DEPARTMENT OF THE AIR FORCE
27TH SPECIAL OPERATIONS CIVIL ENGINEER SQUADRON (AFSOC)
CANNON AIR FORCE BASE NEW MEXICO

26 Jul 17

Steven Leonard Palmer
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Mr. Gabriel Acevedo
Environmental Scientist & Specialist-Operational
New Mexico Environment Department
Hazardous Waste Bureau
2905 Rodeo Park Drive East, Bldg. 1
Santa Fe NM 87501

Dear Mr. Acevedo:

Cannon Air Force Base is pleased to provide the "*Site Inspection of Aqueous Film Forming Foam (AFFF) Release Areas Environmental Programs Worldwide Installation-Specific Work Plan*" for Cannon AFB. This document is provided to NMED as a courtesy to keep you informed of the environmental restoration activities on Cannon AFB in relation to the emerging contaminants contained in AFFF.

Cannon AFB appreciates the valued working relationship established with you and your department. If you have further comments or questions pertaining to the referenced work plan, please contact Steven Palmer, steven.palmer@us.af.mil (575) 904-6744 or Sheen T. Kottkamp, sheen.kottkamp.ctr@us.af.mil (575) 904-6743.

Sincerely,

Steven Leonard Palmer

Attachment:
Site Inspection of Aqueous Film Forming Foam (AFFF) Release Areas Environmental Programs Worldwide Installation-Specific Work Plan

FINAL

INSTALLATION-SPECIFIC WORK PLAN

CANNON AIR FORCE BASE, NM

Site Inspection of Aqueous Film Forming Foam (AFFF) Release Areas Environmental Programs Worldwide

Contract FA8903-16-D-0027
Task Order 0004

Prepared for:

Air Force Civil Engineer Center
JBSA Lackland, Texas

July 2017

Submitted by:

amec foster wheeler

FINAL

SITE INSPECTION OF AQUEOUS FILM FORMING FOAM (AFFF) RELEASE AREAS
ENVIRONMENTAL PROGRAMS WORLDWIDE
INSTALLATION-SPECIFIC WORK PLAN

CANNON AIR FORCE BASE
CLOVIS, NEW MEXICO

Prepared for:
Air Force Civil Engineer Center
Joint Base San Antonio – Lackland, Texas

Prepared by:

Amec Foster Wheeler Environment & Infrastructure, Inc.

Contract FA8903-16-D-0027
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July 2017

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ACRONYMS

AFB	Air Force Base
AFCEC	Air Force Civil Engineer Center
AFFF	aqueous film forming foam
AFSOC	Air Force Special Operations Command
Amec Foster Wheeler	Amec Foster Wheeler Environment & Infrastructure, Inc.
ASTM	ASTM International
bgs	below ground surface
BRAC	Base Realignment and Closure
CE	Civil Engineering
CFR	Code of Federal Regulations
CSM	conceptual site model
CY	cubic yard
DO	dissolved oxygen
DoD	Department of Defense
DOT	Department of Transportation
DQO	data quality objective
DRO	diesel range organics
EOD	Explosive Ordnance Disposal
FAA	Federal Aviation Administration
FTA	fire training area
FTS	fluorotelomer sulfonate
GPS	Global Positioning System
GRO	gasoline range organics
HA	Health Advisory
HDPE	high-density polyethylene
HGL	HydroGeologic, Inc.
HSP	Health and Safety Plan
IDW	investigation-derived waste
ISWP	Installation-Specific Work Plan
JP	jet propellant
LC-MS/MS	liquid chromatography-tandem mass spectrometry
µg/kg	milligrams per kilogram
µg/L	micrograms per liter

MW	Monitoring Well
NEtFOSAA	n-ethyl perfluorooctanesulfonamidoacetic acid
NMED	New Mexico Environmental Department
NMeFOSAA	n-methyl perfluorooctanesulfonamidoacetic acid
OWS	oil/water separator
ORP	oxidation-reduction potential
PA	Preliminary Assessment
PCB	polychlorinated biphenyl
PFAS	per-and polyfluorinated alkyl substances
PFBA	perfluorobutyric acid
PFBS	perfluorobutanesulfonic acid
PFDA	perfluorodecanoic acid
PFDoA	perfluorododecanoic acid
PFHpA	perfluoroheptanoic acid
PFHxA	perfluorohexanoic acid
PFHxS	perfluorohexane sulfonic acid
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid
PFTA	perfluorotetradecanoic acid
PFTrDA	perfluorotridecanoic acid
PFUnA	perfluoroundecanoic acid
pH	potential of hydrogen
PPE	personal protective equipment
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
QPP	Quality Program Plan
RPM	Remedial Program Manager
RSL	Regional Screening Levels
SI	Site Inspection
SIR	Site Inspection Report
SOP	Standard Operating Procedure
SOW	Special Operations Wing
SVOC	semi-volatile organic compound
SWMU	Solid Waste Management Unit
TAC	Tactical Air Command
TFW	Tactical Fighter Wing
THQ	Total Hazard Quotient

TO	Task Order
TOC	total organic carbon
TPH	total petroleum hydrocarbons
UFP	Uniform Federal Policy
USAF	United States Air Force
USCS	Unified Soil Classification System
USEPA	United States Environmental Protection Agency
USFS	United States Fish and Wildlife
VOC	volatile organic compound
WWTP	waste water treatment plant

1.0 PROJECT OVERVIEW

This Installation-Specific Work Plan (ISWP) was prepared under Contract No. FA8903-16-D-0027, Task Order (TO) 0004 between Amec Foster Wheeler Programs, Inc. and the Air Force Civil Engineer Center (AFCEC), and is provided as an addendum to the General Quality Program Plan (QPP) (Amec Foster Wheeler Environment and Infrastructure, Inc. [Amec Foster Wheeler], 2017). This ISWP describes Site Inspection (SI) activities to be conducted at aqueous film forming foam (AFFF) areas located at Cannon Air Force Base (AFB) to determine, through environmental media sampling, if a release of per- and polyfluorinated alkyl substances (PFAS) may have occurred. The AFFF areas proposed for inspection under this ISWP were identified during Preliminary Assessment (PA) research activities as locations where AFFF was released to the environment (HydroGeoLogic, Inc. [HGL], 2015), and during a scoping visit conducted by Amec Foster Wheeler in October 2016.

This ISWP and the QPP have been prepared to: (1) clearly identify the SI objectives and data quality objectives (DQOs) for this project; (2) ensure that field investigations and survey protocols are documented and reviewed in a consistent manner; and (3) describe the means and methods necessary to achieve the SI objectives and DQOs and to provide data that is scientifically valid and legally defensible. Specific Uniform Federal Policy (UFP) Quality Assurance Project Plan (QAPP) worksheets are provided in the following sections to accompany the General QPP. The Installation-Specific Health and Safety Plan (HSP) is provided in **Appendix A** of this ISWP.

1.1 PER- AND POLYFLUORINATED ALKYL SUBSTANCES OVERVIEW

PFAS are a class of synthetic organofluorine compounds that possess a chemical structure that gives them unique properties, including thermal stability and the ability to repel both water and oil. These chemical properties make them useful components in a wide variety of consumer and industrial products, including non-stick cookware, food packaging, waterproof clothing, fabric stain protectors, lubricants, paints, and firefighting foams such as AFFF. AFFF concentrate contains fluorocarbon surfactants to meet required performance standards for fire extinguishing agents (Department of Defense [DoD] Military Specification MIL-F-24385F [SH], Amendment 1, 5 August 1984). The United States Air Force (USAF) began purchasing and using AFFF containing PFAS (perfluorooctanesulfonic acid [PFOS] and/or perfluorooctanoic acid [PFOA]) for extinguishing petroleum fires and firefighting training activities in 1970, as confirmed by the following federal government documents:

- Military Specification for AFFF (MIL-F-24385), formally issued in 1969;
- General Accounting Office determination on sole source award protest to provide AFFF to the Navy in December 1969; and,
- *A History of USAF Fire Protection Training at Chanute Air Force Base*, 1964-1976 (Coates, 1977).

AFFF was primarily used on USAF installations at fire training areas (FTAs), but may have also been used, stored or released from hangar fire suppression systems, at firefighting equipment testing and maintenance areas, and during emergency response actions for fuel spills and aircraft mishaps. The USAF

is actively replacing their current inventory of AFFF with more formulations based on shorter carbon chains, which may be less persistent and bioaccumulative in the environment. However, the potential exists for an incident or future contributing source of PFAS until the USAF completely replaces their inventory of AFFF.

The United States Environmental Protection Agency (USEPA) Office of Water issued lifetime drinking water Health Advisory (HA) values for PFOS and PFOA in May 2016 to protect humans from potential risk of exposure to these chemicals through drinking water; the 2016 HA values replace 2009 Provisional HA values. The HA values for PFOS and PFOA are 0.07 micrograms per liter (µg/L) for each constituent; however, when these two chemicals co-occur in a drinking water source, a conservative and health-protective approach is recommended that compares the sum of the concentrations (PFOS + PFOA) to the HA value (0.07 µg/L). The HA values identify the concentration of a contaminant in drinking water at which adverse health effects are not anticipated to occur over specific exposure durations (e.g., 1 day, 10 days, a lifetime). They serve as informal technical guidance to assist federal, state, and local officials, and managers of public or community water systems in protecting public health when emergency spills or other contamination situations occur. The HA documents provide information on the environmental properties, health effects, analytical methodology, and treatment technologies for removing drinking water contaminants. HA values are not to be construed as legally enforceable federal standards and are subject to change as new information becomes available (USEPA, 2016a and USEPA, 2016b).

Currently, the USEPA has not published Regional Screening Levels (RSLs) for PFOS or PFOA for soil or sediment; however, for this project, a screening level of 1,260 micrograms per kilogram (µg/kg) for soil and sediment was calculated using the USEPA RSL calculator (https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search). The toxicity value input for the calculator is the Tier 3 value reference dose of 0.00002 milligrams per kilogram per day derived by USEPA in their Drinking Water HA values for both PFOS and PFOA (USEPA, 2016a and USEPA, 2016b). The New Mexico Environment Department (NMED) has not issued screening criteria or promulgated standards for any PFAS constituent to date.

1.2 INSTALLATION MISSION AND HISTORY

Cannon AFB is located in eastern New Mexico, approximately 7 miles southwest of the City of Clovis, in Curry County, New Mexico, and encompasses approximately 3,789 acres (**Figure 1**). The installation is comprised of two perpendicular active runways in the central and southwestern portions; maintenance, support, and operational facilities west of the central runway/flightline; supplemental hangars and apron areas in the south-central region; a wastewater treatment plant to the east; and, a golf course and residential and service facilities in the northwestern portion (HGL, 2015).

Cannon AFB dates to 1929 when Portair Field was established as a civilian passenger terminal. The Army Air Corps took control of the civilian airfield in 1942, and it became known as the Clovis Army Air Base. The installation was renamed Clovis Army Air Field in early 1945, where flying, bombing, and gunnery classes continued until the installation was deactivated in May 1947. The installation was reassigned to the Tactical Air Command (TAC) and formally reactivated as Clovis AFB in 1951. The installation became

permanent in June 1957 and was renamed Cannon AFB in honor of the late General John K. Cannon, a former commander of the TAC. The 312th Tactical Fighter Wing (TFW) was deactivated in 1959 and replaced at Cannon by the 27th TFW. The installation mission changed in 1965 to that of a replacement training unit (Versar, 2013).

The Secretary of Defense recommended the closure of Cannon AFB to the Base Realignment and Closure (BRAC) Commission in May 2005. The BRAC Commission recommended that the installation remain open until the end of 2009 or until a new mission was found. The 27th Special Operation Wing (SOW) was activated at Cannon AFB in 2006 under the control of the Air Force Special Operations Command (AFSOC). The 27th SOW continues to be the host unit at Cannon AFB, supporting the USAF in conducting sensitive special operations missions including close air support, unmanned aerial vehicle operations, non-standard aviation in response to the Secretary of Defense (Versar, 2013).

1.3 PRELIMINARY ASSESSMENT

HGL was contracted by AFCEC to prepare a PA of FTA and non-FTA sites at Cannon AFB to identify locations where PFAS may have been used and released into the environment, and to provide an initial assessment of possible migration pathways and receptors of potential contamination (HGL, 2015). Twenty-one potential AFFF release areas were identified during the PA research, with the following 10 potential AFFF release areas recommended for SI (**Figure 2**):

- Former FTA No. 2 (Installation Restoration Program [IRP] Site ID FT-07 and Solid Waste Management Unit [SWMU] No. 106 [SWMU-106]): Former FTA No. 2 is located in the southeast corner of the installation, approximately 1,000 feet south of the active FTA, and was used for fire training exercises from approximately 1968 to 1974. The area consisted of two round depressions in the land surface, each measuring approximately 100 feet in diameter. Fire training exercises were conducted twice per quarter using approximately 300-gallons of unused jet propellant (JP)-4. No specific AFFF use was reported at former FTA No. 2; however, since the FTA operated after initial use of AFFF at the installation, it is likely that AFFF was used at this location.
- Former FTA No. 3 (IRP Site ID FT-08 and SWMU-107): Former FTA No. 3 is located in the southeast corner of the installation, approximately 800 ft southeast of the active FTA, and was used concurrently with FTA No. 2 between approximately 1968 and 1974. Training exercises were conducted twice per quarter in an unlined, half-moon shaped area, approximately 100 feet in length. No specific use of AFFF at former FTA No. 3 was recorded; however, since the FTA operated after initial use of AFFF at the installation (1970), it is likely that AFFF was used.
- Former FTA No. 4 (IRP Site ID FTA-4 and SWMU's 109, 110, 111, and 112): Former FTA No. 4 was used from 1974 through approximately 1995 for fire training exercises. Training activities were conducted twice per quarter, during which an unknown volume of AFFF was used. FTA No. 4 consisted of an unlined circular area approximately 400 feet in diameter with a mock aircraft located in the center. Prior to 1985, JP-4 and AFFF runoff generated during fire training exercises collected in an unlined pit. The pit was backfilled in 1985 and a new, lined pit with an oil/water

separator (OWS) was installed to handle collected runoff. The OWS was subsequently removed in 1996.

- Hangar 119: General storage warehouse/hangar located in the west central portion of the installation, west of the flight apron, with three accidental AFFF releases. The first incident occurred in September 2006 when approximately 60 gallons of AFFF discharged into a storm drain after the AFFF system was accidentally activated, possibly due to a corroded valve. The second incident occurred in September 2012 when a "significant amount" of AFFF was discharged into bay number one and flowed onto the asphalt on the north side of the structure between Hangar 119 and Building 102. Incident reports indicated that a "huge amount" of AFFF entered a storm drain while the rest was left to evaporate. The third incident occurred in July 2013 when an unknown quantity of AFFF was discharged onto the concrete flight ramp near Hangar 119. It is unclear if AFFF entered a storm drain during this release. Currently, the only outlets for AFFF at Hangar 119 are storm drains on the flight ramp outside the bays, which convey liquid directly to the South Playa Lake. Due to the large quantity of AFFF reportedly released at Hangar 119, there is the potential that AFFF migrated to grassy areas to the south and southwest of the structure.
- Hangar 133: Small aircraft hangar located in the west central portion of the installation, immediately southwest of Hangar 119, with two accidental AFFF releases. Several hundred gallons of AFFF were reportedly released during a scheduled rinsing of the hangar fire system in December 2000 and entered a nearby storm drain. Approximately 200 gallons of AFFF were released into a hangar bay following a power outage in July 2001. Most of the AFFF entered a floor trench and was routed to the wastewater treatment plant (WWTP); however, AFFF that did not enter the floor trench was washed to nearby infield soil and allowed to evaporate.
- Hangar 204: A CV-22 aircraft storage and maintenance hangar located in the north central portion of the installation, with an accidental AFFF release reported in May 2002 when the AFFF fire suppression system activated after a building heater caused a birds nest to catch fire. Approximately 700 gallons of AFFF were discharged onto the nearby concrete ramp and were left to evaporate.
- Former Sewage Lagoons: The former sewage lagoons consisted of two unlined surface impoundments that were used from 1966 to 1998 and received sanitary and industrial waste from base facilities prior to the construction of the WWTP. The former sewage lagoons would have received any AFFF that entered the sanitary sewer system from 1966 to 1998. Documented releases of AFFF to the sanitary sewer system from Hangars 199 and 208 were reported prior to and during 1998. As such, there is evidence that AFFF was released to the environment at the former sewage lagoons.
- North Playa Lake Outfall: North Playa Lake, located southeast of the WWTP, received all of Cannon AFB sanitary and industrial wastewater from 1943 to 1966. Currently, all treated effluent from the WWTP is released primarily to North Playa Lake with a portion also released to the golf course for irrigation. Since there is no accepted wastewater treatment process for PFAS, any wastewater collected at the WWTP containing PFAS would be passed on to North Playa Lake.

- South Playa Lake Outfall: South Playa Lake is located in the southwestern portion of Cannon AFB and serves as the installation's primary stormwater collection point. The lake has received stormwater runoff from portions of the flightline area since 1943. Solvents, fuels, oils, greases, and AFFF are all potential contaminants that would have discharged to the lake from the flightline area. Documented releases of AFFF in the hangars resulted in AFFF entering storm drains with liquid being subsequently routed to South Playa Lake.
- Whispering Winds Golf Course Outfall: The installation golf course (officially known as Whispering Winds Golf Course) began receiving a portion of the treated effluent from the WWTP to fill ponds and irrigate the greens in approximately 2002. According to the golf course supervisor, the golf course is irrigated 5 nights per week for approximately 4 hours per night using a sprinkler system. Any wastewater collected at the WWTP containing AFFF therefore has the potential to be released at the golf course.

Hangar 204 was identified as an area for additional investigation due to the release of AFFF outside the structure; however, it was determined during the scoping visit that based on surface topography surrounding the hangar, any AFFF released from hangar doors would drain directly to storm drains in the apron or would evaporate on the concrete apron. Any AFFF that entered the storm drain would have been routed to South Playa Lake. Infiltration of AFFF into soils in the vicinity of Hangar 204 is unlikely and, therefore, Hangar 204 was removed from further investigation.

The following five additional areas were recommended for investigation based on data obtained during the scoping visit conducted on 24 and 25 October 2016 (see **Figure 2** and **Worksheet #9**):

- Hangar 109: Parking and general maintenance hangar located in the west central portion of Cannon AFB, with two accidental AFFF releases. The first release occurred in December 1999 when an office fire activated the AFFF fire suppression system, releasing approximately 500 gallons of AFFF in the hangar bay that reported entered the floor trench and was routed to the WWTP. No AFFF was reportedly released outside the hangar in 1999. A second release of approximately 20 to 30 gallons of AFFF solution occurred in 2016. Installation personnel identified that AFFF was released outside the hangar and was allowed to evaporate west and southwest of the hangar.
- Landfill #4: Closed landfill covering approximately 7 acres in the east central portion of Cannon AFB that was only operational for one year between 1967 and 1968. The landfill received domestic and industrial wastes including solvents, paints, thinners, and waste oils. Disposal activities consisted of placing waste material into a trench, burning the accumulated waste, and then covering the burned material with soil. Due to the period of operation, AFFF would not have been included in landfilled refuse; however, during the scoping visit, Amec Foster Wheeler was informed that the landfill cover was revegetated and used water from North Playa Lake, located immediately south of Landfill #4, which receives treated effluent from the WWTP.

- Active FTA: Active FTA located in the southeast portion of the installation, immediately northwest of FT-07, FT-08, and FTA-4. The FTA became operational in 1997 and consists of a circular lined burn pit with a mockup of a large aircraft, a propane fuel tank, a control panel and a lined evaporation pond. Fire training exercises are conducted at the active FTA approximately monthly using water or AFFF. The fire department also conducts annual vehicle foam checks at the FTA. Liquids discharged into the lined burn pit, including water and AFFF, drain to the lined evaporation pond located approximately 300 ft southwest of the pit and are left to evaporate. According to installation personnel, the liner of the evaporation pond has required repairs in the past, and any breaches in the liner would allow AFFF to infiltrate into the soils beneath the liner. Additionally, storms in May 2015 resulted in significant flash flooding across the installation, which likely resulted in any residual AFFF located in the evaporation basin to overflow and be released to the surrounding environment.
- Perimeter Road Fuel Spill: According to Cannon AFB Fire Chief, Mr. Bruce Ford, a fuel tanker truck overturned while traveling along Perimeter Road in the southeast corner of the installation where the road curves south of Landfill #5. All fuel from the tanker was released on the southeast side of the road. The fire department responded with crash trucks and reportedly sprayed AFFF on the fuel spill. The response was conducted over several days with multiple fire trucks discharging the entire supply of AFFF on the release. Installation personnel identified that contaminated soils were excavated; however, the excavation depth was unknown.
- Flightline Crashes: During the scoping visit, Cannon AFB Fire Department personnel identified three aircraft crashes that had occurred along the flightline where the fire department responded with the use of AFFF. Two incidents involving F-16 aircraft were identified at the southern end of the flightline, and a third incident involving an F-111 aircraft occurred at the north end of the flightline. No records regarding the crash responses had been maintained and no information regarding the amount of AFFF released was known. Although the exact AFFF release areas were unknown, Chief Ford identified approximate crash areas that are depicted on **Figure 2**.

1.4 SITE INSPECTION OBJECTIVES AND SCOPE

In accordance with DoD Instruction 4715.18, "Emerging Contaminants (ECs)" (DoD, 2009), the *Interim USAF Guidance on Sampling and Response Actions for Perfluorinated Compounds at Active and Base Realignment and Closure (BRAC) Installations* (USAF, 2012), and the *SAF/IE Policy on Perfluorinated Compounds of Concern* (USAF, 2016) the USAF will:

1) Identify locations where there is a reasonable expectation that there may have been a release of PFAS (defined below) associated with USAF actions;
2) Determine if there is unacceptable risk to human health and the environment; and,
3) Address releases that pose an unacceptable risk including offsite migration.

The primary objectives of this study are to:

1) Determine if PFAS are present in groundwater, soil, or surface water/sediments at AFFF areas selected for inspection;

2) Determine if a release of PFAS has occurred at each AFFF area at concentrations exceeding USEPA HA values, RSL values, or other applicable state or federal standards; and,

3) Identify potential receptor pathways with immediate impacts to human health.

An installation-specific SI report (SIR) will be prepared to meet the objectives described above via the collection of chemical, physical, and hydrologic data, as well as appropriate environmental samples. The SIR will also include recommendations regarding the need for further delineation of confirmed AFFF releases where there are receptor pathways with potential impacts to human health.

As a result of the initial SI, follow-on objectives may include the following:

1) Conduct a well survey on the installation and on private property to assess the locations of downgradient drinking water supplies to identify potential receptor pathways with immediate impacts to human health.

2) Conduct follow-on investigation and step-out sampling (to include delineation of plumes as necessary) in areas determined necessary by the USAF. The follow-on investigations will:

    a. Further evaluate the distribution of PFAS concentrations at areas where additional characterization is determined to be necessary by USAF personnel;

    b. delineate downgradient groundwater plumes (as applicable);

    c. define the environmental setting including potential mechanisms for PFAS migration for each area where PFAS exceed applicable criteria; and,

    d. identify AFFF release areas with potential impacts to down-stream and/or downgradient receptors;

3) Perform initial and follow-up sampling of off-Base public/private drinking water wells to identify and verify where PFAS releases have occurred (as defined below)and evaluate potential exposure pathways with immediate threats to human health; and,

4) Apply mitigation measures to private drinking water wells that present an imminent threat to human health from PFAS.

Follow-on objectives and sampling design and rationale, if applicable, will be defined and described in addenda to this ISWP.

In accordance with Interim USAF Guidance on Sampling and Response Actions for Perfluorinated Compounds at Active and BRAC Installations (USAF, 2012) and USEPA lifetime drinking water HA values for PFOS (USEPA, 2016a) and PFOA (USEPA, 2016b), a release will be considered confirmed if exceedances of the following concentrations are identified:

PFOS

- 0.07 µg/L in groundwater/surface water that is used as, or contributes to, a drinking water source.
- 1,260 µg/kg in soil (calculated using a total hazard quotient [THQ] of 1.0, in the absence of RSL values).
- 1,260 µg/kg in sediment (calculated in the absence of RSL values).

PFOA

- 0.07 µg/L in groundwater/surface water that is used as, or contributes to, a drinking water source.
- 1,260 µg/kg in soil (calculated using a THQ of 1.0, in the absence of RSL values).
- 1,260 µg/kg in sediment (calculated in the absence of RSL values).

PFOS + PFOA

- 0.07 µg/L in groundwater/surface water that is used as, or contributes to, a drinking water source.

While PFOS and PFOA are the focus of the HA and provide specific targets for the USAF to address in the SI, USEPA has also derived RSL values for perfluorobutanesulfonic acid (PFBS) for which there is a Tier 2 toxicity value (Provisional Peer Review Toxicity Value). The USAF will also consider a release to be confirmed if exceedances of the following concentrations are identified:

PFBS

- 380 µg/L in groundwater/surface water.
- 1,600,000 µg/kg in soil and sediment.

