Y	Y	N/A	N/A				Drill rig operating manual on-site?
Y	Y	Y	Y	Y	N/A	N/A				Drill rigs inspected weekly and documented?
Y	Y	Y	Y	Y	N/A	N/A				Personnel near drill rig or other overhead hazards wearing hardhats?
Y	Y	Y	Y	Y	N/A	N/A				Each of two drill rig kill switches tested daily?
Y	Y	Y	Y	Y	N/A	N/A				Employees excluded from under lifted loads?
Y	Y	Y	Y	Y	Y	Y				Unnecessary personnel excluded from hazardous areas, specifically near drill rigs?
Y	Y	Y	Y	Y	N/A	N/A				Radius of exclusion zone around drill rig at least equal to mast height?
N/A	Y	Y	Y	Y	N/A	N/A				Personnel wearing hearing protection when within 25 feet of operating drill rigs?
Y	Y	Y	Y	Y	N/A	N/A				Containers of flammable liquids closed and labeled properly?
Y	Y	Y	Y	Y	Y	Y				Fully charged fire extinguishers available (serviced annually and inspected monthly)?

DAILY SAFETY INSPECTION

PROJECT:

Date										ITEM
9/4/18	9/5/18	9/6/18	9/7/18	9/8/18	9/9/18	9/10/18				
Response (Use Y, N, or NA)										
N/A	Y	Y	Y	Y	Y	Y				Personnel exiting potentially contaminated areas washing hands and face before eating?
N/A	Y	Y	Y	Y	Y	Y				Portable electrical equipment double-insulated or plugged to a GFCI?
Y	Y	Y	Y	Y	Y	Y				Electrical wiring covered by insulation or enclosure?
N/A	Y	Y	Y	Y	N/A	N/A				Three-wire, UL-approved extension cords used?
Y	Y	Y	Y	Y	Y	X				Housekeeping adequate (walkways clear of loose, sharp, or dangerous objects and trip hazards; work areas clear of objects that might fall on employees)?
Y	Y	Y	Y	Y	Y	Y				Walking/working surfaces safe (not slippery, no unguarded holes, no trip hazards)?
N/A	—	—	—	—	—	→				Confined-space entry performed according to SSHP and EC&HS Procedure 10?
N/A	—	—	—	—		→				Excavations deeper than 5 feet shored or sloped (if personnel will enter) and in compliance with SSHP?
N/A	Y	Y	Y	Y	N/A	N/A				Moving (rotating) machinery guarded to prevent employee contact?
N/A	N/A	—	—	—	—	→				Fall protection provided for work at elevations greater than 4 feet?
Y	Y	Y	Y	Y	Y	Y				All containers of hazardous material labeled to indicate contents and hazards?
Y	Y	Y	Y	Y	Y	Y				MSDSs for hazardous materials on-site?
N/A	—	—	—	—	—	→				Fifteen-minute eyewash (accessible and full) within 100 feet of areas where corrosive sample preservatives are poured?
Y	Y	Y	Y	Y	Y	Y				Potable and nonpotable water labeled?
N/A	—	—	—	—	—	→				Chainsaws have anti-kickback protection? Personnel wearing cut resistant gloves, protective chaps?
Y	Y	Y	Y	Y	Y	Y				Site hazards and controls consistent with SSHP?
Y	Y	Y	Y	Y	Y	Y				Site hazard controls appropriate and sufficient?

Actions taken to correct or control any "N" responses:

Name Mike Knolzes Signature [signature] Date 9/10/18

EQUIPMENT CALIBRATION

PROJECT NAME: **DELIVERY ORDER NO:**

IDENTIFIER	ITEM DESCRIPTION	BACKGROUND READING	PRE	ADJUSTMENT (IF NEEDED)	POST	NAME	DATE
82577	MiniRAE 3000 PID	0.1 ppm	100.1 ppm	—	100.1 ppm	M. Kudzuss	9/5/18
		0.3 ppm	100.0 ppm	—	100.0 ppm		9/6/18
		0.2 ppm	100.0 ppm	—	100.0 ppm		9/7/18
		0.1 ppm	100.0 ppm	—	100.0 ppm		9/8/18
		0.1 ppm	100.0 ppm	—	100.0 ppm		9/9/18
16369	QED MP-20	pH 7 STN	7.30	TO 7.00	—		
		pH 4 STND	4.04	TO 4.00	3.99		
		COND 4.49 ms/cm	4.52	TO 4.49	4.49		
		TEMP	METER 16.13°C	—	THERM 16°C		
82577	MiniRAE 3000 PID	0.1 ppm	100.0 ppm	—	100.0 ppm		9/10/18
		pH 7 STND					
		pH 4 STND		MK 9/10/18			
		COND 4.49 mS/cm STND					
		TEMP	METER		THERM		
16369	QED MP-20	pH 7 Stnd	7.05	to 7.00	—	C. Spruel	9/10/18
		pH 4 Stnd	3.99	to 4.00	4.00		
		Cond 4.49 ms/cm	4.52	to 4.49	4.49		
		Temp.	meter 15.64°C	—	therm 15°C		
			MK 9/10/18				

QA CHECK BY: _____

EQUIPMENT CALIBRATION

PROJECT NAME: **DELIVERY ORDER NO:**

IDENTIFIER	ITEM DESCRIPTION	BACKGROUND READING	PRE	ADJUSTMENT (IF NEEDED)	POST	NAME	DATE
			MK 9/14/18				

QA CHECK BY: _____

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: SVAD PFAS II **DELIVERY ORDER NO:**

Date (mm/dd/yy): 10/2/18 Su M (Tu) W Th F Sa PAGE 1 OF 6

Task Team Members:

MIKE KLIDZEJS - LEIDOS, P.C.

CHARLES SAURR - LEIDOS, GEOL

MK 10/2/18

MK 10/2/18

Narrative (include time and location):

0645 M. KLIDZEJS ARRIVES AT SVAD SITE 67.

0655 C. SAURR ON SITE. 0700 HOLD H&S BRIEFING (SEE SHEET).

0705 CREW ARRIVES AT MW-67PFAS-01 TO PURGE AND SAMPLE WELL. UNLOAD EQUIPMENT. SET UP DECON LINE CONSISTING OF 1) DEIONIZED WATER (DI) AND LIQUINOX, 2) DI WATER, 3) DI WATER. DECON QED SAMPLE PRO PUMP AND WATER LEVEL INDICATOR (WLI). CALIBRATE PHOTONIZATION DETECTOR (PID); QED MP-20 WATER QUALITY METER, AND HANNA TURBIDITY METER (SEE M&TE LOGSHEETS).

0805 OPEN WELL. PID AT TOP OF CASING (TOC) = 0.0 ppm MEASURE WATER LEVEL (WL) AT 16.09 FT BTOC. RECORDED TOTAL DEPTH (TD) = 23 FT. WATER COLUMN = 7 FT

0820 SET QED PUMP W/ NEW TUBING AT MID-POINT OF WATER

Daily Weather Conditions: A.M. (0650) CLOUDY, TEMP 51, WIND NNW ~5MPH

P.M. (1015) CLOUDY, TEMP 53, WIND NEARLY CALM

Recorded By [signature] 10/2/18 QA Checked By [signature] 10/3/18

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: SYAD PFAS SI **DELIVERY ORDER NO:**

Date (mm/dd/yy): 10/2/18 Su M (Tu) W Th F Sa PAGE 2 OF 6

Task Team Members:

SEE PG 1 OF 6

Narrative (include time and location):

COLUMN (WC) AT 20 FT BTOC.

0822 MEASURE INITIAL WL AT 16.09 FT BTOC

0824 BEGIN PURGING AT CPM 2 R-20 D-10, 30 PSI (SEE PURGE LOG)

0918 PURGING COMPLETED. PARAMETERS STABLE. TURB <10 NTUS

0920 BEGIN COLLECTING SAMPLE ID MW-PFAS-01 LO0S01

MATRIX SPIKE LO0S01M, MATRIX SPIKE LO0S01MD,

AT SPLIT LO0S01X. NOTE: EUROFINS INCLUDED 2, 250-ML

BOTTLES OF PFAS-FREE WATER IN SHIPMENT OF CONTAINERS.

THE PFAS-FREE BOTTLES HAVE CUSTODY SEALS MARKED "TRIP

BLANK - DO NOT OPEN". WILL PREPARE ~~SAM~~ THESE (MK 10/2/18)

AS UNLABELED SAMPLES AND RETURN TO THE LAB WITH THE

SPLIT.

PULL WLI, PUMP AND TUBING FROM WELL, DISCARD TUBING

+ BLADDER. DECON PUMP, WLT, AND FLOW CELL.

1000 COLLECT EQUIPMENT RINSATE SAMPLE ID MW-67PFAS-02

Daily Weather Conditions: A.M. ~~____~~ (MK 10/2/18)

P.M.

Recorded By [signature] 10/2/18 QA Checked By [signature] 10/3/18

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: SVAD PFAS SI **DELIVERY ORDER NO:**

Date (mm/dd/yy): 10/2/18 Su M (Tu) W Th F Sa PAGE 3 OF 6

Task Team Members:

JSB PC 10f6

Narrative (include time and location):

LOOSERØ1 BY POURING TEST AMERICA DI WATER INTO PUMP AND FROM PUMP INTO CONTAINERS

1005 COLLECT DI WATER SOURCE FIELD BLANK ID MW-67PFAS-02 LOOSFBØ2, POURING TEST AMERICA DI WATER FROM CUBITAINER INTO 2, CONTAINERS

1010 MOVE TO MW-67PFAS-02. UNLOAD AND SET UP EQUIPMENT.

1020 OPEN WELL. PID AT TOC = 0.0 PPM. MEASURE WL AT 16.96 FT BTOC. RECORDED TD = 23.3 FT BTOC.

1028 SET PUMP W/ NEW TUBING + BLADDER AT MID-POINT OF WC AT 20 FT BTOC. NOTE: USING PUMP FROM EQUIPMENT RINSATE

1031 MEASURE INITIAL WL AT 16.96 FT BTOC. BELL PURGE AT CPM 2 R-20 0-10 30 PSI

1144 PURGE COMPLETED. PARAMETERS STABLE, TURBIDITY <10 NTUS

1146 COLLECT SAMPLE ID: MW-67PFAS~~01~~-02 MK 10/2/18 LOOSØ1 AND DUPLICATE LOOSØ1D

Daily Weather Conditions: A.M. MK 10/2/18

P.M.

Recorded By MK 10/2/18 QA Checked By 10/3/18

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: SVAD PFAS SI **DELIVERY ORDER NO:**

Date (mm/dd/yy): 10/2/18 Su M (Tu) W Th F Sa PAGE 4 OF 6

Task Team Members:

SEE PG 1 OF 2

Narrative (include time and location):

PULL WLI AND PUMP FROM WELL. DISCARD TUBING AND BLADDER. DECON. LOAD.

1215 MOVE TO MW-67PFAS-03. UNLOAD + SET UP EQUIPMENT, OPEN WELL. PID AT TOC = 0.1 PPM.

MEASURE WL AT 11.52 FT BTOC. RECORDED TD = 27 FT BTOC.

1230 PLACE SAMPLE PRO PUMP W/ NEW TUBING AND BLADDER AT MID-POINT OF SCREEN AT 22 FT BTOC.

1233 MEASURE INITIAL WL AT 11.52 FT BTOC.

1235 BEGIN PURGING AT CPM: R-20 D-20 30 PSI

1408 PURGING COMPLETED. PARAMETERS STABLE, TURB < 10 NT.

1410 COLLECT SAMPLE MW-67PFAS-03 L0050I

1425 PUMP, TUBING, AND WLI REMOVED FROM WELL.

EQUIPMENT LOADED.

OFF WELL SITE TO TRANSFER GROUNDWATER AND

Daily Weather Conditions: ~~P.M.~~ A.M. (1215) CLOUDY, TEMP 56, WIND NEARLY CALM

P.M. (1525) CLOUDY, TEMP 59, WIND SSE AT < 5 MPH

Recorded By [signature] 10/2/18 QA Checked By [signature] 10/3/18

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: **DELIVERY ORDER NO:**

Date (mm/dd/yy): 10/2/18 Su M (Tu) W Th F Sa PAGE 5 OF 6

Task Team Members:

~~SEE~~ PG 1 OF 6

Narrative (include time and location):

DECON WATER TO DRUM.

1453 CREW ARRIVES AT MW-84PFAS-03. UNLOAD EQUIPMENT. PLACE NEW DI WATER IN DECON BUCKETS, DECON PUMP, WLI, AND FLOW CELL. SET UP OPEN WELL. PID AT TOC = 0.3 ppm. MEASURE WL AT 39.28 FT BTOC. RECORDED TD = ~~84 FT~~ 48 FT BTOC MK 10/2/18

1515 SET PUMP W/ NEW TUBING AND BLADDER AT MID-POINT OF WC AT 43.5 FT BTOC

1516 MEASURE INITIAL WL AT 39.28 FT BTOC

1520 BEGIN PURGING AT 4PM 2 R-20 0-10 30 PSI

1415 PURGING COMPLETED. PARAMETERS STABLE; TURB < 10 NTUs

1617 COLLECT SAMPLE MW-84PFAS-03 L0050 1

PULL PUMP + WLI, DECON WLI AND FLOW CELL. LOAD.

1450 OFF WELL SITE.

1705 ARRIVE AT DRUM STAGING AREA. CHARLES TO MAT

Daily Weather Conditions: A.M. MK 10/2/18

P.M.

Recorded By [signature] 10/2/18 QA Checked By [signature] 10/3/18

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: **DELIVERY ORDER NO:**

Date (mm/dd/yy): 10/2/18 Su M (Tu) W Th F Sa PAGE 6 OF 6

Task Team Members:

SEE PL 1 OF L

Narrative (include time and location):

DRUM LOCATIONS

1725 COLLECT IDW ~~SAMP~~ MK 10/2/18 CHARACTERIZATION SAMPLE

NO: IDW-WA-PFA LOOS01 IN FOLLOWING CONTAINERS

TCLP VOCs UNPRESERVED VOA VIALS

TCLP SVOCs - 2, 1L AMBER

TCLP METALS/Hg - 1, 500mL POLY

PCBs, - 2, 1L AMBER

TOTAL CYANIDE - 1,250 mL, NaOH PRESERVED

TOTAL SULFIDE - 1,250 mL, NaOH PRESERVED NO ZINC ACETATE

pH - 1, 250mL POLY

FLASHPOINT/FLAMMABILITY - 1,250 mL POLY

EXTRA - USE AS NEEDED - 1, 500mL Poly

NOTE: ~~HAS~~ MK 10/2/18 BOTTLES DIFFER FROM QAPP BUT MORE CLOSELY MATCH TEST AMERICA BOTTLE SHIPMENT SUMMARY FORM.

~1830 CALLED BROOKE F. TO ADVISE OF NO ZINC ACETATE AVAILABLE FOR (SENT) FOR TOTAL SULFIDE.

Daily Weather Conditions: A.M. MK 10/2/18

P.M.

Recorded By 10/2/18 QA Checked By 10/3/18

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: SWAO PFAS SI **DELIVERY ORDER NO:**

Date (mm/dd/yy): 10/3/18 Su M Tu (W) Th F Sa PAGE 1 OF 3

Task Team Members:

M. KLIDZEJS - LEIDOS, P.G.

C. SRURR - LEIDOS, GEOL.

MK 10/3/18

MK 10/3/18

Narrative (include time and location):

0645 M. KLIDZEJS ARRIVES AT SWAO

0700 MEET W/ C. SRURR AT MW-~~PFAS~~ 84PFAS-01 MK 10/3/18

UNLOAD EQUIPMENT. CALIBRATE PID, MP-20, AND HANNA TURBIDITY METER (SEE METE LOG SHEETS). DECON PUMP.

0735 OPEN WELL. PID AT TOC = 3.0 PPM. BZ = 0.0 PPM

MEASURE WL AT 42.96 FT BTOC. RECORDED TD = 48 FT BTOC.

0743 PLACE QED PUMP W/ NEW TUBING + B. ADDER AT 45 FT BTOC

0745 MEASURE INITIAL WL AT 42.96 FT BTOC.

BEGIN PURGING AT CPM 2 R-20 D-10 30 PSI

0815 COLLECT REAGENT BLANK NO: MW-84PFAS-01 LOGSRB01

BY POURING TRIZMA PRESERVED TA DI WATER INTO 2 UNPRESERVED CONTAINERS

0855 PURGING COMPLETED. PARAMETERS STABLE, TURB < 10 NTU.

Daily Weather Conditions: A.M. (0645) PARTLY CLOUDY, TEMP 64, WIND S ~10 MPH

P.M. ~~(1650)~~ MOSTLY CLEAR, TEMP 74, WIND S AT 10-15 MPH

Recorded By [signature] 10/3/18 QA Checked By _____

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: SVAD PFAS SI **DELIVERY ORDER NO:**

Date (mm/dd/yy): 10/3/18 Su M Tu (W) Th F Sa PAGE 2 OF 3

Task Team Members:

SEE PG 1 OF 3

Narrative (include time and location):

0857 COLLECT SAMPLE MW-84PFAS-01 L00501

PULL WLI + PUMP. DISCARD TUBING + BLADDER.

DECON PUMP, WLI, + FLOW CELL.

LOAD

0920 MOVE TO MW-84PFAS-02

OPEN WELL. PID AT TOC = 1.5 ppm

0930 MEASURE WL AT 42.54 FT BTOC. RECORDED TO = 49.3 FT BTOC

0948 PLACE PUMP W/ NEW TUBING + BLADDER AT 46 FT BTOC

MEASURE INITIAL WL AT 42.54 FT BTOC.

0948 BEGIN PURGING AT CPM 2 R-200 D-10 30 PSI

1114 PURGING COMPLETED, PARAMETERS STABLE, TURB < 10 NTUs

1116 COLLECT SAMPLE MW-84PFAS-02 L00501

PULL PUMP + WLI. DISCARD TUBING + BLADDER.

PERFORM FINAL DECON. LOAD.

1205 OFF WELL SITE.

Daily Weather Conditions: A.M. [illegible] 10/3/18

P.M.

Recorded By [signature] 10/3/18 QA Checked By

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: SVAD PFAS SI **DELIVERY ORDER NO:**

Date (mm/dd/yy): 10/3/18 Su M Tu (W) Th F Sa PAGE 3 OF 3

Task Team Members:

SEE PG 1 OF 3

Narrative (Include time and location):

~1220 ARRIVE AT DRUM STAGING AREA. TRANSFER FINAL PURGE AND DECON WASTEWATER TO DRUMS.

