Phase 1 PFAS Investigation Report
Cannon Air Force Base and Surrounding Area Curry County, New Mexico

Prepared for

New Mexico Environment Department
Hazardous Waste Bureau
Santa Fe, New Mexico

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List of Acronyms and Abbreviations

µg/kg	microgram(s) per kilogram
µg/L	microgram(s) per liter
µS/cm	microSiemen(s) per centimeter
AFB	Air Force Base
AFCEC	Air Force Civil Engineer Center
AFFF	aqueous film forming foam
AFW	Amec Foster Wheeler Environmental & Infrastructure, Inc.
bgs	below ground surface
Bristol	Bristol Environmental Solutions, Inc.
cm/s	centimeters per second
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC	contaminant of concern
CWPC	Clean Water Partnership-Cannon
DBS&A	Daniel B. Stephens & Associates, Inc.
DOD	Department of Defense
DQO	data quality objective
EP	entry point
EPA	U.S. Environmental Protection Agency
EPCOR	EPCOR Water New Mexico, Inc.
EPDS	distribution system entry point
FFY	federal fiscal year
FPM	FPM Remediations, Inc.
FSP	field sampling plan
FTA	fire training area
ft/d	feet per day
ft/ft	feet (or foot) per foot
ft/yr	feet per year
FTSA	fluorotelomer sulfonic acid
FY	fiscal year
gpm	gallons per minute
HA	health advisory
HASP	health and safety plan

HGL	HydroGeoLogic, Inc.
HEAL	Hall Environmental Analysis Laboratory
HWB	Hazardous Waste Bureau [New Mexico Environment Department]
MCL	maximum contaminant level
MDWCA	mutual domestic water consumers association
MOA	memorandum of agreement
mg/kg	milligram(s) per kilogram
mg/L	milligram(s) per liter
mph	miles per hour
NAVD88	North American Vertical Datum of 1988
NCP	National Contingency Plan
ND	not detected
NEtFOSAA	n-ethyl perfluorooctane sulfonamide acetic acid
ng/L	nanograms per liter
NMAC	New Mexico Administrative Code
NMAWC	New Mexico American Water Company
NMBGMR	New Mexico Bureau of Geology & Mineral Resources
NMDOH	New Mexico Department of Health
NMED	New Mexico Environment Department
NMeFOSAA	n-methyl perfluorooctane sulfonamido acetic acid
NMWQCC	New Mexico Water Quality Control Commission
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
NWIS	National Water Information System
OSE	New Mexico Office of the State Engineer
PA	preliminary assessment
PBS	Public Broadcasting System
PFAS	per- and polyfluoroalkyl substances
PFBA	perfluorobutanoic acid
PFBS	perfluorobutanesulfonic acid
PFCA	perfluoroalkyl carboxylic acid
PFDA	perfluorodecanoic acid
PFHpA	perfluoroheptanoic acid
PFHxA	perfluorohexanoic acid
PFHxS	perfluorohexanesulfonic acid

PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctane sulfonate
PFOSA	perfluorooctane sulfonamide
PFPeA	perfluoropentanoic acid
PFSA	perfluoroalkyl sulfonic acid
PWS	public water system
QA	quality assurance
QAPP	quality assurance project plan
QC	quality control
RCRA	Resource Conservation and Recovery Act
RI	remedial investigation
RSL	regional screening level
SAP	sampling and analysis plan
SCP	State Cleanup Program
SI	site inspection
SR 245	State Road 245
SSL	soil screening level
TDS	total dissolved solids
TKN	total Kjeldahl nitrogen
TOC	total organic carbon
Trinity	Trinity Analysis & Development Corporation
UCMR 3	Third Unregulated Contaminant Monitoring Rule
USACE	U.S. Army Corps of Engineers
US 70	U.S. Route 70
USAF	U.S. Air Force
USGS	U.S. Geological Survey
Vista	Vista Analytical
WCC	Woodward-Clyde Consultants
WWTP	wastewater treatment plant

1. Introduction

To better understand the scope of potential and existing environmental contamination associated with per- and polyfluoroalkyl substances (collectively referred to as PFAS) around the state, the New Mexico Environment Department (NMED) has worked with state and federal partners to conduct sampling for PFAS in sediment, surface water, and groundwater around the state. The NMED Hazardous Waste Bureau (HWB) contracted with Daniel B. Stephens & Associates, Inc. (DBS&A) to characterize PFAS in groundwater on and in the vicinity of Cannon Air Force Base (AFB) in Curry County (the Cannon site) and Holloman AFB in Otero County (the Holloman site). This report presents the results of the first phase of work conducted in 2021 and 2022 at the Cannon site under this contract.

1.1 Purpose of the Investigation

The purpose of this work is to quantitatively evaluate the contaminant source and potential migration pathways using a systematic approach through environmental sampling and analysis. This approach will assist in further characterizing the PFAS release within the study area by quantifying contaminants of concern (COCs) present in sediment, surface water, and groundwater at and in the vicinity of the release. The results will assist NMED in the selection of a remedy that reduces risks to human health and the environment.

The investigation will identify and sample all participating Cannon AFB monitor wells and private water supply wells that have had PFAS detections or are at potential risk of future PFAS contamination. The hydrogeology of the Cannon site has been characterized, and potential migration (e.g., paleochannels) and exposure pathways will be identified and assessed to the extent practicable.

In addition to collecting sediment and groundwater samples at the site, DBS&A has evaluated the investigation results to assess the risk to human health and the environment, in support of recommendations for remedial action under Sections 20.6.2.4000 through 20.6.2.4115 of the New Mexico Administrative Code (NMAC). The work has been conducted consistent with the National Oil and Hazardous Materials Pollution Contingency Plan (National Contingency Plan or NCP) described in Title 40, Code of Federal Regulations (CFR), Part 300.

1.2 Project Objectives

NMED identified three objectives for the investigation of the Cannon site:

1. Provide better definition of existing PFAS groundwater plume geometry and predictions of future plume migration and surface water contamination, including empirically derived rates of movements of PFAS contaminants in the subsurface.
2. Identify and sample all participating public and private water supply wells that have had PFAS detections or are at potential risk of future PFAS contamination.
3. Establish regular and comprehensive groundwater monitoring program.

Progress was not made on all of the project objectives during Phase 1 due to a reduction in the project budget after the project was awarded, as well as access issues. The total project budget for both the Cannon and Holloman sites was reduced by approximately 20 percent after award. The project scope was reduced accordingly, by holding off on (1) the groundwater and contaminant transport modeling tasks for the Cannon site and (2) establishing a regular groundwater monitoring program.

A sampling and analysis plan (SAP) (DBS&A, 2021 and 2022) was prepared in accordance with the *Guidance on Systematic Planning Using the Data Quality Objectives Process, EPA QA/G-4* (U.S. EPA, 2006). The final SAP was provided to NMED on February 1, 2022. The SAP describes procedures to ensure that the project-specific data quality objectives (DQOs) are met and that the quality of data is known and documented. The SAP presents the project description, project organization and responsibilities, and quality assurance (QA) objectives associated with the sampling and analytical services to be provided in support of characterization activities at the Cannon site.

The overall QA objectives are as follows:

- Obtain technically defensible data and information of known quality to support goals set forth for this project
- Document all aspects of the quality program, including performance of the work and any required changes to work at the site
- Attain quality control (QC) requirements for analyses specified in this SAP

1.3 Confidentiality

Some of the parties that have allowed groundwater and drinking water samples to be collected from their property for PFAS analysis have requested that the laboratory results be held confidential. In those cases, neither the sample location nor specific results have been divulged herein, and discussions of the results have been generalized. Results for sampling that occurred prior to the current NMED Phase 1 PFAS investigation that are described herein are those that are already in the public domain and available on the internet, unless otherwise noted. Results in the public domain include investigations conducted by the U.S. Air Force (USAF), both on Cannon AFB and off-base. Also included are results of sampling published on the NMED PFAS website and the U.S. Geological Survey (USGS) National Water Information System (NWIS).

1.4 Report Organization

This report is organized as follows:

- Section 1 describes the report organization, states the purpose and objectives of the project, and provides an overview of the nature, environmental and health effects of PFAS, and regulatory criteria for PFAS in soil and drinking water.
- Section 2 provides the background on PFAS sampling requirements, PFAS compounds and their use, toxicity, persistence, and human health effects, and regulatory framework.
- Section 3 provides discussions of the project area, including Clovis and Cannon AFB, including the physical setting, climate, soil conditions, and the regional and local geology and hydrogeology.
- Section 4 provides a brief discussion of the sources of PFAS contamination in the project area, factors controlling PFAS migration in soil and groundwater, and likely exposure pathways.
- Section 5 summarizes the results of sampling of groundwater and drinking water for PFAS in the local area conducted by various parties, including drinking water providers, the USAF, landowners and dairy operators, the state, and the USGS.
- Section 6 describes the NMED Phase I Investigation work performed by DBS&A under this contract, including compilation of relevant information, development of the work plan, sampling of water supply wells, installation and sampling of a monitor well, sample analysis, and data review.

- Section 7 describes the data gaps that have been identified and provides recommendations for further work to be conducted in fiscal year (FY) 2023.
- Appendix A provides the Notice to Proceed and work plan approval.
- Appendix B provides background information related to the mapping of the elevation at the base of the Ogallala Aquifer.
- Appendix C provides copies of lithologic logs and well construction diagrams for deep soil borings, monitor wells, and water supply wells at Cannon AFB.
- Appendix D provides geophysical logs for deep soil borings and monitor wells at Cannon AFB.
- Appendix E provides maps produced by the USAF, USGS, and others showing groundwater flow in the vicinity of Cannon AFB.
- Appendix F provides maps showing the locations and perfluorooctanesulfonic acid (PFOS) and perfluorooctanoic acid (PFOA) data for EPCOR Water New Mexico, Inc. (EPCOR) water supply wells that were published by Public Broadcasting System (PBS).
- Appendix G provides laboratory reports for groundwater samples from Highland Dairy that were collected by the landowner.
- Appendix H provides a laboratory report for Cannon AFB wastewater treatment plant (WWTP) samples collected in 2019.
- Appendix I provides the laboratory reports for environmental sampling conducted by DBS&A at Cannon AFB under this contract.
- Appendix J provides records for new monitor well DBS-1.
- Appendix K provides data quality assessments of laboratory data.

2. Background

In May 2012, the U.S. Environmental Protection Agency (EPA) required the nation-wide sampling of public water systems (PWSs) serving more than 10,000 people for a list of 21 contaminants, including six PFAS under the Third Unregulated Contaminant Monitoring Rule (UCMR 3) (U.S. EPA, 2017a). The Department of Defense (DOD) later ordered testing of drinking water systems for PFAS at all locations where DOD supplies drinking water (DOD, 2021). PFAS were

first detected in groundwater and drinking water in the Clovis area in samples from the Cannon AFB water supply system. Subsequent sampling has identified PFAS contamination in groundwater emanating from Cannon AFB, extending off-site, and impacting groundwater and drinking water downgradient of the base (AFW, 2018 and 2019). The contamination exceeds the lifetime health advisory (HA) for PFOS and/or PFOA in drinking water established by EPA, and is hazardous to human health and the environment.

On June 15, 2022, the EPA issued lifetime drinking water HAs for 4 perfluoroalkyl substances, replacing the HAs for PFOA and PFOS as discussed in Section 2.3.

2.1 PFAS

PFAS are a large family (perhaps more than 8,000 [Buck et al., 2021]) of manmade organofluorine compounds that were developed in the early 1940s. Certain PFAS, such as PFOA and PFOS, are mobile, persistent, and bioaccumulative, and are not known to degrade in the environment. PFAS chemical structure gives them unique and valuable properties, including the ability to reduce friction and make products more resistant to soil, stain, grease, water, fire, and temperature. These chemical properties make them useful components in a wide array of industrial and commercial applications, such as textiles and leather products, metal plating, the photographic industry, photolithography, semi-conductors, paper and packaging, non-stick cookware, food packaging, waterproof clothing, fabric stain protectors, lubricants, and pesticides. Some PFAS are also used as high-performance surfactants in products where an even flow is essential, such as paints, coatings, cleaning products, and fire-fighting foams, such as aqueous film forming foam (AFFF), for use on liquid (hydrocarbon) fuel fires (U.S. EPA, 2009 and 2021b).

PFAS are characterized by linear or branched carbon-fluorine chains connected to a functional group and can vary in length from 4 to 14 molecules. The number of carbon atoms, and therefore the length of the chain comprising a particular PFAS, affects its toxicity and persistence and behavior in humans, wildlife, and the environment. Perfluorosulfonic acids (PFSAs) with six or more carbons (e.g., PFOS) and perfluorinated carboxylic acids (PFCAs) with seven or more carbon atoms (e.g., PFOA) are considered long-chain substances (Buck et al., 2011; U.S. EPA, 2021b; ATSDR, 2021). In general, as chain length increases, the bioaccumulation potential of PFAS appears to increase. For reference, the names, acronyms, and families of PFAS discussed in this report are provided in Table 1.

PFAS are extremely persistent in environmental media because the highly stable carbon-fluorine structure of PFAS can only be broken down at very high temperature. Larger PFAS compounds may transform in the environment to so-called "terminal" PFAS compounds, which are typically less than or equal to eight carbon-chain molecules such as PFOA and PFOS and are resistant to environmental degradation processes, such as biodegradation, atmospheric photo-oxidation, direct photolysis, and hydrolysis (ITRC, 2021). Dissipation is by advection, dispersion, and sorption to particulate matter. PFOS has low volatility in ionized form, but can adsorb under limited hydrogeochemical conditions to positively charged sediment particles and be deposited on the ground and into surface water bodies. Because of its persistence, it can be transported long distances in air or water (U.S. EPA, 2016a).

2.2 AFFF

Of particular concern at the Cannon site is the use of AFFF to extinguish fires involving highly flammable liquids. AFFF creates a vapor-sealing film on a hydrocarbon fuel surface, cooling the liquid fuel, depriving the fuel of oxygen, and providing protection against re-ignition by preventing evaporation (Leeson et al., 2021). The USAF began purchasing and using AFFF containing PFOS and PFOA for extinguishing petroleum fires and during firefighting training activities in 1970 (AFIMSC, 2017). By mid-2018, the USAF had transitioned to a new AFFF formula, Phos-Check 3 Percent, which is PFOS-free and contains only trace amounts of PFOA (AFCEC, 2018), although it is possible that stockpiles of old AFFF were used after that time. The USAF restricts use of AFFF to emergency responses and treats all releases as hazardous spills. AFFF contained in aircraft hangar fire protection systems was scheduled to be completed by the end of 2018 (AFCEC, 2018).

2.3 Regulatory Framework

In November 2009, EPA issued residential soil screening levels (SSLs) for PFOA of 16,000 micrograms per kilogram (µg/kg) and for PFOS of 6,000 µg/kg that were derived using EPA's regional screening level (RSL) calculator (U.S. EPA, 2009). In May 2016, the EPA issued a lifetime drinking water HA of 0.07 micrograms per liter (µg/L) (70 nanograms per liter [ng/L]) for PFOS and PFOA, both individually and combined (U.S. EPA, 2016a, 2016b, and 2017b). Sampling results are compared to this HA throughout this document.

On June 15, 2022, the EPA issued lifetime drinking water HAs for 4 perfluoroalkyl substances. These include 2 HAs that replace the HAs that EPA issued in 2016, and final HAs for 2 other PFAS: perfluorobutanesulfonic acid (PFBS) and GenX chemicals (U.S. EPA, 2022). The EPA's new

HAs, which identify the concentration of chemicals in drinking water at or below which adverse health effects are not anticipated to occur, are 0.004 ng/L for PFOA, 0.02 ng/L for PFOS, 10 ng/L for GenX chemicals, and 2,000 ng/L for PFBS (FRL 9855-OW). The updated HAs are based on new science that indicates that some negative health effects may occur with concentrations of PFOA or PFOS in water that are near zero (U.S. EPA, 2022). These interim health advisories will remain in place until EPA establishes a National Primary Drinking Water Regulation (U.S. EPA, 2022).

In 2018, the New Mexico Water Quality Control Commission (NMWQCC) added PFOA, PFOS, and PFHxS to the list of toxic pollutants as they relate to groundwater and surface water [20.6.2.3103(A)(2) NMAC and 20.6.2.7(T)(2)(s) NMAC]. In 2019, NMED established preliminary SSLs for PFOA, PFOS, and PFHxS in residential, industrial, and construction worker exposure scenarios at 1.56 milligrams per kilogram (mg/kg), 2.60 mg/kg, and 7.08 mg/kg, respectively. NMED also established a preliminary screening level for these three PFAS compounds in tap water at 0.07 µg/L (NMED, 2019a). These preliminary screening levels applied to each compound individually or in combination (NMED, 2019a).

In June 2022, NMED issued updated preliminary SSLs for PFAS. These include cancer SSLs for perfluorooctanoate and PFOA for residential, industrial/occupational, and construction worker exposure scenarios of 76.1 mg/kg, 498 mg/kg, and 2,690 mg/kg, respectively, as well as a cancer screening level of 11.1 µg/L for tap water (NMED, 2022). Noncancer SSLs were also issued for 12 PFAS compounds, as follows (NMED, 2022):

- Noncancer SSLs of 18.5 mg/kg, 374 mg/kg, and 80.7 mg/kg, respectively, for residential, industrial/occupational, and construction worker exposure scenarios, and a noncancer screening level of 6.02 µg/L for tap water for PFBS and potassium perfluorobutanesulfonate.
- Noncancer SSLs of 1.23 mg/kg, 24.9 mg/kg, and 5.38 mg/kg, respectively, for residential, industrial/occupational, and construction worker exposure scenarios, and a noncancer screening level of 0.401 µg/L for tap water for perfluorohexanesulfonate and PFHxS.
- Noncancer SSLs of 0.185 mg/kg, 3.74 mg/kg, and 0.807 mg/kg, respectively, for residential, industrial/occupational, and construction worker exposure scenarios, and a noncancer screening level of 0.0602 µg/L for tap water, for perfluorononanoate, perfluorononanoic acid (PFNA), perfluorooctanesulfonate, PFOS, perfluorooctanoate, PFOA, and potassium perfluorooctanesulfonate.

EPA issued the final toxicity assessments for PFBS (U.S. EPA, 2021a) and GenX chemicals in 2021 (U.S. EPA, 2021d) and planned to issue drinking water HAs for these constituents in spring 2022 (U.S. EPA, 2021c). EPA is currently developing toxicity assessments for 5 other PFAS—perfluorobutanoic acid (PFBA), perfluorohexanoic acid (PFHxA), PFHxS, PFNA, and perfluorodecanoic acid (PFDA) (U.S. EPA, 2021c).

In October 2021, EPA issued its PFAS Strategic Roadmap, which establishes timelines for specific actions to protect human health and the environment from PFAS contamination. This effort will include establishing enforceable maximum contaminant levels (MCLs) for PFOA and PFOS, while evaluating additional PFAS and groups of PFAS (U.S. EPA, 2021c). EPA anticipated issuing proposed rules in fall 2022, with final rules in fall 2023 (U.S. EPA, 2021c). At least 28 states have established advisory or regulatory limits or screening levels for two or more PFAS (ITRC, 2021 and 2022).

3. Environmental Setting

This section describes the area of interest for the NMED PFAS Investigation project, located southwest of Clovis, New Mexico (Figure 1). The project area includes parts of Townships (T) 1 and 2 North, Ranges (R) 34, 35, and 36 East relative to the New Mexico Baseline and Principal Meridian, but is focused on the south half of T2N, R35E, and the north half of T1N, R35E (Figure 2).

3.1 Site Description

The Cannon site NMED PFAS project area is roughly bounded by the western Cannon AFB boundary on the west, U.S. Highway 70 (US 70) on the east, the Curry-Roosevelt County boundary on the south, and State Road 245 (SR 245) on the north. As shown in Figure 2, the project area encompasses all of Cannon AFB; most of the area outside of the base is occupied by a number of dairy farming operations with fields irrigated with center pivot sprinklers. Principal dairy operations in the project area are shown on Figure 2.

Primary residential areas in the project area are located along the north side of the area along east-west US 60. The residential areas include Chavez Manor (Cannon AFB base housing), Turquoise Estates, and Desert Ranch Mutual Domestic Water Consumers Association (MDWCA) (Figure 2).

The City of Clovis, the county seat of Curry County, is located within an extensive area of large-scale irrigation farming that developed in eastern New Mexico and western Texas following World War II. It is the largest city in eastern New Mexico and is a principal center for trade and agricultural services for the region. The city is also a center for rail transportation, marketing livestock, and processing agricultural commodities, particularly grain, livestock, milk, and poultry. It is surrounded by thousands of acres of farming, ranching, and dairy land.

Cannon AFB, home of the Special Operations Air Force Base and the 27th Special Operations Force Support Squadron, is located a few miles west of Clovis. Cannon AFB occupies 3,789 acres of federally owned land (Figure 3). The administrative area, on-base housing, and a golf course are located in the northwest quadrant of the base. Two ponds at the golf course are an outfall for the base's National Pollution Discharge Elimination System (NPDES) permit. Off-base housing is located north of the golf course and US 60. The base has two active runways (northeast-southwest and northwest-southeast) and an abandoned north-south runway. Aircraft hangars and aprons are southeast of the administrative area and in the south-central portion of the facility. A wastewater treatment plant with storage basins for raw and treated wastewater and sludge drying beds is located in the northeast quadrant of the base (Figure 3). The ordnance storage area is located east of the wastewater plant and north of North Playa Lake, which is also an outfall for the base's NPDES permit. The Cannon AFB community includes more than 20,000 persons, including active duty, civil service and non-allocated federal employees, contractors, dependents, and retirees. In addition to Cannon AFB, major employers in the Clovis area include Burlington Northern Santa Fe Railway and Southwest Cheese, LLC (Clovis Economic Development, 2022).

3.1.1 Physiography

The Cannon site is located in the Llano Estacado, a subsection of the High Plains section of the Great Plains physiographic province (Figure 4) (Fenneman, 1931). The Llano Estacado, commonly referred to as the Southern High Plains, is an easterly dipping plateau with a rather featureless surface that formed during late Tertiary time. The Southern High Plains originally extended east from the central mountains in New Mexico far into Texas, but was separated from the mountains by the Pecos River during the Quaternary. The plateau is bounded on the north and west by erosional escarpments associated with the Canadian River and the Pecos River, respectively. The generally smooth uplands surface extends over a hundred miles to the east and south of Curry and Roosevelt Counties (Falk, 2005). On the south, the Southern High Plains merges into the Edwards Plateau (Cronin, 1969). The top of the plateau, which is capped with a

layer of caliche overlain by a relatively thin layer of sand and silt, is referred to as the "Caprock" (Cronin, 1969).

The Southern High Plains is underlain by Tertiary and Pleistocene unconsolidated deposits, which, in most parts of the plateau, overlie sedimentary rocks of Triassic age. The Muleshoe Dunes, a band of sand dunes about 2 to 4 miles wide in this area, separate the project area on the north from the Portales Valley on the south. The dunes trend east southeast and extend about 80 miles into Texas (Reeves, 1972).

3.1.2 Topography

As noted above, the topographically isolated Southern High Plains plateau consists mostly of relatively featureless, flat to gently rolling plains. The most abundant topographic features on the plateau are the thousands of small shallow topographic depressions called playas or playa basins (Finch and Wright, 1970; Bexfield, 1995), some of which are present on and near Cannon AFB (Figure 3). The land surface in the project area slopes to the south-southeast approximately 20 feet per mile from 4,350 feet relative to the North American Vertical Datum of 1988 (NAVD88) north of Cannon AFB to 4,150 feet NAVD88 at the Curry-Roosevelt county line and US 70. The topography and drainage pattern on Cannon AFB is shown on Figure 5.

3.1.3 Surface Drainage

There are no significant surface drainages in the project area, the closest being Running Water Draw, an ephemeral arroyo located approximately 10 miles north-northeast of Cannon AFB. Running Water Draw and Frio Draw, located farther north, are linear features that trend approximately south 75 degrees east (Figure 1). As noted above, the plateau is dotted with small playa basins (Finch and Wright, 1970), many of which are aligned in a direction similar to Running Water and Frio Draws (Figure 6). Because surface drainage in the project area is not well developed, most runoff from storms flows to these local depressions and is lost to evaporation, transpiration, or infiltration.

3.1.4 Climate

The Clovis area has a cold semiarid climate characterized by cold winters and warm to hot, dry summers. Average monthly data for temperature, precipitation and pan evaporation are summarized in Figure 7. Based on weather data from stations at the Clovis airport and Cannon AFB, the coldest months are December, January, and February, and the hottest months are June, July, and August. Diurnal temperature variations average almost 28°F.

Average annual precipitation for the period of 1910 to 2005 was 17.92 inches, with nearly 70 percent of precipitation occurring from May through September. The average annual pan evaporation rate for Clovis Station 13N for the period of 1929 to 2005 was more than 86 inches, ranging from 3.21 inches in December to 11.65 inches in July. Relative humidity is highest in the early morning, and ranges from 54 percent in April to 72 percent in September. Later in the day as temperatures rise, relative humidity typically falls averaging approximately 29 percent in April and 41 percent in September.

Average wind speeds in the area are generally moderate, although relatively strong winds often accompany occasional frontal activity, especially during late winter and spring months. Large-scale (or synoptic) winds in the Clovis region are most frequently from the west during the winter months and from the south during the summer months. The average annual wind speed at Cannon AFB for the period 1996-2006 was approximately 12 miles per hour (mph), ranging from 13.8 mph in April to 10 mph in August.

During the past century, severe droughts have occurred in this area in 1887-1897, 1910-1913, 1932-1938, 1952-1957, 2002-2004, and 2011-2015.

3.1.5 Soils

The distribution of soils in the project area mapped by the U.S. Department of Agriculture Natural Resources Conservation Service (NRCS) are shown on Figure 8. Approximately 80 percent of the project area is covered by three main soil types, each derived from loamy eolian deposits of the Blackwater Draw Formation: Amarillo fine sandy loam (0 to1 percent slopes) (map symbol AfA), Amarillo loamy fine sand (0 to 1 percent slopes) (map symbol AnB), and Acuff loam (0 to 1 percent slopes) (map symbol AcA). As shown on Figure 8, Cannon AFB and the area to the north are covered primarily by Amarillo fine sandy loam, while the area southeast of the base is covered mostly by Amarillo loamy fine sand (NRCS, 2007).

A typical AfA soil profile consists of fine sandy loam in the Ap1 horizon (0 to 9 inches), sandy clay loam in the Bt1 and Bt2 horizons (9 to 42 inches), and clay loam in the Btk horizon (42 to 80 inches). A typical AnB profile consists of loamy fine sand in the Ap zone (0 to 7 inches), sandy clay loam and loam in the Bt1 and Bt2 horizons (7 to 37 inches), and clay loam in the Btk horizon (37 to 80 inches). A typical Acuff loam soil profile consists of loam in the A horizon (0 to 9 inches), and clay loam in the B1 horizon (9 to 16 inches), the B2 horizon (16 to 33 inches), and the B3 horizon (33 to 80 inches) (NRCS, 2007).

These three soil units are very deep and well-drained with moderate to high water capacity (about 8.9 to 9.9 inches) and negligible to low runoff potential. The capacity of the most limiting layer in each unit to transmit water (K_{sat}) is moderate (0.6 to 2 in/hr). Average calcium carbonate content of about 40 percent is found in the horizon of maximum accumulation (NRCS, 2007).

3.2 Geology

The geologic units of primary interest in the project area are, from oldest to youngest, the Chinle Group, the Ogallala Formation, and the Blackwater Draw Formation. In the Cannon site project area, the Chinle Group forms the base of the Ogallala Aquifer, also referred to as the High Plains Aquifer. The Ogallala Formation contains the Ogallala Aquifer, which is the primary source of water for irrigated agriculture and industrial, municipal, and domestic uses for the region (Gustavson and Winkler, 1988; Rawling and Rinehart, 2018). These units are described in the following subsections.