Table 1 summarizes screening values for analytical results comparison.

Table 1. Regulatory Screening Values.

Parameter	Chemical Abstract Number	USEPA Regional Screening Level Table (May 2016)[a]			Calculated RSL for Soils and Sediments[b] (µg/kg)	USEPA Health Advisory for Drinking Water (Surface Water or Groundwater) (µg/L)[c]
		Residential Soil (µg/kg)	Industrial Soil (µg/kg)	Tap Water (µg/L)		
perfluorobutanesulfonic acid (PFBS)	375-73-5	1.6E+6	2.3E+7	380	NL	NL
perfluorooctanoic acid (PFOA)	335-67-1	NL	NL	NL	1,260	0.07[d]
perfluorooctanesulfonic acid (PFOS)	1763-23-1	NL	NL	NL	1,260	

Notes:

a USEPA Regional Screening Levels (May 2016) [https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-may-2016]. RSLs shown are calculated using a THQ of 1.0.

b Screening levels calculated using the USEPA Regional Screening Level calculator [https://epa-prgs.oml.gov/egi-bin/chemicals/csl_search] using a THQ of 1.0.

c USEPA, May 2016a. "Drinking Water Health Advisory for Perfluorooctane Sulfonate (PFOS)" and EPA, May 2016b. "Drinking Water Health Advisory for Perfluorooctanoic Acid (PFOA)."

d When both PFOA and PFOS are both present, the combined concentrations of PFOA and PFOS should be compared with the 0.07 µg/L health advisory level.

µg/kg = micrograms per kilogram

µg/L = micrograms per liter

NL = not listed

RSL = risk-based screening level

USEPA = United States Environmental Protection Agency

The proposed sampling approach for Cannon AFB is detailed in **Worksheets #9, #10, #11, #13, #14/16, #17, #18, and #20** of this ISWP. The QAPP consists of 37 prescriptive worksheets documenting aspects of the environmental investigation process of the SI and to guide the fieldwork. **Table 2** presents the required elements of the QAPP, the worksheets where these elements can be found, and the document containing the worksheet.

Table 2. List of UFP-QAPP Worksheets.

Required Element	UFP-QAPP Worksheet Number	Contents of Worksheet(s)	Presented in QPP	Presented in ISWP
Title and Approval Page	1 and 2	Identifies the principal points of contact for all organizations having decision-making authority in the project and documents their commitment to implement the QAPP.	X	
Project Organization and QAPP Distribution	3 and 5	Identifies key project personnel, lines of authority, and lines of communication among the lead agency, prime contractor, subcontractors, and regulatory agencies.	X	
Personnel Qualifications and Sign-Off Sheet	4, 7, and 8	Identifies key project personnel for each organization performing tasks defined in the QAPP and documents their commitment to implementing the QAPP.	X	
Communication Pathways and Procedures	6	Documents specific issues (communication drivers) that will trigger the need to communicate with other project personnel or stakeholders.	X	
Project Planning Session Summary	9	Provides a record of the notes taken during the site scoping visit.		X
Conceptual Site Model (CSM)	10	Presents the installation-wide CSM with information on each AFFF release area.		X
Project/Data Quality Objectives (DQOs)	11	Documents the DQOs, the environmental decisions that need to be made, and the level of data quality needed to ensure that those decisions are based on sound scientific data using USEPA's seven-step DQO process.		X

Required Element	UFP-QAPP Worksheet Number	Contents of Worksheet(s)	Presented in QPP	Presented in ISWP
Measurement Performance Criteria	12	Documents the quantitative measurement performance criteria in terms of precision, bias, and sensitivity for field and laboratory measurements and is used to guide the selection of appropriate measurement techniques and analytical methods.	X	
Secondary Data Uses and Limitations	13	Identifies sources of secondary data and summarizes information relevant to their uses for the current project.		X
Project Tasks and Schedule	14 and 16	Presents the proposed installation-specific schedule for the SI activities, specific tasks, the group responsible for their execution, and planned start and end dates.		X
Project Action Limits and Laboratory-Specific Detection/Quantitation Limits	15	This worksheet is completed for each matrix, analyte, and analytical method. The purpose is to make sure the selected analytical laboratory and method can provide accurate data at the project action limit.	X	
Sampling Design and Rationale	17	Describes the sampling design and the basis for selection of each AFFF release area for SI.		X
Sampling Locations and Methods	18	Provides a completeness check for field personnel and auditors for all samples anticipated for collection during the SI. It will facilitate checks to ensure all planned samples have been collected and appropriate methods have been used. The worksheet lists each individual sample that is planned to be collected, including field quality control (QC) samples.		X
Sample Containers, Preservation, and Hold Times	19 and 30	Worksheets serve as a reference guide for field personnel. They are also an aid to completing the chain of custody forms and shipping documents.	X	
Field Quality Control	20	Provides a summary of the types of samples to be collected and analyzed for the project to show the relationship between the number of field samples and associated QC samples.		X
Field Standard Operating Procedures (SOPs)	21	Documents the specific field procedures being implemented. The QPP contains detailed descriptions of procedures for all field activities, including sample collection; sample preservation; equipment cleaning and decontamination; equipment testing, maintenance, and inspection; and sample handling and custody.	X	

Required Element	UFP-QAPP Worksheet Number	Contents of Worksheet(s)	Presented in QPP	Presented in ISWP
Field Equipment Calibration, Maintenance, Testing and Inspection	22	Documents procedures for calibrating, maintaining, testing, and/or inspecting all field equipment.	X	
Analytical Standard Operating Procedures	23	Documents information about the specific sample preparation and analytical procedures to be used.	X	
Analytical Instrument Calibration	24	Documents the laboratory calibration procedures and is completed for all analytical instruments referencing the project laboratory quality manual.	X	
Analytical Instrument and Equipment Maintenance, Testing, and Inspection	25	Documents the procedures for maintaining, testing, and inspecting laboratory analytical equipment and was completed referencing the project laboratory quality manual.	X	
Sample Handling, Custody, and Disposal	26 and 27	Documents responsibilities for maintaining custody of samples from sample collection through disposal.	X	
Analytical Quality Control and Corrective Action	28	Ensures that the selected analytical methods are capable of meeting the project-specific measurement performance criteria.	X	
Project Documents and Records	29	Records information for all documents and records that will be generated for the project. It describes how information will be collected, verified, and stored. The purpose is to support data completeness, data integrity, and ease of retrieval.	X	
Assessments and Corrective Action	31, 32, and 33	Documents responsibilities for conducting project assessments, responding to assessment findings, and implementing corrective action.	X	
Data Verification and Validation Inputs	34	Lists the inputs that will be used during data verification and validation.	X	
Data Verification Procedures	35	Documents procedures that will be used to verify project data.	X	
Data Validation Procedures	36	Documents procedures that will be used to validate project data.	X	
Data Usability Assessment	37	Documents procedures that will be used to perform the data usability assessment.	X	

Notes:

AFFF – aqueous film forming foam
CSM – conceptual site model
DQOs – data quality objectives
ISWP – Installation-Specific Work Plan
QAPP – Quality Assurance Project Plan
QC – Quality Control
QPP – Quality Program Plan
SI – Site Inspection
SOP – Standard Operating Procedure
UFP – Unified Federal Program
USEPA – United States Environmental Protection Agency

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QAPP WORKSHEET #9: PROJECT PLANNING SESSION SUMMARY

Date of planning session: Installation Scoping Visit conducted on 24 and 25 October 2016.

Location: Cannon AFB, Clovis, New Mexico

Purpose: The purpose of the Installation Scoping Visit was to (1) inspect potential AFFF release areas identified in the PA (HGL, 2015) to confirm if sampling is warranted during the TO 0004 investigation, (2) understand site logistics so that they could be incorporated into this ISWP, and (3) understand existing conditions so that they could be used to develop the investigation strategy and be factored into this ISWP and subcontractor scopes of work. The results of the Installation Scoping Visit were used to develop the sampling plan as detailed in **Worksheets #17** and **#18**.

Attendees:

- Ron Lancaster, Chief of Asset Management Flight, 27th SOCES
- CMsgt Ralph Sprout, 27th SOCES/CEF
- Bruce Ford, Fire Chief, 27th SOCES/CEF
- Sheen Kottkamp, Environmental Program Manager AGEISS Inc., SOCES/CEIER
- Anita Lafuente, AFSOC 27th SOCES/CEIE
- Cornell Long, AFCEC Technical Lead AFCEC/CZTE
- Emma Driver, Amec Foster Wheeler Base Lead
- Shannon Williams, Amec Foster Wheeler Field Team

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24 October 2016: Amec Foster Wheeler personnel (Ms. Emma Driver and Ms. Shannon Williams) arrived at Cannon AFB and obtained necessary visitor badging for the 2-day installation scoping visit. Amec Foster Wheeler conducted a project in-brief meeting with attendees identified above to discuss the objectives for the installation scoping visit, provide an overview of the general SI scope requirements, and to provide an overview of the AFFF release areas proposed for investigation.

During the project in-brief, Mr. Kottkamp informed Amec Foster Wheeler of two additional releases of AFFF that occurred after completion of the PA report. The first release was a release of approximately 20 to 30 gallons of 3 percent (%) AFFF solution at Hangar 109. The AFFF was released outside the hangar with evidence of impacts to soil west-southwest of the hangar bay door. No investigation has been conducted relative to the release. A second release of 3% AFFF solution was reported at Hangar 197. The release again consisted of approximately 20 to 30 gallons of solution that was released from the mechanical room on the north side of the building and drained toward the grassy area, north of Liberator Avenue. The release was contained, and the soil was excavated, containerized, and disposed of off-site as a special waste.

Installation representatives expressed concern in installing monitoring wells at each of the identified AFFF release areas since groundwater at Cannon AFB is regulated basewide by NMED rather than evaluating groundwater impacts specific to an area of concern. It was determined that the SI would focus on determination of PFAS presence or absence utilizing existing monitoring wells that are already approved by NMED as part of the Cannon Basewide Groundwater Monitoring Program. Mr. Kottkamp provided copies of groundwater elevation contour maps depicting groundwater flow direction in June and September 2014 (**Figure 3a** and **3b**).

Mr. Ford, Cannon AFB Fire Chief, also informed Amec Foster Wheeler that AFFF has been used at the installation in response to aircraft crashes and fuel spills. Although Mr. Ford could not recall the exact locations of all fire department response activities along the flightline, he did identify the general location of three aircraft crashes **(Figure 2).** Two crashes involving F-16 aircraft were noted to have occurred at the southern end of the flightline, including one at the intersection of Runway 13/31 and Runway 22/04, and another at the end of Runway 22/04 at the intersection of Taxiway F (**Figure 2**). A third crash involving an F-111 aircraft occurred at the northeastern end of Taxiway A. According to Mr. Ford, no incident records for these crashes have been maintained and therefore the amount of AFFF released was unknown.

Mr. Ford also provided details of an incident involving a fuel tanker truck that overturned in the southeast corner of the installation releasing "a significant amount" of fuel directly on the ground, southeast of Perimeter Road. The fire department responded with crash trucks utilizing AFFF on the fuel spill. The fire department response reportedly occurred over several days with multiple trucks spraying AFFF onto the spill to prevent a fire. Contaminated soils were subsequently excavated; however, the excavation depth was unknown.

Mr. Lancaster also provided details of a significant storm event that occurred at Cannon AFB in May 2015 that resulted in most of the installation being flooded.

On the first day of the scoping visit, Amec Foster Wheeler and AFCEC personnel visited the following AFFF release areas to determine potential sampling locations and any utility/site conflicts with said locations. The following AFFF release area summaries provide information discussed and clarified during the visit.

Former FTA No. 2: Former FTA FTA-02 is located south of an abandoned taxiway and south of the active Explosive Ordnance Disposal (EOD) area. A gravel access road is present immediately north of former FTA. Surface topography slopes downward from the access road towards the south; however, no defined surface drainage pathway was evident in the vicinity of former FTA No. 2. The area was observed to be an open area with limited grasses and shrubs (Plains-Mesa grassland). Two topographic depressions were observed that were likely the former burn pit areas where fire training occurred. SI activities in this area would require coordination/scheduling with EOD personnel prior to drilling. Two proposed soil boring locations were identified, one in the center of each of the burn pit depressions.

Former FTA No. 3: Former FTA No. 3area is located on the east side of the abandoned North-South runway, northeast of the active EOD area. Fire training activities were originally conducted in an unlined

pit that was surrounded by a berm. Previous remedial activities have been conducted at former FTA No. 3, including excavation of approximately 250 cubic yards (CY) of petroleum-contaminated soil. Mr. Kottkamp provided map documentation showing excavation limits that were incorporated into the sample design and rationale (**Worksheet #17** and **#18**). According to Mr. Kottkamp, the surface topography in this area had been affected by recent subsidence associated with previous excavation activities. The general surface topography in the vicinity of former FTA No. 3 slopes downward to the east-southeast. Two soil borings will be completed in this area at locations outside of the previous excavation footprint.

Former FTA-4: Former FTA-4 is located southeast of the abandoned North-South runway and immediately north of Landfill #5. The FTA formerly consisted of a mock aircraft on a concrete pad in the center of the area, an automobile chassis in the northwest portion of the area, an unlined collection pit, and an OWS; however, no evidence of former structures remain at former FTA-4. The area is currently covered with grass/shrub type vegetation and crushed gravel fill material. Excavation activities have been conducted at FTA-4 in multiple phases. Approximately 740 tons of petroleum contaminated soil were excavated from the former fire training pit in 2005 and, based on results from confirmation sampling, an additional 2,235 cubic yards of soil were excavated in 2009. The depth of excavation varied across the area; however, previous reports identified the maximum excavation depth was 15 ft below ground surface (bgs). Three proposed soil boring locations were identified at FTA-4 including one at the former fire training pit, one at the OWS location, and one at the former automobile chassis location where fire training was also conducted.

Active FTA: The active FTA is located in the southeast portion of the installation, immediately northwest of FT-07, FT-08 and FTA-4. The FTA consists of a circular lined burn pit with a mockup of a large aircraft, a propane fuel tank, a control panel, and a lined evaporation pond surrounded by fencing. According to installation personnel, the liner of the evaporation pond has required repairs in the past. Additionally, storms in May 2015 resulted in significant flash flooding across the installation, which likely resulted in any residual AFFF located in the evaporation basin to overflow and be released to the surrounding environment. The surface topography slopes to the south away from the evaporation pond. Ground cover around the FTA was predominantly gravel with limited shrubs and desert grasses south of the evaporation pond. Three soil borings are proposed to be completed including one on the east side, one on the south side and one on the west side of the evaporation basin.

North Playa Lake Outfall: North Playa Lake is located in the east central portion of the base. At the time of the scoping visit, water was present in the playa. Discharge from the WWTP enters North Playa Lake through a drainage pipe that outfalls on the west side of the playa. An apparent berm structure was visible that was reportedly an artifact from previous dredging activities. According to installation personnel, water from North Playa Lake was used to support revegetation of the cover on Landfill #4 that is located on the north side of the playa. Two sediment and surface water samples are proposed to be collected from the playa lake. One existing monitoring well (MW-Oa) was identified downgradient (southeast) of North Playa Lake.

Landfill #4: Landfill #4 is an approximate 7-acre, closed landfill in the east-central portion of Cannon AFB, immediately north of North Playa Lake. The landfill was only operational for one year between 1967 and 1968. Installation personnel identified that between August and October 2014, water from North Playa Lake was applied to the landfill cover in support of a revegetation project. It was indicated that a total of 1,305,300 gallons of water from North Playa Lake was applied directly to the landfill surface. One existing monitoring well (MW-Na) was identified downgradient (southeast) of Landfill #4. Investigation activities at Landfill #4 will consist of collecting groundwater samples from existing monitoring well MW-Na. No soil sampling is required relative to the landfill.

South Playa Lake Outfall: South Playa Lake is located in the southwestern portion of Cannon AFB and serves as the installation's primary stormwater collection point. The lake has received stormwater runoff and wastewater discharge from the flightline, apron, and industrial area of the installation since 1943. Three separate storm sewer outfalls are present: one on the west side, one on the south side, and one of the east side of the playa. No water was present in the playa at the time of the installation scoping visit and no outfalls exist from the playa. Four proposed soil boring locations were identified: one at each of the outfall locations, and one in the center of the playa where water would accumulate and eventually infiltrate into the soil. If water is present at the South Playa Lake during the SI, sediment and surface water sampling will be conducted. SI activities at this location would require additional coordination with operations personnel.

Whispering Winds Golf Course Outfall: The golf course began receiving treated effluent from the WWTP to fill two ponds and irrigate the greens in 2002. Treated effluent is piped to a 9 million gallon tank located on the eastern portion of the golf course. The effluent in the storage tank is then discharged to the larger of two ponds located in the north central portion of the golf course. The northern pond is connected to the pond located further southeast via piping. A sediment and a surface water sample are proposed to be collected from each of the golf course ponds.

Hangar 109: Hangar 109 is a parking and general maintenance hangar operated by the 27th SOW. The hangar is located in the west central portion of Cannon AFB and is bordered to the south by a restricted flight ramp, and to the east by Hangar 119. A grassy area is present on the northwest side of the hangar. An accidental release of AFFF occurred in the mechanical room in the spring of 2016. The AFFF flowed to the grassy area north and west of the hangar. Evidence of ground staining in the grassy area northwest of the building was observed during the scoping visit. Two proposed soil boring locations were identified in the grassy area northwest of the building.

Hangars 119 and 133: Hangars 119 and 133 are located in the west-central portion of Cannon AFB that have reported releases of AFFF. The hangars are located at the southwest end of the aircraft parking apron, with Hangar 133 located at the southern end and Hangar 119 located immediately northeast of Hangar 133. Based on surface topography, accidental releases of AFFF on the northeast side of Hangar 119 would have drained to storm drains in the concrete parking apron or would have evaporated directly

on the apron. Any AFFF released on the southwest side has the potential to drain via surface flow to the grassy area on the northwest side of Hangar 133.

Two accidental AFFF releases were reported at Hangar 133, including a release of approximately 200 gallons of AFFF that discharged from the hangar and was washed to nearby infield soil (likely the grassy area on the northwest side of the hangar) and allowed to evaporate.

It was determined that AFFF releases from hangars 119 and 133 should be combined into a single area for SI activities. Two proposed soil boring locations were identified in the grassy area northwest of Hangar 133 and southwest of Hangar 119.

25 October 2016: Day two of the scoping visit included site visits for remaining AFFF areas and additional interviews with installation personnel regarding SI logistics.

Information required for inclusion on the Entry Authorization List for base access for Amec Foster Wheeler and all subcontract personnel will be submitted to Mr. Kottkamp approximately 30 days prior to the initiation of SI activities. All personnel will be required to complete flightline drivers training and radio training if driving on the flightline is required. The subject training needs to be conducted prior to the initiation of SI activities.

Dig permits will be required for each location. Amec Foster Wheeler will provide Mr. Kottkamp with the proposed soil boring/monitoring well locations and the drill rig specifications, who will then submit the required dig permits for review/approval. New Mexico State One Call (NM 811) will be contacted to locate underground telephone and cable lines, while the Base Civil Engineering (CE) office will locate water, electric, gas, sewer, and any other base-owned utility lines. All CE utility locating will require completion of a CE Work Clearance Request (Form 103). All daily activities will need to be coordinated with the airfield manager.

Amec Foster Wheeler was informed that Federal Aviation Administration (FAA) permits may be required for activities in several of the proposed AFFF areas due to boring locations and the anticipated mast height of the drill rig. Upon approval of the ISWP, Amec Foster Wheeler will work with Mr. Kottkamp and Base Operations personnel to complete final FAA permit determination. An airfield waiver form must be completed and approved prior to the onset of SI activities.

The following AFFF release area summaries provide information discussed and clarified during day two of the visit.

Former Sewage Lagoons: The former sewage lagoons consisted of two unlined surface impoundments that were used from 1966 to 1998 and received sanitary and industrial waste from installation facilities prior to the construction of the WWTP. Sludge and the underlying contaminated soil from the north lagoon were excavated and consolidated into the south lagoon in 2003. The cover design assumed that the contaminated medium at the site consisted of approximately two feet of sludge overlying a one-foot-thick layer of soil. The former sewage lagoon area is covered with grass and shrubs and is a secured area

that is surrounded by a fencing with a locked gate on the south end. Four monitoring wells were identified in the vicinity of the former sewage lagoons including Well F, Well G, Well H and Well Pa.

Hangar 204: Hangar 204 is located in the north-central portion of the installation bordered on three sides by concrete apron. A small grassy area is present on the northwest side of the structure. An accidental discharge of AFFF was reported in May 2002, where approximately 700 gallons of AFFF were discharged from the hangar onto the concrete ramp and were left to evaporate. A storm drain is present in the flight apron, northeast of the hangar bay doors, that would capture liquid released from the structure and subsequently route the liquids to South Playa Lake. Based on the surface topography, it is unlikely that any AFFF released would flow towards the grassy area on the northwest side of the structure. Based on observations made during the scoping visit, no subsurface investigation was recommended relative to Hangar 204; however, investigation activities will be conducted at South Playa Lake. No existing monitoring wells were identified in the vicinity of Hangar 204.

Perimeter Road Fuel Spill: According to Cannon AFB Fire Chief, Mr. Bruce Ford, a fuel tanker truck overturned along Perimeter Road in the southeast corner of the installation where the road curves south of Landfill #5. All fuel from the tanker was released on the southeast side of the road. The area was observed to be a depression on the southeast side of Perimeter Road covered with grass and shrubs. The depression was a results of excavation activities that occurred as part of the fuel spill response. Monitoring well S was observed immediately northwest of the fuel spill area; however, due to declining groundwater levels, the monitoring well is no longer a viable groundwater monitoring well and is tentatively scheduled to be replaced in 2017. One proposed soil boring location was identified in the center of the depression area. Since soil potentially impacted with AFFF was excavated as part of spill response activities, it is unlikely that PFAS impacted groundwater at this location. As a result, investigation activities will be limited to sampling native soil (i.e., beneath fill material placed after excavation). If PFAS impacts are identified in soil, groundwater sampling downgradient of the spill location may be warranted as part of follow-on activities.

QAPP WORKSHEET #10: CONCEPTUAL SITE MODEL

An installation-wide Preliminary Conceptual Site Model (CSM) with information regarding AFFF release areas is presented below. The preliminary CSM will be revised based upon the information and data collected during the site inspections, additional research, well surveys, and follow-on inspections, and presented as a narrative in the SIRs.