GO TO USACE BLDG AND RETURN KEYS

~1330 LEAVE SVAD. CHARLES TO SHIP RENTAL EQUIPMENT BACK TO EERS. KLIDEJS TO SHIP 2 COOLERS TO TA AND 1 TO EUROFINS VIA FEDEX. KLIDEJS TO THEN PACK + SHIP (OTHER) EQUIPMENT BACK HOME VIA UPS.

ML 10/3/18

Daily Weather Conditions: A.M. ML 10/3/18

P.M.

Recorded By ML 10/3/18 QA Checked By

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: SVAD PFAS SI **DELIVERY ORDER NO:**

Date (mm/dd/yy): _____ Su M Tu W Th F Sa PAGE_____ OF _____

Task Team Members:

_____ _____

_____ _____

_____ _____

Narrative (include time and location):

MW 10/3/18

Daily Weather Conditions: A.M. _____

P.M. _____

Recorded By _____ QA Checked By _____

EQUIPMENT CALIBRATION

PROJECT NAME: **DELIVERY ORDER NO:**

IDENTIFIER	ITEM DESCRIPTION	BACKGROUND READING	PRE	ADJUSTMENT (IF NEEDED)	POST	NAME	DATE
82843	MiniRae 3000	0.2 ppm	0.2 ppm	FA. 0.0 ppm Span 100.0 ppm	0.0	C. Spurr	10/2/18
16369	QED MP20	pH 7.0	7.14	7.00	6.99		
		pH 4.0	3.88	4.00	4.01		
		Spc 4.49 ms/cm	4.48	4.49	4.49		
		D.O. %	748 mmHg	to 754 mmHg	754 mmHg 108.1% SAT		
		ORP 240 mV	248	240	240		
		Temp. °C	14.52	—	14°C		
82987	HANNA HI 9828	<0.1 ONLY TEMP	CALIBRATION STORED				
82843	MINIRAE 3000	0.1 ppm	0.1 ppm	SPAN= 100.1 ppm	0.1 ppm	M. Knieriem	11/3/18
82987	HANNA HI 9828	CALIBRATION	STORED				
16369	QED MP20	pH 7 STND	7.19	TO 7.00	—		
		pH 4 STND	3.92	TO 4.00	3.99		
		COND 4.49 mS/cm STND	4.48	TO 4.49	4.49		
		ORP 240 mV STND	237	TO 240	240		
		DO% 748 mm Hg	748 mm Hg	—	101.4% SAT 748 mm Hg		
		TEMP	METER 16.23°C	—	THERM = 16°C		

mk 11/2/18

QA CHECK BY: _____

EQUIPMENT CALIBRATION

PROJECT NAME: **DELIVERY ORDER NO:**

IDENTIFIER	ITEM DESCRIPTION	BACKGROUND READING	PRE	ADJUSTMENT (IF NEEDED)	POST	NAME	DATE

QA CHECK BY: _____

GROUND WATER MICRO PURGE LOG

WELL ID: MW-67PFAS-01

PROJECT NAME:

DELIVERY ORDER NO:

TIME	µL REMOVED	PURGE RATE (mL/min)	ORP (mv)	TEMP (C)	pH (s.u.)	COND (mS/cm)	DO (mg/L)	TURBIDITY (NTU)	DEPTH TO WATER (FT BTOC)	COMMENTS
0828	0.5	~200	242	14.06	5.97	0.255	12.94	7.48	16.09	
0838	2.5		238	13.70	6.03	0.255	12.95	8.62	16.09	
0848	4.5		235	13.69	6.05	0.262	12.90	5.98	16.09	
0858	6.5		231	13.54	6.08	0.266	12.88	3.36	16.09	
0908	8.5		228	13.62	6.10	0.271	12.88	2.24	16.09	
0918	10.5		226	13.65	6.11	0.273	12.81	2.16	16.09	
					CS 10/2/18					

GROUND WATER MICRO PURGE LOG

WELL ID: MW-67 PFAS-02

PROJECT NAME:

DELIVERY ORDER NO:

TIME	L REMOVED	PURGE RATE (mL/min)	ORP (mv)	TEMP (C)	pH (s.u.)	COND (mS/cm)	DO (mg/L)	TURBIDITY (NTU)	DEPTH TO WATER (FT BTOC)	COMMENTS
1034	0.5	~200	220	16.13	6.47	0.509	9.50	6.47	16.95	
1044	2.5		215	14.64	6.94	0.522	8.05	1.66	16.95	
1054	4.5		212	14.65	6.99	0.527	7.69	0.93	16.95	
1104	6.5		209	14.53	6.99	0.520	7.18	0.83	16.95	
1114	8.5		207	14.44	7.01	0.520	7.07	0.46	16.95	
1124	10.5		205	14.46	7.00	0.521	6.73	0.36	16.95	
1134	12.5		204	14.52	7.00	0.519	6.64	0.31	16.95	
1144	14.5		202	14.38	7.01	0.516	6.50	0.21	16.95	

CS 10/2/18

GROUND WATER MICRO PURGE LOG

WELL ID: MW-1 (7/18/18 - 0.3)

PROJECT NAME:

DELIVERY ORDER NO:

TIME	L REMOVED	PURGE RATE (mL/min)	ORP (mv)	TEMP (C)	pH (s.u.)	COND (mS/cm)	DO (mg/L)	TURBIDITY (NTU)	DEPTH TO WATER (FT BTOC)	COMMENTS
1238	0.5	200	198	14.93	7.12	0.138	9.85	33.2	11.51	
1248	2.5		204	13.17	6.41	0.135	10.23	118	11.51	
1258	4.5		204	13.70	6.22	0.133	10.22	106	11.51	
1308	6.5		205	13.64	6.15	0.132	10.31	99.8	11.51	
1318	8.5		205	13.58	6.15	0.132	10.57	70.1	11.51	
1328	10.5		205	13.55	6.10	0.132	10.62	46.3	11.51	
1338	12.5		206	13.47	6.08	0.131	10.53	28.3	11.51	
1348	14.5		206	13.40	6.08	0.131	10.63	18.3	11.51	
1358	16.5		206	13.43	6.08	0.130	10.65	11.2	11.51	
1408	18.5		206	13.41	6.07	0.130	10.69	7.03	11.51	

CS 10/2/18

GROUND WATER MICRO PURGE LOG

WELL ID: MW-8S/FA-01

PROJECT NAME:

DELIVERY ORDER NO.:

TIME	L REMOVED	PURGE RATE (mL/min)	ORP (mv)	TEMP (C)	pH (s.u.)	COND (mS/cm)	DO (mg/L)	TURBIDITY (NTU)	DEPTH TO WATER (FT BTOC)	COMMENTS
0755	0.5	100	163	17.39	5.96	0.203	10.09	13.8	42.96	Initial DTW 42.96'
0805	1.5		162	15.61	6.69	0.205	10.72	4.37	42.96	
0815	2.5		166	15.04	7.00	0.206	10.64	4.63	42.96	
0825	3.5		163	15.14	7.16	0.208	10.48	4.21	42.96	
0835	4.5		160	15.46	7.24	0.208	10.43	3.09	42.96	
0845	5.5		158	15.70	7.30	0.208	10.31	2.35	42.96	
0855	6.5	↓	156	15.79	7.33	0.209	10.26	1.89	42.96	
					CS 10/3/18					

GROUND WATER MICRO PURGE LOG

WELL ID: MW-84FFAS-02

PROJECT NAME:

DELIVERY ORDER NO:

TIME	L REMOVED	PURGE RATE (mL/min)	ORP (mv)	TEMP (C)	pH (s.u.)	COND (mS/cm)	DO (mg/L)	TURBIDITY (NTU)	DEPTH TO WATER (FT BTOC)	COMMENTS
0954	0.5	~100	170	20.25	7.13	0.211	9.54	102	42.54	initial ΔTW 42.54'
1004	1.5		164	19.75	7.40	0.216	9.07	65.6	42.54	
1014	2.5		159	19.87	7.47	0.213	9.01	47.6	42.54	
1024	3.5		157	20.59	7.51	0.215	8.86	35.6	42.54	
1034	4.5		158	19.34	7.53	0.214	9.08	23.6	42.54	
1044	5.5		158	19.33	7.54	0.215	9.26	16.5	42.54	
1054	6.5		158	19.27	7.57	0.215	9.22	11.1	42.54	
1104	7.5		157	19.18	7.58	0.216	9.32	10.1	42.54	
1114	8.5		156	19.12	7.59	0.215	9.47	6.46	42.54	

CS 10/3/18

GROUND WATER MICRO PURGE LOG

WELL ID: MW-32(TMS-03)

PROJECT NAME:

DELIVERY ORDER NO:

TIME	L REMOVED	PURGE RATE (mL/min)	ORP (mv)	TEMP (C)	pH (s.u.)	COND (mS/cm)	DO (mg/L)	TURBIDITY (NTU)	DEPTH TO WATER (FT BTOC)	COMMENTS
1525	0.5	100	183	16.34	6.84	0.357	11.80	2.97	39.26'	INITIAL WL = 39.28 FT BTOC
1535	1.5	CS 10-2-18 ~~178~~	178	14.62	7.78	0.353	11.93	11.8	39.26	
1545	2.5		174	14.56	7.96	0.349	11.74	19.2	39.26	
1555	3.5		172	14.37	8.01	0.347	11.57	15.3	39.26	
1605	4.5		171	14.42	8.03	0.348	11.45	11.9	39.26	
1615	5.5	↓	170	14.72	8.05	0.346	11.36	8.66	39.26	
						CS 10/2	18			

M & TE INVENTORY

PROJECT NAME: **DELIVERY ORDER NO:**

UNIQUE IDENTIFIER	PROJECT IDENTIFIER	ITEM DESCRIPTION	LAST RECALL	NEXT RECALL	DATE	COMMENTS
82577	82577	MINIRAE 3000 PID	8/15/18	9/15/19	9/5/18	RENTAL FROM ENVIRONMENTAC EQUIP & SUPPLY (EERS)
16369	16369	QRAE MP-20	8/14/18	8/14/19	9/9/18	
82843	82843	MINIRAE 3000 PID			10/2/18	
82987	82987	HANNA HI 98703	9/26/18	9/26/19	10/2/18	

RECORDED BY: _____
(Signature and Date)

QA CHECK BY: _____
(Signature and Date)

CALIBRATION STANDARD

PROJECT NAME:

DELIVERY ORDER NO:

INCLUSIVE DATES FOR CALIBRATION MATERIAL USAGE	INSTRUMENT DESCRIPTION	CALIBRATION MATERIAL *	LOT #	NAME
Start: 9/5/18 Finish: 10/3/18	MINIRAE 3000 PID	100 PPM ISOBUTYLENE	EEC3 LOT: 2812207 EXP: MAY 2021	M. KLIDZEJS
10/3/18	QED MP-20	pH 7 STND	EEC3 LOT: 7GI243 EXP 10/19	
10/3/18	↓	AUTO CAL STND	EEC3 LOT: 8GB192 EXP: 2/19	
10/2/18 10/3/18	↓	ORP 240 MV STND	HANNA LOT: 17411586 EXP:	
10/2/18 10/3/18	HANNA TURBIDITY METER	<0.10 NTU STND	HANNA LOT: 3878 EXP: 8/19	
↓ ↓	↓	15 NTU STND	HANNA LOT: 17491586 EXP: 4/19	
		100 NTU STND	HANNA LOT: 3131 EXP: 11/18	
		750 NTU STND	HANNA LOT: 2187 EXP. 12/18	

MAE 10/3/18

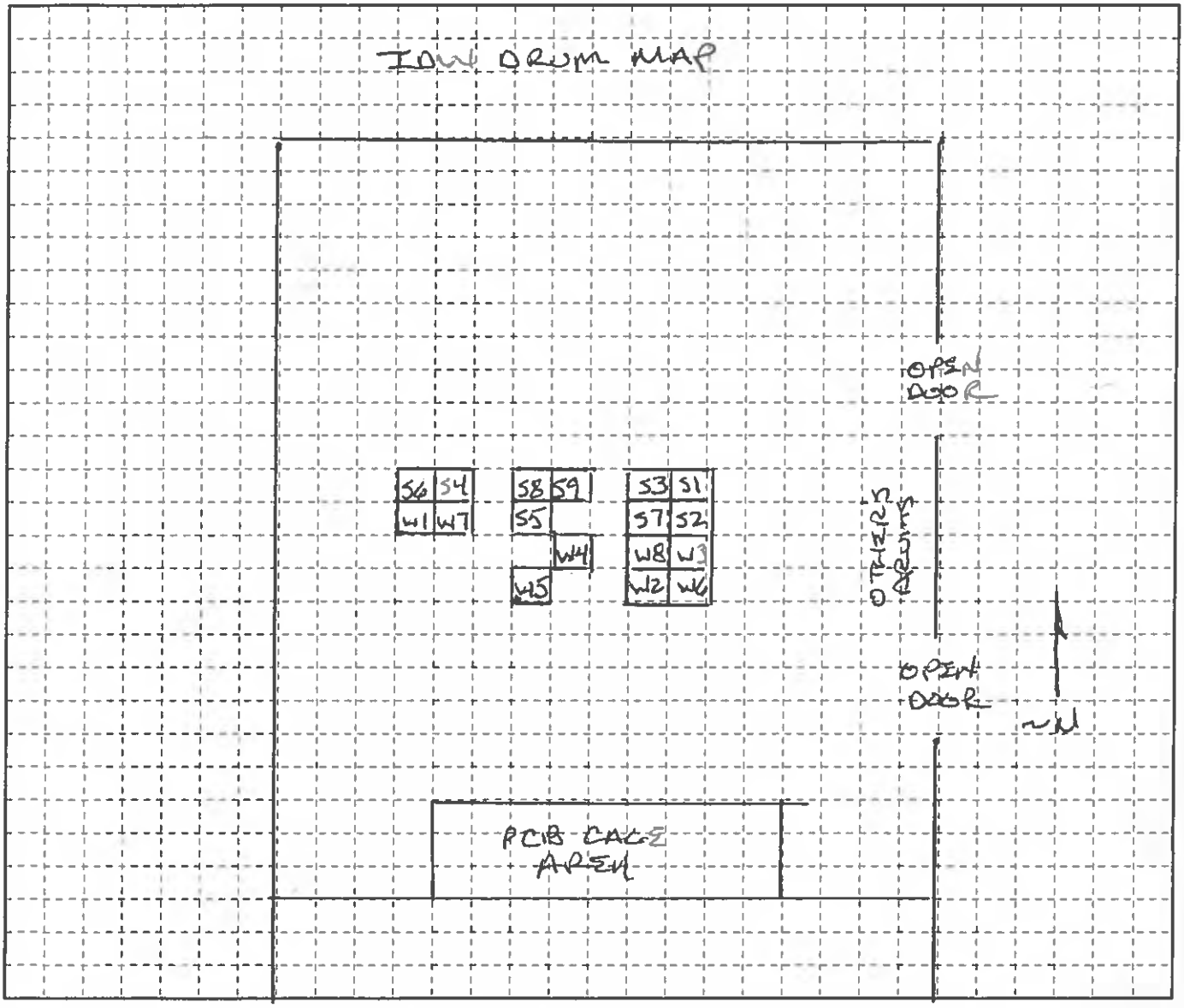
* INCLUDE EXPIRATION DATES FOR STANDARD SOLUTIONS

QA CHECKED BY: _____

LOCATION SKETCH

PROJECT NAME: SVAD PFAS SI **DELIVERY ORDER NO:**

SAMPLE ID NUMBER:	DATE COLLECTED (mm/dd/yy):
SAMPLE LOCATION:	TIME COLLECTED (hh:mm):
SAMPLING POINT:	DEPTH:



COMMENTS:

RECORDED BY:	DATE: 10/3/18	QA CHECK BY:	DATE

WASTE DRUM TRACKING LOG

PROJECT NAME: **DELIVERY ORDER NO:**

DRUM NUMBER	DRUM TYPE AND SIZE	CONTENTS AND APPROXIMATE VOLUME	WASTE SOURCE	GENERATION DATE(S)
SVAO-67/84-S-01	55-GAL, STEEL OPEN-TOP	SOIL CUTTINGS FULL	MW-67PFAS-03	9/5/18
SVAO-67/84-S-02	↓	5	MW-67PFAS-02	9/6/18
SVAO-67/84-S-03			MW-67PFAS-01	9/6/18
SVAO-67/84-S-04			MW-84PFAS-03	9/6/18
SVAO-67/84-S-05			↓	9/6/18
SVAO-67/84-S-06			MW-84PFAS-01	9/7/18
SVAO-67/84-S-07			↓	9/7/18
SVAO-67/84-S-08			MW-84PFAS-02	9/7/18
SVAO-67/84-S-09	↓	↓	↓	9/7/18
~~SVAO-67/84-S10 MK 10/3/18~~				
		MK 10/3/18		
SVAO-67/84-W-01	55-GAL, STEEL OPEN-TOP	DICON WASTEWATER AND GROUNDWATER		9/8/18
SVAO-67/84-W-02	↓	↓		~~9/8/18~~ MK 9/9/18
SVAO-67/84-W-03				9/9/18
SVAO-67/84-W-04				9/9/18
SVAO-67/84-W-05				9/9/18
SVAO-67/84-W-06				9/10/18
SVAO-67/84-W-07				9/14/18
SVAO-67/84-W-08	↓	↓		9/10/18
		MK 10/3/18		~~9/19/18~~ MK 9/19/18

RECORDED BY: 10/3/18

QA CHECK BY:

PRE-ENTRY SAFETY & HEALTH TRAINING RECORD

PROJECT NAME: **DELIVERY ORDER NO:**

PAGE 1 OF 1

DATE: 10/2/18 TIME: 0700

MEETING LOCATION: SWAN SITE 47

SITE SAFETY & HEALTH OFFICER: M. KUDZEJ

SUMMARY OF MEETING ACTIVITIES: JOB ACTIVITIES: 1) PURGING AND SAMPLING NEW MONITORING WELLS; 2) DECON; 3) EQUIPMENT CALIBRATION 4) IDW MANAGEMENT. JOB/SITE HAZARDS 1) WET CONDITIONS 2) SITE CONTAMINANTS; 3) SLIPS, TRIPS, FALLS; 4) CUTS; 5) EXPOSURE TO CHEMICAL TOOLS (TRIBMH, ISOBUTYLENE) 6) POTENTIAL HEAT STRESS (TOMORROW). HAZARD CONTROLS 1) STOP WORK AUTHORITY; 2) PPE USE, 3) WATCH FOOTING

OTHER DISCUSSIONS: PFAS PROHIBITIONS.