3.2.1 Chinle Group

The Chinle Group of Upper Triassic age consists of five formations, including from oldest to youngest, the Santa Rosa Formation, the Garita Creek Formation, the Trujillo Formation, the Bull Canyon Formation, and the Redonda Formation (Scholle, 2003; USGS, 2022). The Chinle Group formations were deposited in lacustrine and fluvial environments (Brown, 2016), and are exposed in the Caprock Escarpment north and west of Curry County. The Chinle Group in east-central New Mexico is stratigraphically equivalent to the Dockum Group in Texas, and is referred to as the Dockum by workers in Texas (McGowen et al., 1982; McGookey et al., 1988; Lehman, 1994; Brown, 2016; Langman et al., 2004) and sometimes in the local area (Rawling, 2016). The term Chinle Group is used here because the project area is located in New Mexico.

The individual formations of the Chinle Group are not differentiated in the Clovis area on the state geologic map (Scholle, 2003). Long et al. (1992) suggest that the Redonda Formation of the Chinle Group might be the uppermost Triassic unit at Melrose Range, a few miles west of Cannon AFB. The Redonda Formation is described as moderate reddish brown, repetitively-bedded mudstone, siltstone, and fine sandstone that is laterally continuous and as much as 300 feet thick (Hester and Lucas, 2001). The underlying Bull Canyon Formation consists primarily of moderate reddish brown and grayish red mudstone with lesser amounts of grayish red to yellowish gray lithic sandstone. The Bull Canyon is as much as 360 feet thick (Hester and Lucas, 2001).

Most groundwater wells in the Clovis area are drilled to the top of the Chinle Group. In drill holes, the top of the Chinle is identified by a distinct change in lithology and color, and is typically described on numerous driller's logs as "redbeds." Geophysical logs of borings and wells that intersect the Chinle Group on Cannon AFB (Appendix D) show a sharp increase in both gamma counts and conductivity with a decrease in resistivity, which indicates that the Chinle is much finer-grained than the overlying Ogallala Formation.

After deposition of the Chinle Group, extensive erosion of the Triassic redbeds and overlying Lower Cretaceous deposits accompanied the uplift of the Rocky Mountain system during the late Cretaceous and early Tertiary (Falk, 2005; Gustavson, 1996). The regional erosional surface includes three broad paleovalley systems: the Slaton, Clovis, and Panhandle paleovalleys. These paleovalley systems generally trend southeast and are separated by upland areas. The Clovis paleovalley system extends into eastern New Mexico and has as much as 200 feet of relief (Gustavson, 1996). The top of the Chinle Group is marked by this erosional nonconformity with the overlying Ogallala Formation.

The pre-Ogallala erosion surface generally controlled the thickness of the Ogallala sediments, with the thickest accumulations occurring along the axes of pre-Ogallala paleovalleys. These Ogallala channels are generally oriented in a northwest to southeast direction that corresponds to the Ogallala Aquifer's present-day regional gradient. The elevation of the pre-Ogallala erosion surface, in effect the top of the Triassic redbeds, has been mapped by various investigators (Cronin, 1969; Hart and McAda, 1985; Musharrafieh and Logan, 1999; Trinity, 2012). For all except the Trinity effort, the data points used for mapping were not provided and/or the contour interval was too large to show detail. Trinity (2012, Table 3-20) compiled information for approximately 367 wells, but identified the contact between the Ogallala and the underlying redbeds at only 43 data points, mostly limited to Cannon AFB itself. For this project, DBS&A identified the top of the redbeds on more than 300 driller's logs from the OSE database and lithologic logs for monitor wells at Cannon AFB prepared by the USGS and various consultants. The results of this effort are presented in Appendix B.

3.2.2 Ogallala Formation

The Ogallala Formation of Miocene-Pliocene age unconformably overlies the redbeds of the Chinle Group. The Ogallala generally consists of clay, silt, fine- to coarse-grained sand, gravel, and caliche. The lithology varies over short distances, both vertically and laterally (Cronin, 1969). Color varies from white to light gray to brownish yellow, olive gray, and red brown (Radian, 1985).

The Ogallala Formation is composed primarily of sand that ranges from fine- to coarse-grained, and is typically well sorted. Silt is commonly present with the fine or medium sand grades that predominate in the upper part of the formation. Thin layers of clay and silt are common throughout the formation. Coarse-grained, well sorted sand and interbedded gravel are commonly present in the lower part of the formation. The base of the Ogallala Formation typically consists of gravel with sand and silt. The basal gravels, where present, are estimated to range in thickness from 5 to 120 feet (Howard, 1954). The sediments are generally loose and friable, except where cemented by calcium carbonate or caliche. The top of the formation is marked by a well-developed layer or layers of caliche consisting of almost pure calcium carbonate. Caliche and calcium carbonate occur throughout the formation as stringers, fracture fillings, rhizocretions, disseminated nodules, and layers 3 to 5 feet thick (Howard, 1954; Cronin and Myers, 1964; Galloway, 1972; Gustavson, 1996).

The Ogallala Formation was deposited on an uneven erosional landscape of paleovalleys and intervening uplands carved by rivers draining east from the Rocky Mountains (Cronin, 1969; Hart and McAda, 1985; Gustavson, 1996). Sands and gravels predominate in the paleovalleys where the unit is thickest, and were deposited in stream channels and adjacent floodplains. The thinner deposits on the paleo-uplands are composed of sandy and silty eolian sediment deposited as dunes and/or sand sheets (Gustavson and Winkler, 1988; Gustavson, 1996; Rawling and Rinehart, 2018). Calcic soils and caliches within the eolian facies commonly contain fine root traces (Gustavson, 1996).

The pre-Ogallala erosion surface generally controls the thickness of the Ogallala sediments, with the thickest accumulations occurring along the axes of pre-Ogallala paleovalleys. These Ogallala channels are generally oriented in a northwest to southeast direction that corresponds to the Ogallala Aquifer's present-day regional gradient. Drillers' logs from Cannon AFB indicate that the Ogallala Formation varies from 360 to 415 feet in thickness on the base (Appendix C).

During deposition, the Ogallala sediments were periodically exposed subaerially, which allowed soil horizons to develop. These depositional hiatuses and the soil formation processes resulted in the cemented layers that occur at intervals throughout the formation (Gustavson, 1996). Best known is the upper caliche zone locally referred to as the "caprock." Regionally, the upper caliche zone varies in thickness, from a few feet to more than 50 feet. In the Cannon AFB area, a continuous layer of caliche occurs at a depth of about 5 feet below ground surface (bgs) and extends to depths between 10 and about 35 feet.

3.2.3 Blackwater Draw Formation

The Blackwater Draw Formation of Quaternary age overlies the Ogallala Formation and consists mostly of clay, silt, and very fine- to fine-grained sand. These sediments were deposited in an eolian and ephemeral pond environment (Gustavson, 1996). In the Cannon site project area, the Blackwater Draw typically consists of silt and clay and is typically about 5 to 10 feet thick. The contact with the underlying Ogallala Formation is marked by the caliche caprock.

3.2.4 Structure

Although faults are extremely rare in the Southern High Plains, a number of studies have focused on prominent lineaments indicated by the alignment of ephemeral drainages, such as Running Water and Frio Draws, and the thousands of playa basins in the region (Figures 1 and 6) (Finch and Wright, 1970; Reeves, 1970; Osterkamp and Wood, 1987; Bexfield, 1995). According to Reeves (1970), the lineament directions on the Southern High Plains are similar to the joint patterns in the underlying Permian and Triassic bedrock, suggesting that they may have a significant effect on recharge to the Ogallala Aquifer.

3.3 Hydrogeology

The High Plains Aquifer, also referred to as the Ogallala Aquifer, is the primary source of potable water in the region, and provides the water supply for Cannon AFB, the City of Clovis, and the vicinity. Depth to groundwater is currently approximately 320 feet bgs in the Cannon AFB area, and groundwater is unconfined. The local groundwater gradient is generally to the southeast at 0.0013 to 0.0028 foot per foot (ft/ft) (Hart and McAda, 1985). A number of regional and local groundwater flow maps for the Cannon AFB area are provided in Appendix E.

A number of studies have concluded that the principal source of recharge to the Ogallala Formation is precipitation focused through the thousands of playa lakes that dot surface of the high plains. There is much evidence that recharge beneath playas is likely 10 to 100 times higher than in the interplaya areas. The net amount of recharge to the aquifer is extremely small, approximately a few tenths of an inch per year (Cronin, 1969; Reedy et al., 2003; Falk, 2005; Rawling and Rinehart, 2017). Some small but unknown amount of aquifer recharge occurs from irrigation return flow and from areas where water is continuously ponded.

3.3.1 Groundwater Levels

Overpumping of the Ogallala Aquifer has resulted in a significant decrease in the saturated thickness of the aquifer. The USGS has been monitoring water levels in the Ogallala Aquifer in a

number of wells in this area on a regular basis since the 1950s. Figure 9 shows the locations of some of the wells monitored by the USGS, the period monitored, and the rate of water table decline. The annual rate of water level decline ranges from about 0.4 feet per year (ft/yr) north of Cannon AFB to 3 ft/yr downgradient to the southeast of Cannon AFB. The hydrograph for the downgradient well, USGS Site 342006103134201, which declined about 169 feet from 1954 to 2010, is shown on Figure 10.

The locations of groundwater monitor wells on Cannon AFB are shown on Figure 11. Groundwater elevations in monitor wells on the east side of Cannon AFB for the period from 1992 and 2021 are shown on Figure 12. The plot indicates that in the early 1990s, the groundwater elevations in all of the wells would have been approximately similar and then began to diverge. Since about 1993, water levels in wells in the northeast portion of the base (MW-E, MW-F/Fa, MW-G/Ga, MW-H, and MW-N/Na) have declined by approximately 44 feet, a bit more than 1.6 ft/yr. Water levels in wells in the southeast corner of the base (MW-B, MW-C/Ca, and MW-D) declined by about 63 feet during the same period, more than 2.2 ft/yr. Water levels in wells MW-A and MW-Q, which are located quite close to each other, declined at a rate between the two groups.

During a water sustainability study at Cannon AFB performed by Trinity Analysis and Development Corporation (Trinity), pressure transducers and data loggers were installed in five groundwater monitor wells (MW-C, -Oa, -T, -V, and -X) to monitor water levels during July and August 2011 (Trinity, 2012). Data were collected at one-minute intervals and the results plotted by Trinity are shown on Figure 13. The water level in well MW-C showed the most obvious fluctuations, which Trinity attributed to pumping at an irrigation well approximately 190 feet to the west. Trinity reported that the irrigation well operated almost continuously for the final 40 days of the monitoring period, but did not know the pumping rate. Well MW-T, about 700 feet from the irrigation well, also showed some drawdown related to the pumping. MW-Oa on the east side of the Base showed a slight drop overall, but showed a small increase in water level from July 13 to 20, 2011. Water levels in wells MW-V, at the northwest corner of the Base, and MW-X, in the southwest portion of Cannon AFB, declined by about 0.5 foot each over the 62-day period.

3.3.2 Hydraulic Conductivity

Musharrafieh and Logan (1999) summarized the estimates of hydraulic conductivity of the Ogallala Formation by several investigators in Texas and New Mexico. They used a range of 5 to 150 feet per day (ft/d) in their groundwater flow model for the Curry and Portales Valley

underground water basins. Howard (1954) used specific capacity test data to estimate conductivity values ranging from 8 to 92 ft/d in the area east of Clovis. Hart and McAda (1985) estimated the conductivity of the High Plains Aquifer in Curry County to range from 11 to 200 ft/d, with an average of 60 ft/d, based on correlations between aquifer tests in the High Plains Aquifer and laboratory grain-size analyses.

Analysis of well pumping or aquifer performance tests in Cannon AFB supply wells 5 and 9 (Figure 11) using the Theis equation yielded "very rough" estimates of hydraulic conductivity of 2.00×10^{-3} centimeters per second (cm/s), or 5.7 ft/d (Lee Wan, 1990). A hydraulic conductivity of 2.00×10^{-2} cm/s (56.7 ft/d) was calculated from water level recovery data from supply well 8 using the Bouwer and Rice method (Lee Wan, 1990). The data used in these calculations were obtained to evaluate pumping rates, efficiency, and well yield, and were not intended for use in calculating aquifer properties (Lee Wan, 1990).

Slug tests were performed in two monitor wells (MW-O and MW-N) by Woodward-Clyde in early 1995, yielding estimated hydraulic conductivities of 3.00×10^{-3} cm/s (8.5 ft/d) (WCC, 1997).

Hydraulic conductivities estimated from the Cannon AFB production well and two nearby irrigation wells ranged from 20 to 60 ft/d (Trinity, 2012), and estimated well pumping capacities ranged from 40 to 180 gallons per minute (gpm) assuming 20 feet of drawdown. Based on this information, Trinity (2012) estimated groundwater flow rates between 0.5 and 2.0 ft/d, generally to the east and southeast across Cannon AFB. Horizontal groundwater velocity in the Cannon AFB area is reported to be about 150 ft/yr. Trinity (2012) estimated the groundwater flow in the Ogallala Aquifer at Cannon AFB is generally to the southeast between 0.5 and 2.0 ft/d based on hydraulic gradients ranging from 0.0020 to 0.0075 foot per foot.

To date, there have been no rigorous aquifer tests conducted on wells at Cannon AFB. The U.S. Army Corps of Engineers (USACE) and the AFCEC are apparently in the process of conducting an aquifer test and a hydraulic containment pilot study in the Ogallala Aquifer at the southeast corner of Cannon AFB (Brice-AECOM, 2021). One extraction well will be installed and an aquifer test will be conducted to define the hydrogeologic properties (e.g., transmissivity, hydraulic conductivity, and storage coefficients) of the Ogallala Aquifer. Work on this project began in or about November 2021 (Daigle, 2021).

4. Conceptual Site Model

This section describes the likely sources of PFAS contamination and exposure pathways at Cannon AFB.

4.1 Sources of Contamination

PFAS have been identified in soil, surface water, and groundwater at several AFFF release areas at Cannon AFB, most likely caused by the use of AFFF, which contained PFOS and PFOA, along with numerous other PFAS (ITRC, 2020). A total of 14 potential AFFF release areas have been identified at Cannon AFB (AFW, 2018).

4.2 PFAS Migration

Soil and groundwater data indicate that the most significant PFAS source areas are the former sewage lagoons and the North Playa Lake on the east side of Cannon AFB. While the firefighting training areas in the southeast portion of Cannon AFB are considered likely sources of PFAS, the groundwater flow direction and the distribution of PFAS in monitor wells in the southeast corner of the Base indicate that Landfill No. 5 is also a likely source of PFAS. PFAS have migrated through the vadose zone and impacted groundwater in the Ogallala Aquifer in and downgradient of these areas. Residual PFAS may have accumulated at the soil gas-sediment interface in the vadose zone under unsaturated flow conditions (Brusseau et al., 2019) that could provide a long-term source of contamination if not remediated.

Since the PFAS reached groundwater, these compounds have flowed with groundwater downgradient to the south and southeast of Cannon AFB. PFAS has likely migrated at the same rate as average groundwater flow in the Ogallala aquifer, with minimal adsorption onto aquifer materials. Based on Figure 14, a map developed by NMED (2020b), concentrations of total PFAS exceeding the 2016 EPA HA of 70 ng/L have been detected as much as 15,000 feet (approximately 3 miles) downgradient (east-southeast) of the Cannon AFB boundary. Figure 15, is based on a map issued by the USAF indicating potentially impacted groundwater in the downgradient direction (AFW, 2019). It is likely that PFAS movement in the Ogallala Aquifer has been affected by seasonal pumping of irrigation wells, creating increasing hydraulic gradients, southeast of Cannon AFB.

4.3 Exposure Pathways

Initial investigations conducted at Cannon AFB by the USAF have demonstrated that surface and subsurface sediment, surface water, and groundwater at the Cannon site are impacted by PFAS (AFW, 2018 and 2019). Potential receptors associated with current and future land use include USAF personnel, residents, visitors, grounds maintenance workers, utility workers, construction workers, and wildlife.

Off-site sampling conducted by USAF, USAF contractors, EPA, NMED, New Mexico Department of Health (NMDOH), the former New Mexico American Water Company (NMAWC), EPCOR, and landowners demonstrates that PFAS have migrated in groundwater miles to the east-southeast beyond the Cannon AFB boundaries. Potential off-site receptors include those parties that may consume or come in contact with water extracted from downgradient wells including wildlife, livestock, residents, visitors, and farm workers in the downgradient area. Wildlife and livestock may also be impacted by feed and forage grown using PFAS contaminated groundwater. Potential receptors also include those who may consume products (e.g., dairy products) derived from livestock that have ingested contaminated water or feed.

5. Previous PFAS Sampling in the Project Area

This section describes the results of sampling for PFAS in samples of environmental media collected by various parties within the project area. The results are presented in chronological order. Over time, the laboratory analysis of PFAS has become more sophisticated, precise, and accurate, and the number of target analytes has increased dramatically (ITRC, 2021). The methods used to analyze samples and the target analytes for each investigation in the Cannon site area are summarized in Table 2.

5.1 Third Unregulated Contaminant Monitoring Rule (UCMR 3) Program

In 2012, under the UCMR 3 program, EPA mandated that all PWSs serving more than 10,000 people and 800 PWSs that serve 1,000 or fewer people collect and analyze representative water samples for two viruses and 28 chemicals, including 6 PFAS (U.S. EPA, 2017a). The 6 PFAS (3 PFSAs, including PFOS, and 3 PFCAs, including PFOA) were to be analyzed using EPA method 537.

In 2013 and 2014, NMAWC (now EPCOR), the private company that provides water for the City of Clovis, collected a total of 15 water samples from eight locations within the system, including four supply wells and four points of entry. Sample locations were identified from the NMED Drinking Water Bureau's Drinking Water Watch website and are shown on Figure 16. The PFAS results for samples collected by various parties in the State of New Mexico were posted to the NMED PFAS Data webpage (NMED, 2020a) on January 8, 2020. The laboratory analytical results of the NMAWC water samples for PFAS are provided in Table 3. No target analytes were detected, although the reporting limits, which ranged from 10 to 90 ng/L for the different compounds, were considerably higher than can be achieved now.

5.2 Cannon AFB Water Supply

In 2016, the DOD ordered testing of drinking water systems for PFAS at all locations where DOD supplies drinking water (DOD, 2021). In August 2016, the USAF collected a total of eight samples of raw and treated drinking water from seven locations on Cannon AFB, including six production wells and the water treatment plant (NMED, 2019b). One of the wells sampled, CAFB-11, is located at the Melrose Air Force Range, located west of Cannon AFB. Samples were analyzed using EPA method 537 for the same six PFAS as listed in UCMR3, including PFOA and PFOS (Table 2). The locations of the water supply wells and the water treatment plant at Cannon AFB were identified from NMED's Drinking Water Watch website and are shown on Figure 17. Construction details for the production wells at Cannon AFB are summarized in Table 4.

The laboratory results for PFAS were posted to the NMED PFAS Data webpage (NMED, 2020a) and are summarized in Table 5. The reporting limits were not provided, so analytes that were not detected are simply reported as ND. Total PFAS ranged from 2.3 to 8.1 ng/L. PFOA and PFOS were not detected. PFBS and/or PFHxS were detected in six of the eight samples, including the sample of treated water from Well 9 and the drinking water sample from the water treatment plant. The results for these samples indicated that groundwater at Cannon AFB was impacted with PFAS.

5.3 USAF PFAS Investigations at Cannon AFB

The USAF has conducted numerous remedial investigations (RIs) of soil and groundwater conditions at Cannon AFB since the late 1980s, but investigation of PFAS has been relatively recent and of limited extent. The USAF has assumed that PFAS present at Cannon AFB are most likely related to the use of AFFF, and has identified a total of 14 AFFF release areas at Cannon AFB, which are shown in Figure 18. The potential AFFF release areas were identified during a

preliminary assessment (PA) conducted by HydroGeoLogic, Inc. (HGL, 2015), and during the installation scoping visit conducted by Amec Foster Wheeler (AFW) in October 2016 (AFW, 2018). The 14 AFFF release areas identified by the USAF at Cannon AFB are briefly described in Table 6. The layout of each AFFF release area is shown in Figures 19 through 30, which are from the 2018 final site inspection (SI) report (AFW, 2018) issued by the USAF.

USAF conducted an SI of the AFFF release areas at Cannon AFB during November and December 2017. Soil or sediment and surface water samples were collected from the AFFF release areas at Cannon AFB to determine whether these areas were impacted by releases of AFFF containing PFAS. Groundwater samples were also collected from 18 groundwater monitor wells at Cannon AFB to determine the nature and extent of PFAS impacts to groundwater (AFW, 2018). The 18 monitor wells sampled included 6 monitor wells (MW-Ca, -Fa, -Ga, -Sa, -Ta, and -Ua) that were installed in August 2017 to replace monitor wells that were screened above the declining water table (FPM, 2017).

During August and September 2018, the USAF collected groundwater samples from 25 wells that were used for irrigation, livestock, or residential water supply. In October 2018, 6 groundwater monitor wells at Cannon AFB were sampled (MW-Ca, -D, -Ga, -Pa, -Sa, and -Ta), including 4 replacement groundwater monitor wells that were installed in August 2017 (MW-Ca, -Ga, -Sa, and -Ta) and 1 well (MW-Y) that was installed in February 2019 (AFW, 2019).

Soil, sediment, surface water, and groundwater samples collected by the USAF in 2017 and 2018 were analyzed for a total of 16 PFAS using EPA method 537 M-ID. Following is a brief review of results from PFAS investigations conducted by the USAF at the AFFF release areas and downgradient of Cannon AFB.

5.3.1 Soil Sampling

USAF collected a total of 54 soil samples, including 5 duplicate samples, from 9 of 14 AFFF release areas at Cannon AFB during the 2017 PFAS SI (AFW, 2018). Generally, 2 soil samples were collected from each boring: at the surface (0 to 0.5 feet bgs) and at depths up to 50 feet bgs. A number of PFAS were detected, including PFOS and PFOA. PFOS and PFOA results were compared to an SSL of 126 µg/kg calculated by the USAF; PFBS results were compared to an SSL of 130 µg/kg. PFOS concentrations exceeded the USAF SSL of 126 µg/kg in 12 samples, including 9 surface samples (0 to 0.5 feet bgs) and 3 samples up to 10 feet deep. PFOA and PFBS were detected at depths to 41 feet, but none of the results exceeded the respective SSLs of

126 and 130 µg/kg. This section summarizes the results of USAF soil sampling at the AFFF release areas.

At Area 1, Former fire training area (FTA) No. 2 (Table 6 and Figure 18), 2 soil borings were advanced to a depth of 30 feet bgs and soil samples were collected at the surface and at 28 to 30 feet bgs. The laboratory results for PFAS analysis of soil from Area 1 are provided in Table 7a. The layout and locations of soil borings at Area 1 are shown on Figure 19. Total PFAS concentrations in the 4 samples ranged from 5.25 to 192.15 µg/kg. Only PFCAs and PFSAs were detected, with PFSAs comprising more than 80 percent of total PFAS in each sample. Maximum PFOA and PFOS concentrations detected were 35 and 49 µg/kg, respectively. PFAS were detected in the deep soil samples indicating that contaminants migrated some distance beneath the surface.

At Area 2, Former FTA No. 3 (Table 6 and Figure 18), 2 soil borings were advanced to a depth of 30 feet bgs and soil samples were collected at the surface and at 28 to 30 feet bgs. The laboratory results for PFAS analysis of soil from Area 2 are provided in Table 7b. The layout and locations of soil borings at Area 2 are shown on Figure 20. No PFAS were detected in the deep soil samples. Total PFAS in the 2 shallow samples were 132.92 and 252.01 µg/kg. Only PFCAs and PFSAs were detected, with PFSAs comprising more than 94 percent of total PFAS in both samples. Maximum PFOA and PFOS concentrations detected in shallow soil were 2.6 and 240 µg/kg, respectively. The PFOS concentration in one sample exceeded the SSL of 126 µg/kg. The results do not indicate that PFAS migrated below the near surface soil at Former FTA No. 3.

At Area 3, Former FTA No. 4 (Table 6 and Figure 18), 3 soil borings were advanced to depths between 41 and 50 feet bgs. Soil samples were generally collected at the surface and from the bottom of the boring. The layout and locations of soil borings at Area 3 are shown on Figure 21. The laboratory results for PFAS analysis of soil from Area 3 are provided in Table 7c. PFAS were detected in 6 of 7 soil samples, with total PFAS concentrations ranging from 9.4 to 844.5 µg/kg. PFCAs, PFSAs, and fluorotelomer sulfonic acids (FTSAs) were detected, with PFSAs generally comprising as much as 73 percent of total PFAS detected. Maximum PFOA and PFOS concentrations detected were 64 and 610 µg/kg, respectively. The PFOS concentration in the 3 shallow soil samples exceeded the SSL of 126 µg/kg. The results indicate that PFAS have impacted soil up to 50 feet deep at Former FTA No. 4.

At Area 4, Hangars 119 and 133 (Table 6 and Figure 18), 2 soil borings were advanced to a depth of 30 feet bgs and soil samples were collected at the surface and at 28 to 30 feet bgs. The laboratory results for PFAS analysis of soil from Area 4 are provided in Table 7d. The layout and

locations of soil borings at Area 4 are shown on Figure 22. Total PFAS concentrations of 577.6 and 603.6 µg/kg were detected in the 2 shallow samples, with up to 6 PFCAs, 3 PFSAs, and 2 FTSAs. In the 2 shallow samples, total PFSAs comprised approximately 74 and 67 percent of total PFAS (dominated by PFOS, which exceeded the SSL of 126 µg/kg); the FTSAs comprised approximately 24 and 30 percent of total PFAS. The soil sample from 28 to 30 feet bgs had a total PFAS concentration of about 20 µg/kg in the duplicate sample from boring SB04001. Both the primary and duplicate sample contained less than 1 µg/kg of PFOS. PFAS were also detected in soil samples from 30 feet bgs, with total PFAS concentrations of 13.1 and 3.81 µg/kg, respectively. The results indicate that PFAS have impacted soil up to 30 feet deep at AFFF release area 4.

At Area 5, the Former Sewage Lagoons (Table 6 and Figure 18), 10 soil borings were advanced to a maximum depth of 10 feet bgs and soil samples were collected from the last 1 foot at each location. The laboratory results for PFAS analysis of soil from Area 5 are provided in Table 7e. The layout and locations of soil borings at Area 5 are shown on Figure 23. Total PFAS concentrations in soil samples at Area 5 ranged from 12.4 to 403.6 µg/kg. At least 3 PFCAs (PFHxA, perfluoroheptanoic acid [PFHpA], and PFOA) were detected in each sample, and up to 8 PFCAs were detected in 3 samples. At least 2 PFSAs (there were only 3 PFSA target analytes) were detected in the 10 soil samples and 1 duplicate from Area 5. PFSAs comprised between 50 and 81 percent of total PFAS in the samples, dominated by PFOS, which made up 41 to 78 percent of total PFAS. PFOS concentrations exceeded the SSL in three samples. N-methyl perfluorooctane sulfonamido acetic acid (NMeFOSAA) and n-ethyl perfluorooctane sulfonamide acetic acid (NEtFOSAA) were consistently detected in soil samples from Area 5, the Sewage Lagoons, and were not reported in soil samples from any other AFFF area at Cannon AFB. The results indicate PFAS impacts to soil at the former Sewage Lagoons, but the vertical extent of impacts is not known.