Facility Profile	Physical Profile	Release Profile	Land Use and Exposure Profile	Ecological Profile
Installation Description/History: • Years of operation: 1942 to the present. • Size: Approximately 3,789 acres. • Location: Eastern New Mexico, approximately 7 miles southwest of the City of Clovis, in Curry County, New Mexico. • Layout: The installation is comprised of two perpendicular active runways in the central and southwestern portions; maintenance, support, and operational facilities west of the central runway/flightline; supplemental hangars and apron areas in the south-central region; a wastewater treatment plant to the east; and, a golf course and residential and service facilities in the northwestern portion (HGL, 2015). • History: Cannon AFB dates to 1929 when Portair Field was established as a civilian passenger terminal. The Army Air Corps took control of the civilian airfield in 1942 and it became known as the Clovis Army Air Base. The installation was renamed Clovis Army Air Field in early 1945, where flying, bombing, and gunnery classes continued until the installation was deactivated in May 1947. The installation was reassigned to the TAC and formally reactivated as Clovis AFB in 1951, and subsequently renamed Cannon AFB in 1957 (Versar, 2013). • Current Mission: Home to the 27th SOW where it conducts infiltration/exfiltration, combat support, tilt-rotor operations, helicopter aerial refueling, close air support, unmanned aerial vehicle operations, non-standard aviation, and other special missions. It directs the deployment, employment, training, and planning for squadrons that operate the AC-130W, MC-130J, CV-22B, C-146A, U-28A, MQ-1, MQ-9, and provides operational support to flying operations (Versar, 2013). **AFFF Use:** •AFFF containing PFAS was used for firefighting training activities, testing of firefighting equipment, extinguishing petroleum fires, and in fire suppression systems at several installation buildings. •Thirteen potential AFFF release areas are recommended for SI at Cannon AFB: • Former FTA No. 2; • Former FTA No. 3; • Former FTA-4; • Hangars 119 and 133;	**Topography:** •The installation is situated in the Southern High Plains Physiographic Province near the center of the Llano Estacado subprovince. This area is a nearly flat plain sloping gently (10 to 15 feet per mile) to the east and southeast. In the vicinity of Cannon AFB, elevations range from 4,250 to 4,350 feet above mean sea level (AECOM, 2011). **Vegetation:** •Vegetation at Cannon AFB is typical of semiarid, short grass prairies (Plains-Mesa grassland) and is limited by water availability (CH2MHill, 1983). •Much of the Llano Estacado (80-90%) has been tilled for agriculture, with farmers producing cotton, corn, and wheat under dryland agriculture or irrigated with water pumped from the Ogallala Aquifer (USEPA, 2006). **Surface Water:** •Permanent surface water streams are non-existent in the Cannon AFB vicinity. Running Water Draw, located approximately 10 miles north of the installation, is the nearest drainage feature and is dry for much of the year. •Historically, surface runoff at Cannon AFB has drained into four natural, ephemeral, playas. Two of the northern playas were converted into plastic-lined golf course ponds. The southern playa, known as South Playa Lake, occupies approximately 9 acres south of the intersection of the main jet runways and is approximately 15 feet deep. Since 1943, stormwater runoff from the flightline has collected in this playa where it either evaporates or percolates into the soil. The northern playa, known as North Playa Lake, was bermed on the north, west, and south sides with topsoil and concrete debris. It covers approximately 13 acres and received treated effluent from the former sewage lagoons (AECOM, 2011). **Soils:** • Soils at Cannon AFB are predominantly fine sandy loams of the Amarillo series, which consists of very deep, well drained, moderately permeable soils derived from loamy eolian sediments from the Blackwater Draw Formation of the Pleistocene (United States Department of Agriculture [USDA], 2017). **Geology:** •The subsurface geology of the Southern High Plains aquifer at Cannon AFB includes the Chinle, Ogallala, and Blackwater Draw Formations. • The Chinle Formation of Triassic Age forms the bottom of the unconfined Southern High Plains Aquifer in this area, and consists primarily of clay with some intermixed sand and silt, and ranges in thickness from 0 to 400 feet in eastern New Mexico. • The Ogallala Formation of Tertiary Age is the main water-yielding unit of the Southern High Plains Aquifer and lies unconformably atop the upper unit of the eastward-dipping Chinle Formation. The Ogallala Formation consists of eolian sand and silt and fluvial and lacustrine sand, silt, clay, and gravel, and ranges in thickness from 30 to 600 ft in eastern New Mexico and west Texas.	**Contaminants of Potential Concern:** •PFAS are the contaminants of potential concern for this investigation. •Fuel related compounds and chlorinated solvents are historical site contaminants. **Media of Potential Concern:** •Soil, sediment, surface water, and groundwater. **Confirmed AFFF Releases:** •No historical sampling for PFAS. •Former FTA No. 2: Possible AFFF use from 1970 to 1974 in unlined FTA with an unknown volume of AFFF used for firefighting training. •Former FTA No. 3: Possible AFFF use from 1970 to 1974 in an unlined FTA with an unknown volume of AFFF used for firefighting training. •Former FTA-4: Possible AFFF use from 1974 to 1995 with an unknown volume of AFFF used for firefighting training. •Hangar 119: Three accidental releases of AFFF inside the hangar likely discharged to grassy areas outside the hangar. •Hangar 133: Two accidental releases of AFFF inside the hangar including one release where AFFF was discharged outside the hangar and "washed" to nearby infield soil. •Former Sewage Lagoons: Operated between 1966 and 1998; during operation, lagoons received any AFFF that entered the sanitary sewer system. Evidence of AFFF releases in hangars during this time period, which may have entered the sanitary sewer system and been routed to the former sewage lagoons. •North Playa Lake Outfall: Any wastewater collected at the WWTP containing AFFF would be passed on to North Playa Lake. Several releases of AFFF from hangars entered the sanitary sewer system and were routed to the WWTP. There is no accepted wastewater treatment process for AFFF or PFAS. •South Playa Lake Outfall: Any stormwater or wastewater containing AFFF that enters storm drains near the flightline is routed to South Playa Lake. Several releases of AFFF from hangars entered nearby storm drains and were routed to the lake.	**Current Land Use:** •Occupied by Cannon AFB. **Future Land Use:** •Land use is not expected to change in the future. **Potential Receptors:** •Potential receptors associated with current and future land use include USAF personnel and residents, grounds maintenance workers, utility workers, construction workers. •Recreational users of Whispering Winds Golf Course.	**Potential Ecological Receptors:** •Inland and aquatic plant species, reptiles, birds, soil invertebrates, and mammals that inhabit or migrate through the installation. **Threatened and Endangered Species:** •Threatened species that were identified in Curry County and may exist at Cannon AFB include the following: • Lesser prairie-chicken (*Tympanuchus pallidicinctus*) – under review.

• Former Sewage Lagoons; • North Playa Lake Outfall; • South Playa Lake Outfall; and, • Whispering Winds Golf Course Outfall. • Hangar 109; • Active FTA; • Landfill #4; • Perimeter Road Fuel Spill; and, • Flightline Crash Areas.	• The Blackwater Draw Formation of Quaternary Age generally overlies the Ogallala Formation at Cannon AFB. The Blackwater Draw Formation is composed primarily of eolian sand deposits, and ranges in thickness from 0 to 80 feet in eastern New Mexico. • A caliche layer is typically present in the unsaturated zone of the Blackwater or Ogallala Formations in New Mexico. **<u>Hydrogeology</u>:** •The lower portion of the Ogallala Formation is the primary regional aquifer for both potable and irrigation water. •The Ogallala Aquifer is part of the Southern High Plains Aquifer that extends across parts of southeast New Mexico and northwest Texas, which in turn is part of the larger High Plains Aquifer that extends continuously from Wyoming and South Dakota into New Mexico and Texas. •At Cannon AFB, the depth to groundwater is approximately 300 feet bgs. The saturated thickness in 1990 ranged from 93 to 143 feet, but continues to decrease. Groundwater flow is generally from northwest to southeast (FPM, 2014). •Cannon AFB is underlain by the portion of the Ogallala Aquifer designated the Curry County Underground Water Basin. The Ogallala Aquifer is a water table, or unconfined, aquifer with the underlying Chinle redbeds serving as the basal confining layer in eastern New Mexico. **<u>Meteorology:</u>** •Average annual rainfall is 17.9 inches/year in Clovis, New Mexico. •Average number of days with measureable rainfall is 54 days. •Average high temperature of 92°F occurs in July, while an average low of 23.4°F occurs in January.	•Whispering Winds Golf Course Outfall: The golf course began receiving effluent from the WWTP plant in approximately 2002. Currently, the golf course stores effluent in a storage tank on the eastern portion of the course. Effluent is regularly used for golf course irrigation and filling the two golf course ponds. A release of AFFF into any of the hangar floor trenches or fire station stalls would be routed through the WWTP. As such, effluent from the WWTP used at the golf course may contain AFFF. •Hangar 109: A recent release of AFFF inside the hangar/mechanical rooms resulted in AFFF being released outside the hangar and draining o grassy areas outside the hangar. •Active FTA: Lined evaporation pond located south of the FTA where AFFF/water mix is collected and left to evaporate has been repaired in the past. Any damage to liner would result in AFFF being released to environment. Extreme flood event in May 2015 likely resulted in the evaporation pond overflowing and also allowing residual AFFF to infiltrate into surrounding soil. •Landfill No. 4: Landfill is located immediately north of the North Playa Lake. Cover was irrigated using water from North Playa Lake where wastewater from WWTP (potentially including AFFF) was discharged. •Perimeter Road Fuel Spill: AFFF was sprayed from crash fire trucks onto a fuel spill associated with an overturned tanker trunk on the southeast side of Perimeter Road. •Flightline Crash Areas: Cannon AFB Fire Department noted three separate crash areas along the flightline where AFFF was released during crash response activities. **<u>Primary Release Pathways:</u>** •Release or application of AFFF to the ground at potential source areas. •Infiltration of PFAS deeper into the soil column over time potentially reaching groundwater. •AFFF washed into drainage, stormwater, and sewer systems. **<u>Secondary Release Pathways:</u>** •Irrigation utilizing water from the WWTP.		

QAPP WORKSHEET #11: PROJECT/DATA QUALITY OBJECTIVES

The following presents site-specific DQOs for the proposed investigation at Cannon AFB. These DQOs were developed using USEPA *Guidance on Systematic Planning Using the Data Quality Objectives Process* USEPA QA/G-4 (USEPA, 2006).

Step 1: State the Problem

AFFF containing PFAS was stored, used, and/or released at Cannon AFB during firefighting testing and training activities, and while suppressing petroleum fires.

Step 2: Identify the Goals of the Study

The objectives of this investigation are to:

- Conduct an initial SI at AFFF release areas selected for inspection to determine if a confirmed release of PFOS and PFOA has occurred;
- Determine if PFOS and PFOA are present in groundwater, soil, or surface water/sediments at each AFFF area at concentrations exceeding USEPA HA values, or other applicable state or federal standards; and,
- Identify potential receptor pathways with immediate impacts to human health.

Step 3: Identify Information Input

The following data and informational needs are required to achieve the initial project goals:

- Collection and laboratory analysis of soil samples from soil borings advanced at areas where AFFF was released at Cannon AFB;
- Collection and laboratory analysis of groundwater samples using existing monitoring wells located downgradient of areas where AFFF was released at Cannon AFB;
- Collection and laboratory analysis of sediment samples from surface water bodies/drainage structures where AFFF may have been discharged at Cannon AFB; and,
- Collection of surface water samples from surface water bodies where AFFF may have been discharged at Cannon AFB.

Follow-on objectives and informational inputs, as applicable, will be provided in addenda to this ISWP as needed.

Step 4: Define the Boundaries of Data Collection

The 13 AFFF release areas at Cannon AFB include locations where AFFF was determined to be released. The investigation boundaries are depicted in **Figures 3** through **16** that illustrate the features and proposed sampling locations at the AFFF release areas at Cannon AFB. The investigation is defined vertically by the depth of groundwater.

Step 5: Develop the Analytical Approach

The following 16 PFAS will be analyzed by Modified USEPA Method 537.1 (USEPA SOP 00894), using liquid chromatography-tandem mass spectrometry (LC-MS/MS):

- PFOS;
- PFOA;
- PFBS;
- Perfluoroheptanoic acid (PFHpA);
- Perfluorohexanesulfonic acid (PFHxS);
- Perfluorononanoic acid (PFNA);
- N-Ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA);
- N-Methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA);
- Perfluorodecanoic acid (PFDA);
- Perfluorotetradecanoic acid (PFTA);
- Perfluorododecanoic acid (PFDoA);
- Perfluorohexanoic acid (PFHxA);
- Perfluorotridecanoic acid (PFTrDA);
- Perfluoroundecanoic acid (PFUnA);
- 6:2 fluorotelomer sulfonate (6:2 FTS); and,
- 8:2 fluorotelomer sulfonate (8:2 FTS).

One composite surface soil sample and one composite subsurface soil sample per AFFF release area will also be collected and submitted for analyses of physiochemical properties, including soil pH (USEPA Method 9045B), particle size analysis (ASTM International D422), and total organic carbon (TOC) content (USEPA 9060 or Lloyd Kahn Method).

Release Determination: In accordance with Interim USAF Guidance on Sampling and Response Actions for Perfluorinated Compounds at Active and BRAC Installations (USAF, 2012) and USEPA HA values for PFOS (USEPA, 2016a) and PFOA (USEPA, 2016b), a release will be considered confirmed if exceedances of the following concentrations are identified:

PFOS

- 0.07 µg/L in groundwater/surface water that is used as, or contributes to, a drinking water source.

- 1,260 µg/kg in soil (calculated, in the absence of RSL values).
- 1,260 µg/kg in sediment (calculated in the absence of RSL values).

PFOA

- 0.07 µg/L in groundwater/surface water that is used as, or contributes to, a drinking water source.
- 1,260 µg/kg in soil (calculated, in the absence of RSL values).
- 1,260 µg/kg in sediment (calculated in the absence of RSL values).

PFOS + PFOA

- 0.07 µg/L in groundwater/surface water that is used as, or contributes to, a drinking water source.

While PFOS and PFOA are the focus of the HA and provide specific targets for the USAF to address in the SI, USEPA has also derived RSL values for PFBS for which there is a Tier 2 toxicity value (Provisional Peer Review Toxicity Value). The USAF will also consider a release to be confirmed if exceedances of the following concentrations are identified:

PFBS

- 380 µg/L in groundwater/surface water.
- 1,600,000 µg/kg in soil and sediment.

Further Evaluation: If PFAS concentrations exceed USEPA HA values, RSLs, and/or concentrations established by state regulations, then the USAF will be informed of the results of follow-on data collection to evaluate the need to conduct further investigation to delineate PFAS concentrations, identify potential migration pathways, and identify downstream and/or downgradient receptors. Follow-on investigation and step-out sampling will be conducted to evaluate the extent of PFAS concentrations, delineate downgradient groundwater plumes (as applicable), further define the environmental setting, and identify AFFF areas with potential impacts to down-stream and/or downgradient receptors. Follow-on objectives and sampling design and rationale will be defined and described in addenda to this ISWP.

Drinking Water Source Assessment: If a PFAS release is verified, as defined above,, and a potential migration pathway is identified to downgradient drinking water supplies, then public/drinking water wells will be sampled. The public/ drinking water well sampling design and rationale will be defined and described in addenda to this ISWP.

Protect Human Health: If a PFAS release is verified, as defined above, then the USAF will be contacted to evaluate the mitigation measures that may be necessary. Mitigation measures will be applied to private drinking water wells that present an imminent threat to human health from PFAS related to USAF activities

at the installation. The mitigation measures design rationale will be defined and described in addenda to this ISWP.

Step 6: Specify Performance or Acceptance Criteria

- Daily standardized PFAS personal protective equipment (PPE)/equipment checklist (provided in the PFAS protocol standard operating procedure [SOP]) will be completed by the field manager. The quality assurance (QA) manager will review and accept the final checklist.
- QA manager or designee will verify field procedures defined in the QPP and ISWP are properly followed through field audits. Any deviations will be promptly communicated, addressed, and documented.
- Analytical laboratories will carry the current DoD Environmental Laboratory Accreditation Program certification and any required state accreditations.
- The laboratories will analyze proficiency testing samples to demonstrate capability prior to the sampling program beginning. The laboratories will identify and quantify proficiency testing samples within acceptance limits to verify reporting of PFAS. Any findings or recommendations will be addressed prior to collection of field samples.

Step 7: Develop the Detailed Plan for Obtaining Data

The detailed plan for obtaining the data is presented in Worksheets **#13, #14/16, #17, #18**, and **#20** of this ISWP. SOPs for collecting environmental samples (groundwater, soil, surface water, and sediment) that will be used during this investigation are provided in Appendix D of the General QPP.

QAPP WORKSHEET #13: SECONDARY DATA USES AND LIMITATIONS

The primary sources of data used to generate the history, meteorology, hydrogeology, hydrology, ecological receptors, and AFFF use at Cannon AFB that are included in this ISWP are identified below.

Data Type	Source	Data Uses Relative to Current Project	Factors Affecting the Reliability of Data and Limitations on Data Use
Site history, Installation History,	*HGL, 2015, Final Preliminary Assessment Report for Perfluorinated Compounds at Cannon Air Force Base, New Mexico. October.*	Provided background information regarding Cannon AFB.	None known.
Geology and Hydrogeology	*USGS, 2006. Ground-Water Hydrology and Water Quality of the Southern High Plains Aquifer, Cannon Air Force Base, Curry County, New Mexico, 1994-2005.* FPM, 2014. *2014 Biennial Groundwater Monitoring and Annual Landfill Inspection Report, Cannon Air Force Base, New Mexico. December*	Provided geologic and hydrogeologic setting. Provide recent groundwater level information and background information regarding existing monitoring wells.	None known. Groundwater level information is presented from 2014; however, may not be representative of current conditions due to declining water levels.
AFFF Use	*HGL, 2015, Final Preliminary Assessment Report for Perfluorinated Compounds at Cannon Air Force Base, New Mexico. October.*	Provided history of AFFF use and a background of AFFF release areas identified for follow on SI activities	Assessment did not include all areas identified for SI. No information about fire department responses for aircraft crashes or fuel spills was included in the PA report. AFFF release area determination based on reporting of others/interviews of base personnel.

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QAPP WORKSHEET #14/16: PROJECT TASKS AND SCHEDULE

To meet the project goals defined in Worksheet #11 of the General QPP, the Cannon AFB SI will include the results of the installation scoping visit to determine the sampling activities, as well as the collection of soil, sediment, surface water, and groundwater samples to confirm if a release of PFAS has occurred. The approach to conducting the SI will include the activities identified in **QAPP Worksheet #14/16** and described below. Fieldwork will be conducted in accordance with the SOPs provided in Appendix D of the General QPP.

INSTALLATION SCOPING VISIT

An installation scoping visit was held on 24 and 25 October 2016 by Amec Foster Wheeler personnel to review available data, interview applicable Cannon AFB personnel, and visit proposed AFFF areas to identify site-specific sampling locations and constraints. Thirteen potential AFFF areas are proposed for further investigation. Refer to **QAPP Worksheet #9** for details.

PRE-MOBILIZATION ACTIVITIES

The following activities will be completed prior to mobilization to Cannon AFB to perform SI field activities.

Health and Safety Plan Preparation

The Installation-Specific HSP is included in **Appendix A**, and is a supplement to the General HSP found in Appendix A of the General QPP. The HSP will be reviewed and updated, as necessary, prior to field mobilization based on final personnel assignments. The HSP has been prepared in accordance with the Occupational Safety and Health Administration's Hazardous Waste Operations and Emergency Response Standard (29 Code of Federal Regulations [CFR] 1910.120 CFR).

Amec Foster Wheler will also review all subcontractor HSPs and training records for subcontracted personnel to ensure compliance with Amec Foster Wheeler's General HSP.

Base Access

Amec Foster Wheeler field personnel and their drilling subcontractor will provide Mr. Kottkamp with all personal information required for access to Cannon AFB a minimum of 30 days prior to initiation of field activities. Thirty-day passes will be obtained at the Cannon AFB main gate Visitor Center on the first day of mobilization upon presentation of a valid identification in accordance with the REAL ID Act, registration/rental vehicle contract, and insurance certificate/documentation for all vehicles. Flightline drivers and radio training will be required for all on-site personnel who will be conducting work in the flightline areas. Training will be required prior to the initiation of SI activities. All applicable training will be coordinated with Mr. Kottkamp and Base Operations prior to mobilization to Cannon AFB.

Utility Clearance

Amec Foster Wheeler will pre-mark all proposed boring locations. Utility clearance at each location will be obtained by completing the following activities:

- Obtain utility clearances and a dig permit ticket through New Mexico One-Call System (New Mexico 811) a minimum of 7 days prior to mobilization of drilling equipment;
- Complete and submit a Base CE Work Clearance Request (Form 103);
- Notify Cannon AFB CE department of all utility clearances;
- Review available utility plans for identification of potential utilities in work areas; and,
- Clearing of all intrusive locations by the drilling subcontractor using a hand auger or post-hole digger to a minimum depth of 5 ft bgs.

Area-Specific Regulations/Permits

A FAA permit is required for all soil boring/monitoring well installations utilizing a drill rig on the active airfield at Cannon AFB. Amec Foster Wheeler will submit all required information to Mr. Kottkamp a minimum of 60 days prior to fieldwork initiation, including anticipated fieldwork dates and duration, boring/well Global Positioning System (GPS) coordinates and elevations, drill rig type and mast heights (lowered and raised), and well development method.

SI activities at Hangars 109, 119 and 133, and the South Playa Lake, will require additional coordination and scheduling with Base Operations. SI activities to be conducted at FTA No. 2 and FTA No. 3 will require additional coordination and scheduling with EOD personnel.

Field Readiness Review

Amec Foster Wheeler will conduct a Field Readiness Review that will include the preparation of a checklist to ensure all permits, procurement items, and notifications have been submitted and/or approved. This information will be discussed during a teleconference with the Remedial Program Manager (RPM) and AFCEC personnel a minimum of 2 weeks prior to fieldwork mobilization. Any required notification to the NMED will be provided by the RPM within the applicable timeframe.

MOBILIZATION/DEMOBILIZATION

Two mobilizations to the installation will be required to complete the SI work. The first mobilization will be to mark boring locations and verify utility clearance with the Base CE, while the second mobilization will be to advance soil borings, complete monitoring well development, collect soil, groundwater, surface water, and sediment samples, and conduct surveying of sampling locations.

ENVIRONMENTAL SAMPLING

Soil, sediment, surface water, and/or groundwater samples will be collected at the 13 identified AFFF release areas at Cannon AFB. The goal of site-specific sampling is to determine the presence or absence of PFAS within media of concern. **QAPP Worksheets #18-1** through **#18-14** and **Figures 3** through **15** provide the sampling details and locations, respectively, for each potential AFFF release area at Cannon AFB. All environmental samples collected will be analyzed for the analytical suite of 16 PFAS, identified in **QAPP Worksheet #11.**

One composite surface soil sample and one composite subsurface soil sample per AFFF release area will also be collected and submitted for analysis of physiochemical properties, including soil pH (USEPA Method 9045B), particle size analysis (ASTM D422), and TOC (USEPA 9060 or Lloyd Kahn Method). The General QPP provides the SOPs and descriptions for sampling activities, while a summary of the proposed field sampling activities is described in the following sections.

Soil Boring Advancement/Abandonment and Soil Sampling

Twenty-four soil borings will be advanced by a New Mexico licensed driller using either direct push technology or hollow stem auger, to identify the presence or absence of PFAS in soil at nine of the AFFF release areas, as well as to characterize subsurface conditions. Soil cores will be continuously collected to the appropriate depth, screened with a photoionization detector equipped with a 10.6 electron volt lamp for volatile organic vapors, and logged by a qualified geoscientist in accordance with the Unified Soil Classification System (USCS).

Discrete surface and subsurface vadose-zone soil samples will be collected from each of the soil borings at specified depths during soil boring advancement for laboratory analysis. Surface soil samples will be collected from the surface or immediately below the vegetative layer to 6 inches bgs. Subsurface soil samples will be collected to assess PFAS presence in the vadose zone at a total depth of approximately 30 ft bgs. Specific details and procedures related to soil sample collection can be found in SOP AFW-02, *Soil Sampling* (Appendix D, General QPP). The boreholes will be abandoned in accordance with SOP AFW-06, *Borehole Abandonment* (Appendix D, General QPP). **QAPP Worksheets #17** and **#18** provide further discussion of sample locations and rationale. Soil sample collection details will be recorded in field logs and soil sample collection logs, while boring lithology will be recorded on drilling logs (Appendix E, General QPP).

Monitoring Well Development and Sampling

Fifteen existing monitoring wells will be sampled for PFAS during the SI since no new monitoring wells will be installed as part of the SI. Groundwater at Cannon AFB is regulated basewide by NMED rather than evaluating groundwater impacts specific to an area of concern. It was determined that the SI would focus on determination of PFAS presence or absence utilizing existing monitoring wells that are already approved by NMED as part of the Cannon Basewide Groundwater Monitoring Program. Prior to sampling, all monitoring wells proposed for sampling will be redeveloped. Existing sampling equipment including dedicated tubing will be removed from the monitoring wells and staged for future use.

The monitoring wells will be developed using a stainless steel submersible pump outfitted with disposable high-density polyethylene (HDPE) tubing, in accordance with SOP AFW-05, *Monitoring Well Development* (Appendix D, General QPP). Water quality parameters (pH, specific conductance, temperature, oxidation-reduction potential [ORP], dissolved oxygen [DO], and turbidity) of the development water will be measured and recorded on well development logs. Well development will continue until the water quality

parameters have stabilized and the development water is generally sediment-free or clear (i.e., less than 50 nephelometric turbidity units).

Static depth to groundwater measurements will be collected from all available existing monitoring wells for use in potentiometric level calculation and groundwater contouring prior to initiating groundwater development, purging, and sampling activities. Low-flow groundwater purging and sampling will be conducted from each monitoring well with a submersible pump outfitted with disposable HDPE tubing. Water levels and quality parameters (pH, specific conductance, temperature, ORP, and DO) will be periodically measured with a multi-purpose water quality meter and turbidity meter until all parameters stabilize in accordance with SOP AFW-03, *Groundwater Sampling* (Appendix D, General QPP). The water levels and quality parameter measurements will be recorded on groundwater sample collection logs during purging activities. A summary of proposed groundwater samples is provided in **Worksheet #18**.

Sediment Sample Collection

Four sediment samples will be collected at two AFFF release areas at Cannon AFB to determine the presence or absence of PFAS in sediment at and adjacent to AFFF areas. Sediment samples will be collected using either a core sampler or by hand using stainless steel spoons or cups mounted on poles as necessary, depending on location-specific conditions. A summary of proposed sediment samples is provided in **Worksheet #18,** and specific details and procedures related to sediment sample collection can be found in SOP AFW-07 (PFAS), *Sediment Sampling* (Appendix D, General QPP).

Surface Water Sample Collection

Four surface water samples will be collected at two AFFF areas at Cannon AFB, if present, to determine the presence or absence of PFAS in surface water. Surface water samples will be collected using the immersion method. A summary of proposed surface water samples is provided in **Worksheet #18,** and specific details and procedures related to surface water sample collection can be found in SOP AFW-08 (PFAS), *Surface Water Sampling* (Appendix D, General QPP).