MK 10/2/18

THE FOLLOWING INDIVIDUALS ATTENDED THE PRE-ENTRY SAFETY & HEALTH TRAINING MEETING:

NAME	SIGNATURE	COMPANY
Charles Spurr	Charles Spurr	Leidos

MK 10/2/18

RECORDED BY: 10/2/18 QA CHECK BY:
(Signature and Date) (Signature and Date)

APPENDIX C

TOPOGRAPHIC SURVEY RESULTS

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Table C-1. Topographic Survey Results
Savanna Army Depot Activity, Savanna, Illinois

Well I.D.	North	East	Ground Surface Elevation	Elevation of Top of Well Casing
Site 67				
MW-67PFAS-01	2009874.14	477838.91	605.08	607.46
MW-67PFAS-02	2009598.94	477773.15	605.95	608.32
MW-67PFAS-03	2009430.10	477778.92	600.73	602.81
Site 84				
MW-84PFAS-01	2010498.38	471326.07	630.13	632.29
MW-84PFAS-02	2010451.04	471250.27	629.78	631.94
MW-84PFAS-03	2010226.62	471216.05	626.13	628.45

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APPENDIX D

DATA QUALITY ASSESSMENT

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TABLE OF CONTENTS

LIST OF ATTACHMENTS

LIST OF TABLES

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APPENDIX D

DATA QUALITY ASSESSMENT

D.1 INTRODUCTION

A comprehensive quality assurance/quality control (QA/QC) program was followed during the Site Inspection conducted in October 2018 by Leidos at Site 67 and Site 84SVAD-084 at Savanna Army Depot Activity (SVDA), Savanna, Illinois, to ensure that analytical results and the decisions based on these results are representative of the environmental conditions. Test America, located in Arvada, Colorado, was the analytical laboratory under contract for the analysis of per- and polyfluoroalkyl substances (PFAS) during the SVAD-067 and SVAD-084 field investigations. Eurofins, located in Lancaster, Pennsylvania, was the analytical laboratory under contract for the split sample analyses of PFAS during the SVAD-067 and SVAD-084 field investigations.

D.2 LABORATORY QUALITY CONTROL ASSESSMENT AND VALIDATION REPORT

All environmental samples and field QC samples collected during the SVAD-067 and SVAD-084 field investigations are presented in Table D-1 (all tables are presented at the end of this appendix) and were analyzed using analytical test methods modified per the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) (DoD 2017) Table B-15 requirements, and laboratory standard operating procedures (SOPs) to accommodate environmental samples from the following document:

- U.S. Environmental Protection Agency (USEPA) Method 537 Rev 1.1, Determination of Selected Pefluorinated Alkyl Acids in Drinking Water.

Leidos verified 100 percent of the analytical results produced by the primary laboratory. Data were verified based on the guidelines and specifications in the Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) (Leidos 2014), the UFP-QAPP Addendum 2 (Leidos 2018), the DoD QSM, Version 5.1 (DoD 2017), and the USEPA Contract Laboratory Program (CLP) *National Functional Guidelines for Organic Data Review* (USEPA 1999). All available CLP-like Forms (e.g., Forms 1 through 14) were reviewed to ensure that the QC results were within appropriate QC limits for holding times, blank contamination, calibrations, matrix spike/matrix spike duplicates (MS/MSDs), laboratory control samples (LCSs), internal standards (ISs), surrogate standards, detection limits, and any other required QC. All data validation qualifiers that resulted from the Leidos data validation process are presented in Table D-2. The QA split sample results were not validated. The data quality objectives (DQOs) for SVAD-067 and SVAD-084 were set at 90 percent for the field sampling and laboratory completeness. Based on the evaluation of the field and laboratory QC results, the data are 100 percent complete.

A secondary stage of verification occurred once the initial validation had been completed. Individual rinsate blanks, equipment blank, and field blanks associated with the corresponding environmental samples were evaluated following the same criteria as method blanks. All data validation qualifiers applied to the sample data based on blank contamination are discussed in Section D.3.

Third-party data validation was required on 10 percent of the data. Third-party data validation was performed by EcoChem, Inc., located in Seattle, Washington. Full validation consisted of validating the data using the guidelines described above and recalculating a portion of the detected compounds from the raw data. A comprehensive discussion of EcoChem's data validation is provided in Section D.4.

All environmental groundwater and field QC samples collected for the SVAD-067 and SVAD-084 field investigations were submitted to Test America for the analytical methods listed in Section D.2. All available CLP-like Forms (e.g., Forms 1 through 14) were reviewed to ensure that the QC results fell within the appropriate QC limits. Any resulting data validation qualifiers were applied. A data verification report

was prepared for each parameter validated. This section summarizes these parameter-specific data validation reports.

The following data validation qualifiers were applied to the results as dictated by QC outliers:

- *U*—The analyte was analyzed for, but was not detected above the reported sample quantitation limit. These results are qualitatively acceptable.
- *J*—The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample. These results are qualitatively acceptable, but estimates.
- *UJ*—The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample. These results are qualitatively acceptable, but estimates.
- *R*—The sample results were rejected due to serious deficiencies in the ability to analyze the sample and meet QC criteria. The presence or absence of the analyte cannot be verified. No data points were rejected.

D.2.1 Sample Shipping/Receiving/Preservation

All chain-of-custody (CoC), analysis request, and sample receipt documentation were complete and correct. All samples were properly preserved.

D.2.2 Technical Holding Times

Based on an evaluation of all samples, all technical holding time criteria were met and no samples required qualification.

D.2.3 Surrogate Standard Recoveries

Surrogates for PFAS were analyzed in accordance with the method. Organic sample results were qualified as estimated (J/UJ) if the associated surrogates were below the lower control limit (LCL). Detected organic sample results were qualified as estimated (J) if the associated surrogates were above the upper control limit (UCL). Non-detected organic sample results were qualified as rejected (R) if the associated surrogates were below 10 percent. All surrogate recoveries were within control limits and no sample results were qualified.

D.2.4 Internal Standard Results

ISs were added in all calibration standards, environmental samples, and QC blanks in accordance with USEPA Method 537 for PFAS. IS results above retention time and/or above percent area recoveries are qualified as estimated (J) for associated analytes. IS results below retention time and/or below $\pm$50 percent area recoveries but above 25 percent are qualified as estimated (J/UJ) for associated analytes. No ISs were below +25 percent and no data were rejected. Sample results qualified due to IS performance are summarized in Table D-2 with reason code K01.

PFAS Analysis—IS area counts associated with three results for sample MW-84PFAS-03 had area counts below control limits and were qualified as estimated (J).

D.2.5 Initial Calibration Results

Initial calibration of each instrument used to analyze the samples collected during the SVAD-067 and SVAD-084 field investigation sampling was conducted in accordance with the methods. Based on the

laboratory summary narrative and evaluation of the initial calibration analyses conducted, all criteria were met.

D.2.6 Continuing Calibration Results

Continuing calibration of each instrument used to analyze the samples collected during the SVAD-067 and SVAD-084 field investigation sampling was conducted in accordance with the methods. Organic sample results were qualified as estimated (J/UJ) if the associated continuing calibration verification (CCV) was below the LCL. Detected organic sample results were qualified as estimated (J) if the associated CCV was above the UCL. No results were qualified due to CCV results.

D.2.7 Method Blank Results

Method blanks were analyzed with each batch (i.e., sample delivery group [SDG]) of samples in accordance with the methods. Any target compounds detected in the method blanks were below the allowable levels as defined by the analytical methods. No results were qualified due to blank contamination. Equipment rinsate blank and field blank analyses are discussed in Section D.3.

D.2.8 Calibration Blank results

Initial calibration blanks (ICBs) and continuing calibration blanks (CCBs) were analyzed with each batch (i.e., SDG) of PFAS analyses. Any analyte detected in the ICBs and/or CCBs were below the allowable levels as defined by the analytical method. Table D-2 lists the sample results that were qualified due to ICB/CCB contamination with reason code F06.

PFAS Analysis—Two perfluorohexane sulfonate (PFHxS) and one perfluoroheptanoic acid (PFHpA) results were qualified as non-detect (U) due to CCB contamination.

D.2.9 Laboratory Control Sample Recovery Results

The LCS monitors the overall accuracy and performance of all steps in the analysis, including the preparation, and was prepared and analyzed in accordance with the methods.

Sample results associated with LCS values outside of acceptance limits are qualified according to the following guidelines. Results associated with LCS recoveries below the LCL but greater than the rejection point should be qualified as estimated (J/UJ). Detected results associated with LCS recoveries above the UCL should be qualified as estimated (J). Sample nondetections are rejected (R) if LCS recoveries are less than 30 percent for organic analysis. No sample results were qualified due to LCS recoveries.

D.2.10 Matrix Spike/Matrix Spike Duplicate Recovery Results

MS/MSD analyses were conducted to assess the accuracy and precision of the analytical system and to evaluate the matrix effect of the sample upon the analytical methodology based upon the percent recovery of each compound. Sample results associated with MS/MSD recoveries outside of acceptance limits are qualified according to the following guidelines. Only native sample results associated with MS/MSD outliers should be qualified according to the latest DoD QSM guidance (DoD 2017). Native sample nondetects are rejected (R) if MS/MSD recoveries are less than 10 percent for organic analyses. MS/MSD recoveries above the UCL result in estimation (J) of detected compounds in the native samples. MS/MSD recoveries below the LCL result in estimation (J/UJ) of associated compounds in the native samples. In addition, if the spiking concentration is less than 25 percent of the native concentration, no action is taken for noncompliant recoveries because the spike level is considered insignificant compared to the native sample concentration. No sample results were qualified due to MS/MSD recoveries.

D.2.11 Matrix Spike/Matrix Spike Duplicate Relative Percent Difference Results

The MS/MSD relative percent difference (RPD) is used to evaluate the precision of the analytical system. Native sample results associated with MS/MSD RPD values outside acceptance limits should be qualified as estimated (J/UJ). No sample results were qualified due to MS/MSD RPD results.

D.2.12 Target Compound Identification

The target compounds that were reported as detects satisfied all qualitative and quantitative identification as specified in the USEPA methods. No problems were encountered that would affect target compound identification.

D.2.13 Reporting Limits

All reporting limit criteria specified in the UFP-QAPP (Leidos 2014) and Addendum 2 to the UFP-QAPP (Leidos 2018) were met for the field investigations, except in instances where dilutions were required. In instances where dilutions were required, lesser diluted analyses were used wherever possible.

D.2.14 System Performance

Based on instrument performance indicators, all analytical systems remained within control throughout the duration of the SVAD-067 and SVAD-084 field investigations with the exceptions noted above.

D.3 FIELD QUALITY CONTROL ASSESSMENT

During all activities conducted as part of the UFP-QAPP (Leidos 2014) and UFP-QAPP Addendum 2 (Leidos 2018), QC samples were collected to gauge the impacts from various components of field activities. Field QC samples were obtained to determine the degree of cross-contamination, ensure successful decontamination procedures, or determine the effects of media heterogeneity on results. Rinsate blanks, equipment blanks, and field blanks provide a measure of various cross-contamination, decontamination efficiency, and other potential error that can be introduced from sources other than the sample. Field sample results associated with uncommon laboratory contaminants found in field QC blanks are considered nondetect if they are at concentrations less than five times the level found in the associated blank. No results were qualified due to field and equipment blank contamination.

Field duplicates were collected to ascertain the contribution of variability (i.e., precision) due to environmental media and sampling precision techniques. Results for the primary and field duplicate samples with detected concentrations are presented in Table D-3. All results were below the 30 percent control limits or were within three times the sample-specific limit of quantitation (LOQ) when the results for both the primary and field duplicate samples were less than five times the sample-specific LOQ.

D.3.1 QA Split Analysis

One field sample was split from the primary samples and sent to a third-party independent laboratory referred to as the QA laboratory. The analysis of QA split samples provides an overall measure of field and laboratory accuracy and precision. Examination of the primary and QA split sample data provides the data user with a degree of acceptance and usability of the chemical data quality. The QA split sample did not undergo data validation by Leidos or the third-party data validator. The QA laboratory for the SVAD-067 and SVAD-084 SI was Eurofins.

Primary and QA laboratory data were assessed using guidelines provided in the Louisville QSM Supplement (USACE 2007). Louisville QSM supplement guidelines suggest that primary and QA split sample data should have a difference of less than two times between the primary and QA sample in order to be considered in agreement for all water analyses. If sample results are less than the reporting limit, a difference of three times between the primary and QA split sample is allowed. In addition, when one

compound or analyte is less than the detection limit, the allowable difference is five times between the primary and QA split sample.

Louisville QSM Supplement guidelines consider compounds or analytes to be in major disagreement if water results have a difference factor of greater than three. In addition, compounds or analytes are in major disagreement if results have a difference factor greater than 5 when one compound or analyte is below the reporting limit, and a major disagreement if results have a difference factor greater than 10 when one compound or analyte is below the detection limit.

Table D-4 provides a comparison of the primary and QA split detected results. All compounds or analytes were detected and included in the table. Sample results that were detected above the reporting limit by both the primary laboratory and the QA laboratory were all in good agreement according to Louisville QSM Supplement guidelines. No samples were in disagreement. The reproducibility between the primary and QA split sample are considered acceptable.

D.4 THIRD-PARTY DATA VALIDATION ASSESSMENT

Third-party full data validation was required on 10 percent of the SVAD-067 and SVAD-084 sample results. Third-party data validation was performed by EcoChem. Full validation consisted of validating the data using the QC data reported by the laboratory against required precision and accuracy limits established in the DoD QSM (DoD 2017) and against QC requirements outlined in the Louisville QSM Supplement (USACE 2007), UFP-QAPP (Leidos 2014) and UFP-QAPP Addendum 2 (Leidos 2018). The following sections summarize all discrepancies between EcoChem's data validation findings and qualifiers and Leidos' data verification qualifiers.

D.4.1 EcoChem Findings

All chemical of concern (COC), analysis request, and sample receipt documentation was complete and correct. The Laboratory Information Management System (LIMS) number, number of coolers, and signature lines were completed for all cooler receipt checklists. The samples were analyzed within the prescribed holding time and properly preserved except where noted. All calibrations, blanks, ISs, surrogates, LCSs, MS/MSDs, and target compound identification were reviewed where appropriate with respect to criteria contained within the documents described in Section D.3. Sample results were qualified for any QC outliers. All recalculations were in agreement with the reported results.

D.4.2 Data Verification/Data Validation Comparison

The following sections and Table D-5 provide a comparison of Leidos' data verification applied qualifiers and EcoChem's data validation applied qualifiers. Some discrepancies existed due to differences in professional judgment used during the verification or validation process as well as fundamental differences between the verification process and the validation process (i.e., the verification process does not involve examining raw data and the validation process requires examining and recalculating raw data). It was not part of EcoChem's scope to validate based on field QC blanks. In all instances, discrepancies in the applied qualifiers were reviewed for the cause of the discrepancy. In each case, a final qualifier was applied based on Leidos' professional judgment. EcoChem's validation reports are provided in Attachment A of this appendix. Table D-5 provides a summary of instances where Leidos' initial data verification qualifier and EcoChem's data validation qualifiers were not in agreement.

PFAS Analysis—Leidos qualified some sample results due to injection IS discrepancies. USEPA Method 537 Revision 1.1 allows injection ISs to be within 50 to 150 percent of the IS area counts of the initial calibration midpoint or CCV standard. EcoChem used the TestAmerica SOP control limits (UCL of $\pm$200 percent per TestAmerica SOP) where no qualification was required due to a wider range of control limits. Leidos qualified three data points as estimated, with reason code K01, because the injection IS was

greater than 150 percent but less than 200 percent, which explains EcoChem's lack of qualifiers due to IS area count outliers. No changes were made to the Leidos-applied qualifiers in these instances.

EcoChem did not apply qualifiers based on continuing calibration blanks. Leidos qualified three results based on calibration blank contamination. No changes were made to the Leidos-applied qualifiers.

EcoChem reported some results with a "DNR" with reason code 20 when the data were above the calibration range of the instrument. Leidos was in agreement in these instances. EcoChem reported some results with "DNR" with reason code 11 for all other data points from dilutions, but not above calibration. In three of these instances, Leidos chose to use the diluted result because the diluted result value was higher than the undiluted result value. None of the Leidos-applied qualifiers were changed in these instances.

Overall, the differences between Leidos' verification qualifiers and Ecochem's validation qualifiers have no impact on the final usability of the data. In instances where the discrepancies were based on professional judgment or where EcoChem's validation protocol differed from the DoD QSM (DoD 2017) protocol or the UFP QAPP (Leidos 2014) and/or UFP-QAPP Addendum 2 (Leidos 2018), no changes were made to the Leidos-applied qualifiers.

D.5 REFERENCES

DoD (U.S. Department of Defense). 2017. Quality Systems Manual for Environmental Laboratories. Version 5.1. Final. January.

Leidos. 2014. Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) for Remedial Investigation at SVAD-045 and SVAD-222. Final. Savanna Army Depot Activity, Savanna, Illinois. Prepared for the U.S. Army Corps of Engineers, Louisville District. November.

Leidos. 2018. Addendum 2 Site Inspection at SVAD-067 and SVAD-084. Savanna Army Depot Activity, Savanna, Illinois. Final. Prepared for the U.S. Army Corps of Engineers, Louisville District. August.

USACE (U.S. Army Corps of Engineers). 2007. DOD Quality Systems Manual Supplement. USACE Louisville District. March.

USEPA (U.S. Environmental Protection Agency). 1999. Contract Laboratory Program National Functional Guidelines for Organic Data Review. EPA 540-R-01-008. October.