At Area 7, the South Playa Lake Outfall (Table 6 and Figure 18), 4 soil borings were advanced to a depth of 25 feet bgs and soil samples were collected at the surface and at 23 to 25 feet bgs. The laboratory results of PFAS analysis of soil from Area 7 are provided in Table 7f. The layout and locations of soil borings at Area 7 are shown on Figure 25. PFCAs, PFSAs, and FTSAs were detected in soil samples from Area 7. Total PFAS ranged from 0 to 131 µg/kg. Maximum PFOA and PFOS were 2.2 and 85 µg/kg, respectively, with PFAS impacts detected up to 25 feet bgs. The vertical extent of PFAS impacts at the South Playa Lake has not been determined.

At Area 9, Hangar 109 (Table 6 and Figure 18), 2 soil borings were advanced to a depth of 30 feet bgs and soil samples were collected at the surface and at 28 to 30 feet bgs. The laboratory results of PFAS analysis of soil from Area 9 are provided in Table 7g. The site layout and locations of soil borings at Area 9 are shown on Figure 27. PFCAs, PFSAs, and FTSAs were detected in soil samples from Area 9. Total PFAS concentrations in the 4 samples and 1 duplicate ranged from 0.75 to 4,725 µg/kg. Total PFAS in the two deeper samples were 3.0 and 0.75 µg/kg. Maximum PFOA and PFOS concentrations were 27 and 230 µg/kg, respectively, with the PFOS concentration in 1 sample (and its duplicate) exceeding the SSL of 126 µg/kg. FTSAs, including 6:2 FTS at 3,900 µg/kg, were detected in shallow soil samples, but not in deep samples. The initial data suggest that PFAS impacts to soil at Area 9 are mostly limited to shallow soil.

At Area 11, Former Landfill No. 4 (Table 8 and Figure 18), 3 soil borings were advanced to a depth of 25 feet bgs and soil samples were collected at the surface and at 23 to 25 feet bgs. The laboratory results for PFAS analysis are provided in Table 7h. The layout of the former Landfill 4 site is shown in Figure 29, but no map showing the locations of borings at Area 11, or a survey of boring locations, could be located. PFAS were detected in the shallow soil samples, including 4 PFCAs, 2 PFSAs, and 1 FTSA. No PFAS were detected in deep samples, except for a single detection of PFOS, which was also detected in an associated QC blank. PFOS was detected in all three shallow samples at concentrations up to 1,000 µg/kg, with 2 results exceeding the SSL. The initial data suggest that PFAS impacts to soil at Area 11 are mostly limited to shallow soil.

At Area 12, the Perimeter Road Fuel Spill (Table 6 and Figure 18), 1 soil boring was advanced to a depth of 30 feet bgs and soil samples were collected at the surface and at 28 to 30 feet bgs. The laboratory results for PFAS analysis are provided in Table 7i. The site layout and locations of soil borings at Area 12 are shown on Figure 30. No PFAS were detected in soil samples from the fuel spill site.

5.3.2 Sediment Sampling

Samples of surface sediment (0.0 to 0.5 feet bgs) were collected from two AFFF release areas at Cannon AFB: Area 6, the North Playa Lake Outfall, and Area 8, the Golf Course Outfall (Table 6 and Figure 18). The laboratory results for PFAS analysis of sediment samples from these two areas are provided in Table 8. This section summarizes the results of USAF sediment sampling at these AFFF release areas.

A total of 2 surface sediment samples were collected at Area 6, the North Playa Lake Outfall. The site layout and locations of sediment samples at Area 6 are shown on Figure 24. Total PFAS concentrations in the 2 samples were 40.08 and 10.19 µg/kg. PFHpA, PFHxS, and PFOS were detected in North Playa Lake sediment, with a maximum PFOS concentration of 39 µg/kg. The initial data suggest that PFAS impacts to surface sediment at the North Playa Lake are low.

A total of 2 surface sediment samples and 1 duplicate sample were collected at Area 8, the Golf Course Outfall. The site layout and locations of sediment samples at Area 6 are shown on Figure 26. Total PFAS concentrations ranged from 16.46 to 86.36 µg/kg. PFCAs and PFSAs were detected in all 3 samples, with PFSAs comprising more than 80 percent of total PFAS. PFOA was not detected and maximum PFOS concentration was 77 µg/kg. The initial data suggest that PFAS impacts to surface sediment at the Golf Course Outfall warrant further investigation.

5.3.3 Surface Water Sampling

A total of 4 surface water samples were collected from two AFFF release areas at Cannon AFB: Area 6, the North Playa Lake Outfall, and Area 8, the Golf Course Outfall (Table 6 and Figure 18). The laboratory results for PFAS analysis of surface water samples from these two areas are provided in Table 9. Areas 6 and 8 are shown on Figures 24 and 26.

Analytical results showed that 3 PFCAs, 3 PFSAs, and 1 FTSA (6:2 FTS) were detected in both water samples from the North Playa Lake (Table 9). PFCAs comprise about 48 and 60 percent of the total PFAS detected. PFOA and PFOS were detected in both samples, with maximum concentrations of 27 and 110 ng/L, respectively. PFOS levels in both water samples exceeded the 2016 EPA HA of 70 ng/L.

Only PFOS was detected in the two water samples from the Golf Course Outfall (Table 9). PFOS was detected in each surface water sample, but concentrations did not exceed the LHA established by EPA.

5.3.4 Groundwater Sampling

In 2017 and 2018, USAF collected a total of 24 groundwater samples from 18 on-site groundwater monitor wells. The well locations are shown on Figure 11. Construction information for the monitor wells is summarized in Table 10. The laboratory results for PFAS analysis of groundwater samples from the monitor wells at Cannon AFB are provided in Tables 11a through 11c.

A total of 8 monitor wells at Cannon AFB have no detectable PFAS or low levels of only 1 or 2 PFAS, neither of which are PFOA or PFOS, as shown in Table 11a. No PFAS were detected in samples from 5 wells: MW-E, MW-Na, MW-V, MW-W, and MW-X. Only 1 PFAS (PFHxA) was detected in the sample from well MW-Rb, and only 2 PFAS (PFHxA and either PFBS or PFHxS) were detected in samples from wells MW-A and MW-Fa. Wells MW-V and MW-X are located in the northwest corner and southwest portion of Cannon AFB, respectively (Figure 11). Well MW-A is generally upgradient of former FTAs 2, 3, and 4, while wells MW-E, Fa, Rb, Na, and W are upgradient or side-gradient (north) of the Former Sewage Lagoons and North Playa Lake. Well MW-Na is generally downgradient of Former Landfill 4.

5.3.4.1 East Monitor Wells

Significant levels of PFAS were detected in 4 groundwater monitor wells generally located downgradient of the former Sewage Lagoons and the North Playa Lake (Figure 11). These 4 wells, MW-Ga, MW-H, MW-Oa, and MW-Pa, are referred to here as the east monitor wells. The laboratory results for PFAS analysis of groundwater samples from the east monitor wells are provided in Table 11b.

Total PFAS in groundwater samples from the southeast monitor wells ranged from 252.4 to 1,506 ng/L. PFOA and PFOS were detected in each of these wells with maximum concentrations of 71 and 130 ng/L, respectively, in the sample from well MW-Ga. Samples from wells MW-Ga and Pa exceeded the 2016 HA of 70 ng/L for PFOS and for PFOA plus PFOS.

A total of 3 PFCAs (PFHxA, PFHpA, and PFOA), 3 PFSAs (PFBS, PFHxS, and PFOS), and 1 FTSA (6:2 FTS) were detected in samples from each of the 4 east wells. The proportions of selected PFAS detected in the east monitor wells as a percentage of total PFAS detected are shown in Figure 31. The samples are generally dominated by PFHxA and PFHxS.

Water samples from well MW-Pa also contained NEtFOSAA (5.7 ng/L) and NMeFOSAA (3.9 ng/L). As discussed in Section 5.3.1, these 2 PFAS were only detected in soil samples from the former Sewage Lagoons located upgradient of well MW-Pa. NEtFOSAA and NMeFOSAA were not detected in any other groundwater samples from Cannon AFB.

5.3.4.2 Southeast Monitor Wells

There are 6 monitor wells at the southeast corner of Cannon AFB, with well MW-Sa closest to the southeast corner (Figure 11). Wells MW-Ua, MW-B, and MW-Ta are north of well MW-Sa near the east property line, and wells MW-Ca and MW-D are west of well MW-Sa near the south property line. These wells, referred to herein as the southeast monitor wells, are designed to

monitor releases from the active and former FTA, but also monitor groundwater from beneath Landfill 5. The laboratory results for PFAS analysis of groundwater samples from the southeast monitor wells are provided in Table 11c.

Total PFAS concentrations in groundwater samples from the southeast monitor wells ranged from 181.6 ng/L at well MW-UA (farthest north of the southeast corner) to 56,504 ng/L at well MW-Ca, about 500 feet west of well MW-Sa. PFOA and PFOS were detected in each of these wells with a maximum PFOA concentration of 2,800 ng/L at well MW-D, and a maximum PFOS concentration of 24,000 ng/L at well MW-Ca. Samples from wells MW-Ca, MW-D, MW-Sa, and MW-Ta exceeded the 2016 HA of 70 ng/L for PFOS and/or PFOA, individually and in combination.

At least 3 PFCAs (PFHxA, PFHpA, and PFOA) were detected in each of the 6 wells, with PFHxA most often at the highest concentration. A total of 2 PFSAs (PFBS and PFHxS) were also detected in each sample, but the samples from wells nearest the southeast corner of the site (MW-D, MW-Ca, MW-Sa, and MW-Ta) also contained PFOS (note that only 3 PFSAs were target analytes) and 6:2 FTS. The proportions of selected PFAS detected in the southeast monitor wells as a percentage of total PFAS detected are shown in Figure 32a. The proportions of selected PFAS in wells MW-D, MW-Ca, MW-Sa, and MW-Ta are shown in Figure 32b.

5.3.4.3 Confirmation Sampling in 2018 and 2019

In October 2018, USAF collected confirmation groundwater samples from 6 groundwater monitor wells at Cannon AFB, including MW-Ca, MW-D, MW-Sa, and MW-Ta in the southeast area and MW-Ga and MW-Pa in the east area. In early 2019, a sample was collected from well MW-Y, which was installed west of well MW-Oa and downgradient of the former Sewage Lagoons (Figure 11). The laboratory results for PFAS analysis of groundwater samples from the wells sampled in 2018 and 2019 are provided in Table 12. Also shown are the results for 2017 samples for those wells. The analytical results from confirmation samples collected in 2018 are substantially the same as for the initial PFAS samples collected in 2017. One difference is that NEtFOSAA and NMeFOSAA, which were detected in well MW-Pa at concentrations below the reporting limit, and therefore considered as estimates, were not detected in the 2019 sample.

The PFAS results for the groundwater sample from well MW-Y, downgradient of the former Sewage Lagoons, were similar to those in other wells in the east area (Section 5.3.4.1). The sample contained total PFAS at a concentration of 1,255.2 ng/L; the duplicate contained a total PFAS concentration of 1,336.3 ng/L. PFOA and PFOS were detected in the primary and duplicate sample and exceeded the 2016 HA of 70 ng/L for PFOS and for PFOA plus PFOS (Table 12).

As in other wells in the east area, 3 PFCAs (PFHxA, PFHpA, and PFOA), 3 PFSAs (PFBS, PFHxS, and PFOS), and 1 FTSA (6:2 FTS) were detected in the primary and duplicate samples from well MW-Y. The samples from well MW-Y are also dominated by PFHxA and PFHxS.

The PFAS results for groundwater samples collected from monitor wells at Cannon AFB in 2018 confirmed the 2017 sample results. PFAS data from well MW-Y provide further evidence that contamination from the sewage lagoons has migrated off-site to the southeast.

5.3.5 Off-Base Well Sampling

In August and September 2018, USAF collected water samples from 25 irrigation and residential wells located east and southeast of Cannon AFB (AFW, 2019). The USAF submitted the results of the off-base well sampling to NMED, and those results are publicly available through an index of documents for key sites maintained by the NMED HWB at https://hwbdocuments.env.nm.gov. The locations of off-site wells sampled by USAF in 2018 are shown on Figure 33. The results of laboratory analysis of groundwater samples for PFAS from off-base wells are provided in Table 13.

Portable document files (pdfs) of some of the laboratory data sheets in Appendix C to the SI report addendum (AFW, 2019) were found to be corrupted and hard to decipher or illegible. Table 3.1-2 in the addendum to the SI report (AFW, 2019) provides only PFOA, PFOS, and PFBS results for the off-base wells. Those results were the primary source for values listed in Table 13; the remaining values were obtained from the laboratory data sheets in Appendix C to the SI report addendum (AFW, 2019). However, some pages of the laboratory reports were found to be corrupted and difficult to read or illegible. Table 13 is a best effort to present all PFAS data; however, some of the values posted may be incorrect and some results could not be determined and were not posted on the table. This issue affects the following evaluation of these off-base results.

No PFAS were detected in 14 (possibly 15) of 25 samples from off-base wells. At the other 11 locations, total PFAS concentrations ranged from 4.17 to 5,153 ng/L. PFOA and PFOS were detected in samples from 4 of the 25 off-base locations. Concentrations of PFOA exceeded the 2016 EPA HA of 70 ng/L in 3 samples, with a maximum concentration of 539 ng/L. Concentrations of PFOS exceeded the 2016 EPA HA of 70 ng/L in 4 samples, with a maximum concentration of 1,110 ng/L.

PFHxA and PFHxS appear to be the most commonly detected PFAS. At least 3 PFCAs, 3 PFSAs, and 1 FTSA (6:2 FTS) were detected in samples from the two locations with the highest total PFAS concentrations, RES-650-01 and RES948-01.

5.3.6 Wastewater Sampling

Samples of influent and effluent were collected at the Cannon AFB WWTP in August 2019 (EA, 2019). The WWTP is located on the east side of Cannon AFB, as shown on Figure 3. The information reviewed does not indicate why the sampling was conducted or whether samples of wastewater from the base have been analyzed for PFAS before or since preparation of this report. The laboratory results for PFAS analysis of the wastewater samples are provided in Table 14.

PFAS were detected in both influent and effluent samples with total PFAS concentrations of 136.95 and 419.78 ng/L, respectively. A duplicate sample of the effluent had a total PFAS concentration of 412.72 ng/L. PFSAs comprised more than 63 percent of the total PFAS in both influent and effluent. PFOA (4.67 ng/L) was detected in the effluent sample, but was not detected in the influent. PFOS was detected in both influent and effluent samples, but neither PFOA, PFOS, nor the combined concentrations exceeded the 2016 HA of 70 ng/L.

The concentrations and proportions of the 9 PFAS detected in the wastewater samples are shown in Figures 34a and 34b, respectively. Except for the PFSA PFHxS, which decreased in concentration between the influent and effluent samples, all other PFAS detected increased in concentrations between the influent and effluent samples. Most notable were the differences in perfluoropentanoic acid (PFPeA) and 6:2 FTS, which increased 10-fold. The differences between individual PFAS in influent and effluent samples is not clear at this time, but it seems likely that other PFAS that were not analyzed for are present in the wastewater.

5.3.7 USAF PFAS RI

The USAF is currently conducting an RI related to PFAS at Cannon AFB and downgradient of the Base (Bristol, 2021) under EPA Region 6 oversight. The RI will include on-base investigations at AFFF release areas 2 through 6 and 8 through 10, which are described in Table 6. Area 8 has been expanded to include other areas of Cannon AFB where treated wastewater has been used for irrigation. The scope of work for the RI includes the following:

- Sample 19 existing groundwater monitor wells on Cannon AFB and up to 40 off-base irrigation wells on two occasions, six months apart.

- Install and sample at least 8 new groundwater monitor wells on Cannon AFB and up to 15 new groundwater monitor wells off-base. Soil samples will be collected from each boring at 9 to 10 feet bgs and just above the water table. At one on-base location, soil samples will be collected every 50 feet. Groundwater will be sampled on two occasions, six months apart.
- Collect surface soil samples at more than 70 locations on Cannon AFB.
- Collect soil samples from more than 150 borings on Cannon AFB.
- Sample irrigated soil from 40 off-base irrigation well locations at the 0 to 0.5 feet bgs and 1.5 to 2 feet bgs.
- Install 12 lysimeters at six locations during the wet season and sample porewater.

New monitor wells will be installed using sonic drilling methods. The locations of the proposed off-base activities, including new monitor wells, are currently not known because those portions of the work plan (Bristol, 2021) have been redacted.

USAF is also conducting an aquifer performance test in a newly installed extraction well in the southeast corner of Cannon AFB. The purpose of the test is to develop estimates of site-specific aquifer parameters to facilitate the design and construction of a pilot-scale groundwater containment and treatment system (Brice-AECOM, 2021).

While these activities are believed to have begun in early 2022, the schedule for completion of filed activities is not currently known. It will likely be sometime in 2023 before a report(s) is issued to the public.

5.4 Highland Dairy Sampling

In September 2018, Mr. Arthur Schaap, owner of Highland Dairy, collected water samples from a total of 12 locations on his property, including 6 irrigation wells, the supply well for Highland Dairy (well D-1), 3 residential wells, and 2 locations referred to as "milk tanks." The sample locations are shown on Figure 35. These samples from wells were analyzed for 16 PFAS using EPA method 537 (Table 3); the samples from the milk tanks were analyzed only for PFOA and PFOS. Mr. Schaap provided a copy of the laboratory report to former NMED employee, Dennis McQuillan, and has given verbal permission to publish the results herein. The results for wells W-5 and D-1 were part of the results posted to the NMED website on April 5, 2019 (NMED, 2019c). Laboratory results provided by Mr. Schaap are included as Appendix G. The target

analyte list included 11 PFCAs, 4 PFSAs, and 1 perfluoroalkane sulfonamide, perfluorooctane sulfonamide (PFOSA).

PFAS were detected in 11 of 12 water samples collected by Mr. Schaap, as shown in Table 15. Excluding the sample from location W-3, in which no target analytes were detected, total PFAS concentrations ranged from 7.6 to 30,125.9 ng/L. Excluding the sample from well W-3 and the samples from the milk tanks, which were only analyzed for 3 PFAS, all of the remaining samples contained 3 PFCAs (PFBA, PFPeA, and PFHxA) and 2 PFSAs (PFBS and PFHxS). PFOA and PFOS were detected in 7 and 8 samples, respectively, with maximum concentrations of 2,920 and 11,400 ng/L detected in the sample from well W-5. Well W-5 is located adjacent to the pivot point of the irrigation sprinkler south of Cannon AFB monitor well MW-D (Figure 35), and is closest to the source area on Cannon AFB. Concentrations of PFOA and PFOS exceeded the 2016 EPA HA of 70 ng/L in samples from 5 wells and the 2 milk tanks.

The proportions of selected PFAS as a percentage of total PFAS detected in selected samples collected by Mr. Schaap are shown in Figure 36. Samples with the highest concentrations of total PFAS (wells W-3, W-4, and W-5) are dominated by PFSAs, while samples with lower total PFAS (W-1, W-1-2, H-2, H-3) are dominated by PFCAs. The samples with the highest total PFAS (wells W-3, W-4, and W-5) also contain low levels of PFOSA.

During the project's initial site visit in June 2021, Mr. Schaap informed DBS&A personnel that EPCOR was sampling one of his wells (W-5) on a quarterly basis (Schaap, 2021), and provided DBS&A with EPCOR's sample results for that well dated March 23, 2021 and June 2, 2021 (Appendix G). All of the available results for well W-5 are discussed further in Section 6.4.3.

5.5 NMED Sampling

5.5.1 Cannon AFB

In November 2018, NMED collected water samples from the points of entry 1 and 4 to the water system at Cannon AFB (NMED, 2019c). Samples were analyzed for 6 PFAS, including PFOA and PFOS using EPA method 537 (NMED, 2019c). The sample results were posted to the NMED PFAS Data webpage (NMED, 2020a) on April 5, 2019, and are summarized in Table 16. The sample locations are shown in Figure 37. No target analytes were detected. The reporting limits were not provided, so analytes that were not detected are simply reported as ND.

In March 2019, NMED collected water samples from drinking water supply wells 3, 8, 9, and 12 at Cannon AFB (NMED, 2019c). Samples were analyzed for 15 PFAS, including PFOA and PFOS

using EPA method 537-M (NMED, 2019c). The sample results were posted to the NMED PFAS Data webpage (NMED, 2020a) on April 5, 2019, and are also summarized in Table 16. The sample locations are also shown in Figure 37. PFOA and PFOS were not detected in these samples, but 2 PFSAs (PFHxA and PFHpA) and 2 PFCAS (PFHxS and PFHpS) were detected in samples from well 3 and 12. Total PFAS in wells 3 and 8 were 44.6 and 33.5 ng/L, respectively. In both samples, PFCAs comprised about 60 percent of total PFAS. The laboratory reporting limits were not provided, so analytes that were not detected are simply reported as ND.

5.5.2 Clovis and Area West

In November 2018, NMED collected a total of 6 water samples from five small water suppliers located west of Clovis and north of Cannon AFB. Those systems included the treatment units at Allsup's convenience store 45, Clovis West, and Desert Ranch MDWCA, and wells at Turquoise Estates and Traveler's World Campground (Figure 2 and 37). The samples were analyzed for 6 PFAS using EPA method 537. The results were posted to the NMED PFAS Data webpage (NMED, 2020a) in April 2019, and the results are summarized in Table 17. A total of 1 PFAS, PFHxS, was detected in the primary and duplicate samples from Turquoise Estates Well 1. PFOA and PFOS were not detected.

5.5.3 EPCOR Water System

During the November 2018 field event, NMED also obtained water samples from 10 entry points for the water system, which is owned and operated by EPCOR, the private water supplier that provides water supply to the City of Clovis. Samples were analyzed for 15 PFAS, including PFOA and PFOS using EPA method 537-M (NMED, 2019c). The sample results were posted to the NMED PFAS Data webpage (NMED, 2020a) on April 5, 2019, and are summarized in Table 17. Although NMED did not publish sample locations, the sample identifiers provide sufficient information to identify sample locations from NMED's Drinking Water Watch website, which contains such information for PWSs in the state. The locations sampled by NMED in November 2018 are also shown in Figure 37. No PFAS target compounds were detected in the samples from the EPCOR water system, including the Mesa entry point (EP), which is located near the northwest corner of the Southwest Cheese facility (Figure 2). The laboratory reporting limits were not provided, so analytes that were not detected are simply reported as ND.

5.6 New Mexico Department of Health Sampling

The NMDOH collected a total of 5 water samples from five locations in February 2019, including the Turquoise Estates distribution point and four private residences. The samples were analyzed for 21 PFAS using EPA method 537 modified with isotope dilution (M-ID). The results were posted to the NMED PFAS Data webpage (NMED, 2020a) in April 2019, and are summarized in Table 18. The location of the Turquoise Estates distribution point is shown on Figure 37. The State of New Mexico is withholding the locations of the residential well samples as confidential.

PFAS were detected in 2 of the 5 samples, including the Turquoise Estates distribution point and one of the residential wells (Table 18). PFOA and PFOS were not detected, but the 2 samples contained total PFAS concentrations of 63 and 87 ng/L, respectively. Both samples contained up to 4 PFCAs (PFBA, PFPeA, PFHxA, and PFHpA) and 2 PFSAs (PFBS and PFHxS). PFSAs comprised more than 70 percent of total PFAS in both samples.

5.7 EPCOR Sampling

The City of Clovis and more than 16,000 residents obtain potable water from EPCOR, which owns and operates the water system in Clovis. EPCOR reportedly operates more than 80 water supply wells in the Clovis area, including a large well field south of Clovis. Information from NMED's Drinking Water Watch website was used to develop Figure 38, showing the locations of EPCOR's wells. DBS&A contacted EPCOR to request copies of the laboratory reports for PFAS analyses of water samples that EPCOR has been collecting from its water system in Clovis. Although EPCOR has reportedly provided copies of their sampling results to the State of New Mexico, the results are being withheld under a confidentiality agreement. DBS&A did not obtain the EPCOR data.

In or about 2020, EPCOR reportedly collected water samples from 82 wells from which Clovis derives its drinking water. Those samples were analyzed for 21 PFAS, and EPCOR reported to its customers that unspecified PFAS were detected in 10 of the 82 samples. Although concentrations of PFAS were below the 2016 EPA HA, EPCOR reportedly removed those unspecified wells from service (EPCOR, 2020; KOB 4, 2020).

In February 2020, the PBS published five maps attributed to EPCOR showing the results for some of the water samples collected (PBS, 2020 PF126, 126a). Those five maps are provided as Appendix F, and data posted on the maps was used to compile Table 19, which lists PFOS+PFOA and total PFAS for 15 locations (3 distribution system entry points [EPDS] and 12 supply wells) that were sampled either once or twice during the latter half of 2019. The EPDS samples are

presumably treated water; the well samples are presumably untreated water. The source maps do not indicate how many PFAS were analyzed for, which limits the following discussion of results.

PFAS were detected in samples from 3 EPDS locations and 8 supply wells with maximum total PFAS concentrations of 47.2 ng/L at EPDS Well 20 and 29.8 ng/L at Well 10. PFOA and/or PFOS were detected at one EPDS (40 North) and 8 wells. At 3 wells (10, 18, 201, and 37), PFOA or PFOS were the only PFAS detected, which is unusual, although the PFAS analyzed for are not known.

5.8 NMED-USGS Sampling

In December 2021, the NMED Drinking Water Bureau and the USGS entered into a memorandum of agreement (MOA), under which the USGS would collect samples from surface water and groundwater locations throughout the state of New Mexico and analyze those samples for water quality parameters, including PFAS (NMED and USGS, 2020). The USGS would also collect water samples from active community PWS systems within Curry and Otero Counties, and from private and public wells in Curry and Roosevelt Counties. In Curry County, the community systems to be sampled included Desert Ranch MDWCA and Turquoise Estates Water Coop, which have been sampled previously as described in Section 5.5.2, and Longhorn Estates Water System, located about 1.5 miles north of the Desert Ranch MDWCA. Concurrent sampling of private and public wells was to be conducted by NMED and Clean Water Partnership-Cannon (CWPC) under a separate MOA. Sampling was to be conducted in federal fiscal years (FFY) 2020 and 2021. The USGS is to prepare a comprehensive interpretive report in FFY 2022 (NMED and USGS, 2020).

In October 2021, NMED issued an interim report on the PFAS sampling in Curry and Roosevelt Counties (NMED, 2021). The NMED and USGS collected water samples from a total of 57 private (residential) wells during May and June 2021. Samples were tested for 28 PFAS (Table 3). A total of 5 PFAS (PFBA, PFHxA, PFHpA, PFPeA and PFBS) were detected in a total of 9 private wells—3 wells in Curry County and 6 wells in Roosevelt County. The maximum total PFAS concentration was 7.4 ng/L, and concentrations of individual PFAS were generally below the method reporting limits and qualified as estimates (NMED, 2021). The interim report does not include sample results, but it does include a map that shows very approximate locations of samples collected, which is reproduced here as Figure 39. The 3 wells in Curry County where PFAS were detected (red dots on Figure 39) are located northeast and southeast of Clovis, and are not within the project area.

During 2021, the USGS collected at least 25 groundwater samples from 21 wells in the Clovis area (Figure 40). [Note: it is possible that the USGS also collected samples from locations where the well owner did not give permission to make the data public.] These 25 samples were part of a larger state-wide surface water and groundwater sampling effort conducted under contract to the NMED. The data, reviewed and approved by the USGS, were posted to the USGS NWIS and were downloaded from that website. The 25 samples were analyzed for 28 PFAS, and a subset were analyzed for metals and general water chemistry. The PFAS analyses were performed by Accutest Laboratories using EPA method 537 Modified (LM102 - PFAS SPE/LC/MS/MS EPA537M). The PFAS and general chemistry results are summarized in Tables 20 and 21, respectively. The locations of the 21 wells sampled by the USGS are shown on Figure 40.