PFAS SAMPLING CONSIDERATIONS

Given the low detection limits associated with PFAS analysis and the many potential sources of trace levels of PFAS, field personnel will follow strict protocols to help mitigate the potential for false detections of PFAS. A list of prohibited and acceptable clothing/equipment for sampling at PFAS sites is provided in Table 5 of the General QPP. Specific details and procedures related to sampling for analysis of PFAS can be found in SOP AFW-01 (PFAS), *PFC-Specific Procedures* (Appendix D, General QPP).

SURVEYING

Amec Foster Wheeler personnel will locate, survey, and mark all proposed soil borings and monitoring well locations using a handheld GPS unit for utility clearance. After well sampling activities are completed, all monitoring wells will be surveyed by a licensed land surveyor. In order to ensure accuracy, existing monitoring wells will be re-surveyed to enable accurate placement of well locations on a map and to provide accurate data for calculating groundwater elevations. Horizontal coordinates will be surveyed to the nearest 0.1 ft and referenced to the relevant State Plane Coordinate System using the North American Datum of 1983, as adjusted in 1991. Elevation measurements will be made at ground surface and at the top of casing at each of the monitoring wells. Elevations will be surveyed to the nearest 0.01 ft and referenced to the North American Vertical Datum of 1988.

INVESTIGATION-DERIVED WASTE MANAGEMENT

Investigation-derived waste (IDW) will consist of soil cuttings from soil boring advancement, well development water, groundwater sampling purge water, decontamination water, disposable PPE, and other miscellaneous refuse. Used PPE and other miscellaneous refuse will be placed in plastic bags and discarded in an on-site sanitary trash container for disposal at a sanitary landfill. Soil IDW will be placed into Department of Transportation (DOT)-approved 55-gallon, open-top steel drums with locking lids and staged in the designated laydown area, pending analysis and disposal. Liquid IDW generated from equipment decontamination, and monitoring well development and purging activities will be placed into a frac tank pending analysis and disposal. IDW containers will be appropriately labeled with site/contact information and contents, and will be staged in the designated laydown area at an area designated by Cannon AFB personnel. Based upon waste characterization results, soil will be transported off-site by a licensed waste hauler to a permitted disposal facility. Depending on the liquid IDW characterization, it will either be profiled and transported off-site by a licensed waste hauler to a permitted disposal facility or discharged to the surface (non-hazardous). A designated USAF representative will oversee IDW loading for transport and disposal and will sign all manifests/bills of lading. Copies of the bills of lading/manifests will be included in the SIR.

Soil IDW

An aliquot of soil will be collected from each soil core during soil boring advancement and stored in a separate 5-gallon plastic container. A composited soil sample will be collected from the container at the conclusion of drilling activities and transferred directly into laboratory-provided containers, labeled, packed on ice in insulated coolers, and delivered under chain-of-custody protocol to the selected laboratory. The samples will be analyzed for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), pesticides, herbicides, and metals, polychlorinated biphenyls (PCBs), TPH-gasoline range organics (GRO), TPH-diesel range organics (DRO), flashpoint, pH, sulfide, and cyanide, to determine the applicable disposal option.

Liquid IDW

The liquid IDW will be collected in a fracture tank from monitoring well development/purge water and equipment decontamination water. A composite sample will be retrieved from the tank at the conclusion of drilling and sampling activities using a disposable bailer. The samples will be decanted directly into laboratory-provided containers, labeled, packed on ice in insulated coolers, and delivered under chain-of-custody protocol to the selected laboratory. The samples will be analyzed for VOCs, SVOCs, pesticides, herbicides, metals, PCBs, TPH-GRO and, TPH-DRO, flashpoint, pH, sulfide, and cyanide, to determine the applicable disposal option.

PROPOSED SITE INSPECTION SCHEDULE

The projected schedule for completion of SI activities is summarized below.

QAPP WORKSHEET #14/16: PROPOSED SCHEDULE OF SI ACTIVITIES.

Activities	Organization	Dates (MM/DD/YY)		Deliverable	Deliverable Due Date
		Actual or Anticipated Date of Initiation	Actual or Anticipated Date of Completion		
Installation Scoping Visit – A scoping visit was made to the installation to conduct interviews with personnel familiar with AFFF use, review information and inspect potential AFFF release areas, and determine logistical information required for the SI fieldwork.	Amec Foster Wheeler	10/24/2016	10/25/2016	Scoping visit notes for all interviews, activities planned for each of the AFFF release areas, and installation logistical information.	1/31/2017
Installation-Specific Work Plan – This report will be generated using information gathered from the installation scoping visit, including information provided by AFCEC and Cannon AFB personnel.	Amec Foster Wheeler	2/3/2017	4/14/2017	Installation-Specific Work Plan.	6/30/2017
Readiness Review – A readiness review will be conducted prior to mobilization to the installation to ensure that the field crew has the proper sampling equipment, sample containers, PPE, site clearances, sample locations, and any miscellaneous materials necessary to conduct the SI fieldwork.	Amec Foster Wheeler	7/31/17	7/31/17	Results of the readiness reviews will be included in the SIR.	4/27/2018
Utility Clearance – All soil boring and monitoring well locations will be located and marked, and verified to ensure no underground utilities will be compromised.	Amec Foster Wheeler	8/14/17	8/16/17	Description of the utility clearance activities will be included in the SIR.	4/27/2018

Activities	Organization	Dates (MM/DD/YY)		Deliverable	Deliverable Due Date
		Actual or Anticipated Date of Initiation	Actual or Anticipated Date of Completion		
SI Field Activities – Field activities will be conducted at the 13 AFFF release areas, including soil boring advancement, monitoring well development, collection of soil, groundwater, surface water and sediment samples for PFAS analysis, and oversight of the monitoring well top of casing elevation survey.	Amec Foster Wheeler Drilling subcontractor Subcontracted Surveyor	9/18/17	12/1/2017	SI field information will be included in the SIR.	4/27/2018
Laboratory Data Validation – Validation of the field sampling analytical data will be conducted for each sample data group.	Amec Foster Wheeler	1/05/2018	1/24/2018	Information to be included in the SIR.	4/27/2018
SI Report – This report will be prepared based upon the data generated during the SI field activities, and will include, at a minimum, geology/hydrogeology, CSM, sampling locations and depths, validated analytical results, and recommendations for further investigation of each AFFF release area.	Amec Foster Wheeler	12/4/17	3/2/2018	SIR.	4/27/2018
ERPIMS – Field notes, sampling logs, boring coordinates, etc. generated during the SI will be upload to the USAF ERPIMS database.	Amec Foster Wheeler	1/24/2018	2/23/2018	ERPIMS Data Upload	3/30/2018

Notes:
AFB – Air Force Base
AFCEC – Air Force Civil Engineer Center
AFFF – aqueous film forming foam
CSM – conceptual site model
DD – day
ERPIMS –- Environmental Resources Program Information Management System
MM – month
NA – not applicable
PFAS – per- and polyfluorinated alkyl substances
PPE – personal protective equipment
RPM – Remedial Project Manager
SI – Site Inspection
SIR – Site Inspection Report
USAF – United States Air Force
YY – year

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QAPP WORKSHEET 17: SAMPLING DESIGN AND RATIONALE

PROPOSED SCOPE OF WORK

Amec Foster Wheeler has developed a sampling program designed to evaluate the potential release of AFFF from FTAs, firefighting equipment testing areas, fire suppression systems, and AFFF discharge locations at Cannon AFB. The sampling plan is based on:

- Discussions between Amec Foster Wheeler and AFCEC during the installation visit from 24 through 25 October 2016;
- Review of background documents; and,
- Development of a preliminary Base-wide CSM (**Worksheet #10**).

Sampling at Cannon AFB is being performed at the locations most likely to have been previously impacted with AFFF from USAF activities, as well as from select existing monitoring wells located hydraulically downgradient of AFFF release areas. The sampling rationale and locations for each of the 13 AFFF release areas are detailed below and presented in **Worksheet 18**. Where applicable, existing monitoring wells are identified by area below; however, since groundwater quality at Cannon AFB is managed across the installation rather than on an area-by-area basis, basewide groundwater sampling is presented separately in **Worksheet #18-14**).

AFFF Release Area 1: Former FTA No. 2

Two soil borings will be advanced within the centers of the west and east burn pits where AFFF may have been released during fire training activities. Surface and subsurface soil samples will be collected from each of the borings advanced. Groundwater will be sampled as part of basewide groundwater sampling activities. The proposed soil sample locations for former FTA No. 2 are illustrated on **Figure 4.**

AFFF Release Area 2: Former FTA No. 3

Two soil borings will be advanced at former FTA No. 3 including, one soil boring in the approximate center of the former FTA and the second will be advanced in a location down-slope of the former FTA. Surface and subsurface soil samples will be collected from two borings advanced at FT-08. Groundwater will be sampled as part of basewide groundwater sampling activities. The proposed soil sample locations for former FTA No. 3are illustrated on **Figure 5.**

AFFF Release Area 3: Former FTA No. 4

Three soil borings will be advanced at the former FTA-4 location, including one soil boring beneath the former mock aircraft burn area; one soil boring at the location of the former unlined discharge pit/OWS location; and one soil boring in the northwest portion of the FTA in the location where fire training was conducted on vehicle chassis. Surface and subsurface soil samples will be collected from three borings at this location. The subsurface soil samples will be collected in native material beneath identified fill material (where applicable). Groundwater will be sampled as part of basewide groundwater sampling activities. The proposed soil sample locations for former FTA-4 are illustrated on **Figure 6**.

AFFF Release Area 4: Hangars 119 and 133

SI activities for hangars 119 and 133 have been grouped into a single area of investigation due to the proximity of the hangars. Two soil borings will be completed at AFFF Area 4 including; one soil boring on the north side of the grassy area, immediately downslope (southwest) of Hangar 119 and one soil boring on the south side of the grassy area, adjacent Hangar 133 in a location where AFFF released from the hangar likely accumulated after being directed to the in-field soil. Surface and subsurface soil samples will be collected from two borings. No existing monitoring wells are present in the vicinity of, or immediately downgradient of hangars 119 or 133; however, basewide groundwater monitoring will be conducted including sampling of monitoring wells downgradient of AFFF Area 4. The proposed soil sample locations are illustrated on **Figure 7**.

AFFF Release Area 5: Former Sewage Lagoons

Five soil borings will be completed at the former sewage lagoon area. The five soil borings are proposed at locations across the southern lagoon area. Two subsurface samples are proposed to be collected from each boring, including a shallow subsurface sample immediately below the sludge/soil layer and a second sample at a depth of 10 ft bgs. Existing monitoring wells MW-F, MW-G, MW-H, and MW-Pa are located downgradient of the former sewage lagoon areas and will be sampled for PFAS as part of basewide sampling activities. The proposed soil sample locations are illustrated on **Figure 8**.

AFFF Release Area 6: North Playa Lake Outfall

Two sediment and two surface water samples will be collected from North Playa Lake; one pair of samples will be collected at the WWTP outfall location on the west side of the playa and the second will be collected from the northeast portion of the playa. Monitoring well MW-Oa is located downgradient (southeast) of the North Playa Lake and will be sampled for PFAS as part of basewide groundwater sampling. The proposed sediment and surface water sample locations for North Playa Lake Outfall are illustrated on **Figure 9**.

AFFF Release Area 7: South Playa Lake Outfall

Four soil borings are proposed at the South Playa Lake for surface and subsurface soil sampling. One soil boring is proposed at each of sewer outfalls from the flightline area; one located on the west side of the playa, a second located along the northern perimeter of the playa, and a third located in the northeastern portion of the playa. A fourth soil boring is proposed in the center of the South Playa Lake at an area where water, if present, would pond. No sediment or surface water sampling is proposed at this time; however, if water is present at the South Playa during SI activities, a surface water and sediment sample will be collected at each of the proposed soil boring locations as an alternative to surface and subsurface soil samples. Groundwater will be sampled as part of basewide groundwater sampling activities. The proposed sampling locations for South Playa Lake are illustrated on **Figure 10.**

AFFF Release Area 8: Whispering Winds Golf Course

One sediment and one surface water sample will be collected from each of the two ponds located at the golf course. In the northern pond, the sediment and surface water sample will be collected near the effluent pipe outlet from the WWTP/effluent tank. The sediment and surface water sample in the eastern pond will be collected near the pipe outlet that discharges from the larger pond. No soil or groundwater samples are proposed at the golf course. The proposed sediment and surface water sampling locations are illustrated on **Figure 11**.

AFFF Release Area 9: Hangar 109

Surface and subsurface soil samples will be collected from two borings completed in the grassy area located on the northwest side of Hangar 109. One soil boring will be completed in the grassy area west of the hangar in an area where AFFF staining was observed on the concrete apron extending into the grassy area. The second boring will be completed on the northwest side of the hangar in a grassy area across from the mechanical room where AFFF was released. No existing monitoring wells are present in the vicinity of, or immediately downgradient of Hangar 109; however, basewide groundwater sampling will be conducted including sampling of monitoring wells downgradient of AFFF Area 9. The proposed soil sample locations are illustrated on **Figure 12**.

AFFF Release Area 10: Landfill #4

SI activities relative to Landfill #4 are limited to collecting one groundwater sample from downgradient monitoring well MW-Na, located southeast of the landfill to evaluate potential PFAS impacts in groundwater associated with historical practice of applying water from North Playa Lake to support revegetation of the landfill cover. No soil samples are required relative to Landfill #4. The proposed groundwater sampling location is illustrated on **Figure 13** and **Figure 17**.

AFFF Release Area 11: Active FTA

Surface and subsurface samples will be collected from three soil borings located around the evaporation pond located on the south side of the active FTA. One boring will be completed west of the evaporation basin, one boring will be completed south of the evaporation basin and one basin will be completed east of the evaporation basin. Existing monitoring well MW-A is located downgradient of the active FTA and will be sampled as part of basewide groundwater sampling for PFAS. The proposed soil borings and existing monitoring wells to be sampled are illustrated on **Figure 14**.

AFFF Release Area 12: Perimeter Road Fuel Spill

Two subsurface samples will be collected from one soil boring located in the center of the fuel spill area located southeast of Perimeter Road. The first subsurface sample will be collected in native material beneath the fill that was placed following excavation activities. The second subsurface sample will be collected at a depth of approximately 30 ft bgs to evaluate potential downward migration of PFAS. The proposed soil sampling location is shown on **Figure 15.**

AFFF Release Area 13: Flightline Aircraft Crashes

SI activities proposed relative to the aircraft crash response sites are limited to groundwater sampling of existing monitoring wells located downgradient of the flightline/runway areas. Since the exact locations of the crash response and AFFF release areas were unknown, source soil sampling could not be adequately located. Five existing monitoring wells MW-A, MW-E, MW-Rb, MW-X, and MW-W will be sampled as monitoring wells located downgradient of the crash sites. Monitoring wells MW-E, MW-Rb and MW-W are also considered upgradient of all AFFF release areas with the exception of those along the flightline/apron area, therefore allowing a determination of whether AFFF use/releases on the flightline have resulted in PFAS presence at the installation. The proposed groundwater sampling locations are illustrated on **Figure 16.**

Basewide Groundwater Sampling

Groundwater at Cannon AFB is regulated installation-wide by the NMED rather than on an area-by-area basis. At the request of Cannon AFB personnel, the determination of PFAS presence or absence in groundwater will therefore be limited to sampling of existing monitoring wells approved by NMED in the Cannon AFB Groundwater Monitoring Program. These monitoring wells were installed to evaluate background groundwater quality and groundwater conditions downgradient of industrial/operational areas of the base.

The groundwater sampling plan presented in this ISWP has been developed to evaluate presence or absence of PFAS in groundwater downgradient of known AFFF release areas. A total of 15 existing monitoring wells will be sampled for PFAS, including one monitoring well (MW-V) serving as a background monitoring well. The background monitoring well is located in the northwest corner of the installation, upgradient of all AFFF release areas. The remaining 14 monitoring wells (MW-A through MW-H, MW-Na, MW-Oa, MW-Pa, MW-Rb, MW-W, and MW-X) are located downgradient of one or more AFFF release areas. The locations of monitoring wells to be sampled are illustrated on **Figure 16**.

The proposed number of samples by media (surface soil, subsurface soil, groundwater, surface water, and sediment) to be collected at each AFFF release area described above are summarized in **Table 3**.

Table 3. Proposed Samples per Media at Each AFFF Release Area.

Site	Surface Soil Samples	Subsurface Soil Samples	Groundwater Samples	Surface Water Samples	Sediment Samples
FT-07 (AFFF Release Area 1)	2	2	BW	0	0
FT-08 (AFFF Release Area 2)	2	2	BW	0	0
FTA-4 (AFFF Release Area 3)	3	3	BW	0	0
Hangars 119 and 133 (AFFF Release Area 4)	2	2	BW	0	0
Former Sewage Lagoons (AFFF Release Area 5)	0	10	BW	0	0
North Playa Lake Outfall (AFFF Release Area 6)	0	0	BW	2	2
South Playa Lake Outfall (AFFF Release Area 7)	4	4	BW	2*	2*
Whispering Winds Golf Course (AFFF Release Area 8)	0	0	BW	2	2
Hangar 109 (AFFF Release Area 9)	2	2	BW	0	0
Landfill #4 (AFFF Release Area 10)	0	0	BW	0	0
Active FTA (AFFF Release Area 11)	3	3	BW	0	0
Perimeter Road Fuel Spill (AFFF Release Area 12)	0	2	BW	0	0
Flightline Aircraft Crashes (AFFF Release Area 13)	0	0	BW	0	0
Basewide Groundwater	0	0	15	0	0
Total Primary Samples	18	30	15	6	6
Field Duplicates	2	3	2	1	1
Matrix Spike/Matrix Spike Duplicates	1	2	1	1	1
Field Blanks (Equipment Rinsate Blanks)	10	11	4	1	1
Total Samples	**31**	**46**	**22**	**9**	**9**

Notes:
*Surface water and sediment samples collected only if surface water is present.
AFFF – aqueous film forming foam
BW – Proposed groundwater sample included in basewide total
FTA – fire training area

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QAPP WORKSHEET #18-1: SAMPLING LOCATIONS AND METHODS

AFFF RELEASE AREA 1: FORMER FTA NO. 2

Sample locations are illustrated on **Figure 4**. The proposed sampling summary for AFFF Release Area 1 is presented below.

Location ID	Sample ID	Matrix	Start Depth (ft bgs)	End Depth (ft bgs)	Sample Method	New or Existing Location	Sample Rationale
SB01001	CANON01-SO-001	Surface Soil	0	0.5	Hand Auger	New	Assess PFAS presence in soil in the area of the western former burn pit.
	CANON01-SO-002	Subsurface Soil	28	30	DPT Core/ Split Spoon	New	
SB01002	CANON01-SO-003	Surface Soil	0	0.5	Hand Auger	New	Assess PFAS presence in soil in the area of the eastern former burn pit.
	CANON01-SO-004	Subsurface Soil	28	30	DPT Core/ Split Spoon	New	

Notes:
AFFF – aqueous film forming foam
ID – identification
DPT – direct push technology
PFAS – per- and polyfluorinated alkyl substances
ft bgs – feet below ground surface
SO – soil

Existing monitoring wells that will be sampled to determine PFAS presence relative to AFFF Area 1 are provided in Worksheet #18-14 basewide groundwater sampling.

QAPP WORKSHEET #18-2: SAMPLING LOCATIONS AND METHODS
AFFF RELEASE AREA 2: FORMER FTA NO. 3

Sample locations are illustrated on **Figure 5**. The proposed sampling summary for AFFF Release Area 2 is presented below.

Location ID	Sample ID	Matrix	Start Depth (ft bgs)	End Depth (ft bgs)	Sample Method	New or Existing Location	Sample Rationale
SB02001	CANON02-SO-001	Surface Soil	0	0.5	Hand Auger	New	Assess PFAS presence in soil in the area of the former burn area.
	CANON02-SO-002	Subsurface Soil	28	30	DPT Core/ Split Spoon	New	
SB02002	CANON02-SO-003	Surface Soil	0	0.5	Hand Auger	New	Assess PFAS presence in soil in a downgradient (southeast) location from the former burn area.
	CANON02-SO-004	Subsurface Soil	28	30	DPT Core/ Split Spoon	New	

Notes:
AFFF – aqueous film forming foam
ID – identification
DPT – direct push technology
PFAS – per- and polyfluorinated alkyl substances
ft bgs – feet below ground surface
SO – soil

Existing monitoring wells that will be sampled to determine PFAS presence relative to AFFF Area 2 are provided in Worksheet #18-14 basewide groundwater sampling.

QAPP WORKSHEET #18-3: SAMPLING LOCATIONS AND METHODS
AFFF RELEASE AREA 3: FORMER FTA NO. 4

Sample locations are illustrated on **Figure 6**. The proposed sampling summary for AFFF Release Area 3 is presented below.

Location ID	Sample ID	Matrix	Start Depth (ft bgs)	End Depth (ft bgs)	Sample Method	New or Existing Location	Sample Rationale
SB03001	CANON03-SO-001	Surface Soil	0	0.5	Hand Auger	New	Assess PFAS presence in soil in the area of the former mock aircraft burn area.
	CANON03-SO-002	Subsurface Soil	48	50	DPT Core/ Split Spoon	New	
SB03002	CANON03-SO-003	Surface Soil	0	0.5	Hand Auger	New	Assess PFAS presence in soil in the area of the former OWS/unlined discharge pit.
	CANON03-SO-004	Subsurface Soil	48	50	DPT Core/ Split Spoon	New	
SB03003	CANON03-SO-005	Surface Soil	0	0.5	Hand Auger	New	Assess PFAS presence in soil in the northwest portion of the FTA in the area of vehicle chassis training.
	CANON03-SO-006	Subsurface Soil	48	50	DPT Core/ Split Spoon	New	

Notes:
AFFF – aqueous film forming foam
FTA – fire training area
PFAS – per- and polyfluorinated alkyl substances
DPT – direct push technology
ID – identification
SO – soil
ft bgs – feet below ground surface
OWS – oil-water separator

Existing monitoring wells that will be sampled to determine PFAS presence relative to AFFF Area 3 are provided in Worksheet #18-14 basewide groundwater sampling.

QAPP WORKSHEET #18-4: SAMPLING LOCATIONS AND METHODS
AFFF RELEASE AREA 4: HANGARS 119 AND 133

Sample locations are illustrated on **Figure 7**. The proposed sampling summary for AFFF Release Area 4 is presented below.

Location ID	Sample ID	Matrix	Start Depth (ft bgs)	End Depth (ft bgs)	Sample Method	New or Existing Location	Sample Rationale
SB04001	CANON04-SO-001	Surface Soil	0	0.5	Hand Auger	New	Assess PFAS presence in soil in a grassy area where surface flow from Hangar 119 could have collected.
	CANON04-SO-002	Subsurface Soil	28	30	DPT Core/ Split Spoon	New	
SB04002	CANON04-SO-003	Surface Soil	0	0.5	Hand Auger	New	Assess PFAS presence in soil in a grassy area where surface flow from Hangar 133 could have collected.
	CANON04-SO-004	Subsurface Soil	28	30	DPT Core/ Split Spoon	New	

Notes:
AFFF – aqueous film forming foam
ID – identification
DPT – direct push technology
PFAS – per- and polyfluorinated alkyl substances
ft bgs – feet below ground surface
SO – soil

Existing monitoring wells that will be sampled to determine PFAS presence relative to AFFF Area 4 are provided in Worksheet #18-14 basewide groundwater sampling.

QAPP WORKSHEET #18-5: SAMPLING LOCATIONS AND METHODS
AFFF RELEASE AREA 5: FORMER SEWAGE LAGOONS

Sample locations are illustrated on **Figure 8**. The proposed sampling summary for AFFF Release Area 5 is presented below.

Location ID	Sample ID	Matrix	Start Depth (ft bgs)	End Depth (ft bgs)	Sample Method	New or Existing Location	Sample Rationale
SB05001	CANON05-SO-001	Subsurface Soil	4	5	DPT Core	New	Assess PFAS presence in sludge in the former southern lagoon below the engineered cap
	CANON05-SO-002	Subsurface Soil	9	10	DPT Core	New	
SB05002	CANON05-SO-003	Subsurface Soil	4	5	DPT Core	New	
	CANON05-SO-004	Subsurface Soil	9	10	DPT Core	New	
SB05003	CANON05-SO-005	Subsurface Soil	4	5	DPT Core	New	
	CANON05-SO-006	Subsurface Soil	9	10	DPT Core	New	
SB05004	CANON05-SO-007	Subsurface Soil	4	5	DPT Core	New	
	CANON05-SO-008	Subsurface Soil	9	10	DPT Core	New	
SB05005	CANON05-SO-009	Subsurface Soil	4	5	DPT Core	New	
	CANON05-SO-010	Subsurface Soil	9	10	DPT Core	New	

Notes:
AFFF – aqueous film forming foam
DPT – direct push technology
ft bgs – feet below ground surface
ID – identification
PFAS – per- and polyfluorinated alkyl substances
SO – soil

Existing monitoring wells that will be sampled to determine PFAS presence relative to AFFF Area 5 are provided in Worksheet #18-14 basewide groundwater sampling.