Table D-1. Sample Summary
SVAD-067 and SVAD-084
Savanna Army Depot, Savanna, Illinois

Site I.D.	Sample I.D.	Matrix	Sample Date	Analyses
MW-67PFAS-01	LDOS01	W	10/02/2018	PFAS
MW-67PFAS-01	LDOS01N	W	10/02/2018	PFAS
MW-67PFAS-01	LDOS01ND	W	10/02/2018	PFAS
MW-67PFAS-01	LDOS01X	W	10/02/2018	PFAS
MW-67PFAS-02	LDOS01	W	10/02/2018	PFAS
MW-67PFAS-02	LDOS01D	W	10/02/2018	PFAS
MW-67PFAS-02	LDOS0EB01	W	10/02/2018	PFAS
MW-67PFAS-02	LDOS0FB02	W	10/02/2018	PFAS
MW-67PFAS-03	LDOS01	W	10/02/2018	PFAS
MW-67PFAS-03	LDOS0FB01	W	9/05/2018	PFAS
MW-84PFAS-01	LDOS01	W	10/03/2018	PFAS
MW-84PFAS-01	LDOSRB01	W	10/03/2018	PFAS
MW-84PFAS-02	LDOS01	W	10/03/2018	PFAS
MW-84PFAS-03	LDOS01	W	10/02/2018	PFAS

Table D-2. Leidos Applied Data Validation Qualifiers
SVAD-067 and SVAD-084
Savanna Army Depot, Savanna, Illinois

Site I.D.	Sample I.D.	Matrix	Method	Analyte	Validation Qualifier	Reason Code 1
MW-84PFAS-01	LDOSRB01	W	USEPA 537	Perfluorohexanesulfonic acid	U	F06
MW-67PFAS-01	LDOS01	W	USEPA 537	Perfluoroheptanoic acid	U	F06
MW-84PFAS-03	LDOS01	W	USEPA 537	Perfluorohexanesulfonic acid	J	K01
MW-84PFAS-03	LDOS01	W	USEPA 537	Perfluorooctane sulfonate	J	K01
MW-84PFAS-03	LDOS01	W	USEPA 537	Perfluorononanoic acid	J	K01
MW-84PFAS-01	LDOS01	W	USEPA 537	Perfluorohexanesulfonic acid	U	F06

F06 – Continuing calibration blank contamination
K01 – Injection internal standard area count outside control limits

Table D-3. Field Duplicate
SVAD-067 and SVAD-084
Savanna Army Depot, Savanna, Illinois

Site ID	Sample I.D.	Method	Analyte	Parent Result	Parent Qualifier	Duplicate Result	Duplicate Qualifier	Units	RPD
MW-67PFAS-02	LDOS01	EPA 537	Perfluorobutanesulfonic acid	3.1		3.3		ng/L	6.2
MW-67PFAS-02	LDOS01	EPA 537	Perfluoroheptanoic acid	19		19		ng/L	0
MW-67PFAS-02	LDOS01	EPA 537	Perfluorohexanesulfonic acid	52		51		ng/L	1.9
MW-67PFAS-02	LDOS01	EPA 537	Perfluorononanoic acid	0.69	J	1.2	J	ng/L	53.9
MW-67PFAS-02	LDOS01	EPA 537	Perfluorooctane sulfonate	160		170		ng/L	6.1
MW-67PFAS-02	LDOS01	EPA 537	Perfluorooctanoic acid	200		200		ng/L	0

Table D-4. Split Sample
SVAD-067 and SVAD-084
Savanna Army Depot, Savanna, Illinois

Site ID	Sample I.D.	Method	Analyte	Parent Result	Parent Qualifier	Duplicate Result	Duplicate Qualifier	Units	Agreement
MW-67PFAS-01	LDOS01	USEPA 537	Perfluorobutanesulfonic acid	3.4		3.3		ng/L	Y
MW-67PFAS-01	LDOS01	USEPA 537	Perfluoroheptanoic acid	1.9	U	1.9		ng/L	Y
MW-67PFAS-01	LDOS01	USEPA 537	Perfluorohexanesulfonic acid	99		100		ng/L	Y
MW-67PFAS-01	LDOS01	USEPA 537	Perfluorononanoic acid	1.4	J	1.25	J	ng/L	Y
MW-67PFAS-01	LDOS01	USEPA 537	Perfluorooctane sulfonate	33		34		ng/L	Y
MW-67PFAS-01	LDOS01	USEPA 537	Perfluorooctanoic acid	350		340		ng/L	Y

Table D-5. Third Party Data Validation
SVAD-067 and SVAD-084
Savanna Army Depot, Savanna, Illinois

Client Sample ID	Matrix	CAS	Analyte	Result	Unit	Lab Flag	Dil	Leidos DV Qualifier	Leidos DV Reason Code	Third Party DV Qualifier	Third Party DV Reason Code	Final Qualifier	Resolution
MW-84PFAS-01 LDOSRB01	Water	355-46-4	PFHxS	0.44	ng/L	J	1	0.83 U	F06	None	None	U	Third party did not evaluate CCBs; Leidos did evaluate CCBs
MW-84PFAS-01 LDOS01	Water	375-85-9	PFHpA	1.3	ng/L	J	1	1.3 U	F06	None	None	U	Third party did not evaluate CCBs; Leidos did evaluate CCBs
MW-84PFAS-02 LDOS01	Water	355-46-4	PFHxS	420	ng/L	J1	1	DNU	N/A	DNR	20	N/A	Agree
MW-84PFAS-02 LDOS01	Water	375-73-5	PFBS	110	ng/L	D	5	DNU	N/A	DNR	11	N/A	Agree
MW-84PFAS-02 LDOS01	Water	375-85-9	PFHpA	22	ng/L	D M	5	None	None	DNR	11	None	Used diluted value because it's higher (1X = 20 ng/L)
MW-84PFAS-02 LDOS01	Water	375-95-1	PFN/A	6.9	ng/L	U	5	DNU	N/A	DNR	11	N/A	Agree
MW-84PFAS-02 LDOS01	Water	1763-23-1	PFOS	120	ng/L	D	5	DNU	N/A	DNR	11	N/A	Agree
MW-84PFAS-02 LDOS01	Water	335-67-1	PFOA	13	ng/L	D M	5	DNU	N/A	DNR	11	N/A	Agree
MW-67PFAS-01 LDOS01	Water	375-85-9	PFHpA	1.9	ng/L	M	1	U	F06	None	None	U	Third party did not evaluate CCBs; Leidos did evaluate CCBs
MW-67PFAS-03 LDOS01	Water	355-46-4	PFHxS	430	ng/L	J1	1	DNU	N/A	DNR	20	N/A	Agree
MW-67PFAS-03 LDOS01	Water	335-67-1	PFOA	450	ng/L	J1	1	DNU	N/A	DNR	20	N/A	Agree
MW-67PFAS-03 LDOS01	Water	375-73-5	PFBS	6.2	ng/L	J D	5	None	None	DNR	11	None	Used diluted value because it's higher (1X = 5.9)
MW-67PFAS-03 LDOS01	Water	375-85-9	PFHpA	16	ng/L	D M	5	DNU	N/A	DNR	11	N/A	Agree
MW-67PFAS-03 LDOS01	Water	375-95-1	PFN/A	6.7	ng/L	U	5	DNU	N/A	DNR	11	N/A	Agree
MW-67PFAS-03 LDOS01	Water	1763-23-1	PFOS	100	ng/L	D	5	DNU	N/A	DNR	11	N/A	Agree
MW-84PFAS-03 LDOS01	Water	355-46-4	PFHxS	1000	ng/L	D	10	J	K01	None	None	J	Third party did not qualify for IS outliers >150% (only >200%)
MW-84PFAS-03 LDOS01	Water	355-46-4	PFHxS	850	ng/L	J1	1	DNU	N/A	DNR	20	N/A	Agree
MW-84PFAS-03 LDOS01	Water	375-95-1	PFN/A	1900	ng/L	D	10	J	K01	None	None	J	Third party did not qualify for IS outliers >150% (only >200%)
MW-84PFAS-03 LDOS01	Water	375-95-1	PFN/A	1700	ng/L	J1	1	DNU	N/A	DNR	20	N/A	Agree
MW-84PFAS-03 LDOS01	Water	1763-23-1	PFOS	530	ng/L	D	10	J	K01	None	None	J	Third party did not qualify for IS outliers >150% (only >200%)
MW-84PFAS-03 LDOS01	Water	1763-23-1	PFOS	560	ng/L	J1	1	DNU	N/A	DNR	20	N/A	Agree
MW-84PFAS-03 LDOS01	Water	375-73-5	PFBS	45	ng/L	D	10	None	None	DNR	11		Used diluted value because it's higher (1X = 44)
MW-84PFAS-03 LDOS01	Water	375-85-9	PFHpA	14	ng/L	U	10	DNU	N/A	DNR	11	N/A	Agree
MW-84PFAS-03 LDOS01	Water	335-67-1	PFOA	160	ng/L	D	10	DNU	N/A	DNR	11	N/A	Agree

11 = Do not report; value from another dilution used
20 = Calibration range Exceeded
CCB = Continuing calibration blank
D = Value from dilution
DNR = Do not report
DNU = Data point not used
F06 = Continuing calibration blank contamination
IS = Internal standard
J = Value between DL and LOQ or value considered an estimate
J1 = Value greater than calibration range of the instrument
K01 = Injection internal standard area count outside control limits
M = Manually integrated
N/A = Not applicable
U = Non-detect

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ATTACHMENT A

ECOCHEM DATA VALIDATION REPORT

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ATTACHMENT A

ECOCHEM DATA VALIDATION REPORT

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ECOCHEM
Data Quality

DATA VALIDATION REPORT

SITE INSPECTION AT SVAD-067 AND SVAD-084
SAVANNA ARMY DEPOT

Savanna, IL

Prepared for:

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November 15, 2018

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PROJECT NARRATIVE

INTRODUCTION

This report documents the results of the full (EPA Stage 4) data validation performed for groundwater and associated quality control data collected in support of the Savanna Army Depot Site Inspection project.

Samples were analyzed by Test America, Sacramento, CA. Data were validated by the following EcoChem, Inc. chemists:

TEST	METHOD	PRIMARY REVIEW CHEMIST	SECONDARY REVIEW CHEMIST
Perfluorinated Organic Compounds by LCMS	EPA537Mod (TA SOP)	C. Ransom	C. Frans

The data validation process and measurement quality objectives (MQO) were based on requirements and guidance found in the laboratory Standard Operating Procedure WS-LC-0025, Rev 1.9 *Perfluorinated Compounds (PFCs) in Water, Soils, Sediments and Tissue [Method 537 modified]* (TestAmerica, 05/27/2016) and the *Addendum 2, Uniform Federal Policy Quality Assurance Project Plan, Site Inspection at SVAD-067 and SVAD-084, Savanna Army Depot Activity, Savanna, Illinois* (Leidos., August 2018); and the USEPA *National Functional Guidelines for Organic Data Review* (Aug 2014).

EcoChem's goal in assigning qualifiers is to assist in proper data interpretation. If values are assigned a J or UJ, data may be used for site evaluation and risk assessment purposes, but reasons for data qualification should be taken into consideration when interpreting sample concentrations. If values are assigned an R or DNR, the data should not be used for any site evaluation purposes. If values have no data qualifier assigned, then the data meet all measurement quality objectives as stated in the documents and methods referenced in this report.

The overall quality of the data is acceptable. No data were qualified. Data were flagged DNR to indicate which results should not be used from multiple reported analyses. All data not flagged DNR are acceptable for use. Completeness is 100%. Data validation criteria, developed from the analytical method, the QAPP, and EPA Functional Guidelines, are included in **APPENDIX A.** A Qualified Data Summary Table is presented in **APPENDIX B**.

Sample Index
Savanna Army Depot

Sample ID	Laboratory ID	Matrix	Perfluorinated Compounds
MW-67PFAS01 LD0501	280-115117-1	Groundwater	✓
MW-67PFAS01 LD0501N	280-115117-2	Groundwater	✓
MW-67PFAS01 LD0501ND	280-115117-3	Groundwater	✓
MW-67PFAS-02 LD05EB01	280-115117-4	Rinsate Blank	✓
MW-67PFAS-02 LD05FB02	280-115117-5	DI Source	✓
MW-67PFAS-02 LD0501	280-115117-6	Groundwater	✓
MW-67PFAS-02 LD0501D	280-115117-7	Groundwater	✓
MW-67PFAS-03 LD0501	280-115117-8	Groundwater	✓
MW-84PFAS-03 LD0501	280-115117-9	Groundwater	✓
MW-84PFAS-01 LD05RB01	280-115117-11	Reagent Blank	✓
MW-84PFAS-01 LD0501	280-115117-12	Groundwater	✓
MW-84PFAS-02 LD0501	280-115117-13	Groundwater	✓

DATA VALIDATION REPORT
Savanna Army Depot
Perfluorinated Compounds by EPA Method 537
Liquid Chromatography Mass Spectrometry (LCMS)

This report documents the review of analytical data from the analysis of groundwater samples and the associated laboratory and field quality control (QC) samples. Samples were analyzed by TestAmerica, Sacramento, California. Refer to the Sample Index for a complete list of samples.

SDG	NUMBER OF SAMPLES	VALIDATION LEVEL
J115117-1	9 Groundwater, 3 Field Blank	EPA Stage 4

DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables for a full validation. The laboratory followed adequate corrective action processes and any anomalies were discussed in the case narrative.

EDD TO HARDCOPY VERIFICATION

A verification of the electronic data deliverable (EDD) results to the hardcopy was performed. The transcription errors were noted.

The laboratory logged in samples with an ID sequence of "LD05" instead of "LDOS". No action was taken other than to note the discrepancy.

TECHNICAL DATA VALIDATION

The QC requirements that were reviewed are listed below.

✓	Sample Preservation and Holding Times	1	Matrix Spikes/Matrix Spike Duplicates ((MS/MSD)
✓	Initial Calibration (ICAL)	1	Field Duplicates
✓	Continuing Calibration (CCAL)	✓	Target Analyte List
✓	Laboratory Blanks	✓	Reporting Limits
1	Field Blanks	1	Reported Results
✓	Labeled Surrogate Compounds	✓	Compound Identification
✓	Laboratory Control Samples (LCS/LCSD)	✓	Calculation Verification

✓ ***Stated method quality objectives (MQO) and QC criteria have been met. No outliers are noted or discussed***
1 Quality control issues are discussed below, but no data were qualified.
2 Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed below.

Sample Preservation and Holding Times

As stated in the validation guidance documents, sample shipping coolers should arrive at the laboratory within the advisory temperature range of 2° to 6°C. The laboratory received the sample coolers within the advisory range.

All samples were extracted within the holding time of 14 days from collection and were analyzed within the holding time of 28 days from extraction.

Initial Calibration (ICAL)

The initial calibration (ICAL) percent relative standard deviation (%RSD) values were within the control limit of 20%.

The independent source initial calibration verification (ICV) percent difference (%D) values were within the criteria of ±30%.

Continuing Calibration (CCAL)

A continuing calibration verification standard was analyzed at the l required frequency: at the start of an analysis sequence, every 10 samples, and at the end of the analysis sequence. All %D values were within the criteria of ±30%. A low level CCV at the LOQ was also analyzed at the beginning of every sequence with acceptable recoveries.

Laboratory Blanks

A method blank was analyzed at the required frequency of one per extraction batch. No target analytes were detected in the method blank at levels greater than ½ the limit of quantitation (LOQ) as per QAPP requirements.

Field Blanks

Three field blanks were submitted: one rinsate blank MW-67PFAS-02 LD05EB01; one DI source water MW-67PFAS-02 LD05FB02; and one trizma preserved reagent blank MW-84PFAS-01 LD05RB01. No target analytes were detected in these blanks at levels greater than ½ LOQ as per QAPP requirements. There was a positive result less than the limit of detection (LOD) but greater than the detection limit (DL) for PFHxS in the reagent blank. This result was not used to evaluate potential contamination in the field samples as they did not require trizma preservation.

Labeled Surrogate Compounds

One labeled surrogate compound specific to each target analyte was added to all samples. All recoveries were within the QAPP specified control limits of 50-150%.

Laboratory Control Samples

Laboratory control sample/laboratory control sample duplicates (LCS/LCSD) were analyzed at the required frequency of one per batch of 20 or fewer samples. All recoveries were within the QAPP specified control limits. The relative percent difference (RPD) values were also within the QAPP specified limit of 30%.

Matrix Spike/Matrix Spike Duplicates

Matrix spike/matrix spike duplicates were not analyzed. The laboratory control sample/laboratory control sample duplicate (LCS/LCSD) analyses were used to evaluate precision and accuracy.

Field Duplicates

The RPD control limit is 30% for results greater than 5x the LOQ. For results less than 5x the LOQ, the difference between the sample and duplicate must be less than the 3x the LOQ.

One set of field duplicates were submitted: MW-67PFAS-02 LDOS01 and MW-67PFAS-02 LDOS01D. All RPD and difference values were less than the control limits.

Target Analyte List

All requested target analytes were reported.

Reporting Limits

Reporting limits were adjusted correctly for sample aliquot size. All LOD and LOQ values met those specified in the QAPP and were less than the project action limits.

Compound Identification

All criteria for compound identification were met.

Reported Results

Several samples were re-analyzed at dilution due to high concentrations of one or more target analytes. The following dilutions were analyzed:

Sample ID	Lab ID	DF	Affected Analytes
MW-67PFAS-03 LDOS01	280-115117-8	5X	PFHxS, PFOA
MW-84PFAS-03 LDOS01	280-115117-9	10X	PFHxS, PFNA, PFOS
MW-84PFAS02 LDOS01	280-115117-13	5X	PFHxS

Results for both sets of analyses were reported. The results that exceeded the calibration range in the original analysis were flagged as do-not-report (DNR-20). The results for all other analytes in the dilutions were flagged as do-not-report (DNR-11).

Calculation Verification

Several results were verified by recalculation from the raw data. Recalculations were done for Sample MW-84PFAS-03 LDOS01. No calculation or transcription errors were found.

OVERALL ASSESSMENT

As determined by this evaluation, the laboratory followed the specified analytical procedure. Accuracy was acceptable as demonstrated by the labeled compound and LCS/LCSD recovery values. Precision was also acceptable as demonstrated by the LCS/LCSD and field duplicate RPD values.

Data were flagged as do-not-report (DNR) to indicate which results should not be used form multiple reported analyses. A usable result remains for all analytes in all samples; completeness was not affected.

Data flagged DNR should not be used. All other data, as reported, are acceptable for use.

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Data Quality

APPENDIX A

DATA QUALIFIER DEFINITIONS
REASON CODES
AND CRITERIA TABLES

DATA VALIDATION QUALIFIER CODES
Based on National Functional Guidelines

The following definitions provide brief explanations of the qualifiers assigned to results in the data review process.

U	The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
J	The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
NJ	The analysis indicates the presence of an analyte that has been "tentatively identified" and the associated numerical value represents the approximate concentration.
UJ	The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
R	The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.

The following is an EcoChem qualifier that may also be assigned during the data review process:

DNR	Do not report; a more appropriate result is reported from another analysis or dilution.