PFAS were detected in water samples 4 wells, GS-2, GS-13, GS-15, and GS-18, with total PFAS concentrations ranging from 3.6 to 41.3 ng/L. PFOA and PFOS were not detected in any of the USGS samples. At GS-18, only PFCAs were detected; up to 3 PFCAs (PFBA, PFPeA, and PFHxA) and 3 PFSAs (PFBS, PFHxS, and PFPeS) were detected in each of the other 3 samples. Where both PFCAs and PFSAs were detected, PFCAs comprised between 59 and 76 percent of total PFASs. Two wells, GS-2 and GS-13, were sampled in January and October 2021, with the same PFAS detected at similar concentrations (Table 20). The concentrations of PFOS, PFOA, and PFHxS in water samples collected by the USGS are shown on Figure 41.

A total of 21 groundwater samples collected by the USGS were also analyzed for general field parameters (temperature, pH, dissolved oxygen, and specific conductance) and isotopes of oxygen and hydrogen. Only 9 samples from 8 locations were analyzed for major ions, metals, and other parameters identified in Table 21. Of the 9 samples, 3 were not analyzed for nitrogen compounds (ammonia, nitrate, nitrite). Sample GS-7 collected on May 12, 2021 was analyzed for nitrogen compounds and isotopes, but no other laboratory parameters. The general chemistry data for water samples collected by the USGS are provided in Table 21. The summary includes minimum, maximum, and average results for each parameter, as well as the number of samples analyzed and the number of samples detected.

6. NMED Phase I Investigation

This section presents the results of work performed by DBS&A during the NMED Phase 1 characterization and monitoring activities at the Cannon site. The scope of services included the following six tasks:

- Compiling and reviewing existing documents and data
- Preparing the necessary planning documents, including a work plan, SAP, and site-specific health and safety plan (HASP)
- Participating in a site visit to evaluate potential monitor well locations
- Performing the site characterization activities identified in the work plan and SAP
- Performing groundwater modeling using data derived from field activities (this work was not started during Phase 1)
- Preparing this Phase 1 progress report summarizing the results of the file review, field investigation, and groundwater monitoring, and presenting recommendations for Phase 2 activities

Each of these activities is described in the following subsections.

6.1 Existing Site Data

DBS&A has identified and compiled documents and data related to the PFAS investigations at Cannon AFB and the surrounding area, as discussed in Section 5. This has been an ongoing process as new references and new sources of such data are identified. DBS&A has stored all of the compiled materials in a searchable document index, which is updated as needed. Efforts to compile existing information are summarized in this section.

The USAF has issued several documents related to the PFAS investigations at Cannon AFB, including the *Preliminary Assessment Report* (HGL, 2015), the *Final Site Inspection Report* (AFW, 2018), the *Addendum 01 to the Final Site Inspection Report* (AFW, 2019), the *Final AFFF Release Areas Phase I Remedial Investigation Work Plan* (Bristol, 2021), and the *Aquifer Test Work Plan for the Pilot Study and Hydraulic Containment* (Brice-AECOM, 2021). These and many other documents related to environmental investigation and response activities conducted at USAF installations, including Cannon AFB, under the federal Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), are publicly available at https://ar.afcec-cloud.af.mil, a website maintained by the USAF Civil Engineering Center (AFCEC). Some of these documents were provided to NMED and are publicly available at https://hwbdocuments.env.nm.gov/Cannon%20AFB/. The NMED site includes copies of many reports and correspondence related to historical soil, surface water, and groundwater investigations at Cannon AFB.

Analytical data from various sampling efforts for PFAS were identified and reviewed and are discussed in Section 5 of this report. Analytical data were obtained from the USAF PFAS reports listed above, the NMED PFAS Data website at https://www.env.nm.gov/pfas/data, and the USGS NWIS website. In addition, Mr. Arthur Schaap shared laboratory results from groundwater data samples collected from his property by himself and EPCOR. Mr. Schaap also gave his permission to use data from his property in this report.

Existing PFAS data reviewed related to PFAS contamination in the project area has been limited to the final SI report (AFW, 2018a), Addendum 1 to the final SI report (AFW, 2019), and spreadsheets of water sampling data for PFAS conducted by EPA, NMED, and NMDOH (NMED, 2019c).

Information on the geology and hydrogeology of Cannon AFB and the surrounding area were obtained from various reports prepared by the USGS, the New Mexico Bureau of Geology and Mineral Resources (NMBGMR), the Texas Bureau of Geology, the New Mexico Office of the State Engineer (OSE), and various consultants working for the USAF at Cannon AFB. The lithologic logs for the majority of deep soil borings, supply wells, and groundwater monitor wells at Cannon AFB were compiled and are provided in Appendix C. Driller's logs for more than 300 off-site wells were compiled from records on the OSE water rights website.

6.2 Planning Documents

Prior to the site visit, DBS&A prepared an SAP for sampling of groundwater at Cannon AFB (DBS&A, 2021). The SAP was prepared as a combination quality assurance project plan (QAPP) and field sampling plan (FSP) to detail sample collection procedures and analytical methods for the characterization and monitoring of PFAS on and in the vicinity of Cannon AFB. These two standard deliverables were combined into one document to streamline the planning process, while ensuring that data collected were of sufficient quality for their intended use.

6.3 Site Visit

DBS&A conducted a site visit to the Cannon-Clovis area on June 10 and 11, 2021. NMED was not able to participate in the site visit. The site visit did not include Cannon AFB. During the site visit, DBS&A personnel met with several landowners and their environmental consultants to discuss the scope of the NMED PFAS investigation project and to obtain access for sampling of irrigation wells located downgradient of Cannon AFB.

DBS&A conducted a second site visit to the Cannon-Clovis area on October 6, 2021 to visit Cannon AFB. Environmental personnel escorted DBS&A personnel on-base and toured the locations of each of the groundwater monitor wells to be sampled. Base access and logistics related to the sampling event were discussed.

6.4 Field Activities

To achieve NMED's Objective 2 and to contribute to the achievement of NMED's Objective 1 (Section 1.2), DBS&A identified the locations of existing irrigation and residential wells downgradient of Cannon AFB that were known to be contaminated or are at risk of becoming contaminated. During the June 2021 site visit, DBS&A obtained landowner permission to access their property and collect water samples from selected wells downgradient of Cannon AFB.

On December 7, 2021, DBS&A obtained a signed access agreement (Appendix J) from Mr. Juan Jimenez allowing for the installation and sampling of a monitor well (DBS-1) on his property. The OSE well permit for DBS-1 (CC-02631 POD1) was issued on December 28, 2021. DBS-1 was installed February 8 through 26, 2022 and sampled on February 27, 2022, as discussed in Section 6.5.

Field activities were conducted in accordance with the SAP approved by NMED (DBS&A, 2021), and with the NMED Remediation Oversight Section State Cleanup Program (SCP), outlined in 20.6.2 NMAC. All field activities were performed in accordance with the HASP (Appendix A of the SAP [DBS&A, 2021]).

6.4.1 Data Confidentiality

As mentioned in Section 1.3, with the exception of Mr. Arthur Schaap, owner and operator of Highland Dairy, and Mr. Juan Jimenez, on whose property new downgradient monitor well DBS-1 was installed, the landowners downgradient of Cannon AFB did not give permission for the results of the water sampling to be included in this report. Copies of the laboratory results have been sent to the owners of the properties from which they were obtained. The locations of the off-site wells sampled by DBS&A are shown on Figure 42, but the discussion of the results is limited to those samples from the Schaap and Jimenez properties. The laboratory reports for off-site sampling are provided in Appendix I, but include only the results from the Schaap and Jimenez properties.

6.4.2 Sample Handling and Analytical Methods

NMED contracted directly with Hall Environmental Analysis Laboratory (HEAL) in Albuquerque for laboratory analysis of sediment, surface water, and groundwater samples from the Cannon site. HEAL subcontracted with Vista Analytical (Vista) in El Dorado Hills, California, for the analysis of samples for PFAS. Sample containers with appropriate preservatives were provided by HEAL. Upon collection, all samples were placed on ice in dedicated sample coolers and shipped to HEAL under appropriate chain-of-custody. HEAL separated the sample volumes for PFAS analysis and forwarded those containers to Vista.

Vista analyzed sediment, surface water, and groundwater samples for 29 PFAS using either EPA methods 533 and 537.1M-ID. HEAL analyzed surface water and groundwater samples for total organic carbon (TOC), total Kjeldahl nitrogen (TKN), dissolved nitrate-nitrite, dissolved major anions and cations, and dissolved metals, including aluminum, antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, selenium, vanadium, and zinc. The laboratory reports for sediment, surface water, and groundwater samples analyzed by HEAL and Vista are provided in Appendix I. The results of laboratory analyses for PFAS and general chemistry are discussed in the following sections.

6.4.3 Off-Base Water Sampling

The locations of the 28 pre-existing wells downgradient (east and southeast) of Cannon AFB that were sampled by DBS&A and monitor well DBS-1 are shown on Figure 42. The locations of wells from which the data generated are being held as confidential have been grayed out. By agreement with the landowners, we are prevented from presenting and discussing all of the data generated and illustrating the current boundaries of the PFAS groundwater plume.

Of the 29 wells sampled, 7 are located on Mr. Schaap's properties and 1, DBS-1, is on Mr. Jimenez's property. The results for 3 PFAS regulated by the State (PFOA, PFOS, and PFHxS) are shown for samples from the Schaap and Jimenez properties on Figure 43. The laboratory results for PFAS analysis of the samples from these 8 locations are provided in Table 22.

Of the 29 wells sampled, PFAS were not detected in 8 wells. The results from DBS-1 are discussed below. Total PFAS concentrations detected in the remaining 20 wells ranged from 1.8 ng/L at location COS-22, on the Schaap property, to 37,732.87 ng/L at well COS-11, also on Schaap property and identified by Mr. Schaap as well W-5 (discussed in Section 5.4). Also, for the 20 wells where PFAS were detected, PFSAs generally comprise more than half of the total PFAS detected.

PFOA was detected in groundwater samples collected from 12 wells at concentrations ranging from 8.5 ng/L to 2,300 ng/L, with samples from 5 wells exceeding the 2016 EPA HA of 70 ng/L. Of these wells, 2 were located on Schaap properties. PFOS was detected in samples from 13 wells at concentrations ranging from 3.02 to 15,100 ng/L with samples from 8 wells exceeding the 2016 EPA HA of 70 ng/L. Of these wells, 3 are on Schaap properties. Samples from 8 wells exceeded the 2016 HA for PFOA+PFOS combined. PFHxS was detected in samples from 19 wells at concentrations ranging from 1.77 to 11,400 ng/L.

Looking specifically at the data for the 7 wells sampled on the Schaap properties, no PFAS were detected in 1 sample (COS-20), and 1 sample (COS-22) contained only PFHxS at a very low level (estimated at 1.8 ng/L) (Table 22). Total PFAS concentrations in the groundwater samples from the other 5 Schaap wells ranged from 1.8 ng/L at location COS-22 to 37,732.87 ng/L at well COS-11, also identified by Mr. Schaap as well W-5 (discussed in Section 5.4). In the Schaap wells, up to 6 PFCAs, 5 PFSAs, and 3 FTSAs were detected.

PFOA was detected in samples from 4 of the 7 Schaap wells that were sampled, at concentrations ranging from 16.6 to 2,300 ng/L; concentrations in samples from 3 wells exceeded the 2016 EPA HA for PFOA of 70 ng/L (Table 22). PFOS was detected in samples from 5 of the Schaap wells that were sampled, at concentrations ranging from 3.02 to 15,100 ng/L; concentrations in samples from 3 wells exceeded the 2016 HA for PFOS of 70 ng/L. Samples from 3 wells exceeded the 2016 EPA HA for PFOA+PFOS combined. PFHxS was detected in samples from 6 of 7 Schaap wells, including the maximum concentration of 11,400 ng/L detected in off-base wells.

Well COS-11 (aka W-5), which is on Mr. Arthur Schaap's property and is located just to the south of Cannon AFB monitor well MW-D, has been sampled for PFAS at least four times between 2018 and 2022. Mr. Schaap sampled the well in September 2018. EPCOR sampled the well in March and June 2021 (and possibly at other times). DBS&A sampled the well in July 2021 (as COS-11). The results of previous (2018) PFAS analyses of well W-5 are provided in Table 15. The concentrations and proportions of the major PFCAs (PFBA, PFPeA, PFHxA, PFHpA, and PFOA) and the major PFSAs (PFBS, PFPeS, PFHxS, and PFOS) are depicted in Figures 44a and 44b, respectively.

The changes in PFAS concentration and distribution that occurred from the first sample in September 2018 to the most recent groundwater sample in July 2022 (based on the results from the primary sample, not the duplicate sample) include the following:

- Total PFAS concentration increased by about 25 percent, from 30,125.9 ng/L to 37,732.87 ng/L.
- Total PFCAs concentration decreased by 17.5 percent, from 9,588 ng/L to 7,910.8 ng/L. PFOA concentration decreased by more than 21 percent, from 2,920 ng/L in 2018 to 2,300 ng/L in July 2021. PFPeA and PFHxA concentrations decreased by more than 31 percent and nearly 16 percent, respectively.
- Total PFSAs concentration increased by 27 percent, from 20,501 ng/L to 26,009 ng/L. PFOS concentration increased from 11,400 ng/L in 2018 to 15,100 ng/L in the most recent sample—an increase of more than 32 percent. PFHxS concentration increased by nearly 9 percent, from 8,530 ng/L to 9,260 ng/L.
- FTSAs were not analyzed for in 2018, but from March 2021 to July 2021, concentration of the FTSA, 6:2 FTS, decreased by 15 percent, from 4,400 ng/L to 3,740 ng/L. Concentrations of the other 2 FTSAs analyzed for decreased by about 14 to 19 percent.

There is variability in some of the results from the 3 groundwater samples collected in 2021 (illustrated by Figures 44a and 44b), and even between the primary and duplicate groundwater samples collected in July 2021. Additional data are needed to determine whether concentrations are increasing or decreasing (e.g., using a statistical analysis), and to further characterize PFAS mass and mass flux in the Ogallala aquifer.

A groundwater sample was also collected from monitor well DBS-1, which was installed in February 2022 as part of this project (Figure 43). The monitor well was sampled following well development, using the pump that had been used for development, after field parameters stabilized. The laboratory results for PFAS analysis of the groundwater sample are included in Table 22. PFBA was the only PFAS detected in the sample from DBS-1. PFBS was detected at an estimated concentration of 2.18 ng/L (this value was flagged with a J qualifier, meaning that, while PFBA was positively identified in the sample, the concentration was below the laboratory reporting limit and was qualified by the laboratory as being an estimated concentration). Additional sampling of DBS-1 will be conducted during Phase 2 of this project in FY2023 to confirm the detection of PFBA and absence of other PFAS.

Groundwater samples from the off-base wells were also analyzed for general chemistry, including dissolved major cations and anions, dissolved metals, TOC, total dissolved solids (TDS), and total carbonate alkalinity. The results of the laboratory general chemical analyses of the

samples from the Schaap properties and well DBS-1 are provided in Table 23. The redacted laboratory reports are included in Appendix I. Following is a summary of the results:

- Specific conductivity ranged from 610 to 1,100 microsiemens per centimeter (µS/cm).
- TOC was generally not detected (i.e., less than 1 mg/L) in the irrigation well samples, but the TOC concentration was 17 mg/L in the sample from DBS-1.
- TDS concentrations ranged from 358 to 684 mg/L and averaged about 459 mg/L.
- Dissolved fluoride concentrations in all samples ranged from 1.6 to 2.5 mg/L, with 8 samples exceeding the MCL of 1.6 mg/L, which appear naturally high.

6.4.4 Split Sampling of Cannon AFB Monitor Wells

In December 2021, DBS&A obtained groundwater sample splits and groundwater elevation measurements from 16 monitor wells at Cannon AFB. Groundwater samples obtained from monitor wells at Cannon AFB were collected using dedicated sampling bladder pumps in each well. Depth to water was measured in each of the monitor wells at Cannon AFB on December 8 and 9, 2021. Each well was purged and sampled following micropurge sampling procedures. Measuring water levels and water quality field parameters and purging and sampling of each monitor well was performed by personnel from Bristol Environmental Solutions, LLC (Bristol) in accordance with the long-term groundwater monitoring plan for Cannon AFB (FPM and AECOM, 2022). Water level measurements and final water quality field parameters (temperature, pH, electrical conductivity, oxidation/reduction potential, dissolved oxygen, and turbidity) measured prior to collecting each sample are provided in Table 24.

A potentiometric surface map created by DBS&A using the water level measurements from December 8 and 9, 2021 is provided as Figure 45. The data indicate that groundwater flow direction on the west side of Cannon AFB is generally to the east. In the north and northwest parts of Cannon AFB, groundwater flow is mostly to the southeast toward the WWTP, and becomes more southerly around the North Playa Lake. In the southeast portion of Cannon AFB, groundwater flow is to the southeast. This map is in good agreement with water table maps created by consultants for the USAF and included in Appendix E.

The locations of the monitor wells at Cannon AFB are shown on Figure 45. All of the wells sampled are located on the east side or southeast corner of Cannon AFB. These wells are referred to in Section 5.3.4 as the east monitor wells and the southeast monitor wells, and are discussed separately.

6.4.4.1 East Monitor Wells

Groundwater sample splits were obtained from a total of nine monitor wells in the area around the WWTP, the former Sewage Lagoons, and the North Playa Lake (Figure 46). The results of laboratory analysis of groundwater samples for PFAS from the east monitor wells obtained by DBS&A in December 2022 are provided in Table 25a.

During the 2017 groundwater sampling (AFW, 2018), no PFAS were detected in wells MW-E, MW-N, or MW-W. Only 1 PFAS (PFHxA) was detected in the sample from well MW-Rb, and only 2 PFAS (PFHxA and PFHxS) were detected in the sample from well MW-Fa (Table 11a). In 2021, no PFAS were detected in DBS&A's samples splits from wells Na or W. PFAS were detected in the other 7 wells in the east area, ranging from 4.7 ng/L in well Pa to 854.47 ng/L in well H.

There have been significant changes in total PFAS concentrations in the east monitor wells from 2017 to 2022. Total PFAS concentrations declined by an average of 90 percent in wells Fa, Ga, Oa, and Pa. Most notably, total PFAS concentration in well Ga decreased from 1,506 ng/L in 2017 to 104.09 ng/L in 2022. Total PFAS concentration in well Oa decreased from 1,029.6 ng/L in 2017 to 135.05 ng/L in 2022. Total PFAS concentration in well Pa decreased from 926.6 ng/L in 2017 to 4.72 ng/L in 2022. PFAS concentrations increased in 3 wells, with the total PFAS concentration in well H increasing from 252.4 ng/L in 2017 to 854.47 ng/L in 2022.

PFOA concentrations ranged from non-detect in 6 of 9 wells in 2022, with a maximum detection of 25.9 ng/L in well H, well below the 2016 HA of 70 ng/L (Table 25a). PFOS was not detected in 7 of 9 wells in 2022, with a maximum concentration of 185 ng/L in well H. Only well H exceeded the 2016 HA for PFOS and PFOA+PFOS combined.

Groundwater quality samples from the east monitor wells were also analyzed for general chemistry, including major ions, dissolved metals, TOC, TDS, and total carbonate alkalinity. The results of the laboratory general chemical analyses of the samples from the east monitor wells are provided in Table 25b. The laboratory reports are included in Appendix I. Following is a summary of the results:

- Specific conductivity ranged from 680 to 1,200 µS/cm.
- TOC was not detected (i.e., less than 1 mg/L).
- TDS concentrations ranged from 426 to 800 mg/L, and averaged 543 mg/L.
- Nitrate plus nitrite as nitrogen was non-detect in well MW-W (less than 1 mg/L), but was detected in all other east monitor wells, at concentrations ranging from 1.8 to 2.2 mg/L.

- Dissolved fluoride was detected in all samples at concentrations ranging from 0.6 to 2.2 mg/L, with fluoride concentrations in 8 of 9 samples exceeding the MCL of 1.6 mg/L.

6.4.4.2 Southeast Monitor Wells

Groundwater quality sample splits were obtained from a total of 7 monitor wells in the southeast corner of Cannon AFB in the area southeast of the active FTA and the former FTAs, as well as Landfill No. 5 (Figure 46). The results of laboratory analysis of groundwater samples for PFAS from the southeast monitor wells obtained by DBS&A in December 2022 are provided in Table 25a.

During the 2017 groundwater sampling (AFW, 2018), low levels of PFHxA and PFBS were detected in monitor well MW-A, which is about 3,000 feet northwest of the southeast corner of Cannon AFB. At that time, PFOA was detected in the six wells at the southeast corner of the base, ranging from 10 ng/L at well Ua to 2,800 ng/L in a duplicate sample from well D. PFOA concentrations in wells Ca, D, Sa, and Ta exceeded the 2016 HA of 70 ng/L. PFOS concentrations ranged from 150 ng/L at well Sa to 24,000 ng/L at well Ca, and were non-detect in wells Ta and Ua. PFOS concentrations in wells Ca, D, and Sa exceeded the 2016 HA of 70 ng/L.

As observed in the east monitor wells, the concentrations of total PFAS have declined in each of the wells in the southeast corner of Cannon AFB. At well Ca, total PFAS concentrations declined from 56,504 ng/L in 2017 to 43,332.6 ng/L in 2022—a decrease of 23.3 percent. Total PFAS concentration in well Sa decreased from 9,293.6 ng/L in 2017 to 1,474.5 ng/L in 2022—a decrease of 84.1 percent. Total PFAS concentration in well Ta decreased from 2,088 ng/L in 2017 to 89 ng/L in 2022—a decrease of nearly 96 percent. The highest concentrations of PFAS continue to be found in wells Ca and D along the southern boundary of Cannon AFB.

In the 2022 samples, PFOA was detected in 3 of the 6 wells in the southeast corner of Cannon AFB, down from 6 of 6 wells in 2017. PFOA concentrations ranged from 124 ng/L at well Sa to 1,800 ng/L at well D, with concentrations in all three wells exceeding the LHA. PFOS was detected in 2 wells, down from 4 wells in 2017. PFOS concentrations in well Ca (20,800 ng/L) and well D (2,190 ng/L) exceed the LHA.

Groundwater quality samples from the southeast monitor wells and well MW-A were also analyzed for general chemistry, including dissolved major cations and anions, dissolved metals, TOC, TDS, and total carbonate alkalinity. The results of the laboratory general chemical analyses of the samples from the southeast monitor wells are provided in Table 25b. The laboratory reports are included in Appendix I. Following is a summary of the results:

- Specific conductivity ranged from 360 to 890 µS/cm.
- TOC was not detected (i.e., less than 1 mg/L).
- TDS concentrations ranged from 216 to 490 mg/L, and averaged about 391 mg/L.
- Dissolved fluoride was detected in all samples at concentrations ranging from 2.0 to 6.8 mg/L, with fluoride concentrations in all 7 samples exceeding the MCL of 1.6 mg/L.
- Nitrate plus nitrite as nitrogen was non-detect in well MW-A (less than 1 mg/L), but was detected in all other southeast monitor wells, at concentrations ranging from 1.0 to 2.4 mg/L and averaging 1.4 mg/L.

6.4.5 Laboratory Data Review

The data quality assessments for the sampling performed under this contract are provided in Appendix K. Data collected during the NMED Phase 1 PFAS investigation were found to meet quality objectives.

6.5 Monitor Well Installation and Sampling

DBS&A installed 1 groundwater monitor well during Phase 1 of the NMED PFAS investigation at the Cannon site. Thorough site characterization is a critical step toward implementing a remedial strategy. DBS&A used a phased approach to the installation and sampling of the new groundwater monitor well at the distal end of the PFAS plume. The final location of the new monitor well was selected after the results of the water quality sampling were reviewed.

The new monitor well, designated DBS-1, is located approximately 5.5 miles east-southeast of the southeast corner of Cannon AFB in the northeast quarter of the southeast quarter of Section 1, T1N, R35E, as shown on Figure 41. This property is owned by the Jimenezes of Clovis. Permission to install a groundwater monitor well was granted by Mr. Juan Jimenez on December 7, 2021, and the OSE well permit was issued on December 28, 2021. Copies of the access agreement and the OSE well permit are provided in Appendix J.

Drilling of well DBS-1 began on February 8, 2022, and the well was completed on February 26, 2022. Drilling, installation, and development of the monitor wells was performed by Yellow Jacket Drilling Services of Phoenix, Arizona. The boring was advanced to a depth of 375 feet bgs in the Ogallala Formation using sonic drilling techniques, with continuous core samples collected from surface to total depth. The well was drilled without using any drilling additives

except potable water, which was obtained from a City hydrant in Clovis. The core samples were logged by a DBS&A geologist. The DBS-1 lithologic log is provided in Appendix J.

A total of 4 soil samples were collected for laboratory analysis during installation of monitor well DBS-1. Samples were collected at the surface (0.0 to 0.5 feet bgs), 5.0 to 5.5 feet bgs, 335 feet bgs (a duplicate sample was also collected at this depth), and 340 feet bgs and submitted to HEAL for laboratory analysis of PFAS and general chemistry, as described in Section 6.4.2. There were no PFAS detections in the soil samples. A total of 8 equipment rinsate (aqueous) samples were collected to sample the water that was used to rinse the core barrels used for soil sampling. Of these equipment rinsate samples, 3 had PFAS detections that were below laboratory reporting limits and were qualified by the laboratory as being estimated concentrations.

There were no PFAS detections in other 5 equipment rinsate samples. The well was completed using 5-inch-diameter, flush-threaded Schedule 80 blank polyvinyl chloride (PVC) casing to a depth of 333 feet bgs and 35 feet of Schedule 80 factory-slotted PVC well screen with 0.020-inch slots set from 333 to 368 feet bgs. The well screen was set with approximately 5 feet of screen above the water table and 30 feet below the water table. The well has a 5-foot-long sump and end cap below the screen to capture any sediment that might enter the well. Stainless steel well centralizers were connected to the well casing at approximately 20-foot intervals below 310 feet bgs and at 60-foot intervals from 310 feet bgs to the surface. A filter pack composed of 20/40 silica sand was emplaced using a tremie pipe from the bottom of the boring at 375 feet bgs up to 328 feet bgs, 5 feet above the top of the well screen. A 5-foot-thick bentonite seal was emplaced from 328 to 323 feet bgs, and high-solids bentonite grout was emplaced from 323 to 50 feet bgs. The top 50 feet of the hole was sealed with a cement/ bentonite grout. The well is secured with a locking cap inside a protective well vault that is set in 4-inch-thick concrete pad. The well construction diagram is included in Appendix J.

Depth to water was measured at 338 feet bgs after the well was completed on February 26, 2022. Approximately 24 hours after the well installation was complete, the well was developed to remove sediment from the well casing, using a combination of bailing, surging, airlifting, and pumping. Development activities continued until the water produced was sediment free and substantially clear.

Investigation-derived waste, including soil cores and well development water, were containerized for off-site disposal.

The location and elevation of the top of the protective well vault and the measuring point elevation on the north edge of the PVC well casing were surveyed by a professional surveyor licensed in the State of New Mexico. The survey report is provided in Appendix J. As discussed in Section 6.4.3, a groundwater sample was collected from DBS-1 on February 27, 2022. The monitor well was purged and sampled following well development, using the pump that had been used for development, and the sample was collected after the field parameters stabilized. The laboratory results for PFAS analysis of the groundwater sample are included in Table 22. PFBA was the only PFAS detected in the sample from DBS-1. PFBS was detected at an estimated concentration of 2.18 ng/L. While PFBA was positively identified in the sample, the concentration was below the laboratory reporting limit and was qualified by the laboratory as being an estimated concentration. Additional sampling of DBS-1 will be conducted during Phase 2 of this project to confirm the detection of PFBA and absence of other PFAS.

A dedicated QED pump was purchased for DBS-1 during FY2022, and will be installed during FY2023.