QAPP WORKSHEET #18-6: SAMPLING LOCATIONS AND METHODS
AFFF RELEASE AREA 6: NORTH PLAYA LAKE OUTFALL

Sample locations are illustrated on **Figure 9**. The proposed sampling summary for AFFF Release Area 6 is presented below.

Location ID	Sample ID	Matrix	Start Depth (ft bgs)	End Depth (ft bgs)	Sample Method	New or Existing Location	Sample Rationale
SD/SW06001	CANON06-SD-001	Sediment	0	0.5	Grab	New	Assess PFAS presence in sediment and surface water in North Playa Lake at the WWTP outfall.
	CANON06-SW-001	Surface Water	0	0.5	Grab	New	
SD/SW06002	CANON06-SD-002	Sediment	0	0.5	Grab	New	Assess PFAS presence in sediment and surface water along the northern perimeter of North Playa Lake.
	CANON06-SW-002	Surface Water	0	0.5	Grab	New	

Notes:
AFFF – aqueous film forming foam
PFAS – per- and polyfluorinated alkyl substances
WWTP – waste water treatment plant
ft bgs – feet below ground surface
SD – sediment
ID – identification
SW – surface water

Existing monitoring wells that will be sampled to determine PFAS presence relative to AFFF Area 6 are provided in Worksheet #18-14 basewide groundwater sampling.

QAPP WORKSHEET #18-7: SAMPLING LOCATIONS AND METHODS
AFFF RELEASE AREA 7: SOUTH PLAYA LAKE OUTFALL

Sample locations are illustrated on **Figure 10**. The proposed sampling summary for AFFF Release Area 7 is presented below.

Location ID	Sample ID	Matrix	Start Depth (ft bgs)	End Depth (ft bgs)	Sample Method	New or Existing Location	Sample Rationale
SB07001	CANON07-SO-001	Surface Soil	0	0.5	Hand Auger	New	Assess PFAS presence in soil in South Playa Lake in the area of the western sewer outfall.
	CANON07-SO-002	Subsurface Soil	23	25	DPT Core/ Split Spoon	New	
SB07002	CANON07-SO-003	Surface Soil	0	0.5	Hand Auger	New	Assess PFAS presence in soil in South Playa Lake in the area of the northern sewer outfall.
	CANON07-SO-004	Subsurface Soil	23	25	DPT Core/ Split Spoon	New	
SB07003	CANON07-SO-005	Surface Soil	0	0.5	Hand Auger	New	Assess PFAS presence in soil in South Playa Lake in the area of the eastern sewer outfall.
	CANON07-SO-006	Subsurface Soil	23	25	DPT Core/ Split Spoon	New	
SB07004	CANON07-SO-007	Surface Soil	0	0.5	Hand Auger	New	Assess PFAS presence in soil in the approximate center of South Playa Lake.
	CANON07-SO-008	Subsurface Soil	23	25	DPT Core/ Split Spoon	New	

Notes:
AFFF – aqueous film forming foam
ID – identification
DPT- direct push technology
PFAS – per- and polyfluorinated alkyl substances
ft bgs – feet below ground surface
SO – soil

Existing monitoring wells that will be sampled to determine PFAS presence relative to AFFF Area 7 are provided in Worksheet #18-14 basewide groundwater sampling.

QAPP WORKSHEET #18-8: SAMPLING LOCATIONS AND METHODS
AFFF RELEASE AREA 8: WHISPERING WINDS GOLF COURSE

Sample locations are illustrated on **Figure 11**. The proposed sampling summary for AFFF Release Area 8 is presented below.

Location ID	Sample ID	Matrix	Start Depth (ft bgs)	End Depth (ft bgs)	Sample Method	New or Existing Location	Sample Rationale
SD/SW08001	CANON08-SD-001	Sediment	0	0.5	Grab	New	Assess PFAS presence in sediment and surface water in the western golf course pond.
	CANON08-SW-001	Surface Water	0	0.5	Grab	New	
SD/SW08002	CANON08-SD-002	Sediment	0	0.5	Grab	New	Assess PFAS presence in sediment and surface water in the eastern golf course pond.
	CANON08-SW-002	Surface Water	0	0.5	Grab	New	

Notes:
AFFF – aqueous film forming foam
PFAS – per- and polyfluorinated alkyl substances
ft bgs – feet below ground surface
SD – sediment
ID – identification
SW – surface water

QAPP WORKSHEET #18-9: SAMPLING LOCATIONS AND METHODS
AFFF RELEASE AREA 9: HANGAR 109

Sample locations are illustrated on **Figure 12**. The proposed sampling summary for AFFF Release Area 9 is presented below.

Location ID	Sample ID	Matrix	Start Depth (ft bgs)	End Depth (ft bgs)	Sample Method	New or Existing Location	Sample Rationale
SB09001	CANON09-SO-001	Surface Soil	0	0.5	Hand Auger	New	Assess PFAS presence in soil in the stained area northwest of the hangar.
	CANON09-SO-002	Subsurface Soil	28	30	DPT Core/ Split Spoon	New	
SB09002	CANON09-SO-003	Surface Soil	0	0.5	Hand Auger	New	Assess PFAS presence in soil in the stained area north of the hangar.
	CANON09-SO-004	Subsurface Soil	28	30	DPT Core/ Split Spoon	New	

Notes:
AFFF – aqueous film forming foam
DPT- direct push technology
ft bgs – feet below ground surface
ID – identification
PFAS – per- and polyfluorinated alkyl substances
SO – soil

Existing monitoring wells that will be sampled to determine PFAS presence relative to AFFF Area 9 are provided in Worksheet #18-14 basewide groundwater sampling.

QAPP WORKSHEET #18-10: SAMPLING LOCATIONS AND METHODS
AFFF RELEASE AREA 10: LANDFILL #4

The sample location is illustrated on **Figure 13**. The proposed sampling summary for AFFF Release Area 10 is limited to sampling groundwater from one existing monitoring well. Proposed sampling summary for groundwater is included in **QAPP Worksheet #18-14**.

QAPP WORKSHEET #18-11: SAMPLING LOCATIONS AND METHODS
AFFF RELEASE AREA 11: ACTIVE FTA

Sample locations are illustrated on **Figure 14**. The proposed sampling summary for AFFF Release Area 11 is presented below.

Location ID	Sample ID	Matrix	Start Depth (ft bgs)	End Depth (ft bgs)	Sample Method	New or Existing Location	Sample Rationale
SB11001	CANON11-SO-001	Surface Soil	0	0.5	Hand Auger	New	Assess PFAS presence in soil on the west side of the FTA evaporation basin.
	CANON11-SO-002	Subsurface Soil	23	25	Split Spoon	New	
SB11002	CANON11-SO-003	Surface Soil	0	0.5	Hand Auger	New	Assess PFAS presence in soil on the south side of the FTA evaporation basin.
	CANON11-SO-004	Subsurface Soil	23	25	Split Spoon	New	
SB11003	CANON11-SO-005	Surface Soil	0	0.5	Hand Auger	New	Assess PFAS presence in soil on the east side of the FTA evaporation basin.
	CANON11-SO-006	Subsurface Soil	23	25	Split Spoon	New	

Notes:
AFFF – aqueous film forming foam
ft bgs – feet below ground surface
FTA – fire training area
ID – identification
PFAS – per- and polyfluorinated alkyl substances
SO - soil

Existing monitoring wells that will be sampled to determine PFAS presence relative to AFFF Area 11 are provided in Worksheet #18-14 basewide groundwater sampling.

QAPP WORKSHEET #18-12: SAMPLING LOCATIONS AND METHODS
AFFF RELEASE AREA 12: PERIMETER ROAD FUEL SPILL

Sample locations are illustrated on **Figure 15**. The proposed sampling summary for AFFF Release Area 12 is presented below.

Location ID	Sample ID	Matrix	Start Depth (ft bgs)	End Depth (ft bgs)	Sample Method	New or Existing Location	Sample Rationale
SB12001	CANON12-SO-001	Subsurface Soil	10	12	Split Spoon	New	Assess PFAS presence in soil in the area of the fuel spill, below the limits of the remedial excavation.
	CANON12-SO-002	Subsurface Soil	28	30	Split Spoon	New	

Notes:
AFFF – aqueous film forming foam
PFAS – per- and polyfluorinated alkyl substances
ft bgs – feet below ground surface
SO – soil
ID – identification

Existing monitoring wells that will be sampled to determine PFAS presence relative to AFFF Area 12 are provided in Worksheet #18-14 basewide groundwater sampling.

QAPP WORKSHEET #18-13: SAMPLING LOCATIONS AND METHODS
AFFF RELEASE AREA 13: FLIGHTLINE AIRCRAFT CRASHES

Sample locations are illustrated on **Figure 16**. The proposed sampling summary for AFFF Release Area 13 is limited to sampling groundwater from existing monitoring wells. Proposed sampling summary for groundwater is included in **QAPP Worksheet #18-14**.

QAPP WORKSHEET #18-14: SAMPLING LOCATIONS AND METHODS
BASEWIDE GROUNDWATER SAMPLING

Sample locations are illustrated on **Figure 17**. The proposed sampling summary for basewide groundwater sampling for PFAS is presented below.

Location ID	Sample ID	Matrix	Start Depth (ft bgs)	End Depth (ft bgs)	Sample Method	New or Existing Location	Sample Rationale
MW-A	CANON11-GW-001	Groundwater	320	340	SP	Existing	Sampled to assess potential PFAS presence in groundwater downgradient of the active FTA and South Playa Lake.
MW-B	CANON14-GW-002	Groundwater	350	365	SP	Existing	Sampled to assess potential PFAS presence in groundwater in the southeast corner of the CANONn AFB that serves as downgradient most location for all AFFF areas.
MW-C	CANON14-GW-003	Groundwater	350	370	SP	Existing	Sampled to assess potential PFAS presence in groundwater in the southeast corner of the CANONn AFB that serves as downgradient most location for all AFFF areas.
MW-D	CANON14-GW-004	Groundwater	340	360	SP	Existing	Sampled to assess potential PFAS presence in groundwater downgradient of the FTA sites and South Playa Lake.
MW-E	CANON14-GW-005	Groundwater	330	350	SP	Existing	Assess PFAS presence in groundwater downgradient (southeast) of flightline crash sites and hangars located at the northern end of the parking apron.
MW-F	CANON14-GW-006	Groundwater	350	370	SP	Existing	Assess PFAS presence downgradient (southeast) of the former sewage lagoon area.

Location ID	Sample ID	Matrix	Start Depth (ft bgs)	End Depth (ft bgs)	Sample Method	New or Existing Location	Sample Rationale
MW-G	CANON14-GW-007	Groundwater	350	370	SP	Existing	Assess PFAS presence downgradient (southeast) of the former sewage lagoon area and hangars (109, 119 and 133) located at the southern end of parking apron.
MW-H	CANON14-GW-008	Groundwater	330	350	SP	Existing	Assess PFAS presence downgradient (southeast) of the former sewage lagoon area and hangars (109, 119 and 133) located at the southern end of parking apron.
MW-Na	CANON14-GW-009	Groundwater	300	320	SP	Existing	Assess PFAS presence in groundwater downgradient (southeast) of landfill #4.
MW-Oa	CANON14-GW-010	Groundwater	300	360	SP	Existing	Assess PFAS presence in groundwater downgradient (southeast) of North Playa Lake.
MW-Pa	CANON14-GW-011	Groundwater	300	360	SP	Existing	Assess PFAS presence downgradient (southeast) of the former sewage lagoon area.
MW-Rb	CANON14-GW-012	Groundwater	300	330	SP	Existing	Assess PFAS presence in groundwater downgradient (southeast) of the F-111 crash area at the north end of the runway. The monitoring well is also downgradient of hangar/apron areas where AFFF has been released.
MW-V	CANON14-GW-013	Groundwater	310	370	SP	Existing	Background monitoring well located in northwest corner of the installation, upgradient of all AFFF areas.

Location ID	Sample ID	Matrix	Start Depth (ft bgs)	End Depth (ft bgs)	Sample Method	New or Existing Location	Sample Rationale
MW-W	CANON14-GW-014	Groundwater	300	360	SP	Existing	Assess PFAS presence in groundwater downgradient (southeast) of the F-111 crash area at the north end of the runway. The monitoring well is also downgradient of hangar/apron areas where AFFF has been released
MW-X	CANON14-GW-015	Groundwater	270	330	SP	Existing	Assess PFAS presence in groundwater in the vicinity of an F-16 aircraft crash at the south-western end of the runway.

Notes:

AFFF – aqueous film forming foam
GW – groundwater
PFAS – per- and polyfluorinated alkyl substances
ft bgs – feet below ground surface
ID – identification
SP – submersible pump
FTA – fire training area
MW – monitoring well

QAPP WORKSHEET #20: FIELD QC SUMMARY

The installation wide field QC summary is presented below. Equipment rinsate blanks will be collected at a rate of one per non-dedicated piece of equipment, per day, per crew. As a result, the number of equipment rinsate blanks will be determined in the field. Field blanks will be determined in the field based on the media sampled and sources of PFAS-free water.

Matrix	Analyte	Primary Samples	Field Duplicates (1:10 Basewide)	Equipment Rinsate (1:10 for each piece of equipment per day)	Field Blanks (1 per lot of PFAS-free water)	MS/MSDs (1:20 Basewide)	Total Samples
Soil	PFAS	48	5	21	0	3	73
Groundwater	PFAS	15	2	2	2	1	22
Sediment	PFAS	6	1	1	0	1	9
Surface Water	PFAS	6	1	1	0	1	9
TOTALS		**71**	**9**	**25**	**2**	**6**	**113**

Notes:
MS/MSD – matrix spike/matrix spike duplicate
PFAS – per- and polyfluorinated alkyl substances

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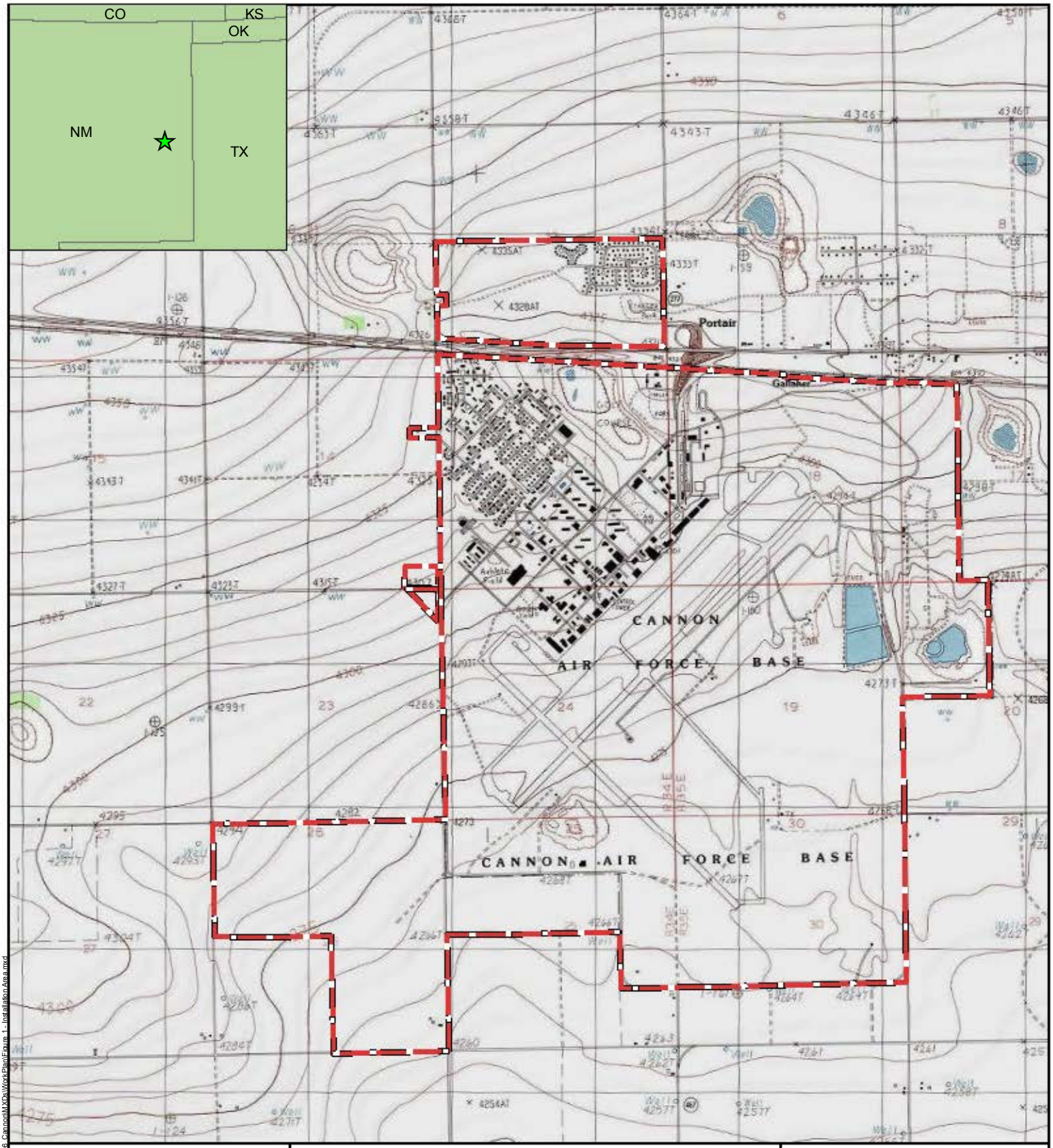
FIGURES



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Project: 775303101.0006

By: M.Vavra | Date: 4/12/2017

0 1,000 2,000 4,000 Feet

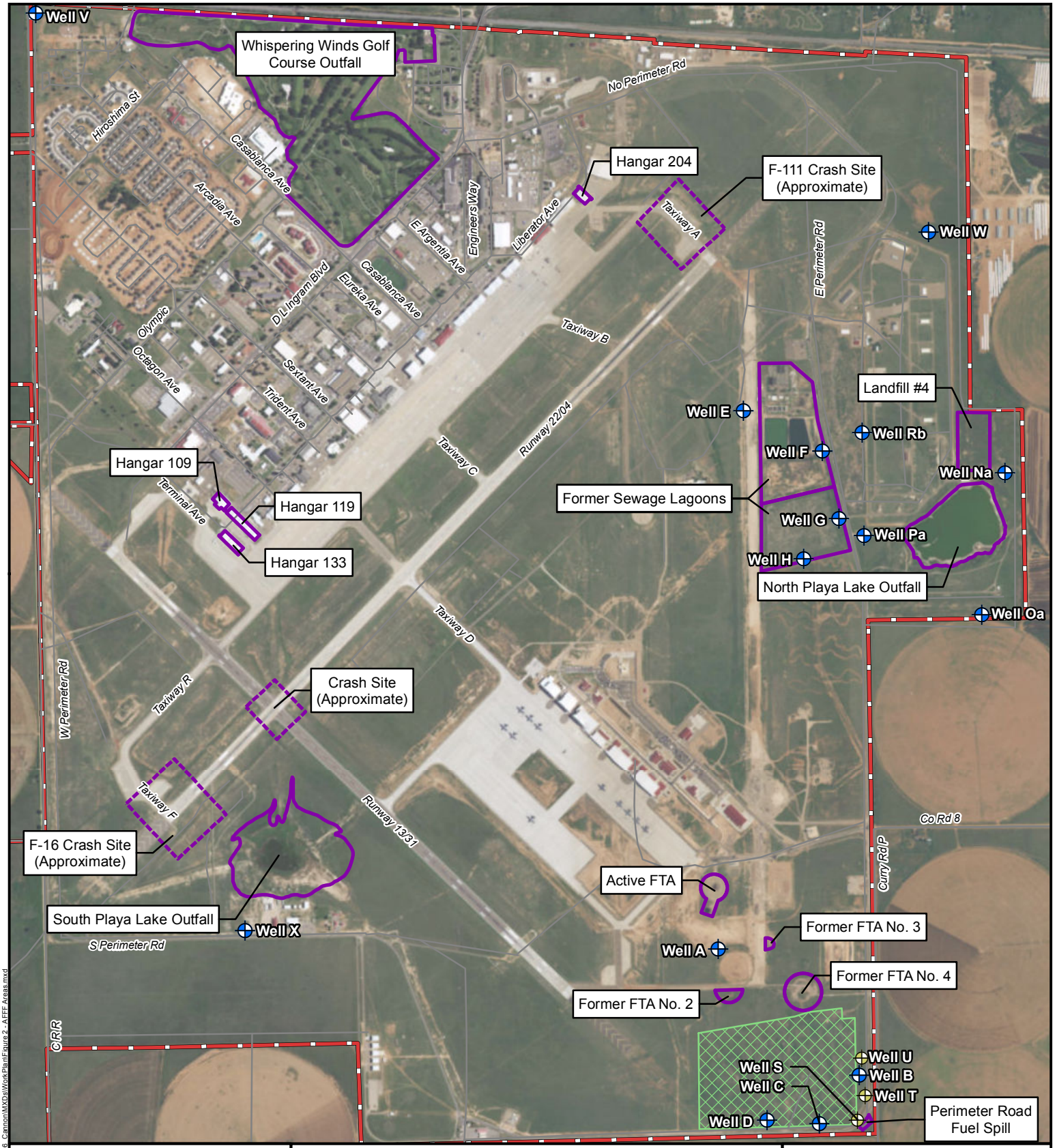
Symbol Key

Cannon Air Force Base Installation Boundary

FIGURE 1
Site Location Map
Cannon Air Force Base
Clovis, New Mexico

Site Inspection of Aqueous Film Forming Foam (AFFF) Release Areas
Environmental Programs Worldwide Installation-Specific Work Plan

Path: C:\Worksace\GIS_Projects\775303101_USAF_Active_PFCs\00006_Cannon\MXDs\WorkPlan\Figure 1 - Installation Area.mxd



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0 500 1,000 2,000 Feet

Symbol Key

- Existing Monitoring Well
- Existing Monitoring Well (Dry, To Be Replaced)
- Roads
- Streams
- Potential AFFF Release
- Potential AFFF Release Area (Approximate)
- Cannon Air Force Base Installation Boundary
- Landfill 5 Area

Figure 2
Proposed AFFF Release Areas for Site Inspection
Cannon Air Force Base
Clovis, New Mexico

Site Inspection of Aqueous Film Forming Foam (AFFF) Release Areas
Environmental Programs Worldwide Installation-Specific Work Plan

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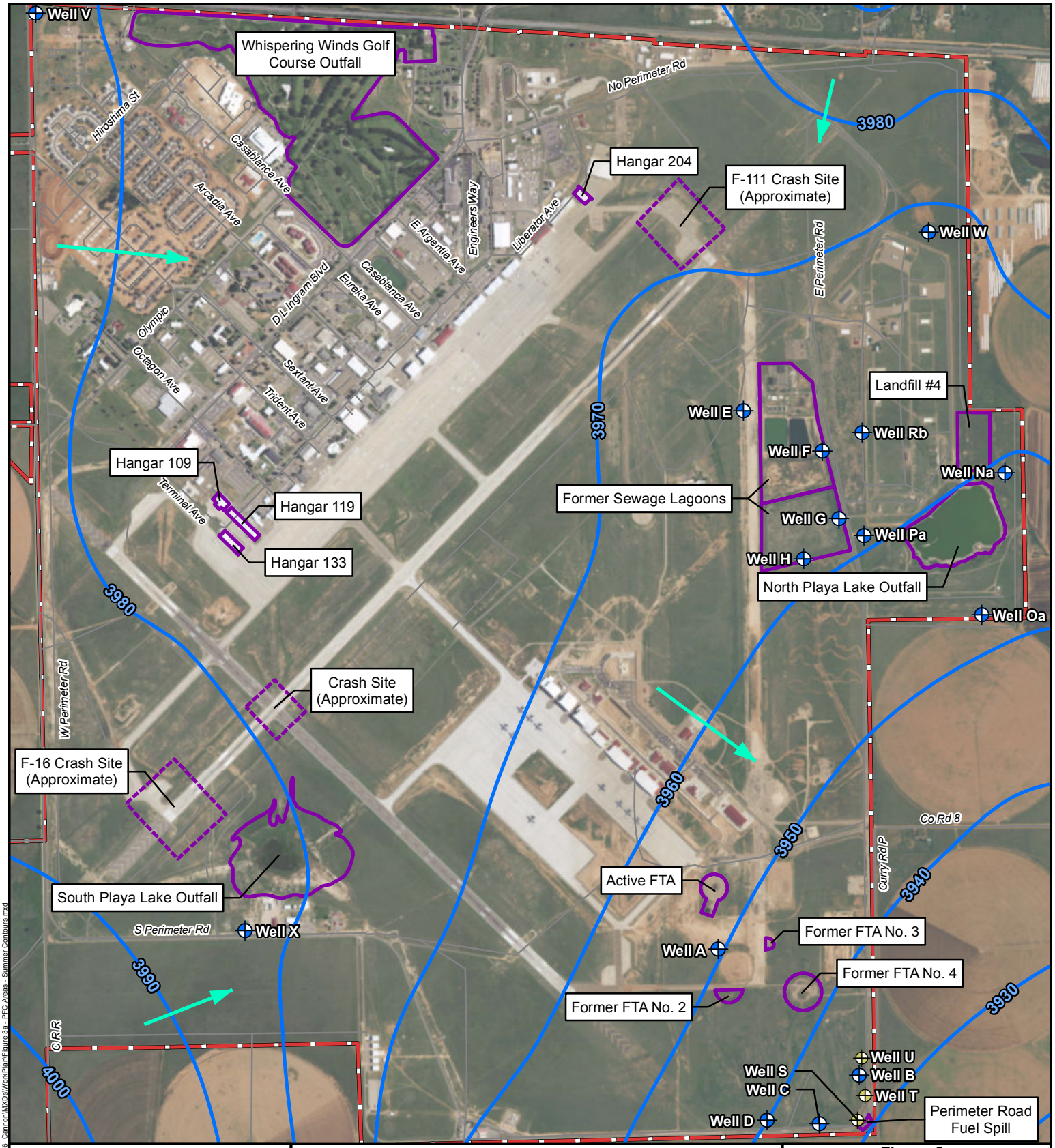