DATA QUALIFIER REASON CODES

Group	Code	Reason for Qualification
Sample Handling	1	Improper Sample Handling or Sample Preservation (i.e., headspace, cooler temperature, pH, summa canister pressure); Exceeded Holding Times
Instrument Performance	24	Instrument Performance (i.e., tune, resolution, retention time window, endrin breakdown, lock-mass)
	5A	Initial Calibration (RF, %RSD, r^2)
	5B	Calibration Verification (CCV, CCAL; RF, %D, %R) Use bias flags (H,L)[1] where appropriate
	5C	Initial Calibration Verification (ICV %D, %R) Use bias flags (H,L)[1] where appropriate
Blank Contamination	6	Field Blank Contamination (Equipment Rinsate, Trip Blank, etc.)
	7	Lab Blank Contamination (i.e., method blank, instrument blank, etc.) Use low bias flag (L)[1] for negative instrument blanks
Precision and Accuracy	8	Matrix Spike (MS and/or MSD) Recoveries Use bias flags (H,L)[1] where appropriate
	9	Precision (all replicates: LCS/LCSD, MS/MSD, Lab Replicate, Field Replicate)
	10	Laboratory Control Sample Recoveries (a.k.a. Blank Spikes) Use bias flags (H,L)[1] where appropriate
	12	Reference Material Use bias flags (H,L)[1] where appropriate
	13	Surrogate Spike Recoveries (a.k.a. labeled compounds, recovery standards) Use bias flags (H,L)[1] where appropriate
Interferences	16	ICP/ICP-MS Serial Dilution Percent Difference
	17	ICP/ICP-MS Interference Check Standard Recovery Use bias flags (H,L)[1] where appropriate
	19	Internal Standard Performance (i.e., area, retention time, recovery)
	22	Elevated Detection Limit due to Interference (i.e., chemical and/or matrix)
	23	Bias from Matrix Interference (i.e. diphenyl ether, PCB/pesticides)
Identification and Quantitation	2	Chromatographic pattern in sample does not match pattern of calibration standard
	3	2nd column confirmation (RPD or %D)
	4	Tentatively Identified Compound (TIC) (associated with NJ only)
	20	Calibration Range or Linear Range Exceeded
	25	Compound Identification (i.e., ion ratio, retention time, relative abundance, etc.)
Miscellaneous	11	A more appropriate result is reported (multiple reported analyses i.e., dilutions, re-extractions, etc. Associated with "R" and "DNR" only)
	14	Other (See DV report for details)
	26	Method QC information not provided

[1] H = high bias indicated
L = low bias indicated

Perfluorinated Compounds by Liquid Chromatography- Mass Spectrometry (LC/MS)
(Based on TestAmerica Sacramento Standard Operating Procedure and EPA 537)

QC Element	Acceptance Criteria	Source of Criteria	Action for Non-Conformance	Reason Code	Discussion and Comments
Sample Handling					
Cooler/Storage Temperature Preservation	PTFE free containers store at < 4 +/-2°C from collection	TA SOP (1)	If required by project: J (pos)/UJ (ND) if greater than 6° C	1	Use PJ for temp outliers; see TM20
Holding Time	Extraction: 14 days from collection Analysis: 28 days from extraction	QAPP(2)	J (pos)/UJ (ND) if HT exceeded J (pos)/R (ND) if gross exceedance (> 2x HT)	1	
Instrument Performance					
Initial Calibration	%RSD of RRF< 20.0% or linear regression r^2>0.990 std within 80%-120% of true value (50%-150% for std conc. <2x RL)	TA SOP (1)	J (pos) if %RSD > 20%	5A	
Initial Calibration Verification (ICV)	Second Source analyzed immediately following calibration %D <30%	TA SOP (1)	J (pos) if %D >30% (high bias) J (pos)/UJ (ND) if %D <- 30% (low bias)	5A (H,L)[3]	
Continuing Calibration Verification (CCV)	mid-level std - start of sequence and every 12 hours %D <30%	TA SOP (1)	J (pos) if %D >30% (high bias) J (pos)/UJ (ND) if %D <- 30% (low bias)	5B (H,L)[3]	
Blank Contamination					
Method Blank (MB)	MB: One per matrix per batch of (of ≤ 20 samples) No detected compounds > 1/2 LOQ	QAPP(2)	U(pos) if sample result is < 5X blank concentration	7	Hierarchy of blank review: #1 - Review MB, qualify as needed #2 - Review FB , qualify as needed
Field Blank (FB)	No detected compounds > 1/2 LOQ	QAPP(2)	U(pos) if sample result is < 5X blank concentration	6	
Precision and Accuracy					
Laboratory Control Sample (LCS)	One per lab batch (of ≤ 20 samples) Limiits Specified in QAPP DoD QSM	QAPP(2)	Qualify all associated samples J(pos) if %R > UCL J(pos)/UJ(ND) if %R < LCL J(pos)/R(ND) if %R < 10% - very low bias	10 (H,L)[3]	PJ - No action if LCSD analyzed and only one spike %R is outside criteria Qualify all associated samples
LCS/LCSD (RPD)	If LCSD analyzed RPD <30%	QAPP(2)	J (pos) if RPD > control limit	9	Qualify all associated samples

Perfluorinated Compounds by Liquid Chromatography- Mass Spectrometry (LC/MS)
(Based on TestAmerica Sacramento Standard Operating Procedure and EPA 537)

QC Element	Acceptance Criteria	Source of Criteria	Action for Non-Conformance	Reason Code	Discussion and Comments
Matrix Spike or MS/MSD (recovery)	one per matrix per batch (of ≤ 20 samples) Limiits Specified in QAPP DoD QSM	QAPP(2)	Qualify parent only unless other QC indicates systematic problems: J(pos) if both %R > UCL J(pos)/UJ(ND) if both %R < LCL J(pos)/R(ND) if both %R < 10% J(pos)/UJ(ND) if one > UCL & one < LCL, with no bias	8 (H,L)3	No action if only one spike %R is outside criteria. No action if parent concentration is >4x the amount spiked. These are default limits from SOP; lab may provide statistically derived limits Qualify parent sample only
MS/MSD (RPD)	If MSD analyzed RPD ≤ 30% (Aqueous)	QAPP(2)	J(pos) in parent sample if RPD > CL	9	Qualify parent sample only
Internal Standard	50%-150% of ICAL midpoint or CCV RT within 60 seconds of most recent CCV	TA SOP (1) QAPP(2)	J (pos) if > 200% J (pos)/UJ (ND) if < 50% J (pos)/R (ND) if < 25% if RT >30 seconds use PJ	19	
Surrogates	Labeled Compounds added to all samples Aqueous: 50%-150%	TA SOP (1) QAPP(2)	J (pos) if %R > UCL J (pos)/UJ (ND) if %R < LCL J (pos)/R (ND) if %R < 10%	13 (H,L)3	Qualify all associated compounds. These are default limits from SOP; lab may provide statistically derived limits
Field Duplicates	Aqueous: RPD < 30% OR difference < 3X LOQ (for results < 5X LOQ)	QAPP(2)	J (pos)/UJ (ND) Qualify only parent and field duplicate samples	9	

Perfluorinated Compounds by Liquid Chromatography- Mass Spectrometry (LC/MS)
(Based on TestAmerica Sacramento Standard Operating Procedure and EPA 537)

QC Element	Acceptance Criteria	Source of Criteria	Action for Non-Conformance	Reason Code	Discussion and Comments
Compound Identification and Quantitation and Calculation					
Retention times	RRT within ±60 seconds of standard RRT in the most recent CCV	TA SOP (1)	U (pos) if identification criteria not met	25	
Calibration Range	Results less than highest calibration standard	EcoChem standard policy	J results > high standard	20	
Dilutions, Re-extractions and/or Reanalyses	Report only one result per analyte	EcoChem standard policy	Use "DNR" to flag results that will not be reported.	11	TM-04 EcoChem Policy for Rejection/Selection Process for Multiple Results

[1] TA SOP: Perfluorinated Compounds in Waters, Soils, Sediments and Tissues [Method 537 Modified], WS-LC-0025, rev 1.9, 05/27/2016

[2] QAPP Addendum 2, Uniform Federal Policy Quality Assurance Project Plan, Site Inspection at SVAD-067 and SVAD-084, Savanna Army Depot Activity, Savanna, Illinois (Leidos., August 2018)

(pos): Positive Result

(ND): Non-detects

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Data Quality

APPENDIX B

QUALIFIED DATA SUMMARY TABLE

Qualified Data Summary Table
Savanna Army Depot

Sample ID	Laboratory ID	Analyte	Result	Units	Lab Flag	DV Qualifier	DV Reason Code
MW-84PFAS-02 LD0501	280-115117-13	Perfluorohexanesulfonic acid (PFHxS)	420	ng/L	J1	DNR	20
MW-84PFAS-02 LD0501	280-115117-13	Perfluorobutanesulfonic acid (PFBS)	110	ng/L	D	DNR	11
MW-84PFAS-02 LD0501	280-115117-13	Perfluoroheptanoic acid (PFHpA)	22	ng/L	D M	DNR	11
MW-84PFAS-02 LD0501	280-115117-13	Perfluorononanoic acid (PFNA)	6.9	ng/L	U	DNR	11
MW-84PFAS-02 LD0501	280-115117-13	Perfluorooctanesulfonic acid (PFOS)	120	ng/L	D	DNR	11
MW-84PFAS-02 LD0501	280-115117-13	Perfluorooctanoic acid (PFOA)	13	ng/L	D M	DNR	11
MW-67PFAS-03 LD0501	280-115117-8	Perfluorohexanesulfonic acid (PFHxS)	430	ng/L	J1	DNR	20
MW-67PFAS-03 LD0501	280-115117-8	Perfluorooctanoic acid (PFOA)	450	ng/L	J1	DNR	20
MW-67PFAS-03 LD0501	280-115117-8	Perfluorobutanesulfonic acid (PFBS)	6.2	ng/L	J D	DNR	11
MW-67PFAS-03 LD0501	280-115117-8	Perfluoroheptanoic acid (PFHpA)	16	ng/L	D M	DNR	11
MW-67PFAS-03 LD0501	280-115117-8	Perfluorononanoic acid (PFNA)	6.7	ng/L	U	DNR	11
MW-67PFAS-03 LD0501	280-115117-8	Perfluorooctanesulfonic acid (PFOS)	100	ng/L	D	DNR	11
MW-84PFAS-03 LD0501	280-115117-9	Perfluorohexanesulfonic acid (PFHxS)	850	ng/L	J1	DNR	20
MW-84PFAS-03 LD0501	280-115117-9	Perfluorononanoic acid (PFNA)	1700	ng/L	J1	DNR	20
MW-84PFAS-03 LD0501	280-115117-9	Perfluorooctanesulfonic acid (PFOS)	560	ng/L	J1	DNR	20
MW-84PFAS-03 LD0501	280-115117-9	Perfluorobutanesulfonic acid (PFBS)	45	ng/L	D	DNR	11
MW-84PFAS-03 LD0501	280-115117-9	Perfluoroheptanoic acid (PFHpA)	14	ng/L	U	DNR	11
MW-84PFAS-03 LD0501	280-115117-9	Perfluorooctanoic acid (PFOA)	160	ng/L	D	DNR	11

APPENDIX E

DATA PRESENTATION TABLES

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Table E-1. Site 67 PFAS Data Presentation
Savanna Army Depot Activity, Savanna, Illinois

Parameter / Location ID / Sample ID / Sample Type / Depth (ft.) / Sample Date	Units	GW Screening Level [G]	Project Action Limit [P]	MW-67PFAS-01 LDOS01 WELL 0 10/02/2018	MW-67PFAS-02 LDOS01 WELL 0 10/02/2018	MW-67PFAS-02 LDOS01D WELL 0 10/02/2018	MW-67PFAS-03 LDOS01 WELL 0 10/02/2018
PFAs							
Perfluorobutanesulfonic acid	ng/L	N/A	**400000**	**3.4**	**3.1**	**3.3**	**6.2 J**
Perfluoroheptanoic acid	ng/L	N/A	N/A	1.9 U	**19**	**19**	**16**
Perfluorohexanesulfonic acid	ng/L	N/A	N/A	**99**	**52**	**51**	**440**
Perfluorononanoic acid	ng/L	N/A	N/A	**1.4 J**	**0.69 J**	**1.2 J**	**1.7 J**
Perfluorooctane sulfonate	ng/L	**370**	**70**	**33**	**160 [P]**	**170 [P]**	**100 [P]**
Perfluorooctanoic acid	ng/L	**370**	**70**	**350 [P]**	**200 [P]**	**200 [P]**	**470 [PG]**

Table E-2. Site 84 PFAS Data Presentation
Savanna Army Depot Activity, Savanna, Illinois

Parameter / Location ID / Sample ID / Sample Type / Depth (ft.) / Sample Date	Units	GW Screening Level [G]	Project Action Limit [P]	MW-84PFAS-01 LDOS01 WELL 0 10/03/2018	MW-84PFAS-02 LDOS01 WELL 0 10/03/2018	MW-84PFAS-03 LDOS01 WELL 0 10/02/2018
PFAs						
Perfluorobutanesulfonic acid	ng/L	N/A	**400000**	**0.62 J**	**110**	**44**
Perfluoroheptanoic acid	ng/L	N/A	N/A	1.3 U	**22**	**4.9**
Perfluorohexanesulfonic acid	ng/L	N/A	N/A	1.3 U	**390**	**1000 J**
Perfluorononanoic acid	ng/L	N/A	N/A	1.3 U	1.4 U	**1900 J**
Perfluorooctane sulfonate	ng/L	**370**	**70**	2.7 U	**120 [P]**	**530 J [PG]**
Perfluorooctanoic acid	ng/L	**370**	**70**	1.3 U	**13**	**160 [P]**

Notes

J = Estimated concentration.
U = Chemical not detected above the laboratory detection limit.

The Project Action Limits are based on the USEPA LHA for groundwater drinking water advisory, as updated in 2016. When both PFOS and PFOA are detected in water, the combined concentrations of PFOS and PFOA should be compared to the 70-ng/L LHA.

The groundwater project action limit for PFBS (400,000 ng/L) is the resident risk-based screening level for tap water from the November 2017 USEPA RSL table (with HQ = 1).

The groundwater screening level of 370 ng/L was referenced in the Army Guidance for Addressing Releases of PFAS (Department of the Army 2018). This screening level does not apply to the combined concentrations of PFOS and PFOA.

Bold values denote detected concentrations.
[P] = Concentration exceeds the USEPA LHA.
[G] = Concentration exceeds the Groundwater Screening Level.
[PG] = Concentration exceeds both the USEPA LHA and the Groundwater Screening Level.
N/A = No PAL available.

Table E-3. PFAS Potable Water Data Presentation
Savanna Army Depot Activity, Savanna, Illinois

Location ID	Sample ID	Sample Date	Method	CAS#	Parameter	Result	Qualifier	Units
MW-67PFAS-03	LDOSFB01	9/5/2018	USEPA 537	375-95-1	Perfluorononanoic acid	1.5	U	ng/L
MW-67PFAS-03	LDOSFB01	9/5/2018	USEPA 537	1763-23-1	Perfluorooctane sulfonate	3	U	ng/L
MW-67PFAS-03	LDOSFB01	9/5/2018	USEPA 537	335-67-1	Perfluorooctanoic acid	1.5	U	ng/L
MW-67PFAS-03	LDOSFB01	9/5/2018	USEPA 537	375-73-5	Perfluorobutanesulfonic acid	1	U	ng/L
MW-67PFAS-03	LDOSFB01	9/5/2018	USEPA 537	375-85-9	Perfluoroheptanoic acid	1.5	U	ng/L
MW-67PFAS-03	LDOSFB01	9/5/2018	USEPA 537	355-46-4	Perfluorohexanesulfonic acid	1	U	ng/L

APPENDIX F

REGULATORY COMMENTS AND ARMY RESPONSES TO COMMENTS

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ILLINOIS ENVIRONMENTAL PROTECTION AGENCY
1021 NORTH GRAND AVENUE EAST, P.O. BOX 19276, SPRINGFIELD, ILLINOIS 62794-9276 · (217) 782-3397
JB PRITZKER, GOVERNOR JOHN J. KIM, DIRECTOR

January 7, 2020

Ms. Cathy Collins
Savanna Army Depot Activity
18935 B St., Building 246
Savanna, IL 61074-9636

Refer to: 0158100002 – Carroll County
Savanna Army Depot Activity
Superfund/Technical Reports

Dear Ms. Collins,

The Illinois Environmental Protection Agency (Illinois EPA) has reviewed the *Draft Final Revision 1 Site Inspection Report for Per and Polyfluoroalkyl Substances at SVAD-067 Fire Training Area and SVAD-084 Scrap Wood Open Burn Area, Savanna Army Depot Activity, Savanna Illinois* dated October 2019 and received October 24, 2019. Illinois EPA's specific comments are provided as follows:

1. **Section 1.4, Regulatory Overview and Project Action Limits:** Please be advised that Illinois is preparing a revision to its groundwater quality regulations, including an extensive update to groundwater quality standards for Class 1 and Class 2 groundwater. Among the likely proposed changes, will be new Class 1 groundwater quality standards for several PFOS/PFOA compounds, including:

Constituent	Proposed Class 1 Standard (mg/L)
Perfluorobutane Sulfonic Acid (PFBS)	0.14
Perfluorohexane Sulfonic Acid (PFHxS)	0.00014
Perfluorononanoic Acid (PFNA)	0.000021
Perfluorooctanoic Acid (PFOA)	0.000021
Perfluorooctane Sulfonic Acid (PFOS)	0.000014
Combined PFOA + PFOS	0.000021

When these standards are adopted by the Illinois Pollution Control Board, these standards will be promulgated, enforceable, and of general applicability to groundwaters of the State, and will be applicable or relevant and appropriate requirements (ARARs) for the sites. Until adopted, these propose standards are "to be considered" (TBC) for any actions.

2. **Section 3.2.1.3, MEC Avoidance:** State what the results of the MEC clearance efforts were; presumably nothing was found.

3. **Section 7, Summary and Conclusions:** The conclusion of "no action" is not consistent with the decision rules in the Final Quality Assurance Project Plan (QAPP, August 2018, Worksheet 11a). The QAPP indicates that further sampling will occur if the project action limits (PALs) are exceeded. Both sites demonstrated detections above the PALs; further sampling should occur.

4. **Section 7, Summary and Conclusions:** The report states that no action is planned because the groundwater at these sites is not a source of drinking water and that no exposure is expected at either site due to the depth of groundwater. The average depth to groundwater at Site 67 is about 16 feet with groundwater levels as shallow as 4 feet. Groundwater could be encountered at this site during construction activities; thereby presenting a risk. Regardless, Illinois EPA advises the Army that action pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) is required if there is a potential of current or future risk at a site. This could be the case at Site 67, and the CERCLA process should be followed to determine extent of contamination, degree of risk associated with such exposures, and need for remediation for this pathway. Additionally, the CERCLA/NCP requirement to define nature and extent of contamination needs to be met, and it appears this was the Army's original intent, based on the QAPP.