The data quality assessments for the sampling associated with the installation and sampling of DBS-1 are provided in Appendix K. Data were found to meet quality objectives.

7. Conclusions and Recommendations

The results of sampling for PFAS conducted by various parties in the Cannon site area indicate that releases of PFAS have occurred from multiple sources at Cannon AFB, which likely include (1) one or more of the FTAs located in the southeast quarter of the Base, (2) the former Sewage Lagoons, located on the east side of the base south of the current WWTP, (3) one or more of the former landfills, such as Landfill No. 5 located in the southeast corner of the base, and (4) current wastewater discharge areas, such as the ponds and irrigated areas at the golf course and the North Playa Lake.

Two main areas of PFAS contaminated groundwater have been identified at Cannon AFB: the area southeast of the former Sewage Lagoons and the area south and southeast of Landfill No. 5. NMED's PFAS data from December 2021 groundwater sampling at Cannon AFB indicate that PFAS concentrations in most of the so-called east monitor wells have decreased dramatically since the USAF SI in 2017 and 2018. PFAS concentrations in groundwater in the southeast corner of the base have also declined, but high concentrations there indicate an ongoing source that presents a continuing threat to residential and agricultural wells

downgradient of Cannon AFB. Additional investigation is required to determine the source(s) of PFAS impacts at Cannon AFB and what steps can be taken to stop what appear to be ongoing impacts to groundwater. Based on previous PFAS detection in soils (Section 5.3.1), further characterization and remediation of PFAS-contaminated soils at and near Cannon AFB is required to address short- and long-term contamination of groundwater in the Ogallala aquifer system.

The USAF is currently conducting an RI of PFAS contamination at Cannon AFB and downgradient of the base, as described in Section 5.3.7. The first phase of the RI is occurring on-base, but the EPA-approved work plan (Bristol, 2021) indicates that substantial work will be conducted off-base. The ongoing RI should be factored into NMED's plans for additional PFAS investigation.

The FY2023 Cannon site PFAs investigation project objectives will include the following:

- Establish a technical dialogue between NMED, USAF, and EPA to determine the nature and extent of USAF's plans for off-site investigation, and to coordinate efforts.
- Ensure that PFAS-contaminated soils are characterized and remediated to address what appear to be ongoing impacts to groundwater.
- Establish a regular and comprehensive groundwater monitoring program.
- Provide better definition of existing groundwater plume geometry (PFAS isoconcentration maps and cross sections) and modeled predictions of future plume migration, including empirically derived rates of movements of PFAS contaminants in the subsurface.

Specific recommendations for Phase II project activities to be conducted during FY2023 at the Cannon site are as follow:

- Conduct analytical and/or numerical modeling activities to assess groundwater flow and PFAS transport and to better define the nature and extent of PFAS contamination at the Cannon site.
- USAF and NMED exchange of copies of complete laboratory reports for sediment and groundwater samples collected from Cannon AFB. NMED should provide the USAF with copies of laboratory reports for sediment and groundwater samples collected from new monitor well DBS-1. To the extent possible, NMED should also provide USAF with copies of laboratory results from the 2021 off-base sampling (i.e., from the Schaap property, with Mr. Schaap's approval).

- Obtain monthly or quarterly progress reports on activities associated with the USAF RI from the USAF or EPA, including access to preliminary data. The USAF RI report documenting the results of the investigation will likely not be prepared for some time (perhaps 2023 or later). Therefore, NMED should coordinate with USAF to obtain characterization data for PFAS-contaminated sediment in the vadose zone, and groundwater sample splits from new and existing monitor wells. NMED should also consider where additional groundwater monitor wells can be installed, and identify existing irrigation wells that may be monitored as "sentinel wells."
- Contact Mr. Schaap to determine if EPCOR continues to sample his well W-5, and obtain any other laboratory data that have been provided to him.
- Contact other downgradient landowners to determine whether they are conducting groundwater sampling for PFAS and if they are willing to share the results with NMED. Determine under what conditions the results of groundwater sampling on other properties can be used to delineate the extent of PFAS impacts.
- Contact landowners to obtain a better understanding of irrigation practices and types of crops being grown, as this information may apply to groundwater modeling efforts and movement of the PFAS plume in groundwater. Such information may include production rates for irrigation wells, and period of use.

Additional project activity recommendations for the Cannon site include conducting investigations to determine or quantify the following:

- Requesting that EPA issue a 104(e) Request to Cannon AFB/USAF for Information to produce all records regarding the purchase, storage, and use of AFFF, including chemical composition, mixing instructions, disposal of empty containers. This information would inform the total mass and chemical composition of AFFF used at and released from Cannon AFB.
- Obtain information from the USAF regarding their PFAS RI investigation and plans to remediate residual PFAS stored in the vadose zone in proximity to known PFAS release sites at Cannon AFB. Characterization and remediation of PFAS-contaminated sediment in the vadose zone is needed in order to stop what appear to be ongoing impacts to groundwater.
- Once the USAF data for the RI are available, construct isopleth maps of individual PFAS distributed in sediment and groundwater vertically and laterally at Cannon AFB or assess USAF maps, if already completed.

- Quantify the mobility of individual PFAS in the Ogallala aquifer at Cannon AFB and, to the extent practicable, along the PFAS plume migrating downgradient to the east-southeast.
- To the extent practicable, quantify mass and mass flux of individual PFAS that have migrated downgradient from Cannon AFB beneath privately owned property (landowner permission would be needed to publish these data).
- To the extent practicable, construct cross sections of individual PFAS showing vertical distributions along the axis (depth) and transverse (width) to the entire plume length (landowner permission would be needed to publish these data).

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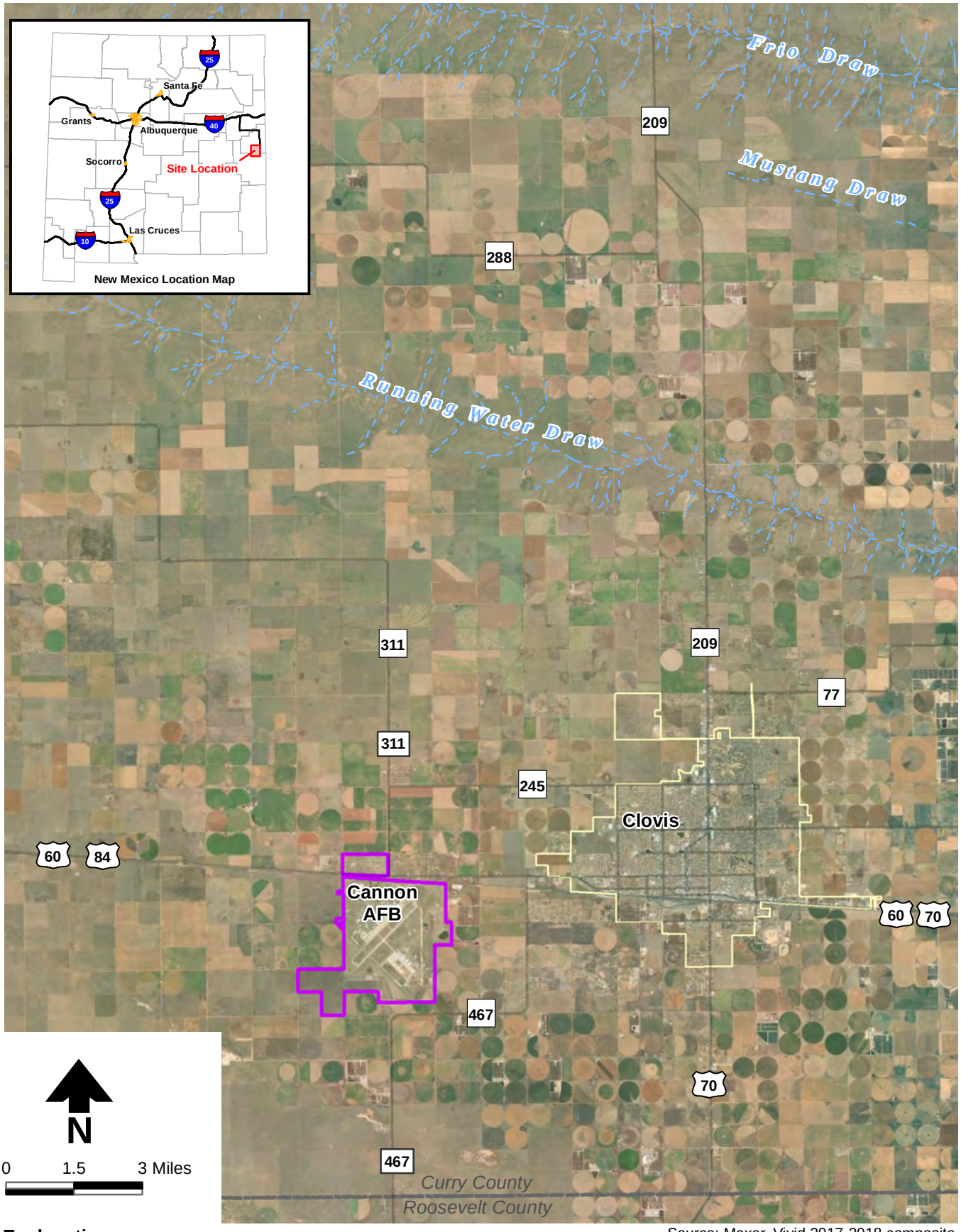
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Figures



Explanation

Cannon Air Force Base City of Clovis Road

Source: Maxar, Vivid 2017-2018 composite

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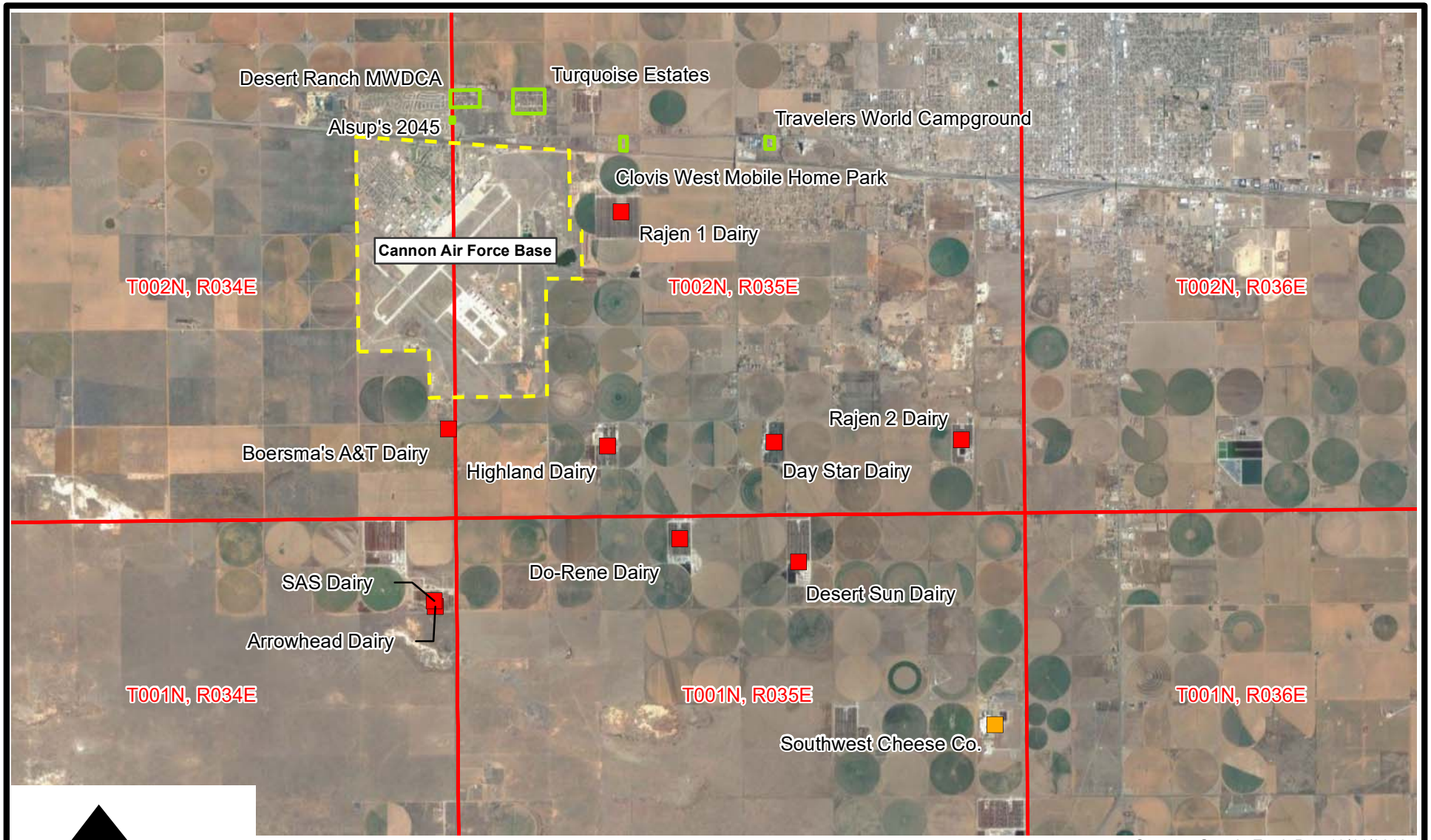
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NMED PFAS INVESTIGATION, CANNON AFB

Vicinity Map

Figure 1

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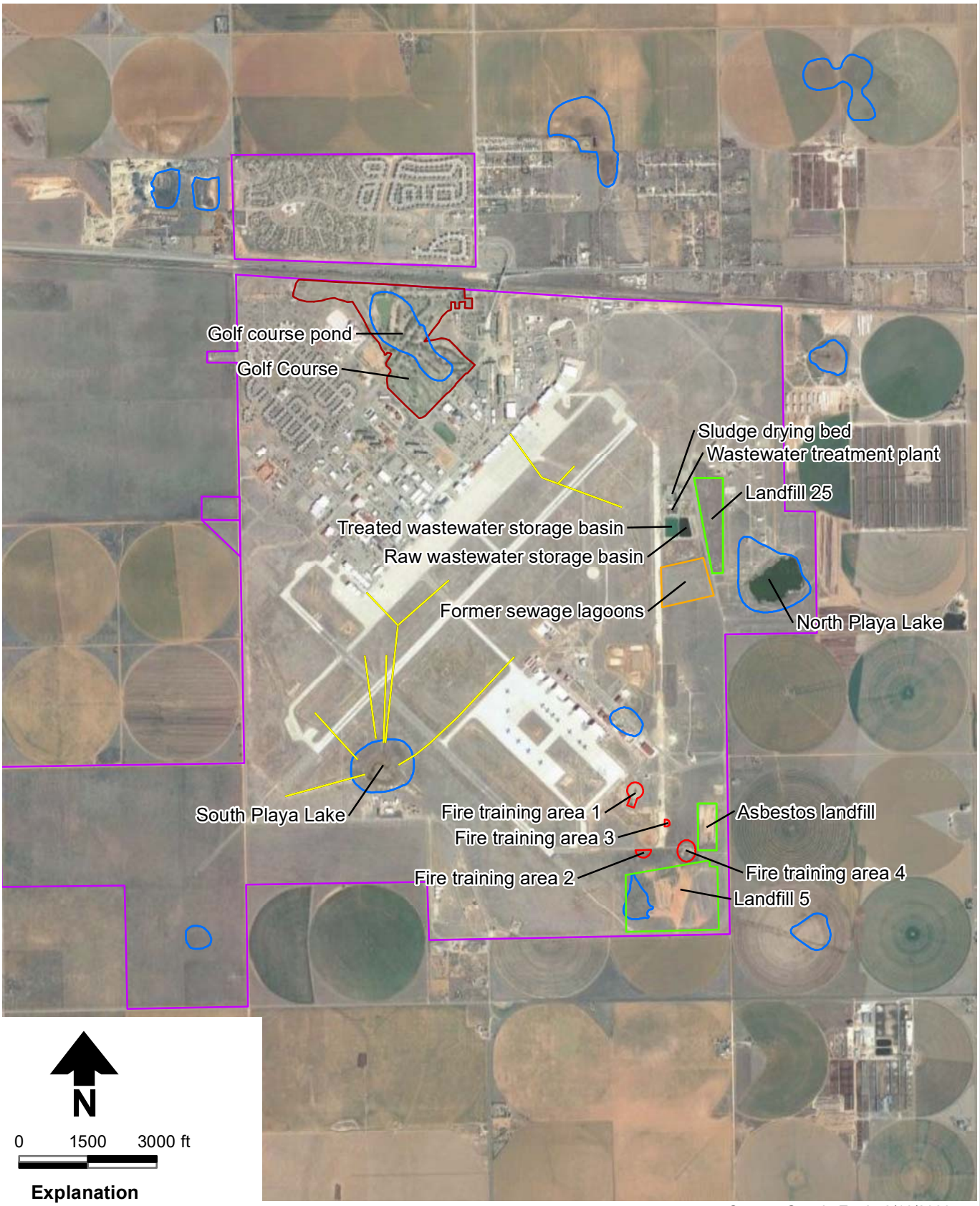
Source: Google Earth Pro, 10/14/2016

Figure 2

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NMED PFAS INVESTIGATION, CANNON AFB

Project Area



Source: Google Earth, 2/16/2020

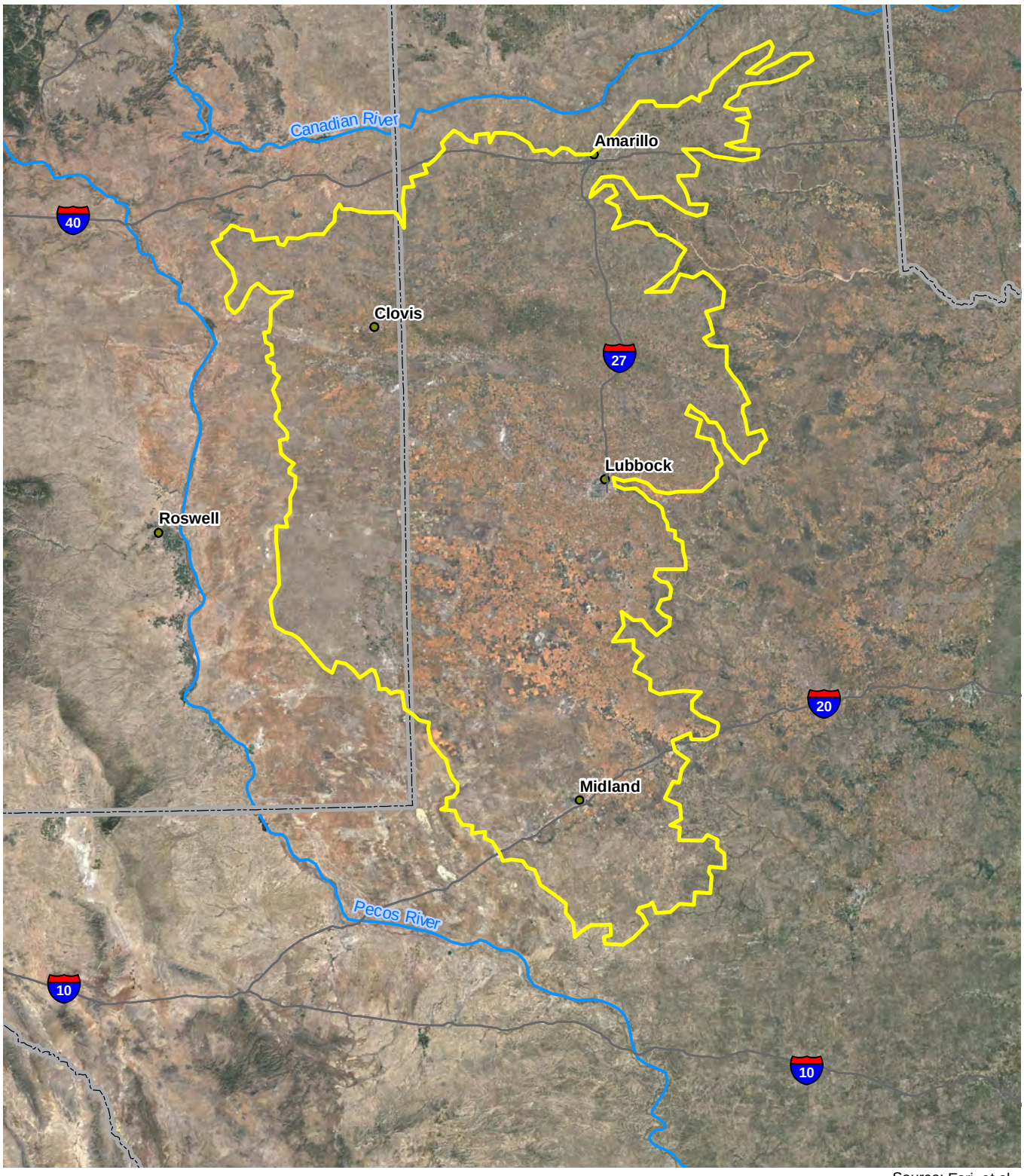
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NMED PFAS INVESTIGATION, CANNON AFB

Cannon AFB Features

Figure 3



Source: Esri, et al.

Explanation

- Approximate boundary of the Llano Estacado
- River
- State boundary
- Interstate highway

N

0 25 50 Miles

NMED PFAS INVESTIGATION, CANNON AFB

Llano Estacado

The Southern High Plains

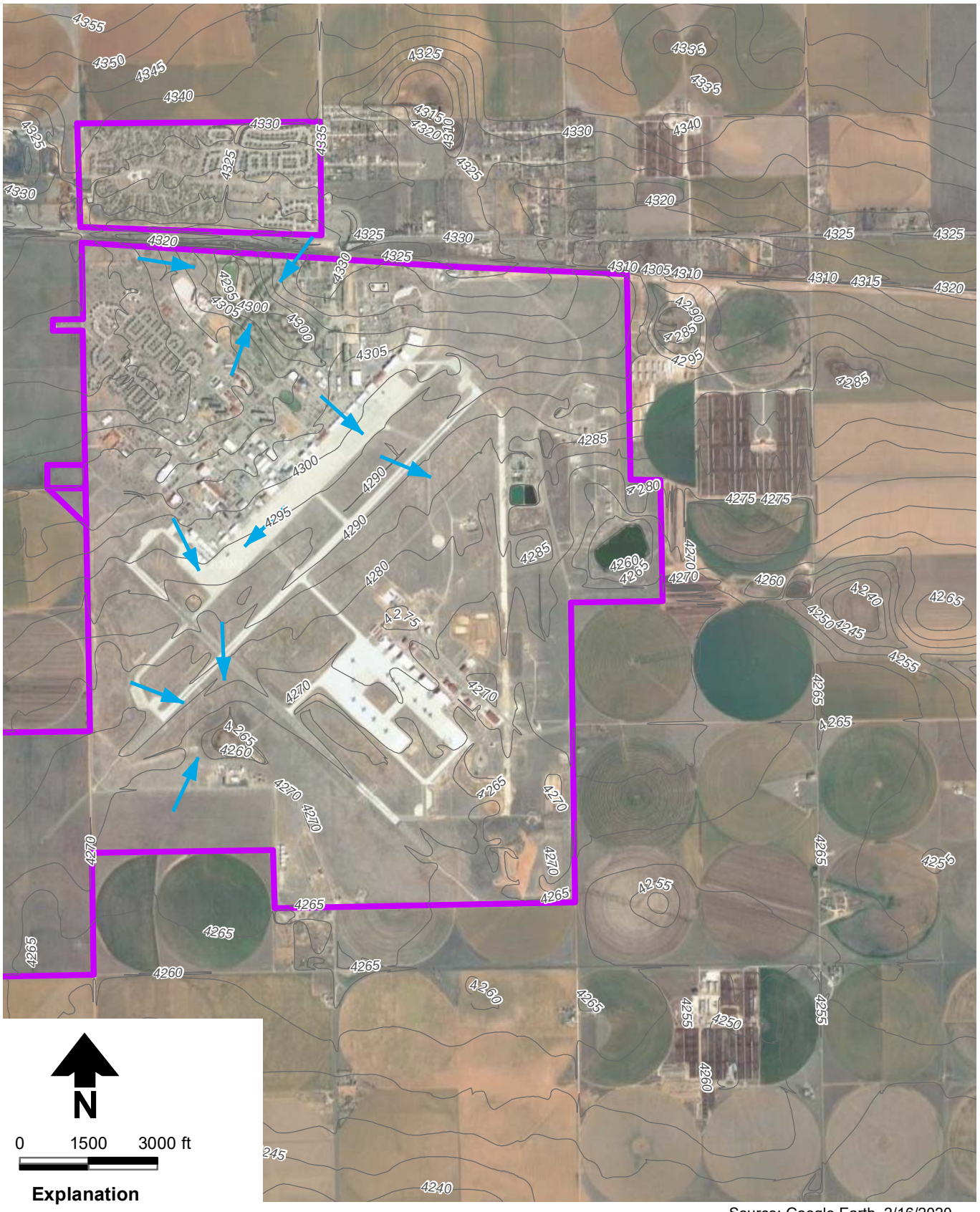
Figure 4

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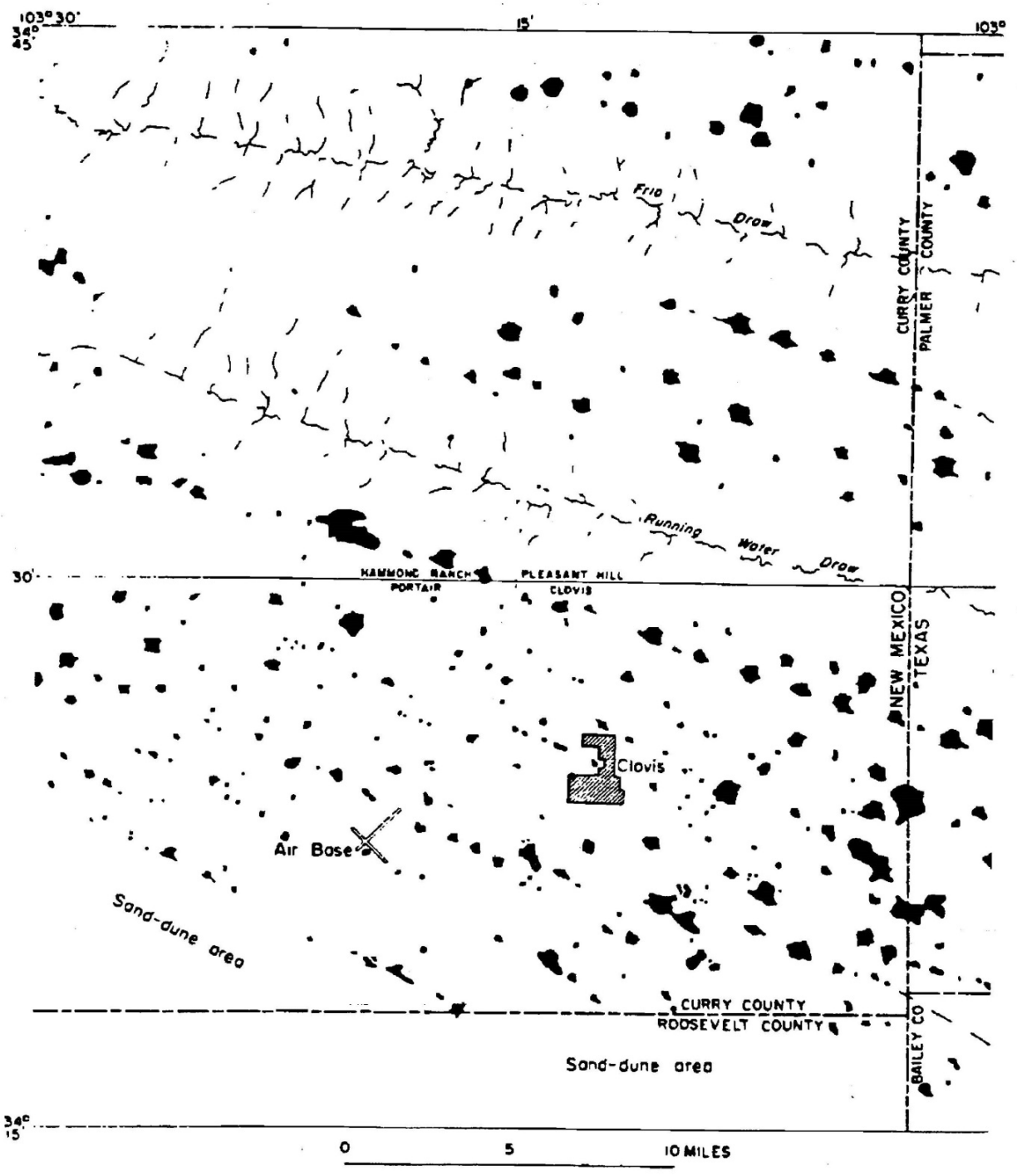
Source: Google Earth, 2/16/2020