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Project: 775303101.0006

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0 500 1,000 2,000 Feet

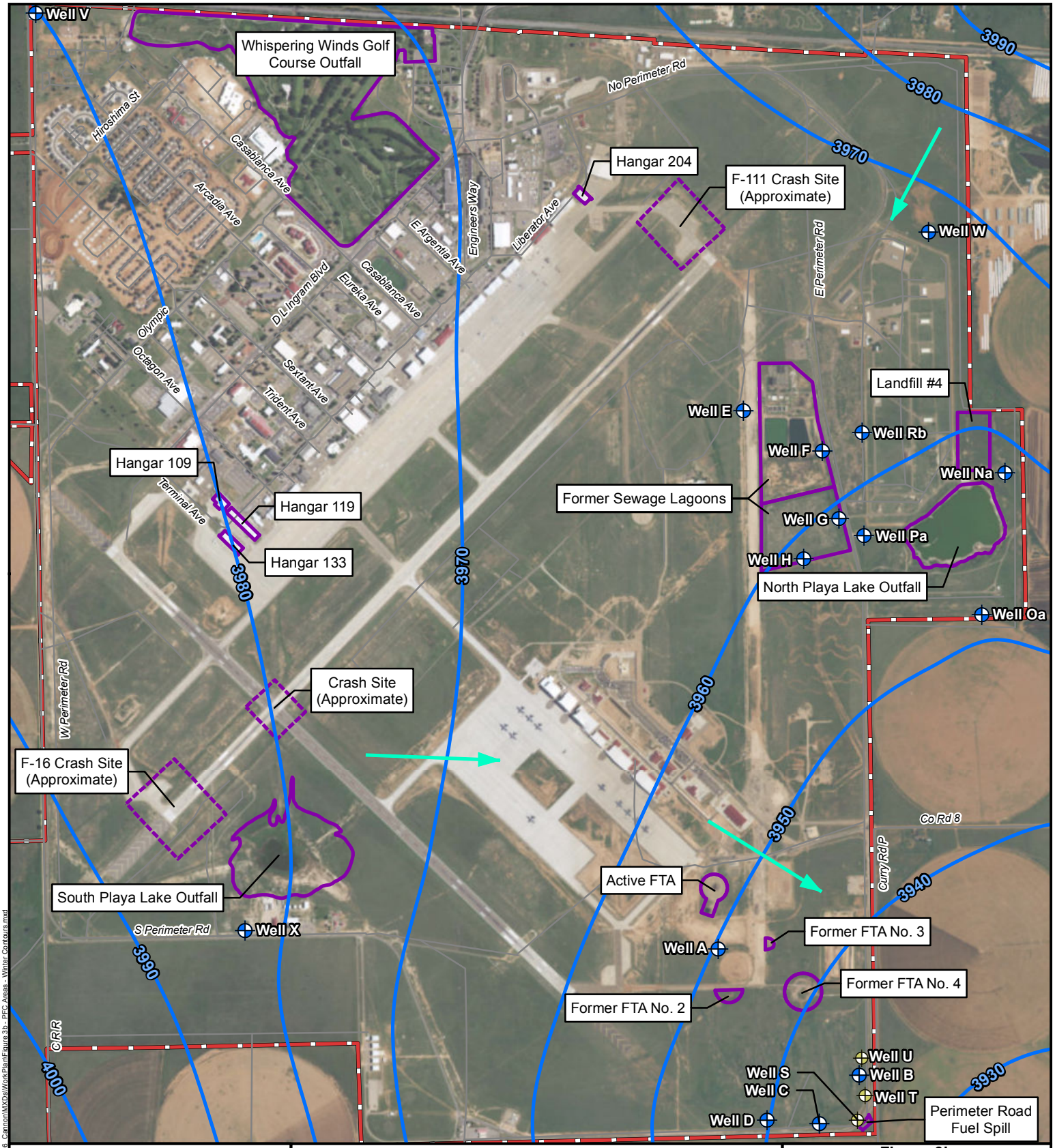
Symbol Key

- Existing Monitoring Well
- Existing Monitoring Well (Dry, To Be Replaced)
- Roads
- Streams
- Approximate Groundwater Elevation Contour - Summer (USGS, 2016)
- Approximate Groundwater Flow Direction
- Potential AFFF Release
- Potential AFFF Release Area (Approximate)
- Cannon Air Force Base Installation Boundary

Figure 3a
Proposed AFFF Release Areas for Site Inspection - June 2014 Groundwater Elevation Contour Map
Cannon Air Force Base
Clovis, New Mexico

Site Inspection of Aqueous Film Forming Foam (AFFF) Release Areas
Environmental Programs Worldwide Installation-Specific Work Plan

Path: C:\Workspace\GIS_Projects\775303101_USAF_Active_PFCs\0006_Cannon\MXDs\Work Plan\Figure 3a - PFC Areas - Summer Contours.mxd



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0 500 1,000 2,000 Feet

Symbol Key

- Existing Monitoring Well
- Existing Monitoring Well (Dry, To Be Replaced)
- Roads
- Streams
- Approximate Groundwater Elevation Contour - Winter (USGS, 2016)
- Approximate Groundwater Flow Direction
- Potential AFFF Release
- Potential AFFF Release Area (Approximate)
- Cannon Air Force Base Installation Boundary

Figure 3b
Proposed AFFF Release Areas for Site Inspection - September 2014 Groundwater Elevation Contour Map
Cannon Air Force Base
Clovis, New Mexico

Site Inspection of Aqueous Film Forming Foam (AFFF) Release Areas
Environmental Programs Worldwide Installation-Specific Work Plan

Path: C:\Workspace\GIS_Projects\775303101_USAF_Active_PFCs\0006_Cannon\MXDs\Work Plan\Figure 3b - PFC Areas - Winter Contours.mxd

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0 50 100 200 Feet

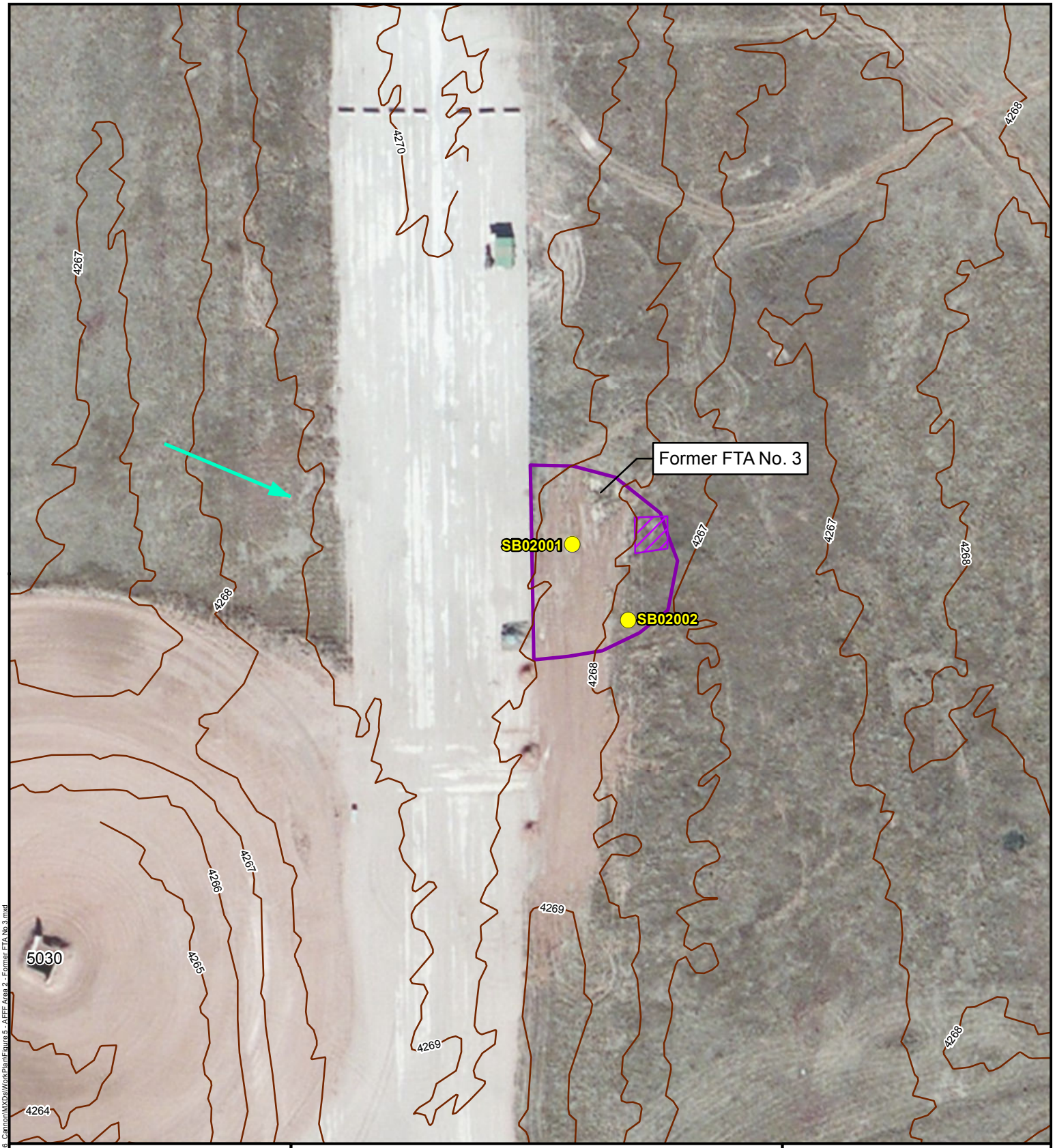
Symbol Key

- Proposed Soil Boring
- Existing Monitoring Well
- Ground Surface Elevation Contour (ft amsl)
- Historic Features
- Approximate Groundwater Flow Direction
- Potential AFFF Release Area

FIGURE 4
Proposed Sampling Locations
Former FTA No. 2
AFFF Release Area 1
Cannon Air Force Base
Clovis, New Mexico

Site Inspection of Aqueous Film Forming Foam (AFFF) Release Areas
Environmental Programs Worldwide Installation-Specific Work Plan

Path: C:\Workspace\GIS_Projects\775303101_USAF_Active_PFCs\0006_Cannon\MXDs\Work Plan\Figure 4 - AFFF Area 1 - Former FTA No 2.mxd



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0 25 50 100 150 Feet

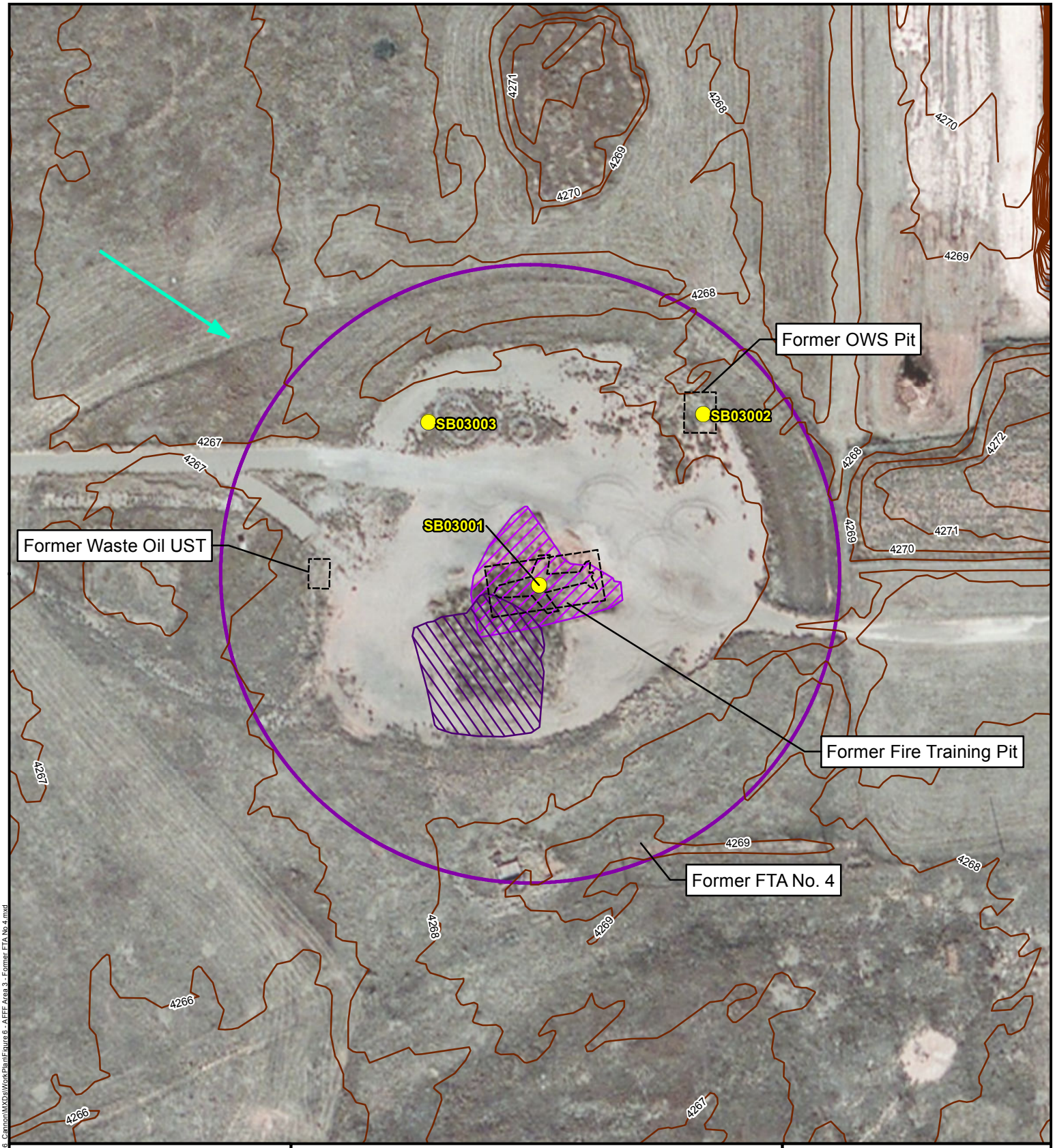
Symbol Key

- Proposed Soil Boring
- Ground Surface Elevation Contour (ft amsl)
- Approximate Groundwater Flow Direction
- Potential AFFF Release Area
- 2013 Excavation Area

FIGURE 5
Proposed Sampling Locations
Former FTA No. 3
AFFF Release Area 2
Cannon Air Force Base
Clovis, New Mexico

Site Inspection of Aqueous Film Forming Foam (AFFF) Release Areas
Environmental Programs Worldwide Installation-Specific Work Plan

Path: C:\Workspace\GIS_Projects\775303101_USAF_Active_PFCs\0006_Cannon\MXDs\Work Plan\Figure 5 - AFFF Area 2 - Former FTA No 3.mxd



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0 25 50 100 150 Feet

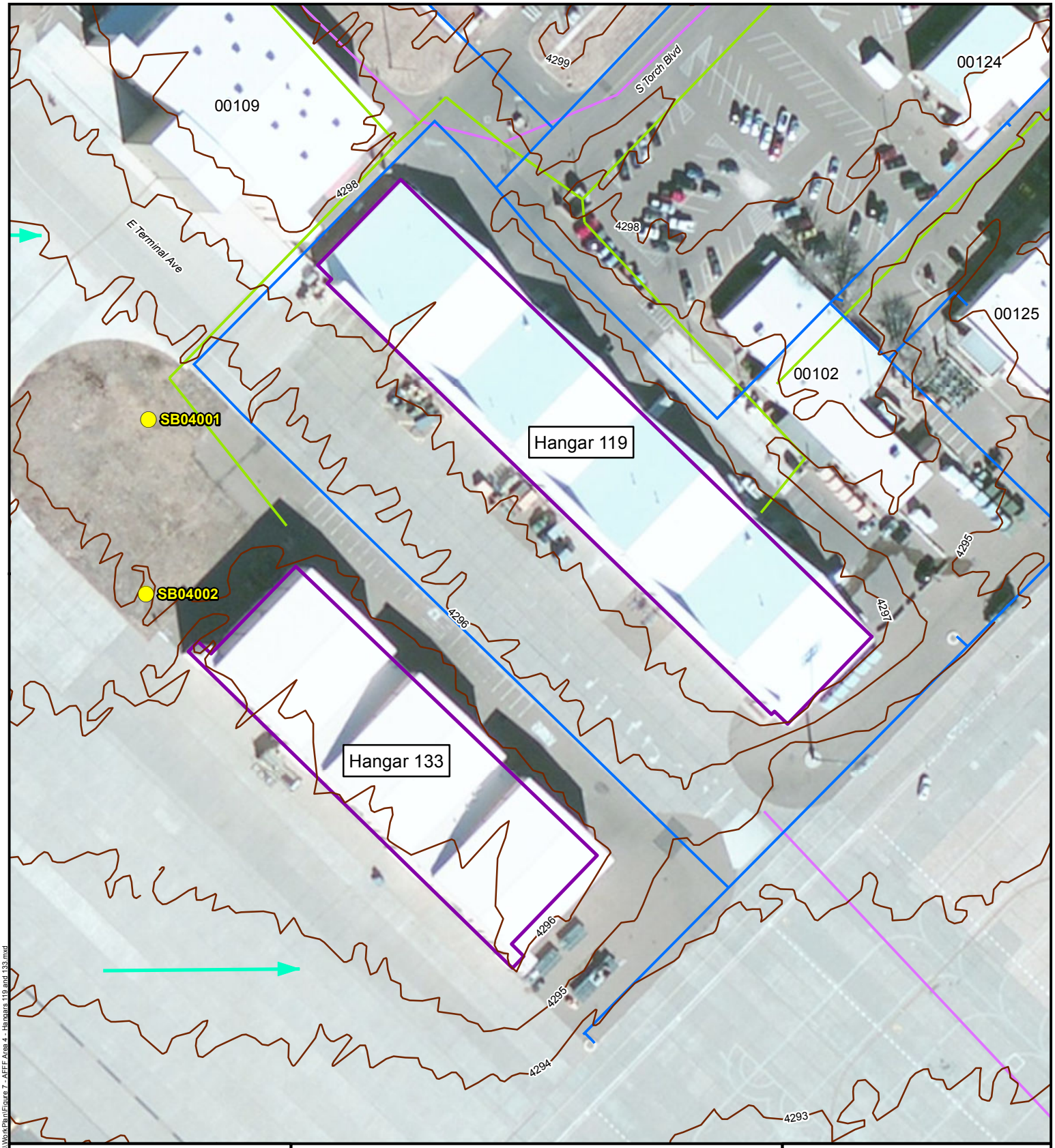
Symbol Key

- Proposed Soil Boring
- Ground Surface Elevation Contour (ft amsl)
- Historic Features
- Approximate Groundwater Flow Direction
- Potential AFFF Release Area
- Limits of 2005 Excavation
- Limits of 2009 Excavation

FIGURE 6
Proposed Sampling Locations
Former FTA No. 4
AFFF Release Area 3
Cannon Air Force Base
Clovis, New Mexico

Site Inspection of Aqueous Film Forming Foam (AFFF) Release Areas
Environmental Programs Worldwide
Installation-Specific Work Plan

Path: C:\Workspace\GIS_Projects\775303101_USAF_Active_PFCs\0006_Cannon\MXDs\Work Plan\Figure 6 - AFFF Area 3 - Former FTA No 4.mxd



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0 25 50 100 150 Feet

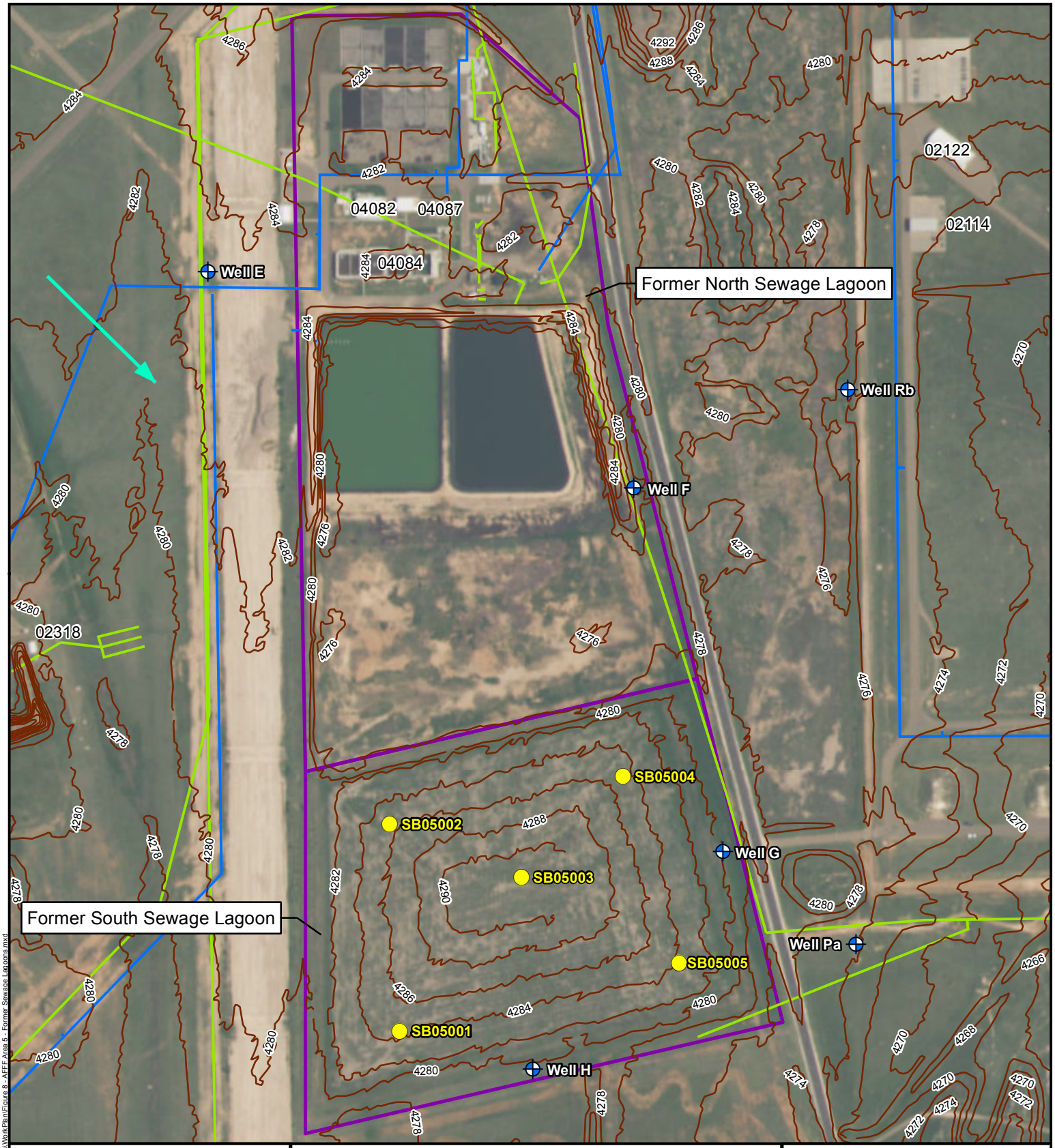
Symbol Key

- Proposed Soil Boring
- Water Line
- Sanitary Sewer Line
- Storm Sewer Line
- Ground Surface Elevation Contour (ft amsl)
- Approximate Groundwater Flow Direction
- Potential AFFF Release Area

FIGURE 7
Proposed Sampling Locations
Hangars 119 and 133
AFFF Release Area 4
Cannon Air Force Base
Clovis, New Mexico