   Moreover, Illinois has primacy over groundwater pursuant to USEPA's July 29, 1997 endorsement of its program developed to meet USEPA's Comprehensive State Groundwater Protection Program (CSGWPP). When Illinois' groundwater quality standards are exceeded, Illinois statute (415 ILCS 55 and 415 ILCS 5) and rule (35 Ill. Adm. Code Part 620) require corrective action until the exceedance(s) are abated. Protection of future beneficial uses of groundwater is a priority of Illinois' groundwater program. Active corrective action is to be undertaken for impacted Illinois groundwaters whether or not they are being actively used.

   Additionally, the State's non-degradation provision of its groundwater regulations (35 Ill. Adm. Code 620.301) prohibits the release of any contaminant that may compromise a potential use of such groundwater. Since the groundwater at the installation is Class I, ongoing contamination at Site 67 and 84 needs to be addressed.

   The State's non-degradation provisions do not preclude the establishment of a groundwater management zone (GMZ) to manage such releases, but the requirements for establishing a GMZ would need to be met, including determining the vertical and horizontal extent of any plumes.

5. Until the above comments are resolved, Illinois EPA does not concur with the Army's conclusion for no further action for either site.

If you have any questions or wish to discuss this further, please contact me at Charlene.falco@illinois.gov or at 217-785-2891.

Sincerely,

Charlene Falco
Project Manager
Federal Site Remediation Section
Bureau of Land

CAF:CMP:CAH:p:\\SVDA\RI\PFAS Investigations\ Site 67 and 84 PFAS SI Review_01 2020.docx

cc: Thomas Barounis, EPA Region 5
Dick Kennard, USACE
Marcy Larriva, Leidos

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

January 14, 2020

REPLY TO THE ATTENTION OF SR-6J

Ms. Cathy Collins
BRAC Environmental Coordinator
Building 246
18935 B Street
Savanna Army Depot
Savanna, IL 61074

Subject: **U.S. EPA Review of the Site Inspection Report for Per- and Polyalkyl Substances at SVAD-067 – Fire Training Area and SVAD-084 – Scrap Wood Open Burn Area, Draft Final, Revision 1, Savanna Army Depot Activity, Savanna, Illinois, October 2019**

Dear Ms. Collins:

The U.S. Environmental Protection Agency (EPA) has reviewed the subject *Site Inspection Report for Per- and Polyalkyl Substances at SVAD-067 – Fire Training Area and SVAD-084 – Scrap Wood Open Burn Area, Draft Final, Revision 1* (SI Report). Enclosed please find our comments. EPA's comments represent review by EPA Region 5 staff and EPA's Federal Facilities Restoration and Reuse Office.

If you have any questions, or require additional information, please feel free to contact me by phone at (312) 353-5577 or by e-mail (barounis.thomas@epa.gov).

Sincerely,

Tom Barounis

Tom Barounis
Remedial Project Manager

cc: Todd Knuth, USACE
Charlene Falco, IEPA
Dick Kennard, USACE
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U.S. EPA Review of the Site Inspection Report for Per- and Polyalkyl Substances at SVAD-067 – Fire Training Area and SVAD-084 – Scrap Wood Open Burn Area, Draft Final, Revision 1, Savanna Army Depot Activity, Savanna, Illinois, October 2019

January 14, 2020

EPA Region 5 Comments

GENERAL COMMENTS

1. According to Section 7 (Summary and Conclusions), no additional action for PFAS in groundwater at SVAD-067 and SVAD-084 is required at this time because the "the six UCMR3 [Third Unregulated Contaminant Monitoring Rule] PFAS compounds were analyzed for and not detected" at the SVDA Lower Post drinking water on September 26, 2016 and "does not pose an imminent and substantial endangerment." However, it is unknown if land use controls (LUCs) are in place to prevent future exposure to the PFAS contamination. Clarify whether appropriate LUCs are in place to prevent future exposure to PFAS in groundwater at SVAD-067 and SVAD-084.

2. According to Section 7 (Summary and Conclusions), analysis of the SVDA Lower Post drinking water was conducted in September 26, 2016 using an outdated analytical method. As such, it is unclear if the SVDA Lower Post drinking water has been re-sampled using EPA Method 537.1 to substantiate that an imminent and substantial endangerment does not exist. Further, it is unclear if outfalls and/or seeps along the Mississippi River were evaluated to determine if PFAS contamination at SVDA is contributing to potential drinking water sources/ambient waters. Per the EPA's Per- and Polyfluoroalkyl Substances (PFAS) Action Plan, EPA 823R18004, dated February 2019 (the EPA PFAS Action Plan), one of the long-term actions identified as a stakeholder concern is the reduction of PFAS releases into ambient waters and sources of drinking water. Clarify if the SVDA Lower Post drinking water has been re-sampled using EPA Method 537.1 to substantiate that an imminent and substantial endangerment does not exist. In addition, revise the SI to clarify if outfalls and/or seeps along the Mississippi River were evaluated to determine that PFAS contamination at SVDA is not contributing to potential drinking water sources/ambient waters.

3. The SI does not discuss or evaluate the potential for contribution of PFAS contamination from upgradient sources at SVAD-067. Although the objective of the SI was to determine the presence or absence of PFAS in groundwater at SVAD-067 and SVAD-084, Section 5.2 (SI Sampling and Results) concludes that PFAS contamination upgradient of SVAD-067 is due to reversing groundwater flow conditions. However, upgradient sources of PFAS contamination at SVAD-067, SVAD-084, and adjacent upgradient sites are not provided in the SI. As a result, it is unknown if such potential upgradient PFAS sources exist. Revise the SI to provide information to substantiate the claim that upgradient PFAS contamination at SVAD-067 is due to reversing groundwater flow conditions and not to other potential upgradient PFAS sources.

4. The discussion of analytical data and data quality in both Section 4 (Laboratory Chemical Analysis Program and Quality Assurance Summary) and Appendix D (Data Quality Assessment) of the SI Report is insufficiently detailed. Examples of insufficient information include, but are not limited to:

   a) Section 4.6.5 (Completeness) states that "Completeness measures the amount of valid data obtained from the laboratory analysis process and sampling" and Section 4.6.7 (Data Usability Assessment) indicates that 100 percent (%) of the data are complete and usable. However, the Addendum 2 Uniform Federal Policy Quality Assurance Project Plan, Site Inspection at SVAD-067 and SVAD-084, Savanna Army Depot Activity, dated August 2018 (the Addendum 2 QAPP) indicates that completeness is calculated based on the number of data points that are not rejected compared to the total number of data points planned. The SI report should clarify how completeness was calculated.

   b) Section 4 and Appendix D indicate that some data were qualified based on quality control (QC) exceedances; however, the SI Report does not provide the QC sample results along with the QC acceptance criteria in order to show the extent of the exceedances.

   c) It is unclear if the split sample analyzed by Eurofins-Lancaster was validated by Leidos and/or EcoChem. The SI Report should specify which sample data was validated by Leidos and which sample data was validated by EcoChem. If the split sample data was not validated, the SI Report should discuss why the split sample data was not validated.

   d) The SI Report does not include the laboratory analytical data packages, and therefore, statements about data usability cannot be verified.

   e) Appendix D includes the EcoChem Data Validation Report as Attachment A; however, it is unclear why data validation reports from Leidos have not been provided.

   Revise the SI Report to provide a clear and complete discussion of the analytical data and data quality.

5. Section 4 (Laboratory Chemical Analysis Program and Quality Assurance Summary) and Appendix D (Data Quality Assessment) of the SI Report both indicate that the October 1999 version of the National Functional Guidelines for Organic Data Review (NFGs) was used to validate the data; however, NFGs have been updated several times since 1999, and it is unclear why a more recent version was not used for data validation. Ensure the appropriate version of the NFGs was used to validate the data and revise the SI Report to discuss why a more recent version was not used.

6. Results are inconsistently presented throughout the SI Report. For example, Appendix E (Data Presentation Tables), Table E-2 (Site 84 PFAS Data Presentation) lists the Perfluorononanoic acid (PFNA) concentration in sample MW-84PFAS-03 LDOS01 as 1,900 nanograms per liter (ng/L), but Qualified Data Summary Table in Appendix B of the EcoChem Data Validation Report (Attachment A of Appendix D) lists the PFNA result as

1,700 ng/L. As a second example, Table E-1 (Site 67 PFAS Data Presentation) lists the Perfluorohexanesulfonic acid (PFHxS) concentration in sample MW-67PFAS-03 LDOS01 as 440 ng/L, but the Qualified Data Summary Table in Appendix B of the EcoChem Data Validation Report lists the PFHxS result as 430 ng/L. As a third example, Table D-5 (Third Party Data Validation) in Appendix D (Data Quality Assessment) lists two different results for the compounds in sample MW-84PFAS-03 LDOS01, which are not always the same as the results listed in the Qualified Data Summary Table in Appendix B of the EcoChem Data Validation Report or Appendix E (e.g., Table D-5 has PFHxS results in sample MW-84PFAS-03 LDOS01 as 850 ng/L and 1,000 ng/L, but the EcoChem Data Validation Report lists the PFHxS result as 850 ng/L, and Table E-2 lists the PFHxS result as 1,000 ng/L). Revise the SI Report to ensure that the correct results are presented for all samples collected.

SPECIFIC COMMENTS

1. **Section 1, Introduction, Page 1-1:** The text indicates that aqueous film-forming foam (AFFF) contained various PFAS, and the objective of the SI was to determine the presence or absence of perfluorooctane sulfonate (PFOS) or perfluorooctanoic acid (PFOA) in groundwater at SVAD-067 and SVAD-084. However, the Army PFAS Guidance does not limit PFAS SI sample analytical to only PFOA and PFOS. Revise the SI to discuss why the presence or absence of comprehensive PFAS were not an objective of this SI.

2. **Section 1, Introduction, Page 1-4:** The text describes the rationale for investigation of PFAS in groundwater at SVAD-067 and SVAD-084 but does not clarify that PFAS-based AFFF was invented in 1966 or that the use of military standard (MILSPEC) AFFF containing PFAS started in December 1969. As a result, although the sites were used for fire training activities, AFFF containing PFASs were unlikely to have been used on the sites until after 1966. Revise Section 1 to clarify that AFFF containing PFAS were unlikely to have been used on the sites until after 1966.

3. **Section 1.3, Fire Training Activities at SVAD-067 and SVAD-084, Page 1-5:** Section 1.3 does not discuss how AFFF was dispensed. For example, it is unclear if AFFF was dispensed from trucks using hoses and nozzles. If trucks, hoses, and nozzles were used, it is unclear where the equipment was washed and dried. This is of note given that AFFF would drip off the equipment on wash and drying racks. Further, if trucks were used, it is unclear where they were filled, where the AFFF was stored prior to filling, etc, and whether accidental spills and releases during transport occurred. Revise the SI to discuss all aspects of AFFF use and storage at SVAD-064 and SVAD-087.

4. **Section 1.4, Regulatory Overview and Project Action Limits, Page 1-6:** The SI text states, "Currently, no legally enforceable Federal standards, such as maximum contaminant levels (MCLs), exist for PFAS in water. However, under SDWA, USEPA issued a series of Health Advisories (HAs) for PFOS and PFOA, including the most recent in May 2016." The EPA PFAS Action Plan also outlines these HAs and includes additional information regarding future PFAS regulation. Revise Section 1.4 to discuss the EPA PFAS Action Plan.

5. **Section 2.5, Surface Water Hydrology, Page 2-4:** The text states, "No surface water features are located on SVAD-067 or SVAD-084." However, Section 5.1 (Site History) states that one of the site features at SVAD-067 included an outfall area used to drain water associated with the waste oil tank, metal trays to support fire training exercises, and aboveground storage tanks. As a result, it is unclear why this outfall area was not investigated as part of the SI. Revise the SI to identify and discuss all potential low-lying areas where PFAS potentially migrated to and demonstrate that these areas were adequately characterized during the Sl activities.

6. **Section 2.6.1, Geology/Hydrogeology at SVAD-067, Page 2-5; Figure 2-2, Lower Post Area Groundwater Elevation Normal Flow Conditions – July 1999, Page 2-6; Figure 2-3, Lower Post Area Groundwater Elevation Reversed Flow Conditions – June 2000, Page 2-7; and, Section 2.6.2, Geology/Hydrogeology at SVAD-084, Page 2-8:** The groundwater flow maps referenced in Sections 2.6.1 and 2.6.2 may not be representative of current groundwater flow conditions. Figures 2-2 and 2-3 indicate that July 1999 and June 2000 groundwater elevation data were used to determine groundwater flow directions, respectively. However, Worksheet #13a (Secondary Data Uses and Limitations) of the Final Addendum 2 Uniform Federal Policy Quality Assurance Project Plan, Site Inspection at SVAD-067 and SVAD-084, dated August 2018 (the Final UFP-QAPP) indicates that information in the Final Remedial Investigation Report for the Lower Post, dated October 2004 (the 2004 Lower Post RI Report) and the Remedial Investigation Report for Sites 46, 76CS, 84, and 184, dated December 2007 (the 2007 RI Report) were to be used to determine geology, hydrogeology, and groundwater flow directions. Revise the SI to address this discrepancy.

7. **Section 3.1, Field Investigation Activities, Page 3-1; Figure 5-1, SVAD-067 Fire Training Area, Page 5-2; and, Figure 6-1, SVAD-084 Scrap Wood Open Burn Area, Page 6-2:** The location description of the groundwater monitoring wells installed, and groundwater samples collected is inconsistent with the Figure depiction. The text in this section states that the groundwater samples were collected at and downgradient from SVAD-067 and SVAD-084. However, Figures 5-1 and 6-1 show the groundwater monitoring well locations as being within each site. Revise the Sl to state that the groundwater samples were collected from groundwater monitoring wells located within SVAD-067 and SVAD-084.

8. **Section 3.2.1.1, Visual Inspections, Page 3-2:** Section 3.2.1.I states, "A visual inspection was conducted at the SVAD-067 and SVAD-084 areas prior to initiating drilling activities for monitoring well installation." However, documentation of the visual inspections is not provided and/or referenced in the SI. Revise the SI to include an appendix of the visual inspection documentation (notes, photographs, identified surface water drainage patterns, etc.).

9. **Section 3.2.1.4, Groundwater Monitoring Well Installation, Page 3-3:** The text states, "The potable water used for hydration and decontamination activities was sampled during the event." However, analytical results for the potable water are not included in the SI. Revise the SI to include the results of the potable water sample.

10. **Section 3.5, Disposition of Field Investigation-Derived Waste, Page 3-7:** The text states, "Veolia advised Leidos to analyze for suspected contaminants based on site history and previous investigations." However, the SI does not indicate whether the investigation-derived waste (IDW) was analyzed for PFAS. Revise the SI to include PFAS results for IDW samples, if available. If PFAS was not analyzed, discuss how proper IDW disposal was achieved without such analyses.

11. **Section 4.1.2, Laboratory Sample Receipt, Page 4-1:** This section states that "All insufficiencies and/or discrepancies were reported immediately to the Laboratory Project Manager, who notified Leidos within 24 hours to determine if resampling was required." However, it is unclear what those insufficiencies and/or discrepancies were and if resampling was required. Revise Section 4.1.2 to discuss all sample receipt insufficiencies and/or discrepancies and whether resampling was required.

12. **Section 4.5.4, Third-Party Data Validation, Page 4-4:** The first sentence in the second paragraph states that Table D-4 in Appendix D (Data Quality Assessment) provides a comparison of data qualifiers applied by Leidos and the third-part validator; however, this information is provided in Appendix D, Table D-5. Revise Section 4.5.4 to reference the correct table in Appendix D.

13. **Section 4.6.1, Precision, Page 4-5 and Appendix D, Section D.3, Field Quality Control Assessment, Page D-4:** Sections 4.6.1 and D.3 indicate that the acceptance limit for field duplicate samples is a maximum relative percent difference (RPD) of 50%; however, the Addendum 2 QAPP indicates that the field duplicate acceptance criteria for aqueous samples is RPD < 30%. Revise the SI Report to reflect the correct acceptance limit for field duplicate samples and discuss any field duplicate exceedances based on the corrected acceptance limit.

14. **Figure 5-1, SVAD-067 Fire Training Area, Page 5-2; Figure 5-2, SVAD-067 Fire Training Area Analytical Results, Page 5-4; Figure 6-1, SVAD-084 Scrap Wood Open Burn Area, Page 6-2; and, Figure 6-2, SVAD-084, Scrap Wood Open Burn Area Analytical Results, Page 6-3:** The SI site-specific figures for each of the sites assessed do not display the location of all relevant current and historical site features discussed in Sections 5.1 (Site History) and 6.1 (Site History) (e.g., outfall areas, storage tanks, etc.). Revise the site-specific figures to include relevant site features for sites SVAD-067 and SVAD-084.

15. **Section 6.1, Site History, Page 6-1; Figure 6-1, SVAD-084 Scrap Wood Open Burn Area, Page 6-2; and, Figure 6-2, SVAD-084, Scrap Wood Open Burn Area Analytical Results, Page 6-3:** Based on Figures 6-1 and 6-2, MW-84PFAS-02 was advanced in the "IRA Actual Remediation Area"; however, it is unclear how advancement of a monitoring well within a previously excavated area is appropriate to investigate site conditions and a source area. This is of note given that Section 6.1 indicates that "approximately 3,232 tons of nonhazardous soil and debris were excavated and disposed of offsite." As such, the analytical results from MW-84PFAS-02 may be under-representing the site conditions and the source area. Revise the SI to clarify how advancement of a monitoring well within a previously excavated area is appropriate to investigate site conditions and a source area.

16. **Appendix A, SVDA Drinking Water PFAS Data:** According to Appendix A (PDF Page 61 of 120), the field blank sample collected on September 26, 2016 (NLS ID: 948929) was not analyzed for PFAS; however, the SI does not discuss why the field blank sample was not analyzed for PFAS. Revise the SI to clarify why the field blank sample collected on September 26, 2016 (NLS ID: 948929) was not analyzed for PFAS.

17. **Appendix D, Data Quality Assessment, Section D.4.2, Data Verification/Data Validation Comparison, Page D-5:** The first and last sentences in the first paragraph of this section state that Table D-4 provides a comparison of data qualifiers applied by Leidos and the third-part validator; however, this information is provided in Table D-5. Revise Section D.4.2 to reference the correct table.