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NMED PFAS INVESTIGATION, CANNON AFB
Topography and Drainage

Figure 5



Source: Finch and Wright, 1970

NMED PFAS INVESTIGATION, CANNON AFB

Alignment of Playa Basins and Drainages in East-Central New Mexico

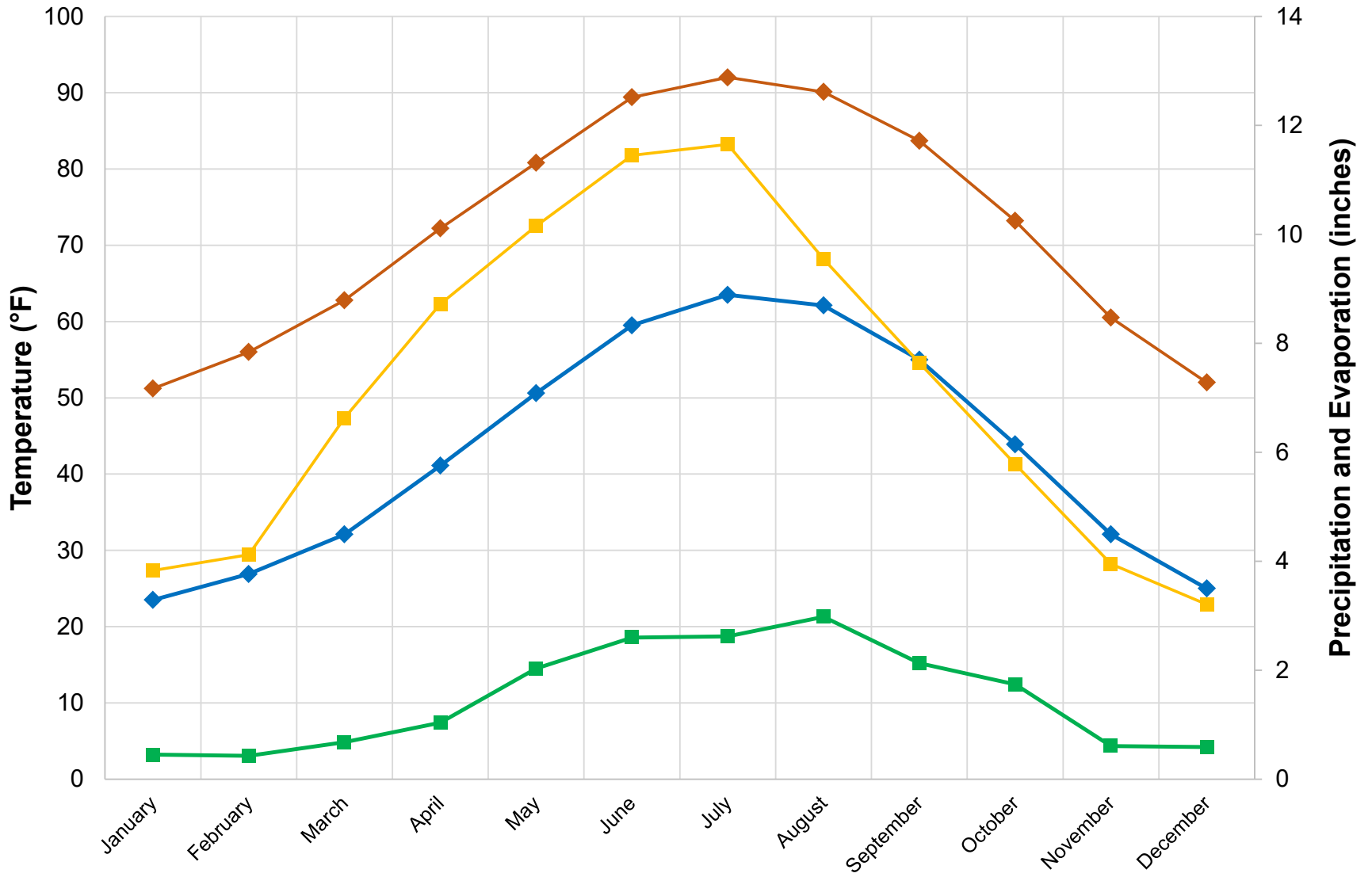
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Figure 6

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Source: WRCC.dri.edu

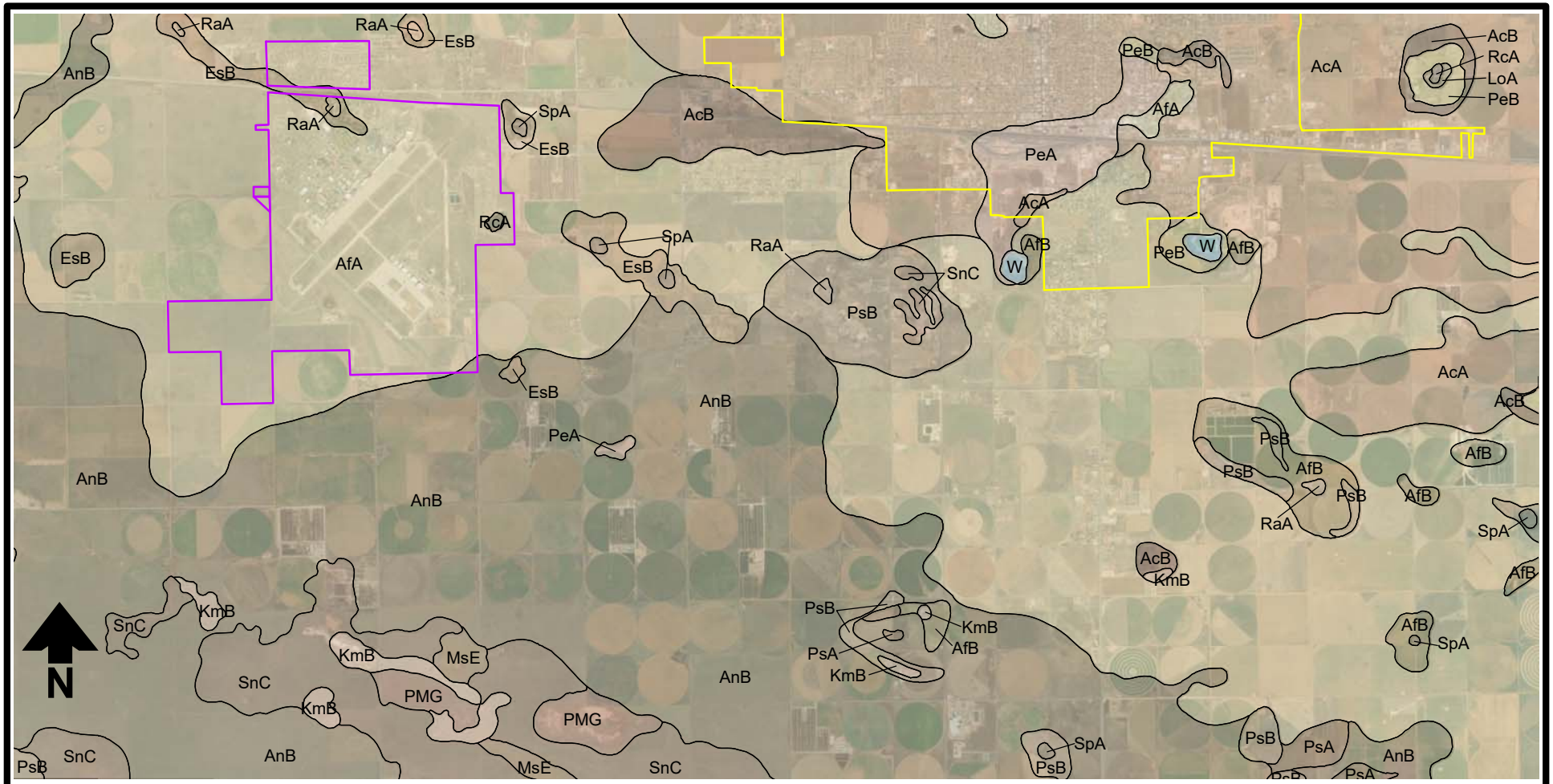
Figure 7

NMED PFAS INVESTIGATION, CANNON AFB

Average Weather Parameters, Clovis, New Mexico

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0 0.75 1.5 Miles

Explanation

- Cannon Air Force Base
- City of Clovis

Soil Data Source:
USDA, SSURGO
SSA version est.: 09/12/2021
https://websoilsurvey.sc.egov.usda.gov/
Downloaded March 18, 2022

AcA	Acuff loam, 0 to 1 percent slopes
AcB	Acuff loam, 1 to 3 percent slopes
AfA	Amarillo fine sandy loam, 0 to 1 percent slopes
AfB	Amarillo fine sandy loam, 1 to 3 percent slopes
AnB	Amarillo loamy fine sand, 0 to 3 percent slopes
EsA	Estacado loam, 0 to 1 percent slopes
EsB	Estacado loam, 1 to 3 percent slopes
KmB	Kimberson gravelly loam, 0 to 3 percent slopes
LoA	Lofton clay loam, 0 to 1 percent slopes, rarely ponded
MsE	Milsand and Arch soils, 1 to 20 percent slopes
PeA	Pep loam, 0 to 1 percent slopes
PeB	Pep loam, 1 to 3 percent slopes
PMG	Potter-Mobeetie association, 8 to 45 percent slopes
PsA	Posey fine sandy loam, 0 to 1 percent slopes
PsB	Posey fine sandy loam, 1 to 3 percent slopes
PsC	Posey fine sandy loam, 3 to 8 percent slopes
RaA	Randall clay, 0 to 1 percent slopes, frequently ponded
RcA	Ranco clay, 0 to 1 percent slopes, frequently ponded
SnC	Spantara fine sand, 1 to 5 percent slopes
SpA	Sparenberg clay, 0 to 1 percent slopes, occasionally ponded
W	Water

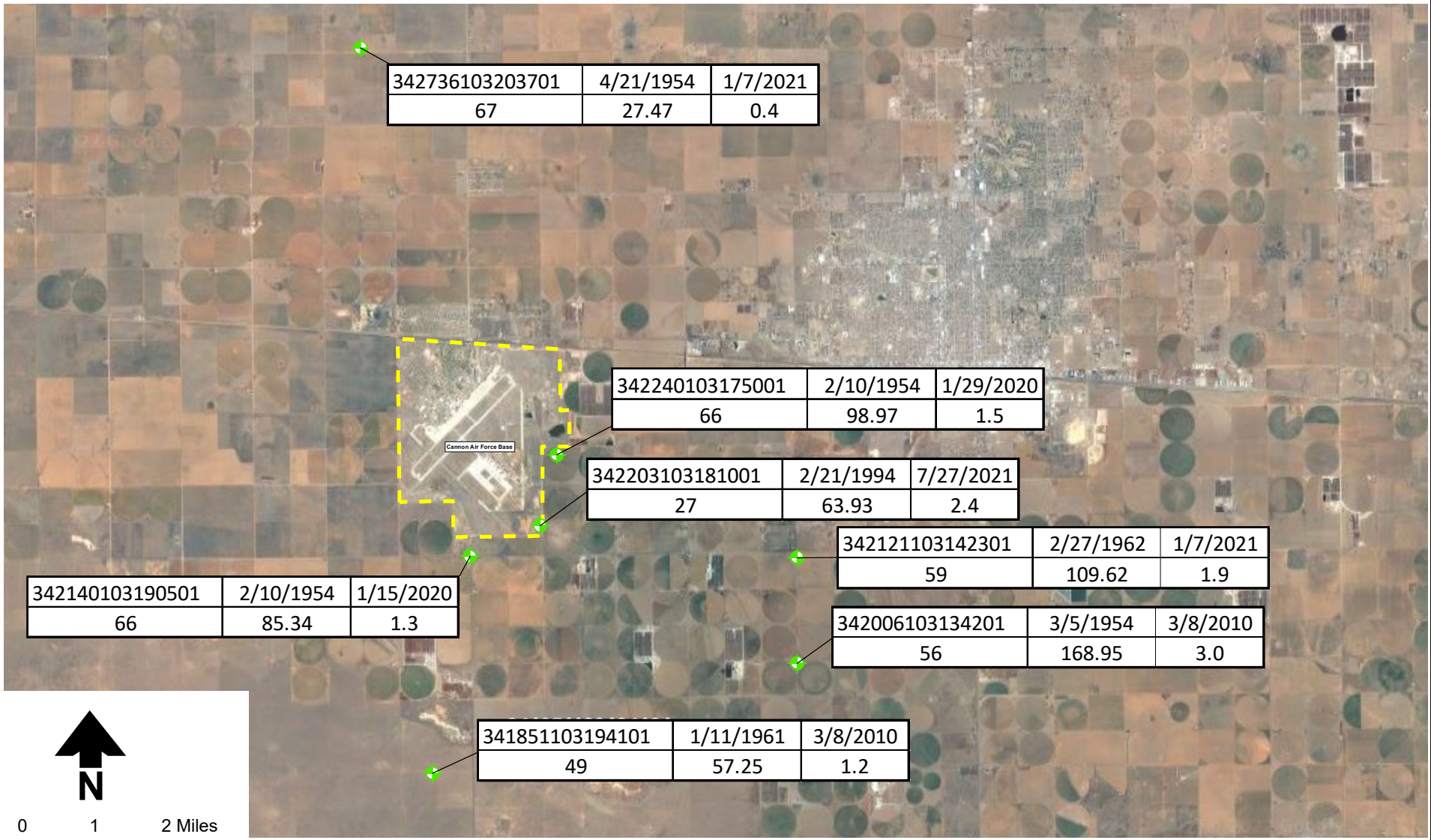
NMED PFAS INVESTIGATION, CANNON AFB

Soil Survey

Figure 8

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S:\PROJECTS\DB21.1060_NMED_PFAS_INVESTIGATIONS\GIS\MXDS\CANNON_REPORT\F09._RATES_OF_WATER_LEVEL_CHANGE_IN_THE_OGALLALA_AQUIFER.MXD



Explanation

- Irrigation well

NWIS Well ID	Date First Measured	Date Last Measured
Number of Years Monitored	Water Level Change (feet)	Water Level Change (feet per year)

Base image source: Google Earth Pro, 10/14/2016
Well data: USGS National Water Information System (NWIS), accessed March 18, 2022

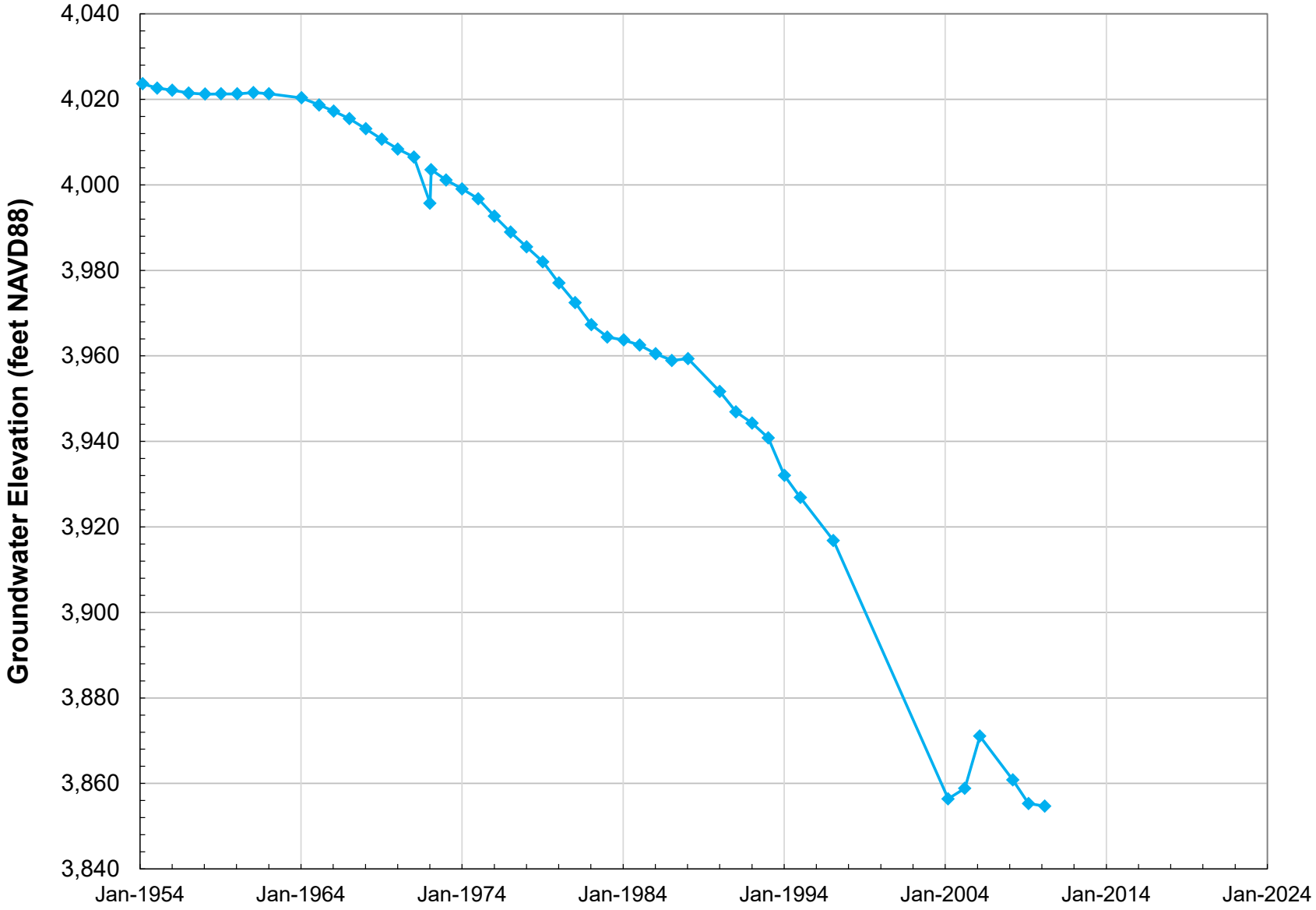
NMED PFAS INVESTIGATION, CANNON AFB

Rate of Water Level Change in the Ogallala Aquifer

Figure 9

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P:_DB21-1060\Cannon Phase I.6-22\Figures\Word\F10_Hydrograph USGS Well .docx



NMED PFAS INVESTIGATION, CANNON AFB

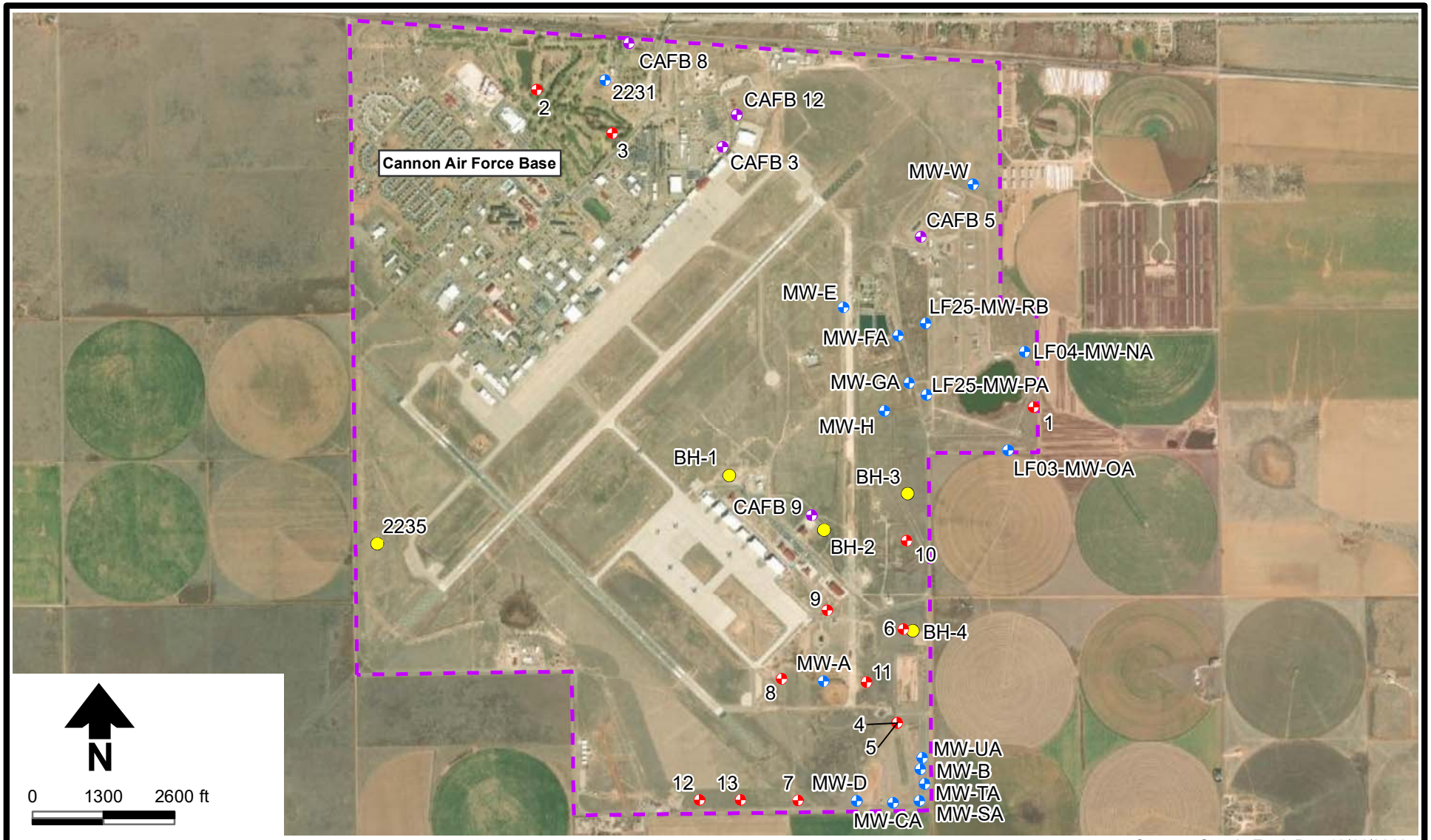
Groundwater Elevation Over Time
USGS Site 342006103134201

Figure 10

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6/21/2022 DB21.1060

S:\PROJECTS\DB21.1060_NMED_PFAS_INVESTIGATIONS\GIS\MXDS\CANNON_REPORT\F05_WELLS_AND_DEEP_BORINGS_AT_CANNON_AIR_FORCE_BASE.MXD