Site Inspection of Aqueous Film Forming Foam (AFFF) Release Areas
Environmental Programs Worldwide Installation-Specific Work Plan

Path: H:\Projects\775303101_USAF_Active_PFCs\0006_Cannon\MXDs\WorkPlan\Figure 7 - AFFF Area 4 - Hangars 119 and 133.mxd



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0 50 100 200 300 400 500 Feet

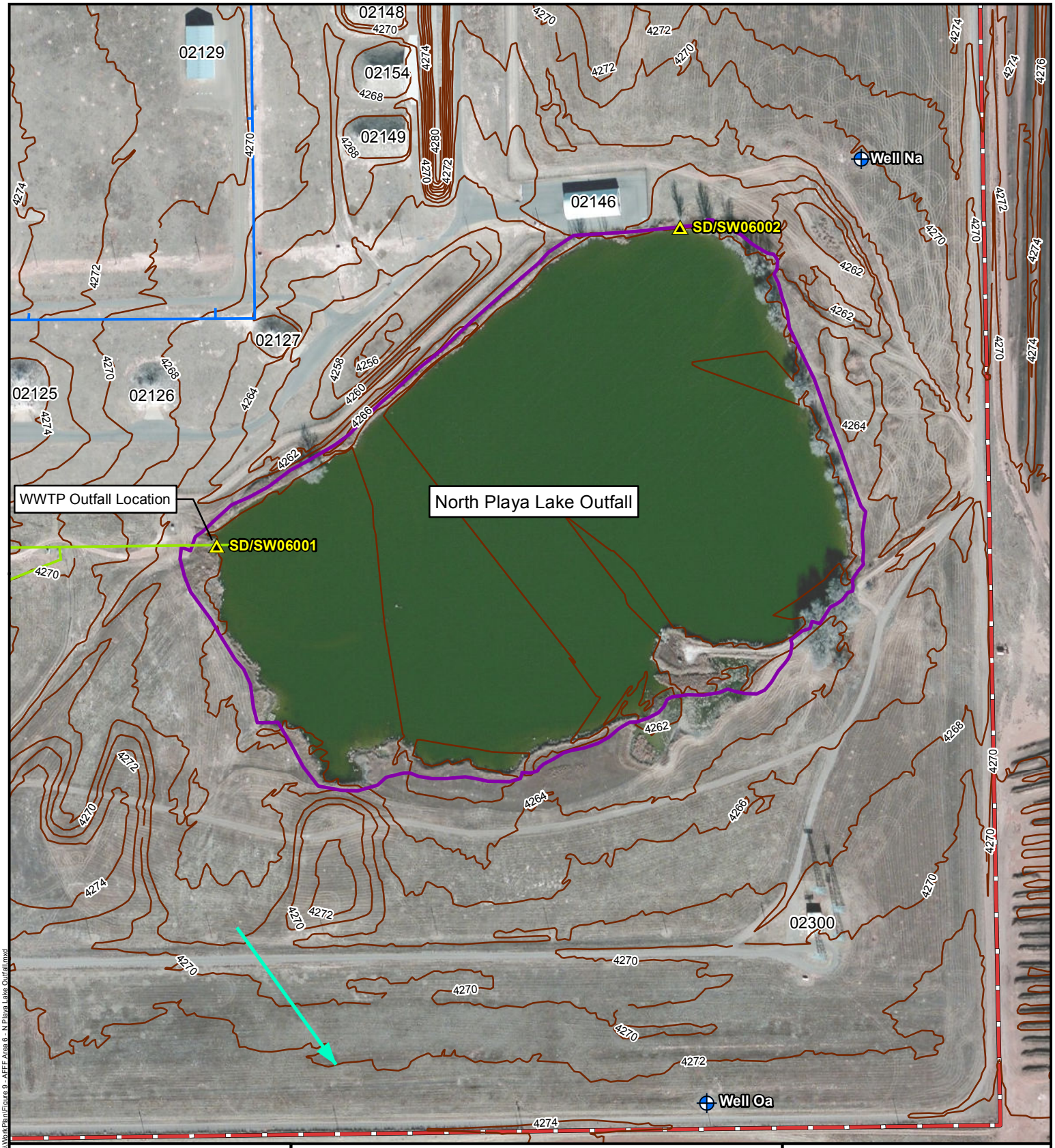
Symbol Key

- Proposed Soil Boring
- Existing Monitoring Well
- Water Line
- Sanitary Sewer Line
- Ground Surface Elevation Contour (ft amsl)
- Approximate Groundwater Flow Direction
- Potential AFFF Release Area

FIGURE 8
Proposed Sampling Locations
Former Sewage Lagoons
AFFF Release Area 5
Cannon Air Force Base
Clovis, New Mexico

Site Inspection of Aqueous Film Forming Foam (AFFF) Release Areas
Environmental Programs Worldwide Installation-Specific Work Plan

Path: H:\Projects\775303101_USAF_Activa_PFCs\0006_Cannon\MXDs\WorkPlan\Figure 8 - AFFF Area 5 - Former Sewage Lagoons.mxd



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0 100 200 400 Feet

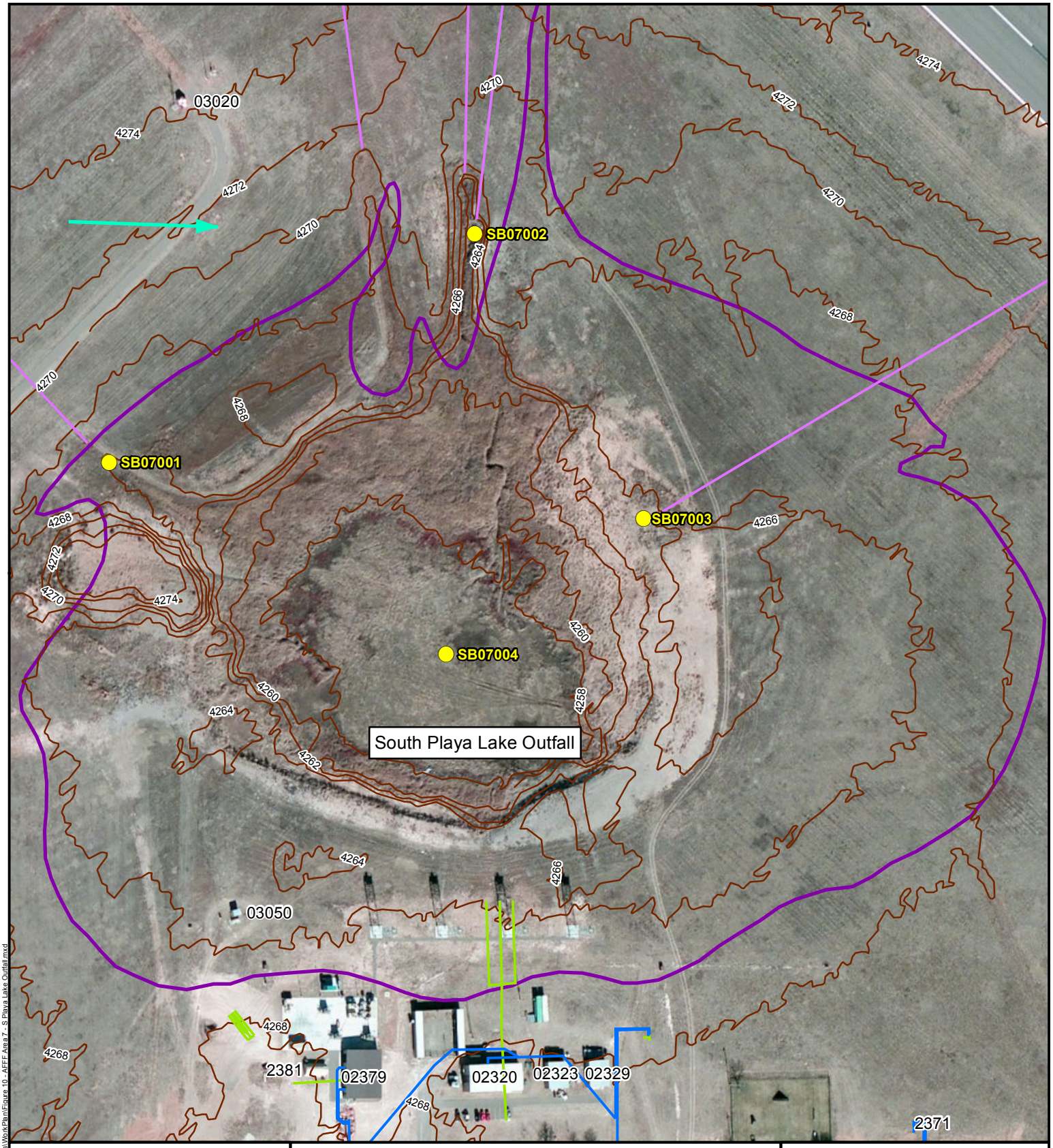
Symbol Key

- Proposed Sediment / Surface Water Sample
- Existing Monitoring Well
- Water Line
- Sanitary Sewer Line
- Ground Surface Elevation Contour (ft amsl)
- Approximate Groundwater Flow Direction
- Potential AFFF Release Area
- Cannon Air Force Base Installation Boundary

FIGURE 9
Proposed Sampling Locations
North Playa Lake Outfall
AFFF Release Area 6
Cannon Air Force Base
Clovis, New Mexico

Site Inspection of Aqueous Film Forming Foam (AFFF) Release Areas
Environmental Programs Worldwide Installation-Specific Work Plan

Path: H:\Projects\775303101_USAF_Activa_PFCs\0006_Cannon\MXDs\WorkPlan\Figure 9 - AFFF Area 6 - N Playa Lake Outfall.mxd



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0 50 100 200 300 Feet

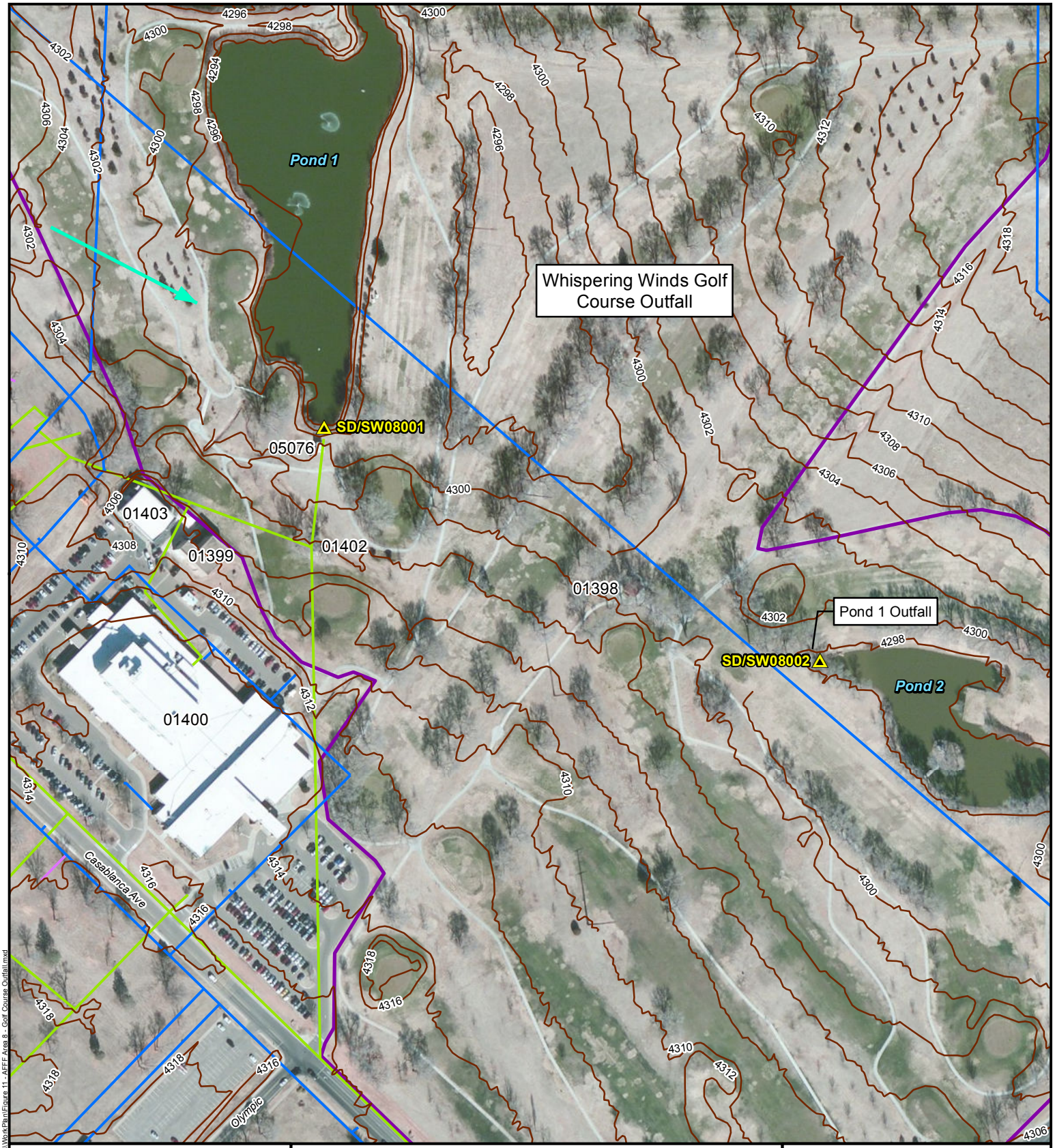
Path: H:\Projects\775303101_USAF_Active_PFCs\0006_Cannon\MXDs\WorkPlan\Figure_10_-_AFFF_Area_7_-_S_Playa_Lake_Outfall.mxd

Symbol Key

- Proposed Soil Boring
- Water Line
- Sanitary Sewer Line
- Storm Sewer Line
- Ground Surface Elevation Contour (ft amsl)
- Approximate Groundwater Flow Direction
- Potential AFFF Release Area

FIGURE 10
Proposed Sampling Locations
South Playa Lake Outfall
AFFF Release Area 7
Cannon Air Force Base
Clovis, New Mexico

Site Inspection of Aqueous Film Forming Foam (AFFF) Release Areas
Environmental Programs Worldwide
Installation-Specific Work Plan



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0 100 200 400 Feet

Symbol Key

- Proposed Sediment / Surface Water Sample
- Water Line
- Sanitary Sewer Line
- Storm Sewer Line
- Ground Surface Elevation Contour (ft amsl)
- Approximate Groundwater Flow Direction
- Potential AFFF Release Area

FIGURE 11
Proposed Sampling Locations
Whispering Winds Golf Course Outfall
AFFF Release Area 8
Cannon Air Force Base
Clovis, New Mexico

Site Inspection of Aqueous Film Forming Foam (AFFF) Release Areas
Environmental Programs Worldwide
Installation-Specific Work Plan

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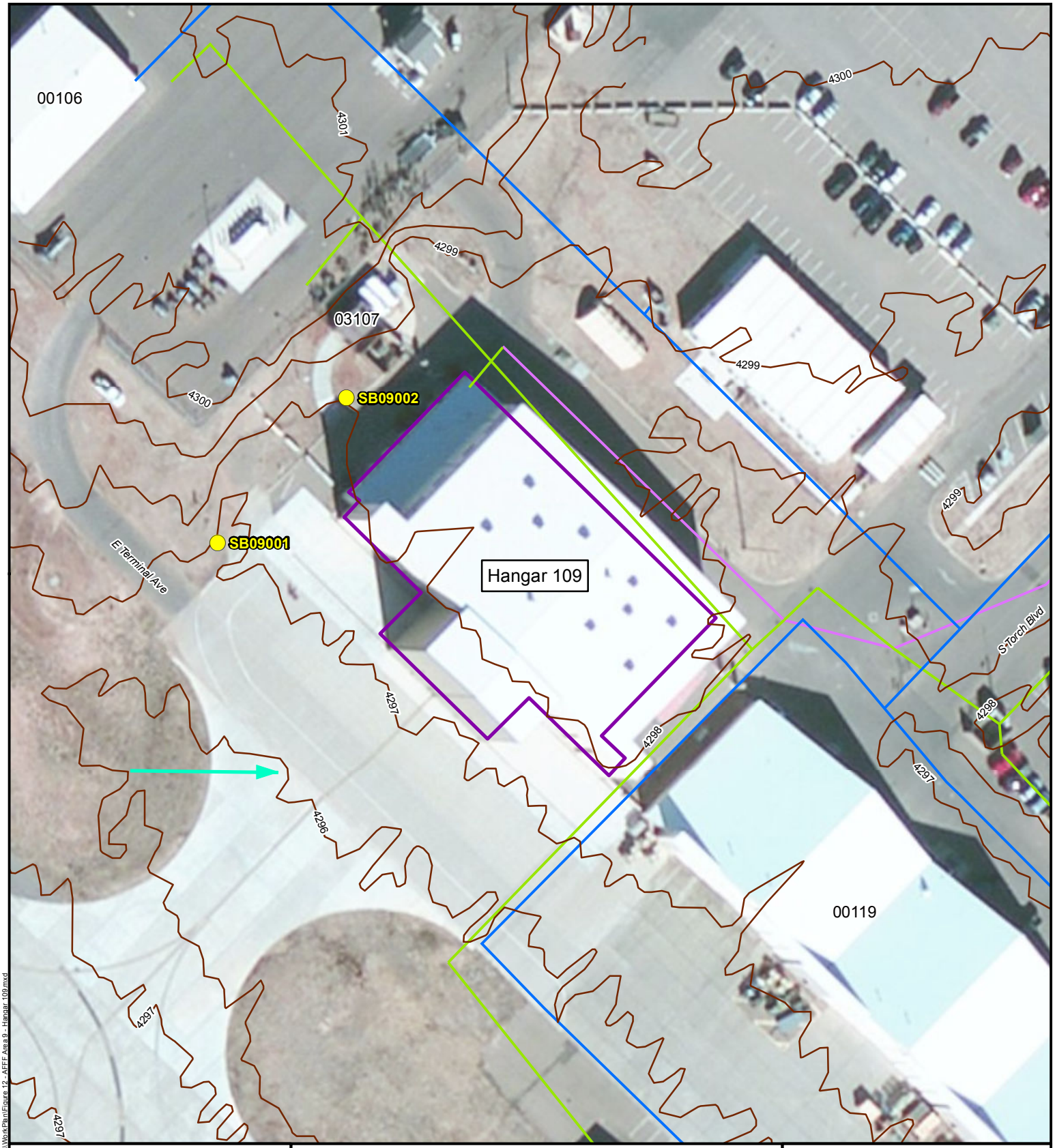

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Project: 775303101.0006

By: M.Vavra | Date: 4/26/2017

0 25 50 100 Feet

Symbol Key

- Proposed Soil Boring
- Water Line
- Sanitary Sewer Line
- Storm Sewer Line
- Ground Surface Elevation Contour (ft amsl)
- Approximate Groundwater Flow Direction
- Potential AFFF Release Area

FIGURE 12
Proposed Sampling Locations
Hangar 109
AFFF Release Area 9
Cannon Air Force Base
Clovis, New Mexico

Site Inspection of Aqueous Film Forming Foam (AFFF) Release Areas
Environmental Programs Worldwide Installation-Specific Work Plan

Path: H:\Projects\775303101_USAF_Active_PFCs\0006_Cannon\MXDs\WorkPlan\Figure 12 - AFFF Area 9 - Hangar 109.mxd

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Project: 775303101.0006

By: M.Vavra | Date: 6/6/2017

0 50 100 200 Feet

Symbol Key

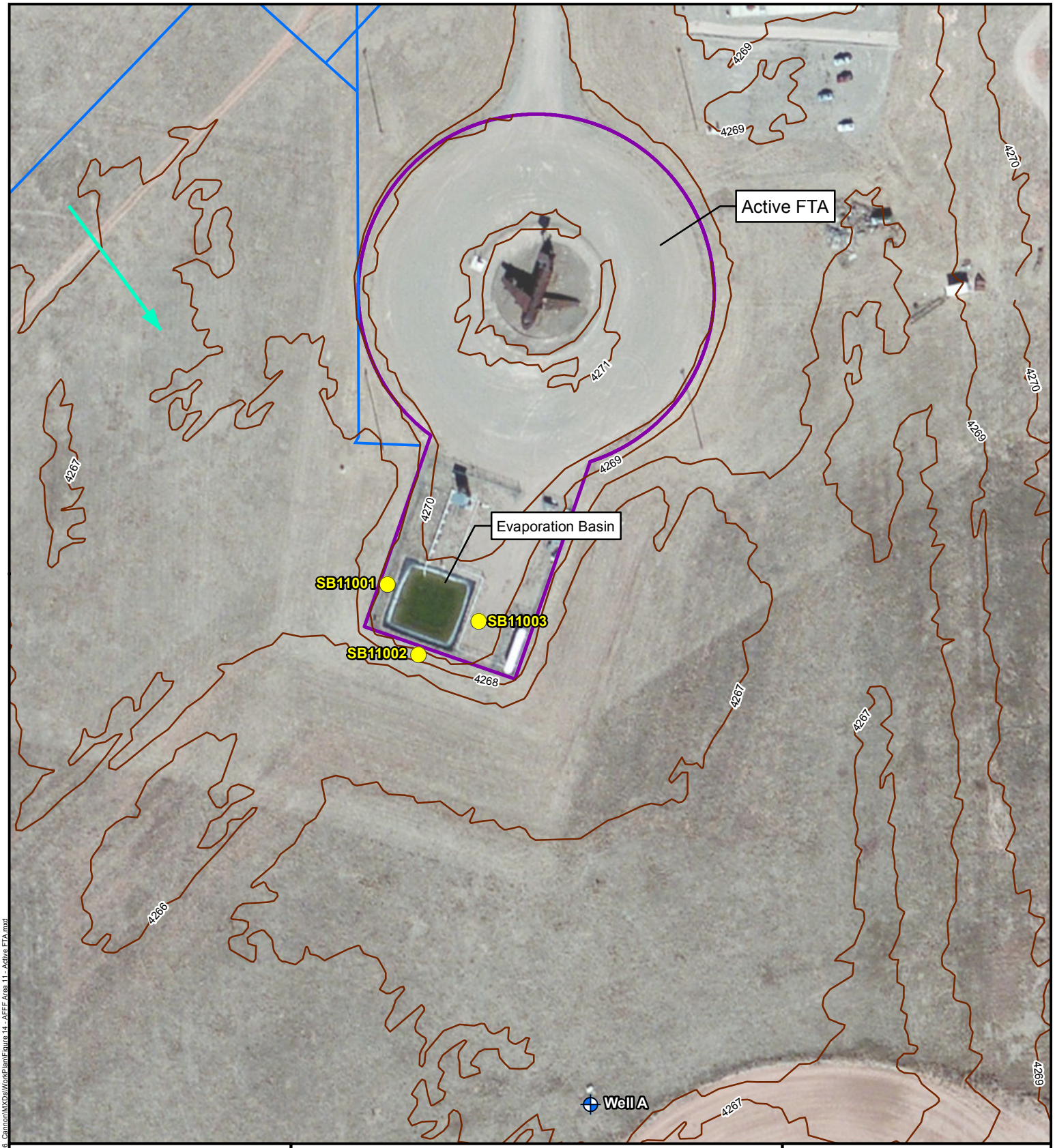
- Existing Monitoring Well To Be Sampled
- Ground Surface Elevation Contour (ft amsl)
- Approximate Groundwater Flow Direction
- Potential AFFF Release Area
- Landfill
- Cannon Air Force Base Installation Boundary

** Note - No soil samples are required for Landfill #4.

FIGURE 13
Proposed Groundwater Sample Location - Landfill #4
AFFF Release Area 10
Cannon Air Force Base
Clovis, New Mexico

Site Inspection of Aqueous Film Forming Foam (AFFF) Release Areas
Environmental Programs Worldwide Installation-Specific Work Plan

Path: C:\Workspace\GIS_Projects\775303101_USAF_Active_PFCs\0006_Cannon\MXDs\WorkPlan\Figure 13 - AFFF Area 10 - Landfill No 4.mxd



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By: M.Vavra | Date: 6/6/2017