18. **Appendix D, Data Quality Assessment, Tables D-1 through D-5, Pages D-7 to D-9:** Tables D-1 through D-5 in Appendix D are incomplete. The tables do not clarify if the information provided in each table is for the primary sample or the split sample. In addition, Section D-2 of Appendix D states that "All data validation qualifiers applied to the data are presented in Table D-2." However, Tables D-3, D-4 and D-5 include qualified data that is not listed in Table D-2; and further, Table D-5 includes qualifier letter and number codes that are not defined in the table or discussed in the Appendix D text. For example, "DNR" is listed as a validation qualifier in Table D-5, but the "Overall Assessment" section in Attachment A (EcoChem Data Validation Report) of Appendix D states, "Data flagged DNR should not be used. All other data, as reported, are acceptable for use." Finally, the column headings in Table D-5 need clarification. The difference between "Parent Qualifier," "Validation Qualifier," and "Duplicate Qualifier" is unclear, and the table does not specify if the qualifiers listed were applied by Leidos or EcoChem. Revise Tables D-1 through D-5 to provide complete information.

19. **Appendix E, Data Presentation Tables, Page E-1:** Tables E-1 (Site 67 PFAS Data Presentation) and E-2 (Site 84 PFAS Data Presentation) present results that are shaded pink with a [P] code and results that are shaded orange with a [PG] code, but these colors and codes are not defined. Revise Appendix E to define the pink and orange shading and [P] and [PG] codes, and ensure their significance is discussed in the SI Report.

Comments from EPA Federal Facilities Restoration and Reuse Office

1. The scope of the SI should be expanded to consider other potential sources of PFAS in the environment (including PFAS beyond PFOA and PFOS) or a rationale should be provided as to why the scope was limited to AFFF areas and these two PFAS.

2. A Conceptual Site Model (CSM) would help to provide context for the interpretation of the results from the sampling. EPA recommends that a CSM be included in with this report.

3. Please add a discussion of any drinking water wells that may be located near the base boundary. Please include justification for not sampling these wells. Also, please discuss how

seasonal groundwater flow reversal impacts PFAS groundwater contamination. Describe how groundwater sampling is designed to account for these changes.

4. According to this report, there are no surface water features located on the study locations and groundwater is likely entering the Mississippi River. Releases of contaminated groundwater to the Mississippi River should be further investigated, given the importance of the River as a drinking water source.

5. Please clearly state in Section 4.2 if Method 537 was modified to measure PFAS in groundwater.

6. The Assistant Secretary of Defense recently issued guidance directing PFAS investigators to use a screening level of 40 parts per trillion for PFOA and PFOS (*ASD Memorandum for Assistant Secretaries of the Army, Navy, Air Force, National Guard Bureau and Defense Logistics Agency, October 15, 2019*). U.S. EPA also recently issued guidance recommending a screening level of 40ng/L for PFOA and PFOS ("*Interim Recommendations to Address Groundwater Contaminated with Perfluorooctanoic Acid and Perfluorooctanesulfonate, OLEM Directive No. 9283.1-47, December 19, 2019*"). The PFOA and PFOS results from the monitoring wells should be re-screened using the updated screening level.

7. Please describe LUCS that may be in place to prevent use of base groundwater. Also, please provide language that describes how/where in the base master plan PFAS contamination information will be tracked and stored.

USEPA Review of the Site Inspection Report for Per- and Polyalkyl Substances at SVAD-067 – Fire Training Area and SVAD-084 – Scrap Wood Open Burn Area, Draft Final, Revision 1, Savanna Army Depot Activity, Savanna, Illinois, October 2019

Comments: January 15, 2020
Responses: January 25, 2021

USEPA Region 5 Comments

GENERAL COMMENTS

1. According to Section 7 (Summary and Conclusions), no additional action for PFAS in groundwater at SVAD-067 and SVAD-084 is required at this time because the "the six UCMR3 [Third Unregulated Contaminant Monitoring Rule] PFAS compounds were analyzed for and not detected" at the SVDA Lower Post drinking water on September 26, 2016 and "does not pose an imminent and substantial endangerment." However, it is unknown if land use controls (LUCs) are in place to prevent future exposure to the PFAS contamination. Clarify whether appropriate LUCs are in place to prevent future exposure to PFAS in groundwater at SVAD-067 and SVAD-084.

Response: *LUCs are not currently in place to prevent future exposure to PFAS in groundwater at SVAD-067 or SVAD-084.*

2. According to Section 7 (Summary and Conclusions), analysis of the SVDA Lower Post drinking water was conducted in September 26, 2016 using an outdated analytical method. As such, it is unclear if the SVDA Lower Post drinking water has been re-sampled using EPA Method 537.1 to substantiate that an imminent and substantial endangerment does not exist. Further, it is unclear if outfalls and/or seeps along the Mississippi River were evaluated to determine if PFAS contamination at SVDA is contributing to potential drinking water sources/ambient waters. Per the EPA's Per- and Polyfluoroalkyl Substances (PFAS) Action Plan, EPA 823R18004, dated February 2019 (the EPA PFAS Action Plan), one of the long-term actions identified as a stakeholder concern is the reduction of PFAS releases into ambient waters and sources of drinking water. Clarify if the SVDA Lower Post drinking water has been re-sampled using EPA Method 537.1 to substantiate that an imminent and substantial endangerment does not exist. In addition, revise the SI to clarify if outfalls and/or seeps along the Mississippi River were evaluated to determine that PFAS contamination at SVDA is not contributing to potential drinking water sources/ambient waters.

Response: *The SVDA drinking water was sampled in 2016 using the appropriate method for sampling PFAS at the time. The intent of the SI sampling was to determine the presence/absence of PFAS constituents at SVAD-067 and SVAD-084. Samples from outfalls and/or seeps along the Mississippi River were not required to meet project DQOs.*

3. The SI does not discuss or evaluate the potential for contribution of PFAS contamination from upgradient sources at SVAD-067. Although the objective of the SI was to determine the presence or absence of PFAS in groundwater at SVAD-067 and SVAD-084, Section 5.2 (SI Sampling and Results) concludes that PFAS contamination upgradient of SVAD-067 is due to reversing groundwater flow conditions. However, upgradient sources of PFAS contamination at SVAD-067, SVAD-084, and adjacent upgradient sites are not provided in the SI. As a result, it is unknown if such potential upgradient PFAS sources exist. Revise the SI to provide information to substantiate the claim that upgradient PFAS contamination at SVAD-067 is due to reversing groundwater flow conditions and not to other potential upgradient PFAS sources.

Response: *Based on the historical records review conducted as part of the SVDA Environmental Baseline Survey and interviews with former SVDA employees conducted as part of the PFAS SI activities, no suspected PFAS sources are upgradient of or adjacent to SVAD-067 and SVAD-084. The*

historical records review and interviews did not reveal how the AFFF was stored or dispensed at SVDA.

4. The discussion of analytical data and data quality in both Section 4 (Laboratory Chemical Analysis Program and Quality Assurance Summary) and Appendix D (Data Quality Assessment) of the SI Report is insufficiently detailed. Examples of insufficient information include, but are not limited to:

a) Section 4.6.5 (Completeness) states that "Completeness measures the amount of valid data obtained from the laboratory analysis process and sampling" and Section 4.6.7 (Data Usability Assessment) indicates that 100 percent (%) of the data are complete and usable. However, the Addendum 2 Uniform Federal Policy Quality Assurance Project Plan, Site Inspection at SVAD-067 and SVAD-084, Savanna Army Depot Activity, dated August 2018 (the Addendum 2 QAPP) indicates that completeness is calculated based on the number of data points that are not rejected compared to the total number of data points planned. The SI report should clarify how completeness was calculated.

Response: *Section 4.6.7 was revised as follows:*

"No data points were rejected during the data validation process. As a result, data completeness was excellent at 100 percent complete. Seventy-eight of the planned 78 data points are considered fully usable for decision making. Three results were qualified as nondetect (U) due to continuing calibration blank contamination, and three results were qualified as estimated (J) due to IS area counts that were slightly above (7 percent) the UCL."

b) Section 4 and Appendix D indicate that some data were qualified based on quality control (QC) exceedances; however, the SI Report does not provide the QC sample results along with the QC acceptance criteria in order to show the extent of the exceedances.

Response: *The only QC exceedances found in the PFAS data are provided in the response above and are now included in Section 4.6.7. No changes were made to the documents.*

c) It is unclear if the split sample analyzed by Eurofins-Lancaster was validated by Leidos and/or EcoChem. The SI Report should specify which sample data was validated by Leidos and which sample data was validated by EcoChem. If the split sample data was not validated, the SI Report should discuss why the split sample data was not validated.

Response: *The QA split sample is generally analyzed by a USACE-selected QA laboratory with results reported directly to USACE. For this project, Leidos was assisting USACE with the contracting of the QA laboratory. The data generated from this QA sample were not included in the SI data evaluations, and the results for the sample will not be used in decision making; therefore, the results did not require data validation. However, it should be noted that the split results were in excellent agreement, as shown in Table D-4. No changes to the documents were made.*

d) The SI Report does not include the laboratory analytical data packages, and therefore, statements about data usability cannot be verified.

Response: *Section 4 and Appendix D of the SI Report provide an accurate summary of all QA measures reviewed to determine data usability. In instances where QC criteria were not met, these deficiencies were noted in detail and any impact on data usability was discussed. The laboratory analytical data packages total more than 4,800 pages and it is not practical to include them in the SI Report. No changes to the documents were made.*

e) Appendix D includes the EcoChem Data Validation Report as Attachment A; however, it is unclear why data validation reports from Leidos have not been provided.

***Response**: Appendix D includes the EcoChem Data Validation Report, which is a summary of their validation. Appendix D is a summary of Leidos' validation. No changes to the documents were made.*

Revise the SI Report to provide a clear and complete discussion of the analytical data and data quality.

***Response:** Appendix D includes the EcoChem Data Validation Report, which is a summary of their validation. Appendix D is a summary of Leidos' validation and provides a clear and complete discussion of the analytical data and data quality.*

5. Section 4 (Laboratory Chemical Analysis Program and Quality Assurance Summary) and Appendix D (Data Quality Assessment) of the SI Report both indicate that the October 1999 version of the National Functional Guidelines for Organic Data Review (NFGs) was used to validate the data; however, NFGs have been updated several times since 1999, and it is unclear why a more recent version was not used for data validation. Ensure the appropriate version of the NFGs was used to validate the data and revise the SI Report to discuss why a more recent version was not used.

***Response:** National Functional Guidelines are written for USEPA Contract Laboratory Program (CLP) analysis, and the 1999 version is more applicable to most USEPA and SW-846 methods than the more recent updates. It is common for data validation to reference the 1999 version when validating non-CLP data.*

6. Results are inconsistently presented throughout the SI Report. For example, Appendix E (Data Presentation Tables), Table E-2 (Site 84 PFAS Data Presentation) lists the Perfluorononanoic acid (PFNA) concentration in sample MW-84PFAS-03 LDOS01 as 1,900 nanograms per liter (ng/L), but Qualified Data Summary Table in Appendix B of the EcoChem Data Validation Report (Attachment A of Appendix D) lists the PFNA result as 1,700 ng/L. As a second example, Table E-1 (Site 67 PFAS Data Presentation) lists the Perfluorohexanesulfonic acid (PFHxS) concentration in sample MW-67PFAS-03 LDOS01 as 440 ng/L, but the Qualified Data Summary Table in Appendix B of the EcoChem Data Validation Report lists the PFHxS result as 430 ng/L. As a third example, Table D-5 (Third Party Data Validation) in Appendix D (Data Quality Assessment) lists two different results for the compounds in sample MW-84PFAS-03 LDOS01, which are not always the same as the results listed in the Qualified Data Summary Table in Appendix B of the EcoChem Data Validation Report or Appendix E (e.g., Table D-5 has PFHxS results in sample MW-84PFAS-03 LDOS01 as 850 ng/L and 1,000 ng/L, but the EcoChem Data Validation Report lists the PFHxS result as 850 ng/L, and Table E-2 lists the PFHxS result as 1,000 ng/L). Revise the SI Report to ensure that the correct results are presented for all samples collected.

***Response:** See response to USEPA Specific Comment #18 for clarification and document revisions regarding this comment. The above examples are values provided in the EcoChem Data Validation Report. In some instances, Leidos used professional judgment and chose the higher result when two equally valid results from different dilutions were available. When no difference in data quality exists, the more conservative approach is to use the higher result for decision making.*

SPECIFIC COMMENTS

1. Section 1, Introduction, Page 1-1: The text indicates that aqueous film-forming foam (AFFF) contained various PFAS, and the objective of the SI was to determine the presence or absence of perfluorooctane sulfonate (PFOS) or perfluorooctanoic acid (PFOA) in groundwater at SVAD-067 and SVAD-084. However, the Army PFAS Guidance does not limit PFAS SI sample analytical to only PFOA and PFOS. Revise the SI to discuss why the presence or absence of comprehensive PFAS were not an objective of this SI.

***Response:** Prior to conducting the PA/SI, stakeholder discussions concluded that the PA/SI would focus on determining the presence/absence of PFOS and PFOA given that the USEPA health advisory levels*

were for these two constituents and that neither USEPA nor IEPA had established screening criteria for any of the other PFAS constituents at the time. SVAD-067 and SVAD-084 samples were analyzed for the six PFAS listed in the SDWA UCMR3. The SI Report was revised to present the results of these analytes.

2. **Section 1, Introduction, Page 1-4:** The text describes the rationale for investigation of PFAS in groundwater at SVAD-067 and SVAD-084 but does not clarify that PFAS-based AFFF was invented in 1966 or that the use of military standard (MILSPEC) AFFF containing PFAS started in December 1969. As a result, although the sites were used for fire training activities, AFFF containing PFASs were unlikely to have been used on the sites until after 1966. Revise Section 1 to clarify that AFFF containing PFAS were unlikely to have been used on the sites until after 1966.

   Response: *Section 1 was amended with the following text: "Based on the timeline for development of AFFF, AFFF-containing PFAS was unlikely to have been used until after 1966."*

3. **Section 1.3, Fire Training Activities at SVAD-067 and SVAD-084, Page 1-5:** Section 1.3 does not discuss how AFFF was dispensed. For example, it is unclear if AFFF was dispensed from trucks using hoses and nozzles. If trucks, hoses, and nozzles were used, it is unclear where the equipment was washed and dried. This is of note given that AFFF would drip off the equipment on wash and drying racks. Further, if trucks were used, it is unclear where they were filled, where the AFFF was stored prior to filling, etc, and whether accidental spills and releases during transport occurred. Revise the SI to discuss all aspects of AFFF use and storage at SVAD-064 and SVAD-087.

   Response: *The historical records review conducted as part of the SVDA Environmental Baseline Survey and interviews with former SVDA employees conducted as part of the PFAS SI activities did not reveal how the AFFF was stored or dispensed.*

4. **Section 1.4, Regulatory Overview and Project Action Limits, Page 1-6:** The SI text states, "Currently, no legally enforceable Federal standards, such as maximum contaminant levels (MCLs), exist for PFAS in water. However, under SDWA, USEPA issued a series of Health Advisories (HAs) for PFOS and PFOA, including the most recent in May 2016." The EPA PFAS Action Plan also outlines these HAs and includes additional information regarding future PFAS regulation. Revise Section 1.4 to discuss the EPA PFAS Action Plan.

   Response: *Section 1.4 was amended with the following text:*

   "USEPA issued the PFAS Action Plan in February 2019. The PFAS Action Plan is the first multi-media, multi-program, national research, management, and risk communication plan to address PFAS and outlines the tools USEPA is developing to address PFAS in drinking water, identify and clean up PFAS contamination, expand monitoring of PFAS manufacturing, increase PFAS scientific research, and promote effective enforcement tools."

5. **Section 2.5, Surface Water Hydrology, Page 2-4:** The text states, "No surface water features are located on SVAD-067 or SVAD-084." However, Section 5.1 (Site History) states that one of the site features at SVAD-067 included an outfall area used to drain water associated with the waste oil tank, metal trays to support fire training exercises, and aboveground storage tanks. As a result, it is unclear why this outfall area was not investigated as part of the SI. Revise the SI to identify and discuss all potential low-lying areas where PFAS potentially migrated to and demonstrate that these areas were adequately characterized during the SI activities.

   Response: *Section 5.1 text was clarified to indicate that the drain water from the waste oil tank was not discharged to a surface water body, but to the ground surface. The sentence was modified as shown below:*

   "Other site features included the ~~outfall~~ area ~~used to~~ where ~~drain~~ water associated with the waste oil tank was discharged to the ground surface, aboveground metal trays…"

Monitoring well MW-67PFAS-03 was placed in the vicinity of the discharge point and downgradient from the waste oil tank, metal trays to support fire training exercises, and the aboveground storage tanks.

6. **Section 2.6.1, Geology/Hydrogeology at SVAD-067, Page 2-5; Figure 2-2, Lower Post Area Groundwater Elevation Normal Flow Conditions – July 1999, Page 2-6; Figure 2-3, Lower Post Area Groundwater Elevation Reversed Flow Conditions – June 2000, Page 2-7; and, Section 2.6.2, Geology/Hydrogeology at SVAD-084, Page 2-8:** The groundwater flow maps referenced in Sections 2.6.1 and 2.6.2 may not be representative of current groundwater flow conditions. Figures 2-2 and 2-3 indicate that July 1999 and June 2000 groundwater elevation data were used to determine groundwater flow directions, respectively. However, Worksheet #13a (Secondary Data Uses and Limitations) of the Final Addendum 2 Uniform Federal Policy Quality Assurance Project Plan, Site Inspection at SVAD-067 and SVAD-084, dated August 2018 (the Final UFP-QAPP) indicates that information in the Final Remedial Investigation Report for the Lower Post, dated October 2004 (the 2004 Lower Post RI Report) and the Remedial Investigation Report for Sites 46, 76CS, 84, and 184, dated December 2007 (the 2007 RI Report) were to be used to determine geology, hydrogeology, and groundwater flow directions. Revise the SI to address this discrepancy.

   Response: *Information from the final Remedial Investigation Report for the Lower Post and the Remedial Investigation Report for Sites 46, 76CS, 84, and 184 were used in the site-specific geology/hydrogeology sections of the SI. However, in addition to the RI data, the extensive Installation-wide continuous groundwater monitoring data that were collected over a 27-month period as well as the groundwater data collected during the 2018 SI also were included in the geology/hydrogeology analysis. The Installation-wide data have been used frequently for groundwater investigations at SVDA. Reference to these data was inadvertently omitted in UFP-QAPP Worksheet #13a.*

7. **Section 3.1, Field Investigation Activities, Page 3-1; Figure 5-1, SVAD-067 Fire Training Area, Page 5-2; and, Figure 6-1, SVAD-084 Scrap Wood Open Burn Area, Page 6-2:** The location description of the groundwater monitoring wells installed, and groundwater samples collected is inconsistent with the Figure depiction. The text in this section states that the groundwater samples were collected at and downgradient from SVAD-067 and SVAD-084. However, Figures 5-1 and 6-1 show the groundwater monitoring well locations as being within each site. Revise the SI to state that the groundwater samples were collected from groundwater monitoring wells located within SVAD-067 and SVAD-084.