Source: Google Earth Pro, 10/14/2016

Explanation

- Supply well
- Monitor well
- Proposed monitor well
- Deep soil boring

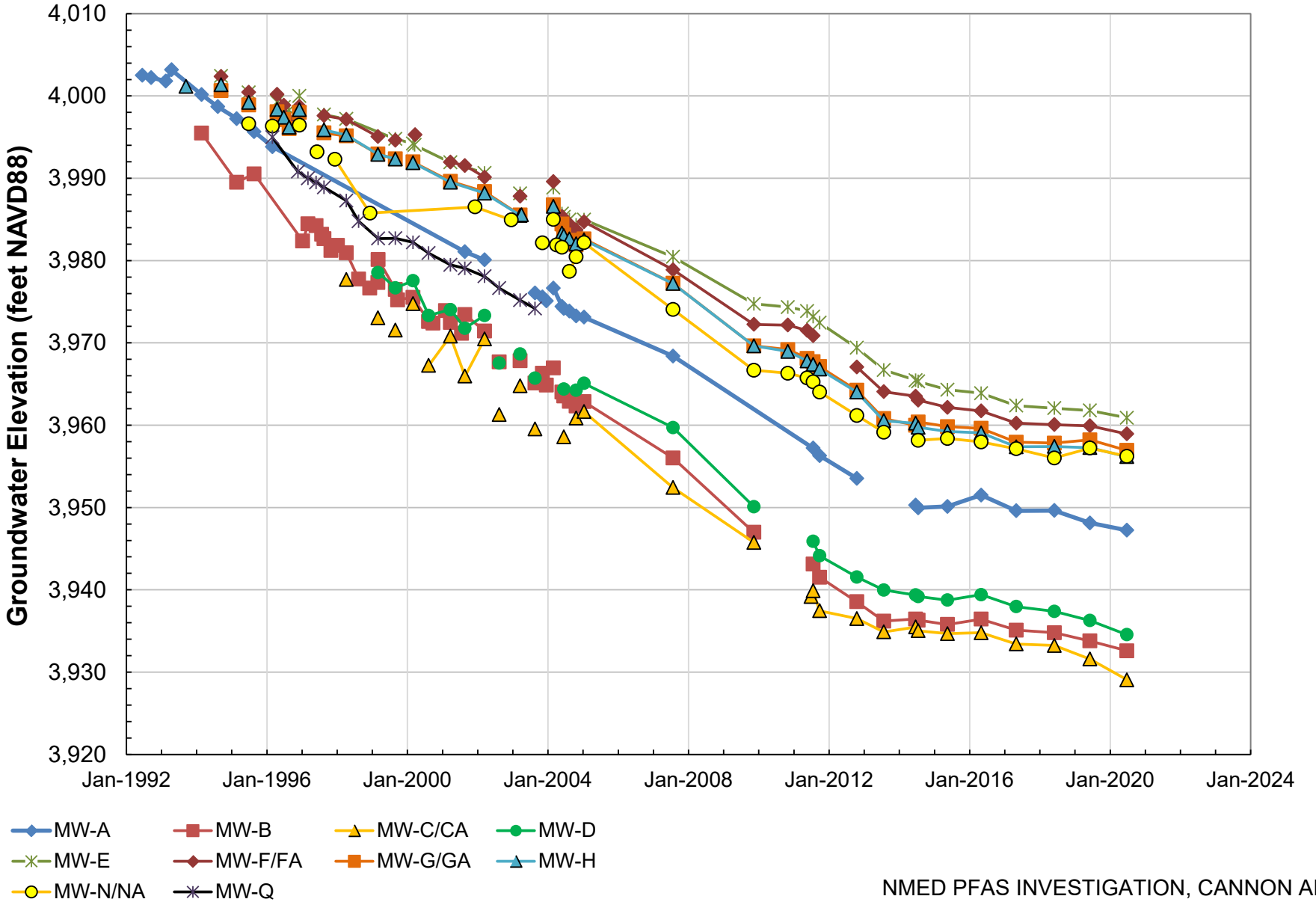
Figure 11

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DB21.1060

NMED PFAS INVESTIGATION, CANNON AFB

Wells and Deep Borings at Cannon AFB

P:_DB21-1060\Cannon Phase I.6-22\Figures\Word\F12_Hydrographs CAFB Wells .docx



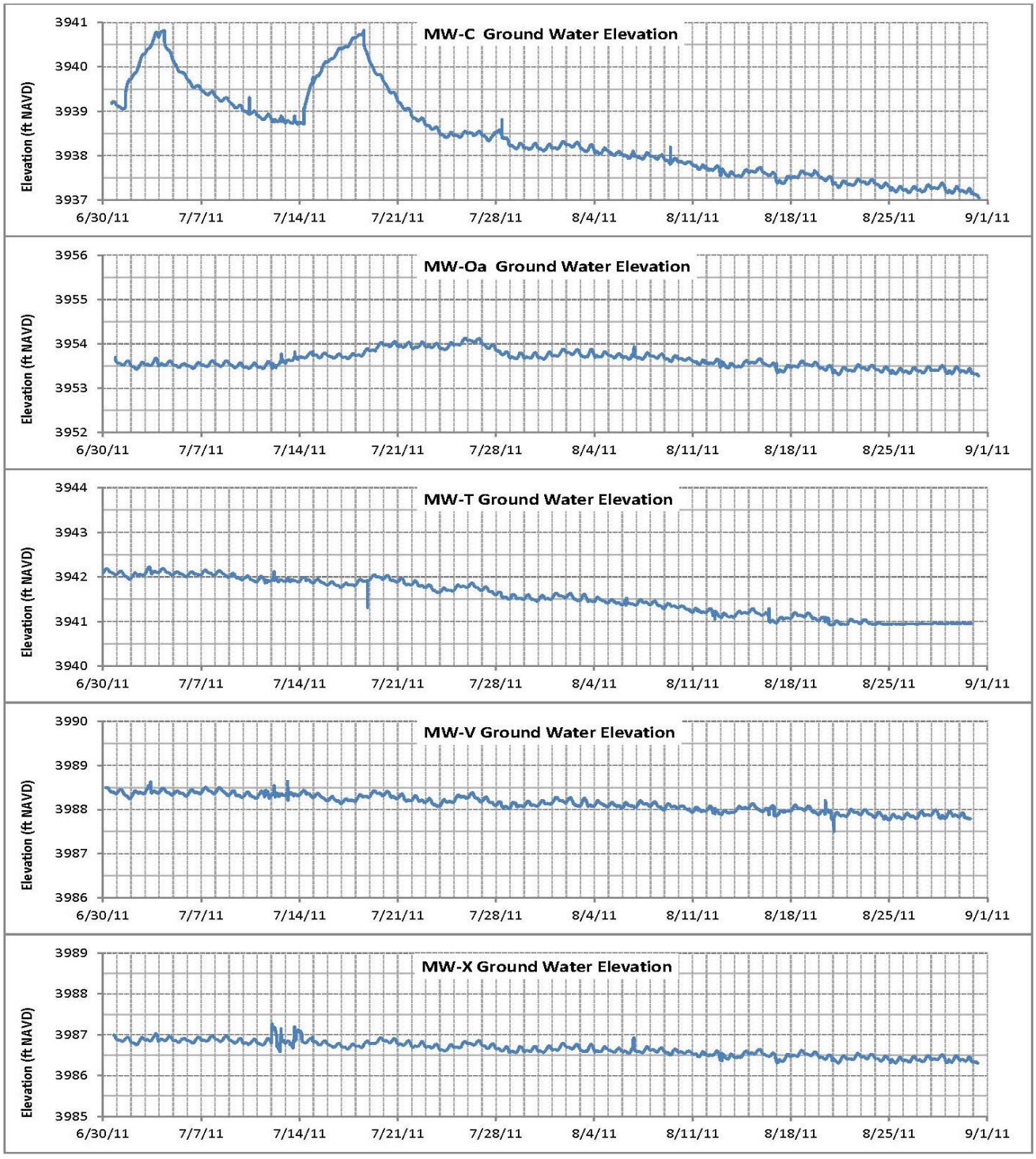
NMED PFAS INVESTIGATION, CANNON AFB

Groundwater Elevations Over Time
Cannon AFB Monitor Wells

Figure 12

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6/21/2022 DB21.1060



Source: Trinity, 2012

NMED PFAS INVESTIGATION, CANNON AFB

Transducer Data

July–August 2011

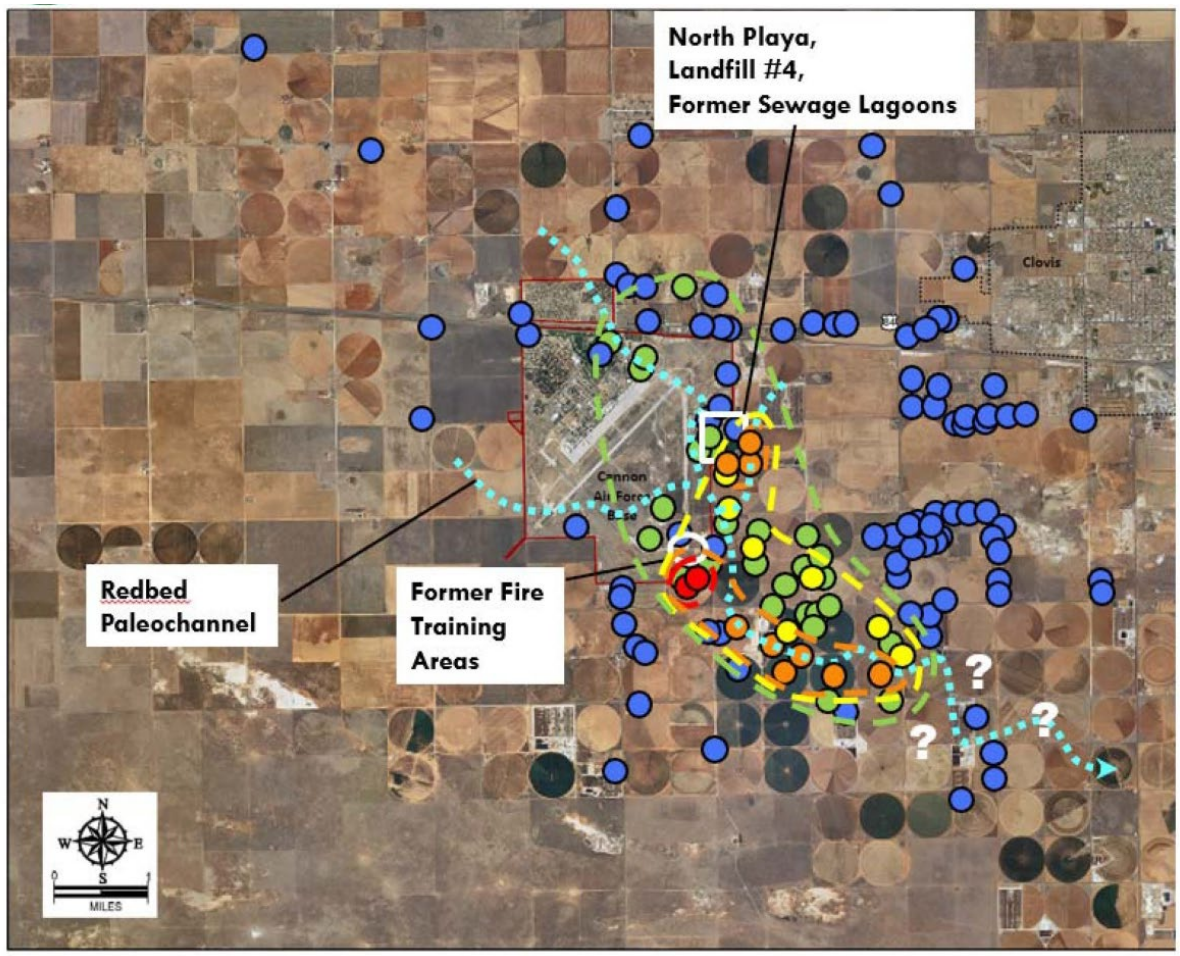
Figure 13

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P:_DB21-1060\Cannon Phase I\6-22\Figures\Word\F13_Transducer Data.docx



Total PFAS (ng/L)

- > 10,000
- 1,000 to 9,999
- 71 to 999
- 1 to 70
- Not Detected

Source: NMED RFP #21 667 1210 0001, Amendment #2

Note: Variability in detection locations may result from differences in laboratory detection, quantification, and reporting limits.

Figure 14

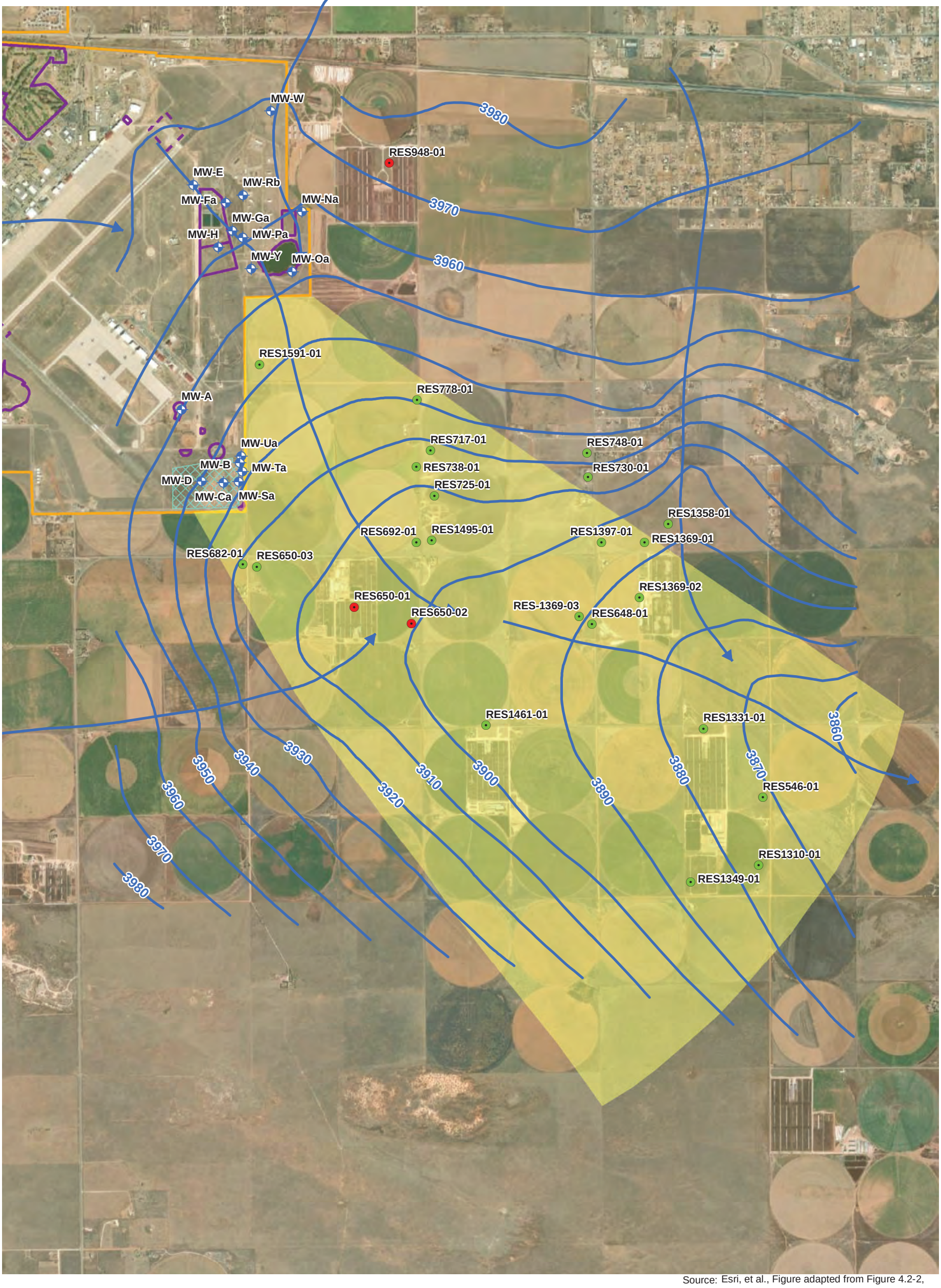
NMED PFAS INVESTIGATION, CANNON AFB

NMED Map of Cannon AFB PFAS Plume from NMED (2020)

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6/21/2022 DB21.1060

S:\Projects\DB21.1060_NMED_PFAS_Investigations\VR_Drawings\AI\PFAS_Plume\F15_USAF_Map_of_Cannon_AFB_PFAS_Plume.ai



Source: Esri, et al., Figure adapted from Figure 4.2-2, Amec Foster Wheeler, 2018. Final Site Inspection Report, Cannon Air Force Base, NM. August 2018.

N

0 1,500 3,000 Feet

Explanation

- Monitor well
- Potentiometric surface elevation contours (ft msl)
- AFFF release area
- Approximate AFFF release area
- Landfill 5
- Cannon AFB Installation boundary
- Groundwater flow direction
- Potentially Contaminated groundwater to 4-miles downgradient

Residential sample locations

- PFOS+PFOA detected
- PFOS+PFOA non-detect

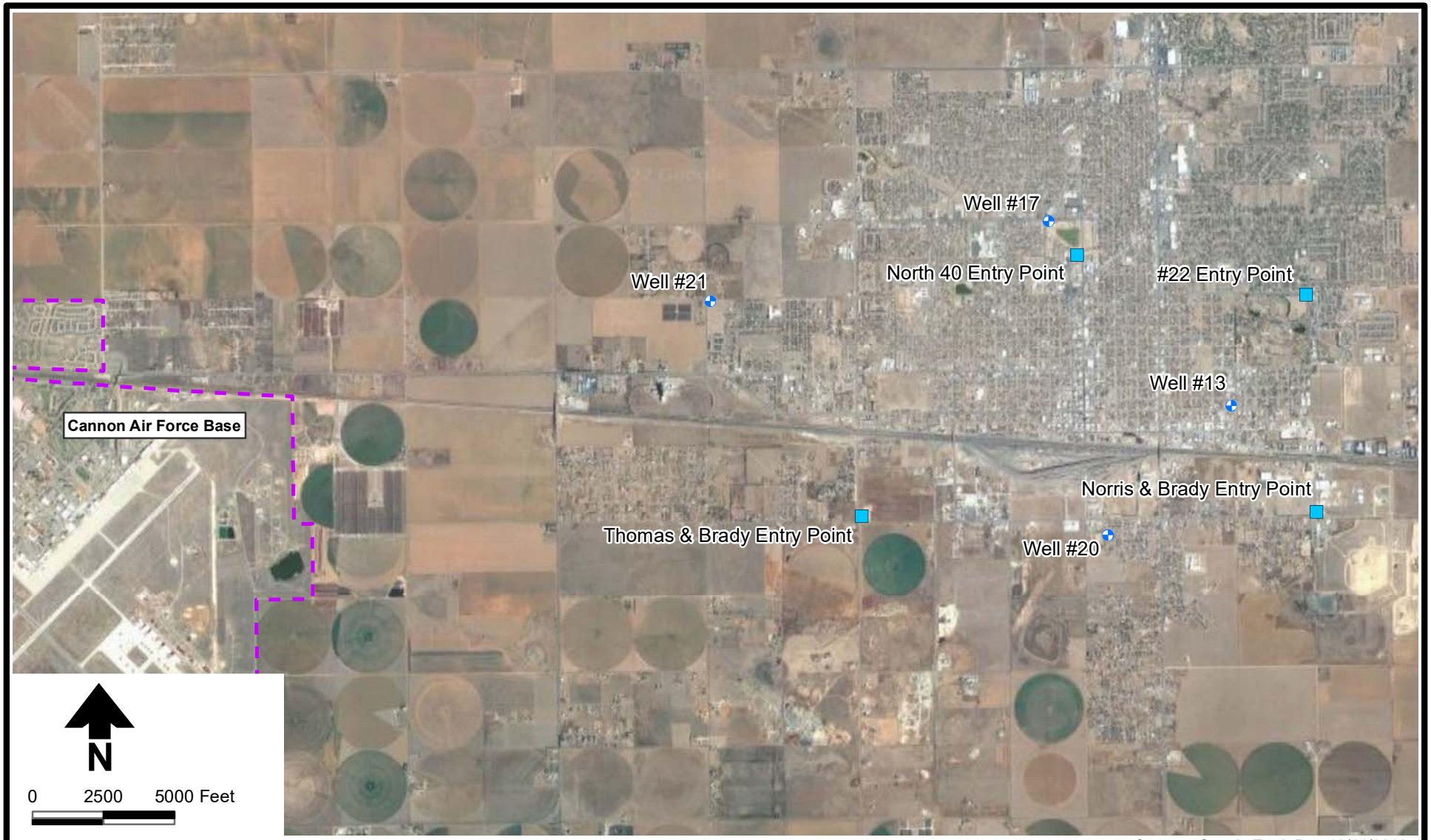
Figure 15

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6/22/2022 JN DB21.1060

NMED PFAS INVESTIGATION, CANNON AFB

USAF Map of Cannon AFB PFAS Plume

S:\PROJECTS\DB21.1060_NMED_PFAS_INVESTIGATIONS\GIS\MXDS\CANNON_REPORT\F16_NMAWC_UCMR3_WATER_SAMPLE_LOCATIONS.MXD



Source: Google Earth Pro, 10/14/2016

Explanation

- Well
- Distribution system entry point

Figure 16

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6/16/2022 DB21.1060

NMED PFAS INVESTIGATION, CANNON AFB

NMAWC UCMR3 Water Sample Locations

S:\PROJECTS\DB21.1060_NMED_PFAS_INVESTIGATIONS\GIS\MXDS\CANNON_REPORT\F17_. CANNON_AFB_PRODUCTION_WELLS_AND_WATER_TREATMENT_PLANT.MXD



Source: Google Earth Pro, 10/14/2016

Explanation

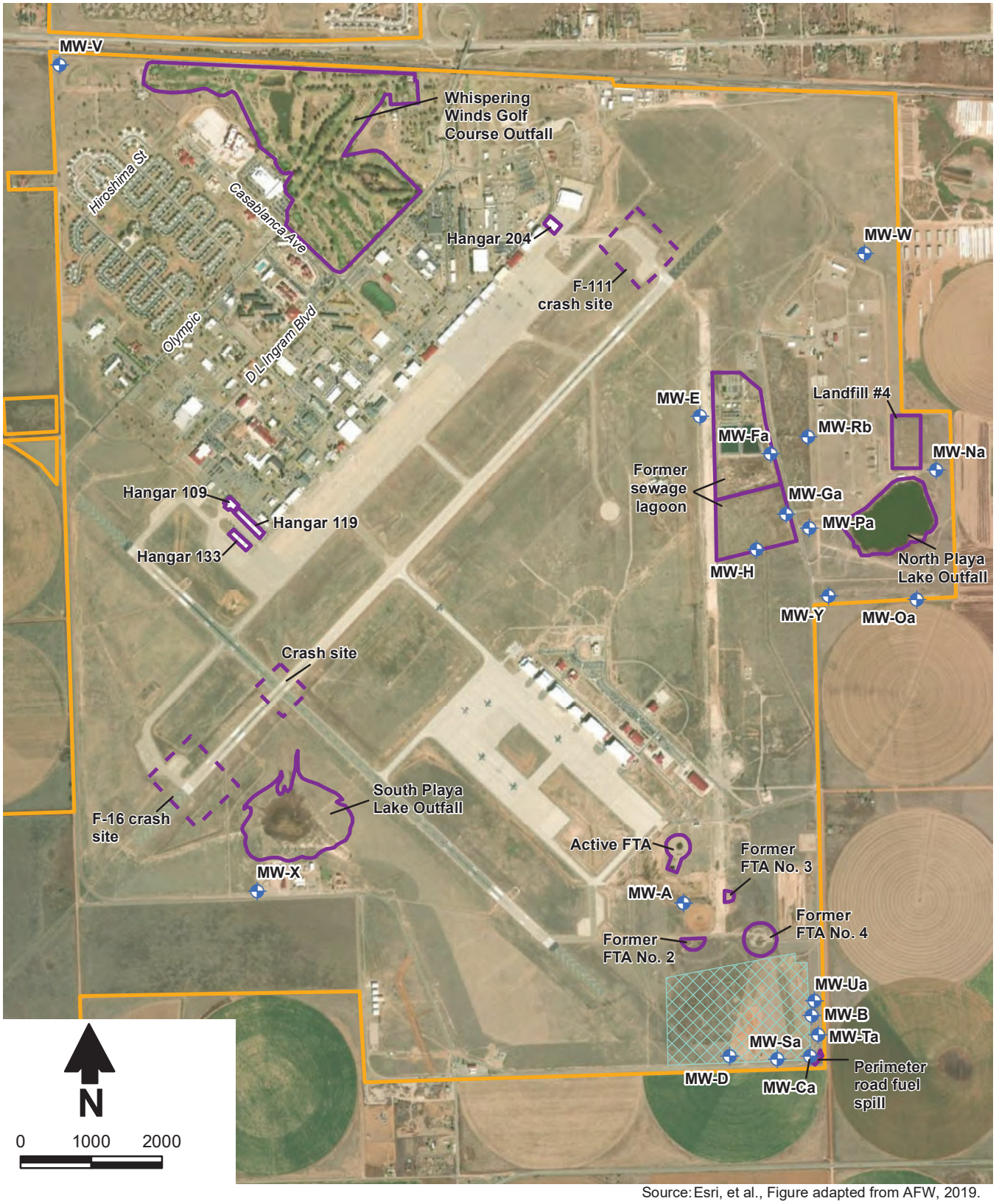
- Well
- Abandoned well
- Water treatment plant

Figure 17

NMED PFAS INVESTIGATION, CANNON AFB

Cannon AFB Production Wells and Water Treatment Plant

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6/16/2022
DB21.1060



Source: Esri, et al., Figure adapted from AFW, 2019.

Explanation

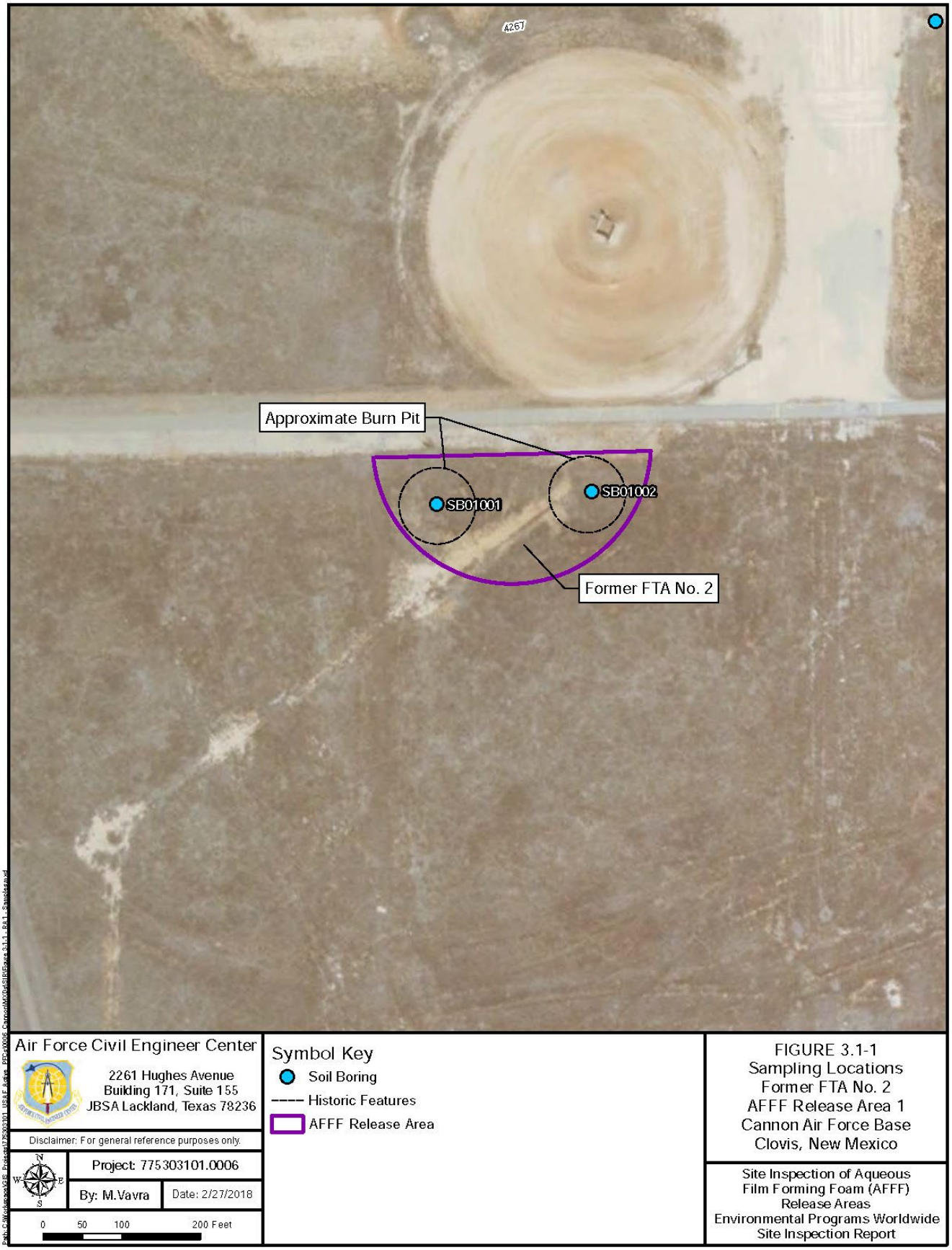
- Monitor well
- AFFF release area
- Approximate AFFF release area
- Landfill 5
- Cannon AFB boundary

S:\Projects\DB21.1060_NMED_PFAS_Investigations\VR_Drawings\AIF02_ AFFF Release Areas.ai