0 50 100 200 Feet

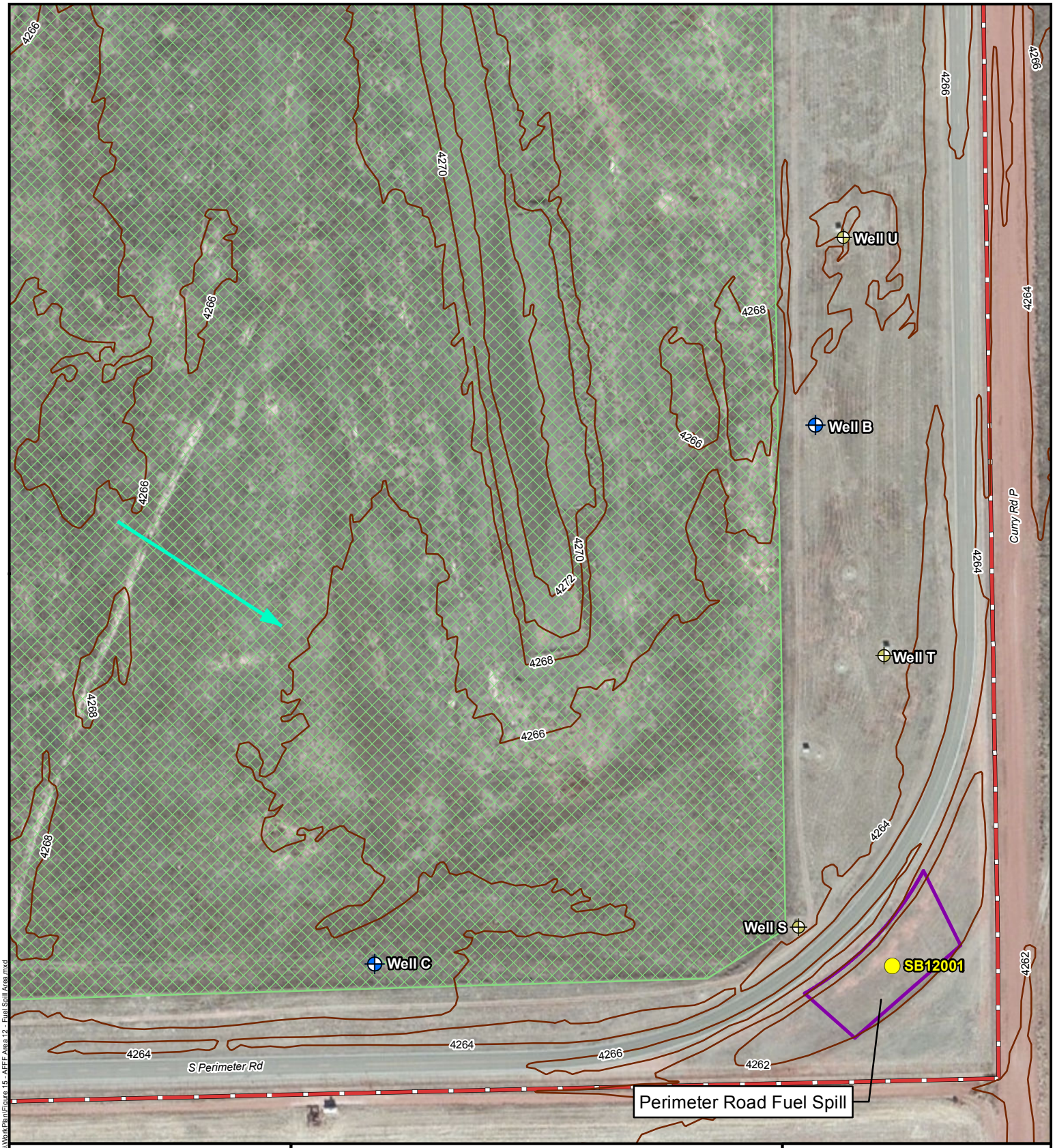
Symbol Key

- Proposed Soil Boring
- Existing Monitoring Well
- Water Line
- Ground Surface Elevation Contour (ft amsl)
- Approximate Groundwater Flow Direction
- Potential AFFF Release Area

FIGURE 14
Proposed Sampling Locations
Active FTA
AFFF Release Area 11
Cannon Air Force Base
Clovis, New Mexico

Site Inspection of Aqueous Film Forming Foam (AFFF) Release Areas
Environmental Programs Worldwide
Installation-Specific Work Plan

Path: C:\Workspace\GIS_Projects\775303101_USAF_Active_PFCs\0006_Cannon\MXDs\WorkPlan\Figure 14 - AFFF Area 11 - Active FTA.mxd



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By: M.Vavra | Date: 4/26/2017

0 50 100 200 Feet

Symbol Key

- Proposed Soil Boring
- Existing Monitoring Well
- Existing Monitoring Well (Dry, To Be Replaced)
- Ground Surface Elevation Contour (ft amsl)
- Approximate Groundwater Flow Direction
- Potential AFFF Release Area
- Cannon Air Force Base Installation Boundary
- Landfill 5 Area

FIGURE 15
Proposed Sampling Locations
Perimeter Road Fuel Spill
AFFF Release Area 12
Cannon Air Force Base
Clovis, New Mexico

Site Inspection of Aqueous Film Forming Foam (AFFF) Release Areas
Environmental Programs Worldwide Installation-Specific Work Plan

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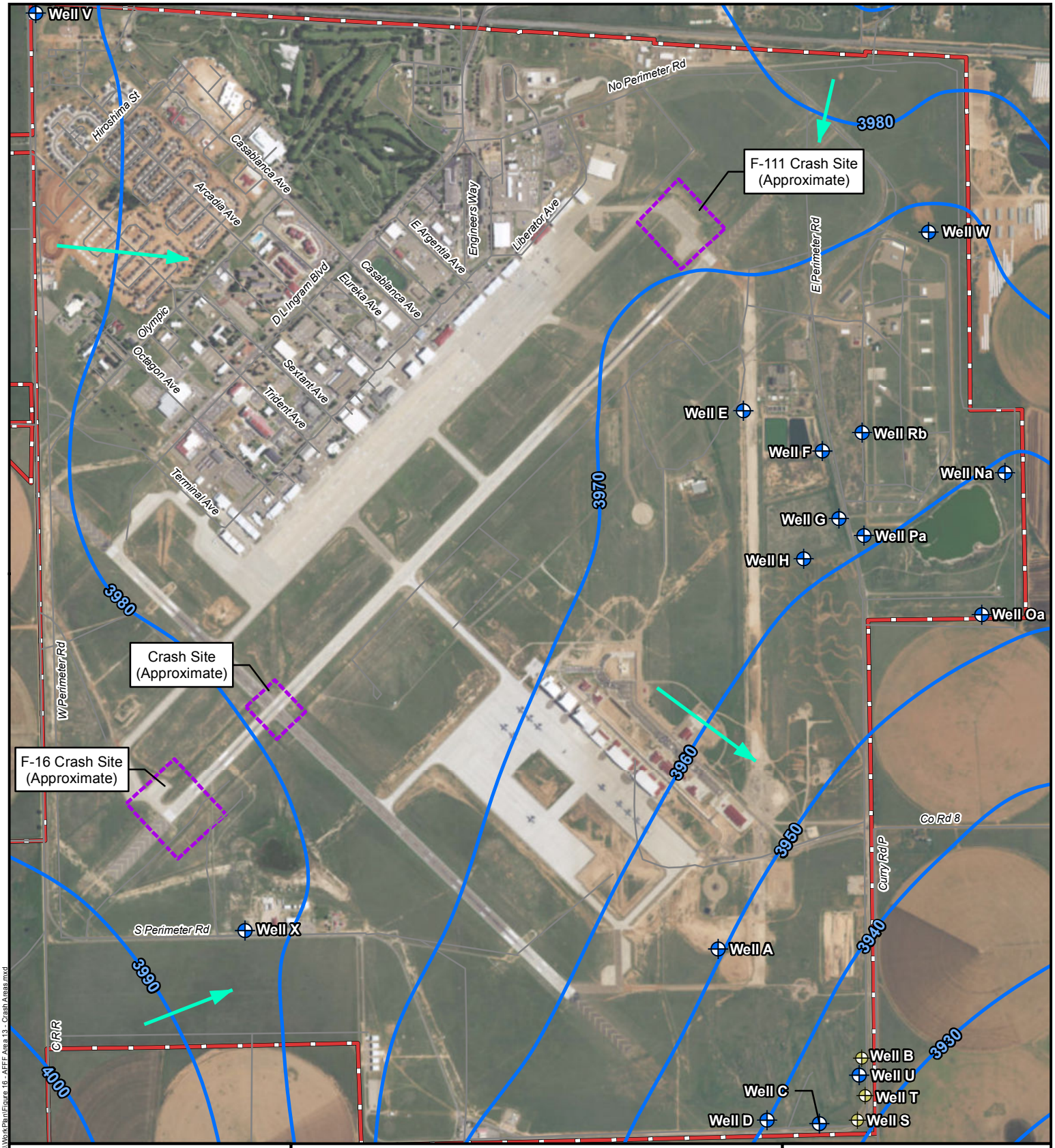

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By: M.Vavra | Date: 4/26/2017

0 500 1,000 2,000 Feet

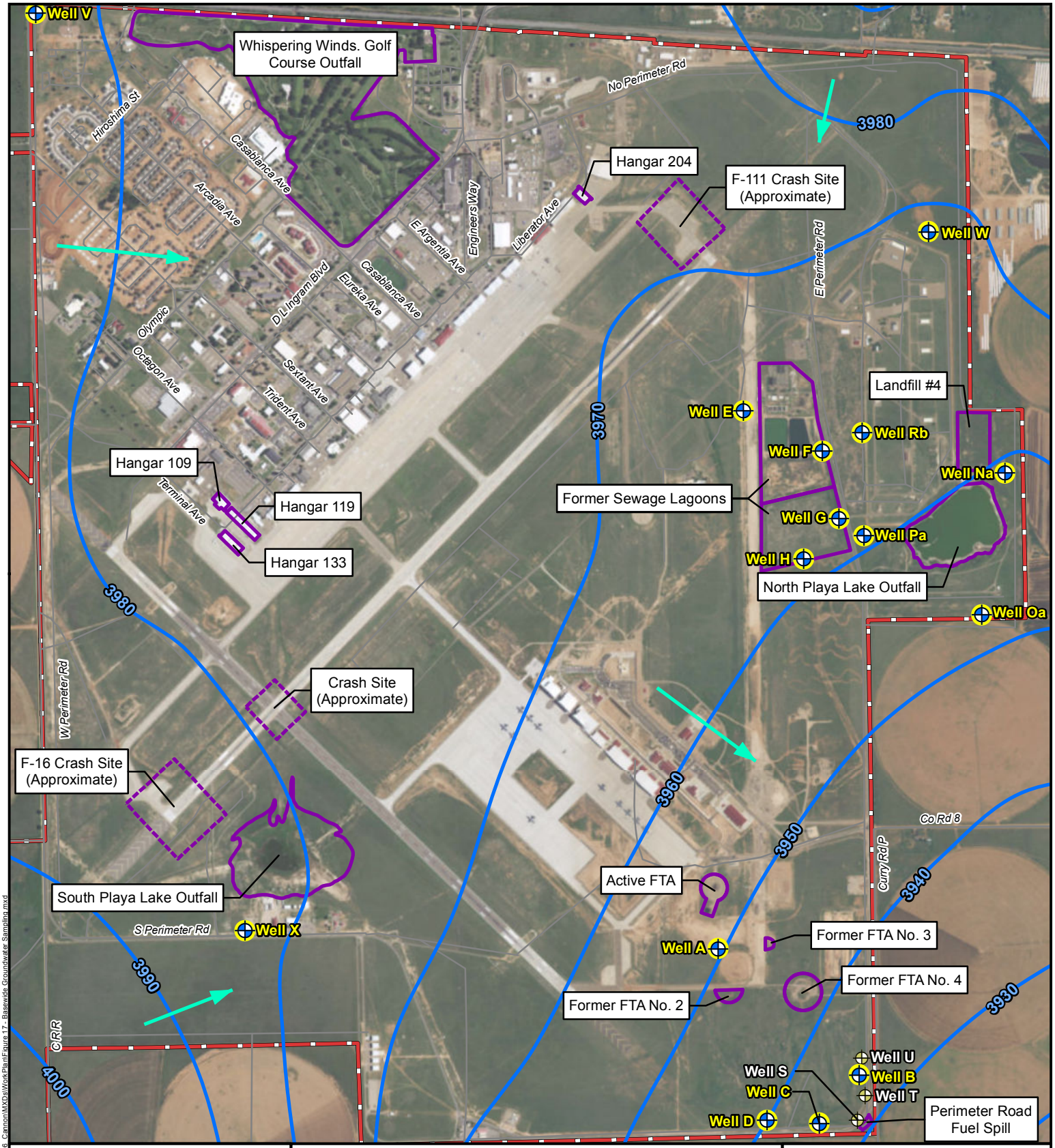
Symbol Key

- Existing Monitoring Well
- Existing Monitoring Well (Dry, To Be Replaced)
- Roads
- Streams
- Approximate Groundwater Elevation Contour - Summer (USGS, 2016)
- Approximate Groundwater Flow Direction
- Potential AFFF Release Area (Approximate)
- Cannon Air Force Base Installation Boundary

Figure 16
Proposed Sampling Locations
Former Crash Sites
AFFF Release Area 13
Cannon Air Force Base
Clovis, New Mexico

Site Inspection of Aqueous Film Forming Foam (AFFF) Release Areas
Environmental Programs Worldwide
Installation-Specific Work Plan

Path: H:\Projects\775303101_USAF_Activa_PFCs\0006_Cannon\MXDs\WorkPlan\Figure_16_-_AFFF_Area_13_-_Crash_Areas.mxd



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0 500 1,000 2,000 Feet

Path: C:\Workspace\GIS_Projects\775303101_USAF_Active_PFCs\0006_Cannon\MXDs\Work Plan\Figure 17 - Basewide Groundwater Sampling.mxd

Symbol Key

- Existing Monitoring Well to be Sampled
- Existing Monitoring Well (Dry, To Be Replaced)
- Roads
- Streams
- Approximate Groundwater Elevation Contour - Summer (USGS, 2016)
- Approximate Groundwater Flow Direction
- Potential AFFF Release
- Potential AFFF Release Area (Approximate)
- Cannon Air Force Base Installation Boundary

Figure 17
Proposed Groundwater Sampling Locations
Basewide
Cannon Air Force Base
Clovis, New Mexico

Site Inspection of Aqueous Film Forming Foam (AFFF) Release Areas
Environmental Programs Worldwide
Installation-Specific Work Plan

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APPENDIX A

Installation-Specific Health and Safety Plan

The Installation-Specific HSP provided in this appendix supplement the General HSP included as Appendix A to the General QPP. Refer to the HSP and QPP for all job hazard analyses, site control requirements, personal protective equipment needs, safety mitigation measures, and standard operating procedures.

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Site: Cannon AFB, Clovis, New Mexico

Prepared by: Cory Vowles Date: 01/23/17

Reviewed by: Emma Driver 03/20/17

Dates of Required Training and Medical Surveillance:

Job duties	Field Team Lead/HSO	Field Team	Base Lead
Name	Cory Vowles	Shannon Williams	Emma Driver
First Aid	4/21/16	--	--
CPR	4/21/16	--	--
Hazard Communication	10/19/16	--	10/19/16
HAZWOPER	12/02/16		12/02/16
Construction Safety & Health (30hr OSHA)	09/17/16		--

At least one worker must be trained in First Aid/CPR and should receive bloodborne pathogen training.
Required for Field Lead and Site Health and Safety Officer.

Notes:

CPR – cardiopulmonary resuscitation
HAZWOPER – hazardous waste operations and emergency response
HSO – health and safety officer
NA – not available

Known or Suspected Contaminants (include permissible exposure limits [PELs]/threshold limit values [TLVs]):

Contaminants of Concern (COC) (Attach Fact Sheets*)	Maximum Concentrations		PEL/TLV
	Soil (mg/kg)	Water/Groundwater (µg/L)	
Per- and Polyfluorinated Alkyl Substances (PFAS)	TBD	TBD	N/A
Benzene	TBD	TBD	1 ppm
Toluene	TBD	TBD	200 ppm
Ethylbenzene	TBD	TBD	100 ppm
Xylenes	TBD	TBD	100 ppm
cis-1,2-Dichloroethene	TBD	TBD	100 ppm
Trichloroethene	TBD	TBD	100 ppm
Vinyl Chloride	TBD	TBD	1 ppm

Notes:

µg/L – micrograms per liter
mg/kg – milligrams per kilogram
N/A = not applicable
PEL – permissible exposure limit
PFOA – perfluorooctanoic acid
PFOS – perfluorooctanesulfonic acid
ppm – parts per million
TBD – to be determined
TLV – threshold limit value

EMERGENCY CONTACTS

NAME	TELEPHONE NUMBERS		DATE OF PRE-EMERGENCY NOTIFICATION (if applicable)
Fire Department:	911		
Hospital: **Plains Regional Medical Center** **2100 North Doctor Martin Luther King Boulevard** **Clovis, NM 88101**	575-769-2141		
Police/Ambulance/Fire:	911		
Client Contact: **Sheen Kottkamp**	(O): 575-904-6743	(C): 806-463-0811	
Client Contact (Alternate: **Steven Palmer**	(O): 575-904-6744	(C): 850-218-1544	
Regional Lead: **Emma Driver**	(O): 612-252-3641	(C): 612-381-7845	
Site Health And Safety Officer: **Cory Vowles**	(O): 612-252-3789	(C): 850-597-1308	
Group Health Safety and Environment (HSE) Manager: **Cynthia Sundquist**	(O): 207-828-3309	(C): 207-650-7593	

EMERGENCY PROCEDURES

- The health and safety officer (HSO) or alternate should be immediately notified via the on-site communication system. The HSO assumes control of the emergency response.
- The HSO notifies the project manager and client contact of the emergency. The HSO shall then contact the group health, safety, and environment (HSE) manager who will then contact the corporate HSE manager.
- If applicable, the HSO shall notify off-site emergency responders (e.g. fire department, hospital, police department, etc.) and shall inform the response team as to the nature and location of the emergency on-site.
- If applicable, the HSO evacuates the site. Site workers should move to the predetermined evacuation point (See Site Map).
- For small fires, flames should be extinguished using the fire extinguisher. Large fires should be handled by the local fire department.
- In an unknown situation or if responding to toxic gas emergencies, appropriate PPE, including self-contained breathing apparatus (SCBA) if available, should be donned. If appropriate PPE is unavailable, site workers should evacuate and call in emergency personnel.
- If chemicals are accidentally spilled or splashed into eyes or on skin, use eyewash and wash affected area. Site worker should shower as soon as possible after incident.
- If a worker is injured, first aid shall be administered by certified first aid provider. See AMEC Triage Program below
- If the emergency involves toxic gases, workers will back off and reassess. Prior to re-entering the work zone, the area must be determined to be safe. Entry will be using Level B PPE and utilize appropriate monitoring equipment to verify that the site is safe.
- Within 24 hours after any emergency response, the Incident Analysis Report (and Vehicle Incident Report if vehicle incident) shall be completed and returned to the group HSE manager, who will forward a copy to the corporate HSE manager. Injuries requiring medical treatment beyond first aid (as well as work-related vehicle incidents) will require the employee to submit a post incident drug and alcohol test.

AMEC WorkCare Program

- If the emergency involves an injury to an AMEC employee, the local HSE coordinator, field lead are to implement the AMEC WorkCare program. Employees whose injuries are true emergencies and who need immediate medical attention will initially bypass this program and are to be immediately sent/taken to the hospital identified in the routes to emergency medical facilities section below.
- For non-emergency injuries, the supervisor field lead and the injured employee will contact the AMEC WorkCare 24/7 Hotline at 1-888-449-7787 and speak to a nurse case manager. The nurse case manager will perform the intake process and ask for information including the following:
    - Explain the process to the caller
    - Determine the nature of the concern
    - Provide appropriate medical advice to the caller
    - Determine the appropriate path forward with the caller
    - Maintain appropriate medical confidentiality
    - Help caller to execute path forward – including a referral to the appropriate local medical facility
    - Send an email notification to the corporate safety contact
- From this, a collaborative decision will be made between the nurse case manager and the injured employee on the most appropriate place for treatment; either the hospital, the clinic, or onsite first aid
- If the employee is to be sent to a clinic or hospital, the nurse will call ahead to explain the situation, the need for testing, and advises options to avoid OSHA recordable & considerations for return to work & transitional/modified duty. The nurse will also arrange for drug and alcohol testing to be conducted at the hospital/clinic. If the employee is to be treated on site (First Aid), the nurse will advise the employee to call if injury gets worse. Attached is a flow diagram that describes this procedure.

Incident flow chart

Call immediately

E&I Corporate HSE department contact list

Name/email	Office location	Contact information
Bruce Voss bruce.voss@amecfw.com	Cathedral City, CA	760.202.3737 (office) 951.897.6381 (cell)
Chad Barnes chad.barnes@amecfw.com	Phoenix, AZ	602.733.6000 (office) 480.495.9846 (cell)
Cindy Sundquist cynthia.sundquist@amecfw.com	Portland, ME	207.828.3309 (office) 207.650.7593 (cell) 207.892.4402 (home)
Gabe Sandholm gabe.sandholm@amecfw.com	Minneapolis, MN	612.252.3785 (office) 206.683.9190 (cell)
John Mazur john.mazur@amecfw.com	Wilmington, NC	910.444.2978 (office) 910.431.2330 (cell) 910.681.0538 (home)
Lori Dowling lori.dowling@amecfw.com	Prince George, BC	250.564.3243 (office)
Philip Neville philip.neville@amecfw.com	Thorold, ON	905.687.6616 (office) 905.380.4465 (cell)
Tim Kihn tim.kihn@amecfw.com	Edmonton, AB	780.944.6363 (office) 780.717.5058 (cell)
Vladimir Ivensky (can call 24/7) vladimir.ivensky@amecfw.com	Plymouth Meeting, PA	610.877.6144 (office) 484.919.5175 (cell) 215.947.0393 (home)
Kirby Lastinger kirby.lastinger@amecfw.com	Lakeland, FL	836-667-2345 x207 (office) 863-272-4775 (cell)

High potential near misses, subcontractor incidents, regulatory inspections, spills, and property damage should be reported within 60 minutes to one of the above HSE Representatives.

***Supervisor Responsible For:**

- **D&A Testing Coordination as per client and AmecFW requirements, Local/Client Notifications, and Completing Initial IAR within 24 hours and forwarding to Corporate HSE.**

Rev. Oct 2015

FIELD TEAM REVIEW: I acknowledge that I understand the requirements of this HSP, and agree to abide by the procedures and limitations specified herein. I also acknowledge that I have been given an opportunity to have my questions regarding the HSP and its requirements answered prior to performing field activities. Health and safety training and medical surveillance requirements applicable to my fieldactivities at this site are current and will not expire during on-site activities.

Name:		Date:	
Name:		Date:	
Name:		Date:	
Name:		Date:	
Name:		Date:	

ROUTES TO EMERGENCY MEDICAL FACILITIES

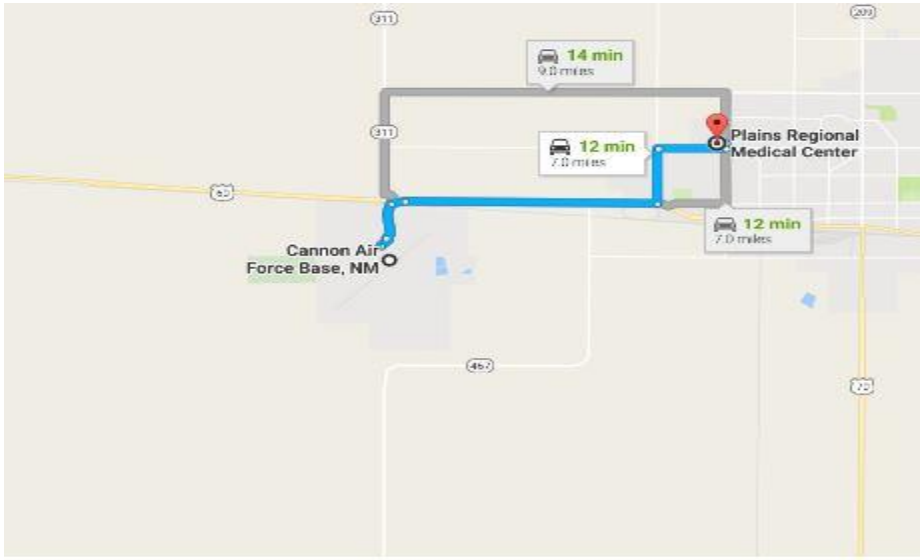
HOSPITAL (for immediate emergency treatment):

Facility Name: Plains Regional Medical Center

Address: 2100 North Doctor Martin Luther King Boulevard

Clovis, NM 88101

Telephone Number: 575-769-2141



Cannon AFB
New Mexico

Get on US-60 E/US-84 E from Chindit Blvd

1. Head northeast on Liberator Ave toward Kermit Evans Ave
   ⚠ Restricted usage road
2. Turn left onto Kermit Evans Ave
   ⚠ Restricted usage road
3. Turn right at the 1st cross street onto Chindit Blvd
   ⚠ Partial restricted usage road
4. Take the ramp onto US-60 E/US-84 E
5. Merge onto US-60 E/US-84 E

Follow N Wheaton St and W 21st St to your destination

6. Turn left onto N Wheaton St
7. Turn right onto W 21st St
8. Turn left onto M.L.K. Jr Blvd
9. Turn left
   ℹ Destination will be on the right

Plains Regional Medical Center
2100 North Doctor Martin Luther King Boulevard, Clovis, NM 88101