   Response: *The text was clarified to convey that the groundwater samples were collected at and downgradient from* ***the source areas at*** *SVAD-067 and SVAD-084.*

8. **Section 3.2.1.1, Visual Inspections, Page 3-2:** Section 3.2.1.1 states, "A visual inspection was conducted at the SVAD-067 and SVAD-084 areas prior to initiating drilling activities for monitoring well installation." However, documentation of the visual inspections is not provided and/or referenced in the SI. Revise the SI to include an appendix of the visual inspection documentation (notes, photographs, identified surface water drainage patterns, etc.).

   Response: *The visual inspection was conducted prior to drilling activities to ensure the proposed sample locations did not require adjustment due to field conditions (e.g., topography). The sample locations did not require modifications. Field notes from the well installations and sampling were included in Appendix B.*

9. **Section 3.2.1.4, Groundwater Monitoring Well Installation, Page 3-3:** The text states, "The potable water used for hydration and decontamination activities was sampled during the event." However, analytical results for the potable water are not included in the SI. Revise the SI to include the results of the potable water sample.

   Response: *The potable water sample results were added to Appendix E.*

10. **Section 3.5, Disposition of Field Investigation-Derived Waste, Page 3-7:** The text states, "Veolia advised Leidos to analyze for suspected contaminants based on site history and previous investigations." However, the SI does not indicate whether the investigation-derived waste (IDW) was analyzed for PFAS. Revise the SI to include PFAS results for IDW samples, if available. If PFAS was not analyzed, discuss how proper IDW disposal was achieved without such analyses.

    Response: *The PFAS sample results from the investigation were provided to Veolia. The waste hauler deemed the data were adequate at the time for determining the proper method for IDW disposal.*

11. **Section 4.1.2, Laboratory Sample Receipt, Page 4-1:** This section states that "All insufficiencies and/or discrepancies were reported immediately to the Laboratory Project Manager, who notified Leidos within 24 hours to determine if resampling was required." However, it is unclear what those insufficiencies and/or discrepancies were and if resampling was required. Revise Section 4.1.2 to discuss all sample receipt insufficiencies and/or discrepancies and whether resampling was required.

    Response: *Section 4.1.2 was revised as follows:*

    "All samples received by the Laboratory Sample Custodian or designee were checked for proper preservation (e.g., pH, temperature of coolant blank above 2°C or below 6°C); integrity (e.g., leaking, broken bottles); and proper, complete, and accurate documentation and ID of the samples. The temperature of the coolant blank was noted. No insufficiencies and/or discrepancies were noted."

12. **Section 4.5.4, Third-Party Data Validation, Page 4-4:** The first sentence in the second paragraph states that Table D-4 in Appendix D (Data Quality Assessment) provides a comparison of data qualifiers applied by Leidos and the third-part validator; however, this information is provided in Appendix D, Table D-5. Revise Section 4.5.4 to reference the correct table in Appendix D.

    Response: *The sentence was revised as suggested.*

13. **Section 4.6.1, Precision, Page 4-5 and Appendix D, Section D.3, Field Quality Control Assessment, Page D-4:** Sections 4.6.1 and D.3 indicate that the acceptance limit for field duplicate samples is a maximum relative percent difference (RPD) of 50%; however, the Addendum 2 QAPP indicates that the field duplicate acceptance criteria for aqueous samples is RPD < 30%. Revise the SI Report to reflect the correct acceptance limit for field duplicate samples and discuss any field duplicate exceedances based on the corrected acceptance limit.

    Response: *The SI Report was revised to reflect the correct acceptance limit for field duplicate samples and exceedances were discussed, as suggested in Appendix D. Note: Although the RPD did exceed 30 percent for perfluorononanoic acid, the results in the primary and field duplicate sample were less than five times the sample-specific LOQ, in which case the absolute difference between the results is allowed to be within three times the sample-specific LOQ. In this case, the sample-specific LOQ was 1.8 ng/L and the difference was only 0.51 ng/L.*

14. **Figure 5-1, SVAD-067 Fire Training Area, Page 5-2; Figure 5-2, SVAD-067 Fire Training Area Analytical Results, Page 5-4; Figure 6-1, SVAD-084 Scrap Wood Open Burn Area, Page 6-2; and, Figure 6-2, SVAD-084, Scrap Wood Open Burn Area Analytical Results, Page 6-3:** The SI site-specific figures for each of the sites assessed do not display the location of all relevant current and historical site features discussed in Sections 5.1 (Site History) and 6.1 (Site History) (e.g., outfall areas, storage tanks, etc.). Revise the site-specific figures to include relevant site features for sites SVAD-067 and SVAD-084.

    Response: *Additional site features were added to site-specific figures for SVAD-067, as requested. The relevant site feature for SVAD-084 is the location of the burn pile. The burn pile location is identified on the figures for SVAD-084.*

15. **Section 6.1, Site History, Page 6-1; Figure 6-1, SVAD-084 Scrap Wood Open Burn Area, Page 6-2; and, Figure 6-2, SVAD-084, Scrap Wood Open Burn Area Analytical Results, Page 6-3:** Based on Figures 6-1 and 6-2, MW-84PFAS-02 was advanced in the "IRA Actual Remediation Area"; however, it is unclear how advancement of a monitoring well within a previously excavated area is appropriate to investigate site conditions and a source area. This is of note given that Section 6.1 indicates that "approximately 3,232 tons of nonhazardous soil and debris were excavated and disposed of offsite." As such, the analytical results from MW-84PFAS-02 may be under-representing the site conditions and the source area. Revise the SI to clarify how advancement of a monitoring well within a previously excavated area is appropriate to investigate site conditions and a source area.

    Response: *The SVAD-084 open burning activities ended circa 2000 after at least 20 years of use as a fire training area. The interim removal action was conducted in 2016. PFAS compounds are known to be extremely mobile in the environment, and it is reasonable that substantial migration of contamination had occurred during 35 years since fire training was initiated at the site. In addition, the depth to groundwater at this site is approximately 45 feet BLS. The interim removal action was limited to the top 1.5 feet of soil and was unlikely successful at removing all PFAS contamination in soil.*

16. **Appendix A, SVDA Drinking Water PFAS Data:** According to Appendix A (PDF Page 61 of 120), the field blank sample collected on September 26, 2016 (NLS ID: 948929) was not analyzed for PFAS; however, the SI does not discuss why the field blank sample was not analyzed for PFAS. Revise the SI to clarify why the field blank sample collected on September 26, 2016 (NLS ID: 948929) was not analyzed for PFAS.

    Response: *The 2016 drinking water sampling was conducted by the Army to fulfill UCMR3 sampling requirements. The quality control data from 2016 do not impact the 2018 SI.*

17. **Appendix D, Data Quality Assessment, Section D.4.2, Data Verification/Data Validation Comparison, Page D-5:** The first and last sentences in the first paragraph of this section state that Table D-4 provides a comparison of data qualifiers applied by Leidos and the third-part validator; however, this information is provided in Table D-5. Revise Section D.4.2 to reference the correct table.

    Response: *Section D.4.2 was revised to refer to Table D-5, as suggested.*

18. **Appendix D, Data Quality Assessment, Tables D-1 through D-5, Pages D-7 to D-9:** Tables D-1 through D-5 in Appendix D are incomplete. The tables do not clarify if the information provided in each table is for the primary sample or the split sample. In addition, Section D-2 of Appendix D states that "All data validation qualifiers applied to the data are presented in Table D-2." However, Tables D-3, D-4 and D-5 include qualified data that is not listed in Table D-2; and further, Table D-5 includes qualifier letter and number codes that are not defined in the table or discussed in the Appendix D text. For example, "DNR" is listed as a validation qualifier in Table D-5, but the "Overall Assessment" section in Attachment A (EcoChem Data Validation Report) of Appendix D states, "Data flagged DNR should not be used. All other data, as reported, are acceptable for use." Finally, the column headings in Table D-5 need clarification. The difference between "Parent Qualifier," "Validation Qualifier," and "Duplicate Qualifier" is unclear, and the table does not specify if the qualifiers listed were applied by Leidos or EcoChem. Revise Tables D-1 through D-5 to provide complete information.

    Response: *The split sample was collected and analyzed solely for the purpose of determining how well the results agreed with the primary laboratory and did not undergo data validation. As shown in Table D-4, the comparison between the primary laboratory results and the QA laboratory results was very good, indicating acceptable agreement. Sections D.2 and D.3.1 were revised to clarify that only the results from the primary laboratory were validated and the QA split sample was not validated.*

    The title of Table D-2 was revised to Leidos Applied Data Validation Qualifiers. Section D.2 states the following: "All data validation qualifiers applied to the data are presented in Table D-2." This sentence

was revised to state: "All data validation qualifiers that resulted from the Leidos data validation process are presented in Table D-2." In some instances where the third-party validator assigned DNR to some of the results, Leidos chose to use the result from a different dilution because the other result was higher and was still within calibration range of the instrument, thus keeping the more conservative value. Section D.4 was revised to clarify the confusion regarding the third-party data validation assessment presented in Section D.4. In addition, Table D-5 was revised to show all Leidos-applied qualifiers and all of the qualifiers applied by the third-party data validator and the corresponding discussion was revised to include the reason behind not using the third-party data validator's suggested use of the data in instances where this occurred.

19. Appendix E, Data Presentation Tables, Page E-1: Tables E-1 (Site 67 PFAS Data Presentation) and E-2 (Site 84 PFAS Data Presentation) present results that are shaded pink with a [P] code and results that are shaded orange with a [PG] code, but these colors and codes are not defined. Revise Appendix E to define the pink and orange shading and [P] and [PG] codes, and ensure their significance is discussed in the SI Report.

Response: *Appendix E was revised to define the bracketed letters in footnotes for clarity.*

Comments from EPA Federal Facilities Restoration and Reuse Office

1. The scope of the SI should be expanded to consider other potential sources of PFAS in the environment (including PFAS beyond PFOA and PFOS) or a rationale should be provided as to why the scope was limited to AFFF areas and these two PFAS.

Response: *AFFF has been the predominant source of PFAS chemicals in the environment related to Army activities. The site history at SVAD-067 and SVAD-084 indicated potential use of AFFF products at these sites and was confirmed with the interview with the fire chief. The samples collected during the SI were analyzed for the six UCMR3 PFAS analytes, and the data are provided in Appendix E. PFOS and PFOA were focused on in the text because the USEPA has established health advisory levels for those constituents. The text was revised to include data for the six UCMR3 PFAS analytes.*

2. A Conceptual Site Model (CSM) would help to provide context for the interpretation of the results from the sampling. EPA recommends that a CSM be included in with this report.

Response: *A CSM was integrated into the SI Report for each site, as requested.*

3. Please add a discussion of any drinking water wells that may be located near the base boundary. Please include justification for not sampling these wells. Also, please discuss how seasonal groundwater flow reversal impacts PFAS groundwater contamination. Describe how groundwater sampling is designed to account for these changes **.**

Response: *The intent of the SI was to determine the presence/absence of PFAS due to AFFF use at SVAD-067 and SVAD-084; therefore, sampling drinking water wells at the base boundary was outside the scope of the investigation.*

It is uncertain how seasonal groundwater flow reversal impacts PFAS groundwater contamination based on data from a single PFAS sampling event. Based on previous investigations of other contaminants (such as TCE) at SVAD-067, it can be expected that because reverse flow conditions, also characterized by higher groundwater elevation, occur most commonly in the spring, the highest contaminant concentrations would occur in the spring. This may be in part because groundwater concentrations increase when water levels are higher due to possible release of contaminant concentrations sorbed to soil. The seasonal groundwater flow reversal also may slow plume migration.

Groundwater samples were collected from potential PFAS release areas, as well as upgradient of and downgradient from the potential source areas. The groundwater sample from the northernmost well at

each site was placed to establish whether the periods of groundwater flow reversal have impacted groundwater in the typically upgradient direction from the source areas.

4. According to this report, there are no surface water features located on the study locations and groundwater is likely entering the Mississippi River. Releases of contaminated groundwater to the Mississippi River should be further investigated, given the importance of the River as a drinking water source.

Response: *The intent of the SI was to determine the presence/absence of PFAS at SVAD-067 and SVAD-084 due to AFFF use; therefore, the requested evaluation is outside the scope of this SI.*

5. Please clearly state in Section 4.2 if Method 537 was modified to measure PFAS in groundwater.

Response: *The second sentence in Section 4.2 was revised as follows:*

"All samples were analyzed for PFAS using modified USEPA Method 537 Version 1.1 (USEPA 2009), the DoD QSM Version 5.1, and the laboratory SOP during the October 2018 sampling event."

USEPA Method 537 Version 1.1 (USEPA 2009) is a drinking water method. The method was modified per DoD QSM Version Table B-15 specifications and the laboratory SOP to accommodate environmental samples. USEPA reviewed the laboratory SOP and provided comments dated July 26, 2018. All comments were adequately addressed and documented in Army responses dated August 7, 2018.

6. The Assistant Secretary of Defense recently issued guidance directing PFAS investigators to use a screening level of 40 parts per trillion for PFOA and PFOS (*ASD Memorandum for Assistant Secretaries of the Army, Navy, Air Force, National Guard Bureau and Defense Logistics Agency, October 15, 2019*). U.S. EPA also recently issued guidance recommending a screening level of 40ng/L for PFOA and PFOS ("*Interim Recommendations to Address Groundwater Contaminated with Perfluorooctanoic Acid and Perfluorooctanesulfonate, OLEM Directive No. 9283.1-47, December 19, 2019"*). The PFOA and PFOS results from the monitoring wells should be re-screened using the updated screening level.

Response: *The draft final revision 1 SI Report for PFAS at SVAD-067 and SVAD-084 was submitted for USEPA and IEPA review prior to the Assistant Secretary of Defense October 2019 issued guidance directing PFAS investigators to use a screening level of 40 parts per trillion for PFOA and PFOS. The SI Report was updated to screen the PFOS, PFOA, and PFBS results based on this guidance.*

7. Please describe LUCS that may be in place to prevent use of base groundwater. Also, please provide language that describes how/where in the base master plan PFAS contamination information will be tracked and stored.

Response: *LUCs are not currently in place to prevent future exposure to PFAS in groundwater at SVAD-067 or SVAD-084. Evaluating LUCs is outside the scope of an SI. If necessary, LUCs would be evaluated during an FS.*

IEPA Review of the Site Inspection Report for Per- and Polyalkyl Substances at SVAD-067 – Fire Training Area and SVAD-084 – Scrap Wood Open Burn Area, Draft Final, Revision 1, Savanna Army Depot Activity, Savanna, Illinois, October 2019

Comments: January 13, 2020
Responses: January 25, 2021

1. **Section 1.4, Regulatory Overview and Project Action Limits:** Please be advised that Illinois is preparing a revision to its groundwater quality regulations, including an extensive update to groundwater quality standards for Class 1 and Class 2 groundwater. Among the likely proposed changes, will be new Class 1 groundwater quality standards for several PFOS/PFOA compounds, including:

Constituent	Proposed Class 1 Standard (mg/L)
Perfluorobutane Sulfonic Acid (PFBS)	0.14
Perfluorohexane Sulfonic Acid (PFHxS)	0.00014
Perfluorononanoic Acid (PFNA)	0.000021
Perfluorooctanoic Acid (PFOA)	0.000021
Perfluorooctane Sulfonic Acid (PFOS)	0.000014
Combined PFOA + PFOS	0.000021

When these standards are adopted by the Illinois Pollution Control Board, these standards will be promulgated, enforceable, and of general applicability to groundwaters of the State, and will be applicable or relevant and appropriate requirements (ARARs) for the sites. Until adopted, these propose standards are "to be considered" (TBC) for any actions.

Response: *Comment noted.*

2. **Section 3.2.1.3, MEC Avoidance:** State what the results of the MEC clearance efforts were; presumably nothing was found.

Response: *Prior to initiating intrusive activities, the SUXOS cleared all proposed boring locations using a Schonstedt handheld magnetic locator to verify the absence of potential subsurface UXO or other metallic obstructions. Section 3.2.1.3 was revised to indicate no metallic anomalies were detected at SVAD-067 and SVAD-084.*

3. **Section 7, Summary and Conclusions:** The conclusion of "no action" is not consistent with the decision rules in the Final Quality Assurance Project Plan (QAPP, August 2018, Worksheet 11a). The QAPP indicates that further sampling will occur if the project action limits (PALs) are exceeded. Both sites demonstrated detections above the PALs; further sampling should occur.

Response: *The SI Report was revised to recommend SVAD-067 and SVAD-084 for further investigation.*

4. **Section 7, Summary and Conclusions:** The report states that no action is planned because the groundwater at these sites is not a source of drinking water and that no exposure is expected at either site due to the depth of groundwater. The average depth to groundwater at Site 67 is about 16 feet with groundwater levels as shallow as 4 feet. Groundwater could be encountered at this site during construction activities; thereby presenting a risk. Regardless, Illinois EPA advises the Army that action pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) is required if there is a potential of current or future risk at a site. This could be the case at Site 67, and the CERCLA process should be followed to determine extent of contamination, degree of risk associated with such exposures, and need for remediation for this pathway. Additionally, the CERCLA/NCP requirement to

define nature and extent of contamination needs to be met, and it appears this was the Army's original intent, based on the QAPP.

Moreover, Illinois has primacy over groundwater pursuant to USEPA's July 29, 1997 endorsement of its program developed to meet USEPA's Comprehensive State Groundwater Protection Program (CSGWPP). When Illinois' groundwater quality standards are exceeded, Illinois statute (415 ILCS 55 and 415 ILCS 5) and rule (35 Ill. Adm. Code Part 620) require corrective action until the exceedance(s) are abated. Protection of future beneficial uses of groundwater is a priority of Illinois' groundwater program. Active corrective action is to be undertaken for impacted Illinois groundwaters whether or not they are being actively used.

Additionally, the State's non-degradation provision of its groundwater regulations (35 Ill. Adm. Code 620.301) prohibits the release of any contaminant that may compromise a potential use of such groundwater. Since the groundwater at the installation is Class I, ongoing contamination at Site 67 and 84 needs to be addressed.

The State's non-degradation provisions do not preclude the establishment of a groundwater management zone (GMZ) to manage such releases, but the requirements for establishing a GMZ would need to be met, including determining the vertical and horizontal extent of any plumes.

Response: *The SI Report was revised to recommend SVAD-067 and SVAD-084 for further investigation.*

5. Until the above comments are resolved, Illinois EPA does not concur with the Army's conclusion for no further action for either site.

Response: *Comment noted.*