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5/10/2021
JN DB21.1060

NMED PFAS INVESTIGATION, CANNON AFB
Cannon AFB AFFF Release Areas

Figure 18



Source: AFW, 2018

NMED PFAS INVESTIGATION, CANNON AFB

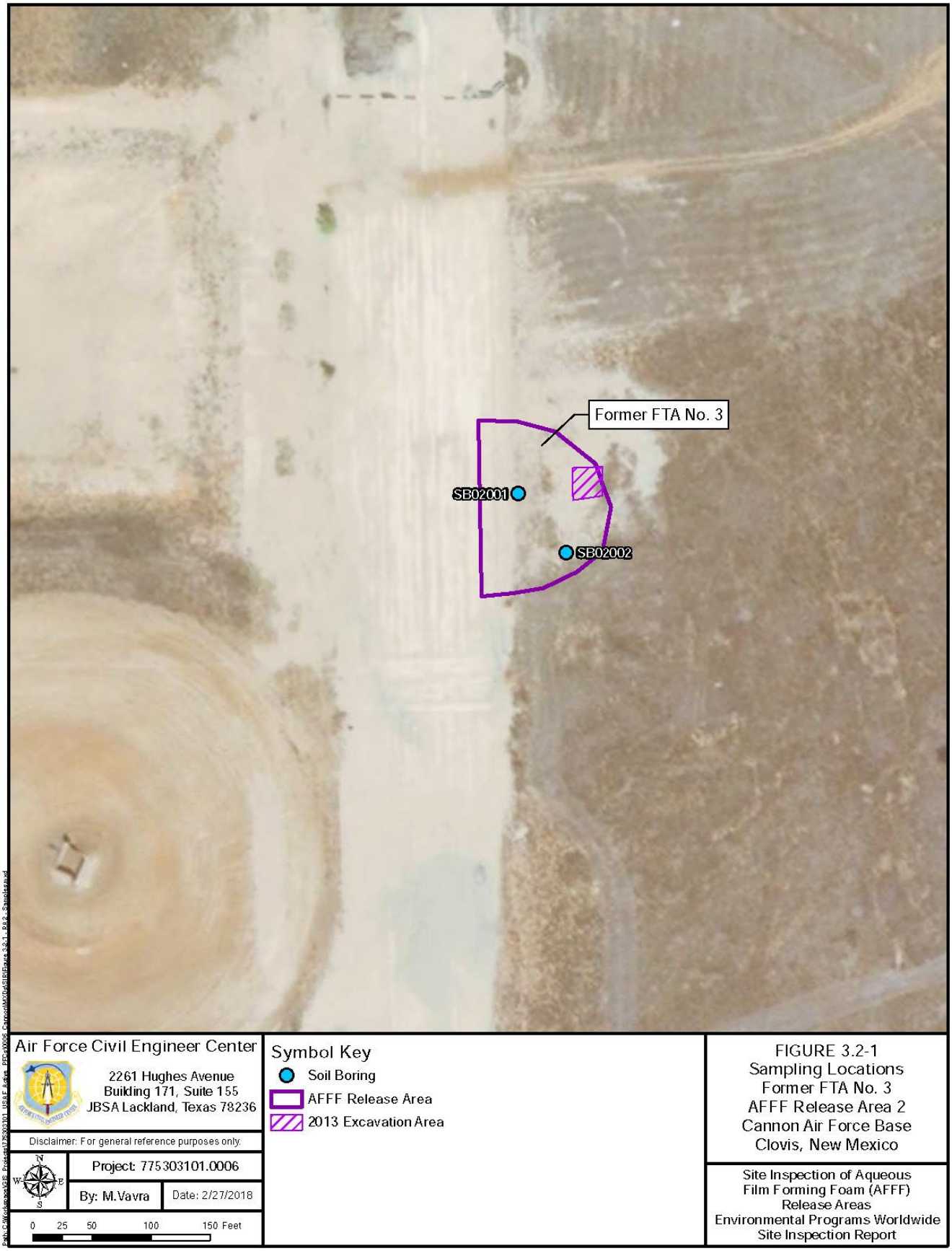
AFFF Release Area 1, Former FTA No. 2

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6/21/2022 DB21.1060

Figure 19

P:_DB21-1060\Cannon Phase I\6-22\Figures\Word\F19_AFFF Area 1_FTA 2.docx



Source: AFW, 2018

NMED PFAS INVESTIGATION, CANNON AFB

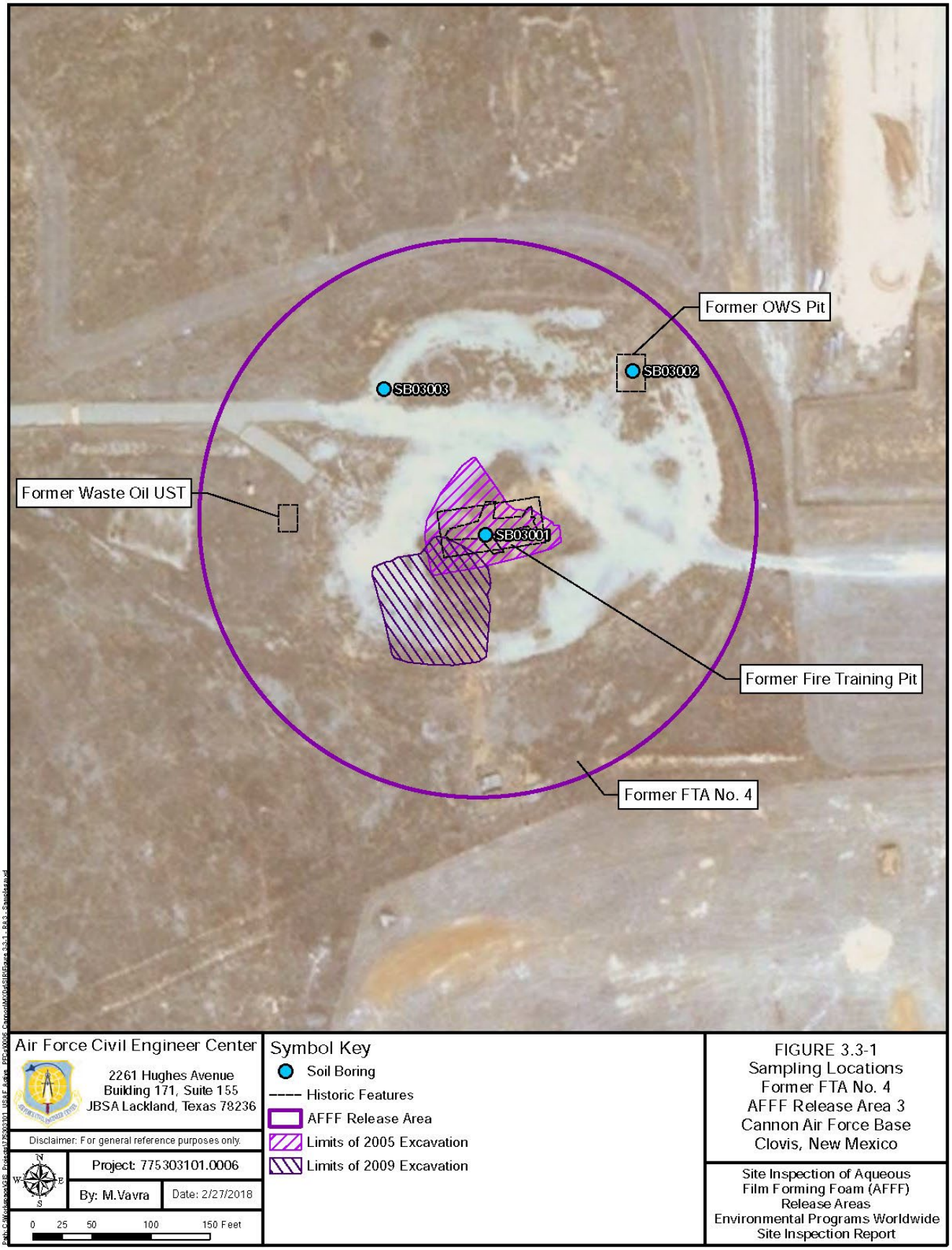
AFFF Release Area 2, Former FTA No. 3

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6/21/2022 DB21.1060

Figure 20

P:_DB21-1060\Cannon Phase I.6-22\Figures\Word\F20_AFFF Area 2_FTA 3.docx



Source: AFW, 2018

NMED PFAS INVESTIGATION, CANNON AFB

AFFF Release Area 3, Former FTA No. 4

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Figure 21

P:_DB21-1060\Cannon Phase I\6-22\Figures\Word\F21_AFFF Area 3_FTA 4.docx



Air Force Civil Engineer Center
2261 Hughes Avenue
Building 171, Suite 155
JBSA Lackland, Texas 78236

Disclaimer: For general reference purposes only.

Project: 775303101.0006
By: M.Vavra
Date: 2/27/2018

0 25 50 100 150 Feet

Symbol Key
- Soil Boring
- AFFF Release Area

FIGURE 3.4-1
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 Site Inspection Report

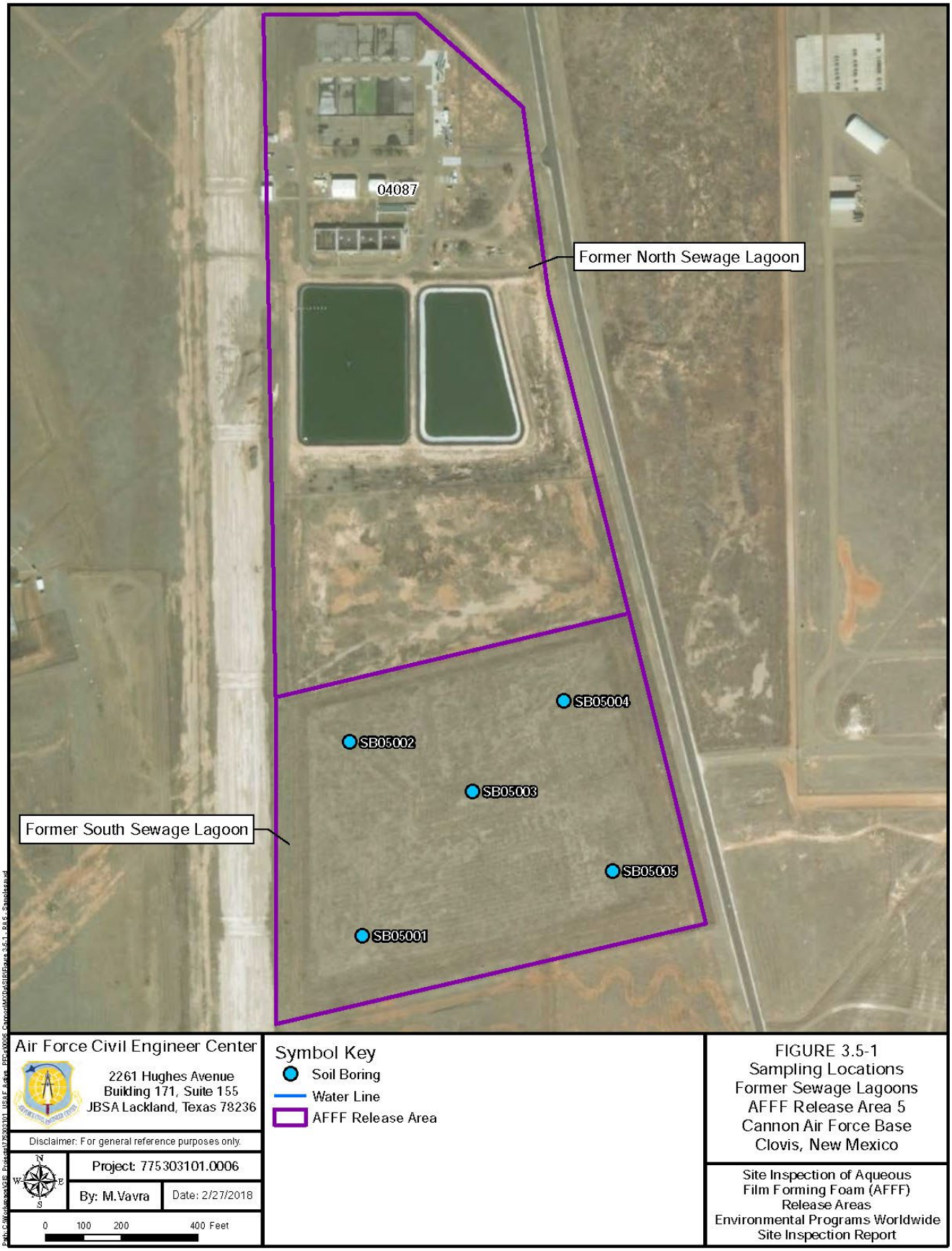
Source: AFW, 2018

P:_DB21-1060\Cannon Phase I\6-22\Figures\Word\F23_AFFF Area 4.docx

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6/21/2022 DB21.1060

NMED PFAS INVESTIGATION, CANNON AFB
AFFF Release Area 4, Hangars 119 and 133

Figure 22



Source: AFW, 2018

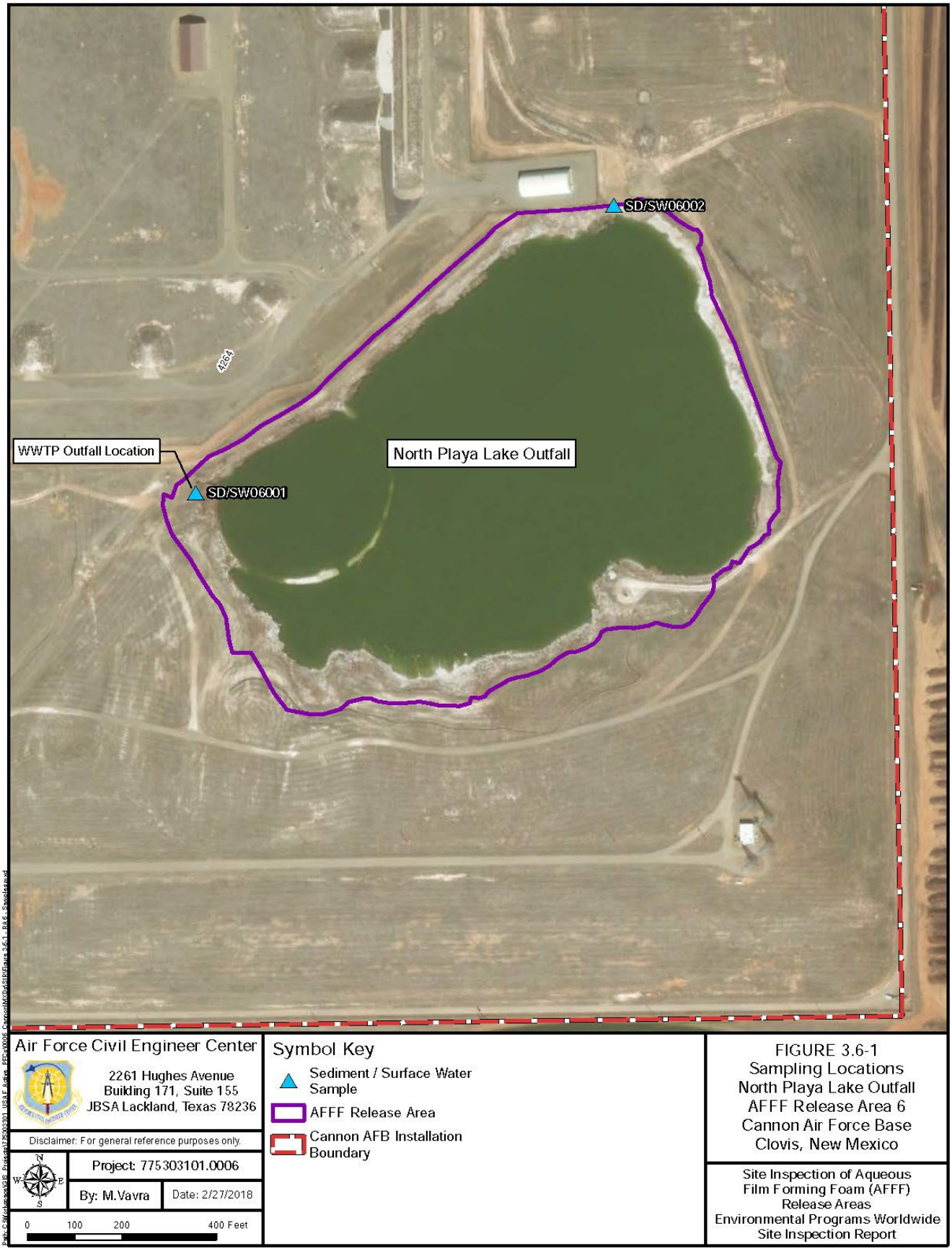
NMED PFAS INVESTIGATION, CANNON AFB

AFFF Release Area 5
Former Sewage Lagoons

DBS&A
Daniel B. Stephens & Associates, Inc.
6/21/2022 DB21.1060

Figure 23

P:_DB21-1060\Cannon Phase I\6-22\Figures\Word\F23_AFFF Area 5.docx



Source: AFW, 2018

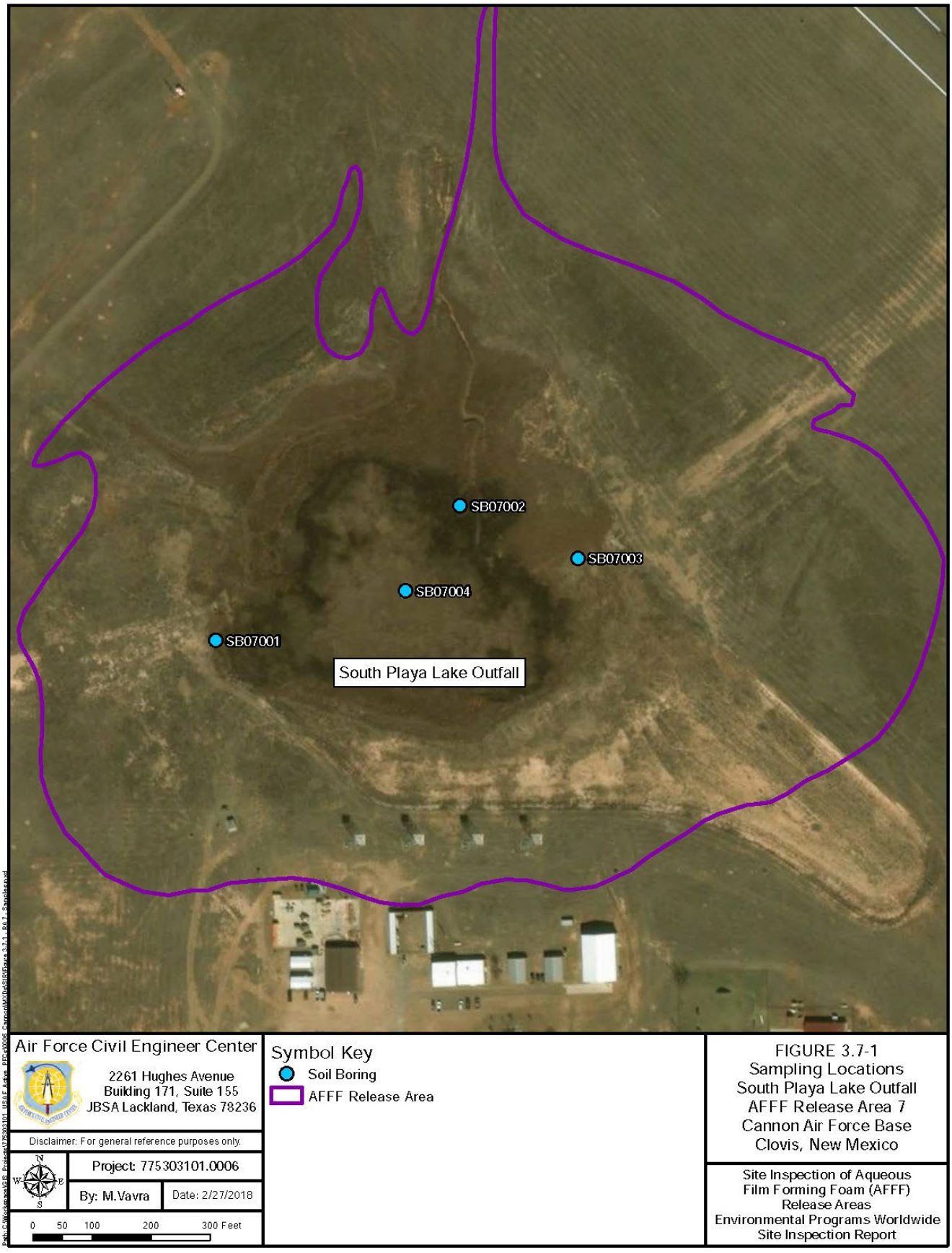
NMED PFAS INVESTIGATION, CANNON AFB

AFFF Release Area 6
North Playa Lake Outfall

DBS&A
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6/21/2022 DB21.1060

Figure 24

P:_DB21-1060\Cannon Phase I.6-22\Figures\Word\F24_AFFF Area 6.docx



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Project: 775303101.0006
By: M.Vavra
Date: 2/27/2018

0 50 100 200 300 Feet

Symbol Key
Soil Boring
AFFF Release Area

FIGURE 3.7-1
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
Site Inspection Report

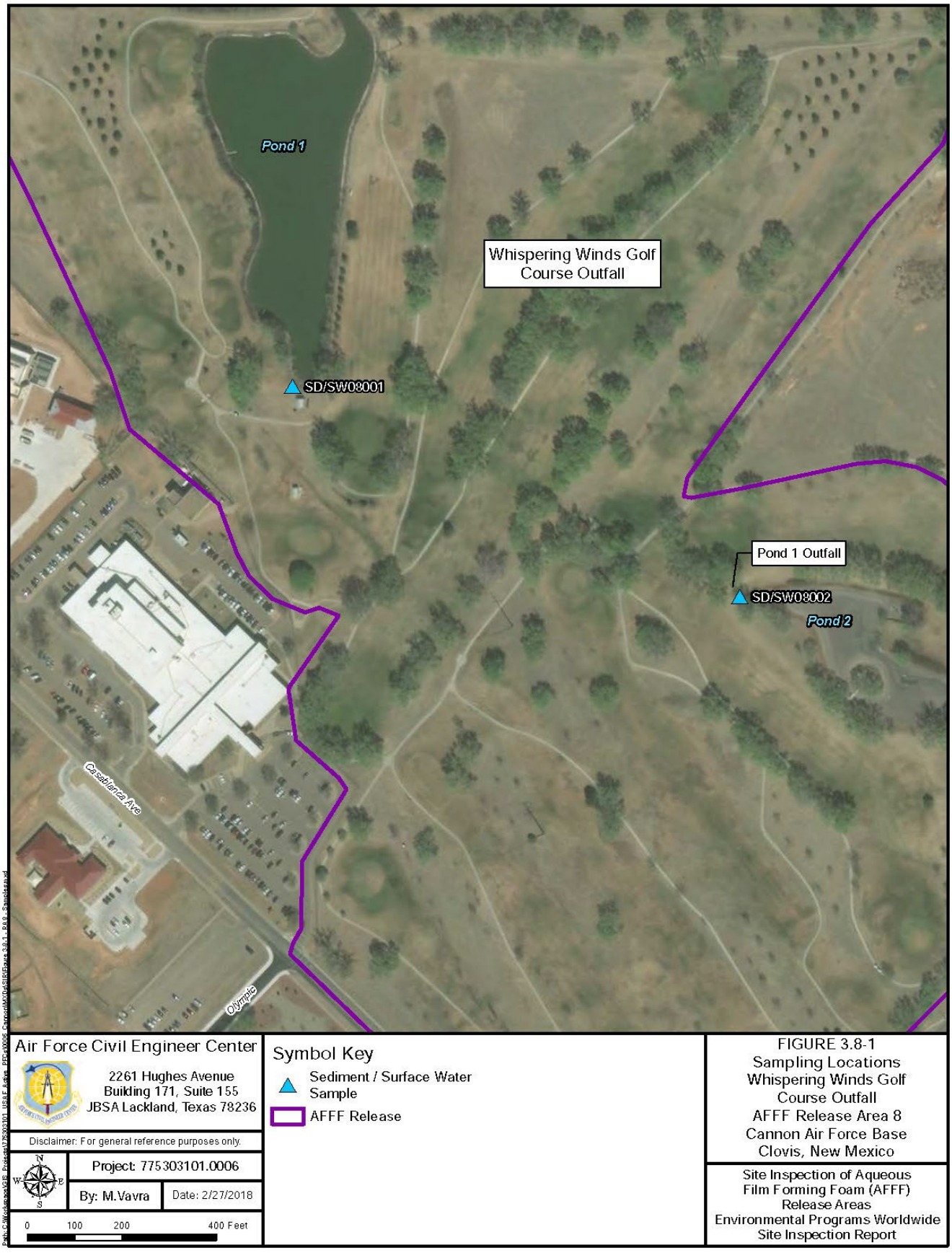
Source: AFW, 2018

NMED PFAS INVESTIGATION, CANNON AFB
AFFF Release Area 7
South Playa Lake Outfall

DBS&A
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6/21/2022 DB21.1060

Figure 25

P:_DB21-1060\Cannon Phase I.6-22\Figures\Word\F25_AFFF Area 7.docx



Source: AFW, 2018

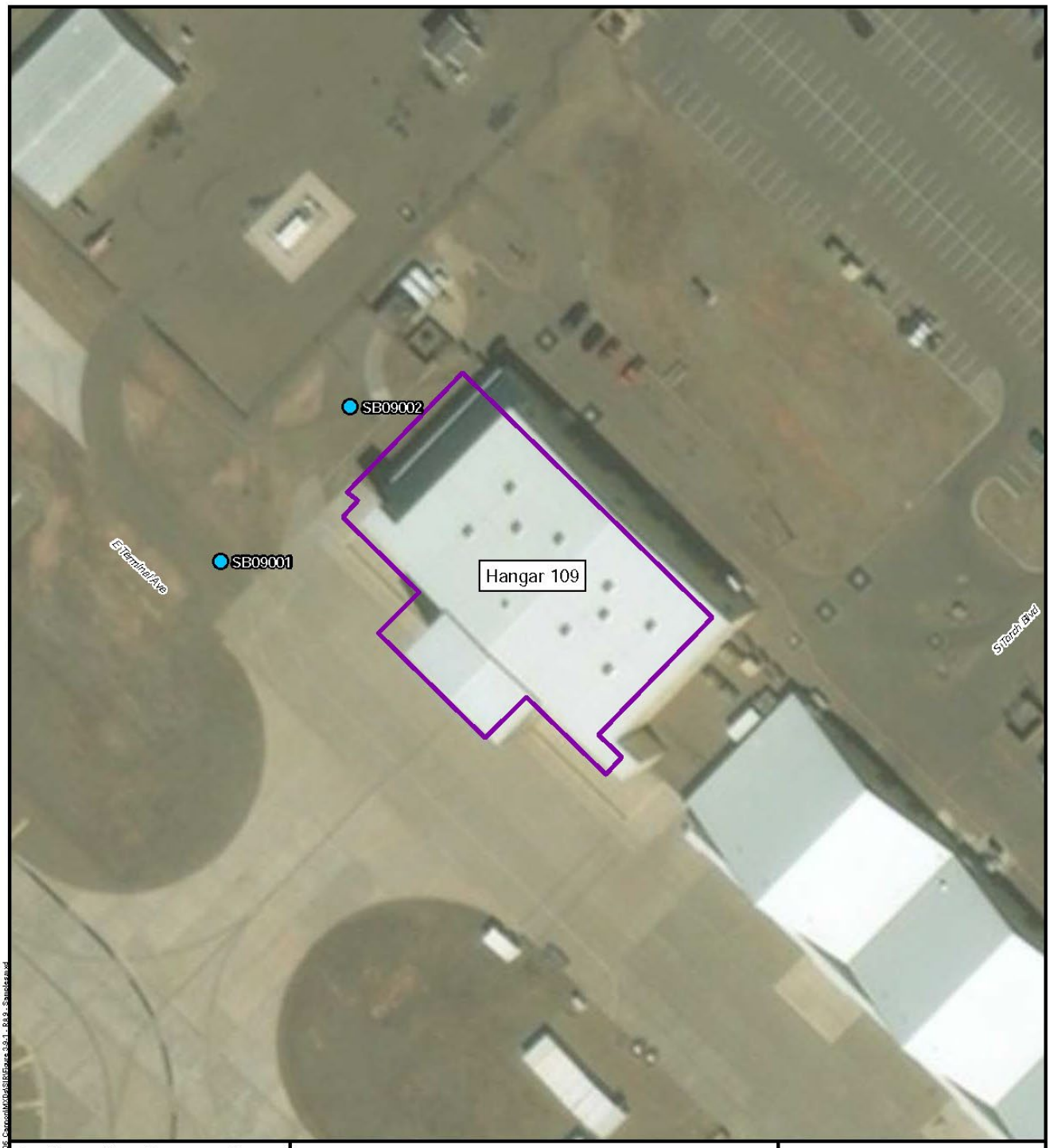
NMED PFAS INVESTIGATION, CANNON AFB

AFFF Release Area 8
Golf Course Outfall

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Figure 26

P:_DB21-1060\Cannon Phase I.6-22\Figures\Word\F26_AFFF Area 8.docx



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Project: 775303101.0006
By: M.Vavra
Date: 2/27/2018

0 25 50 100 Feet

Symbol Key
Soil Boring
AFFF Release Area

FIGURE 3.9-1
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
Site Inspection Report

Source: AFW, 2018

NMED PFAS INVESTIGATION, CANNON AFB
AFFF Release Area 9
Hangar 109

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6/21/2022 DB21.1060

Figure 27

P:_DB21-1060\Cannon Phase I\6-22\Figures\Word\F27_AFFF Area 9.docx



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Project: 775303101.0006
By: M.Vavra
Date: 2/27/2018

0 50 100 200 Feet

Symbol Key
- Monitoring Well
- AFFF Release
- Landfill
- Cannon AFB Installation Boundary

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

FIGURE 3.10-1
Sampling Locations
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
Site Inspection Report

Source: AFW, 2018

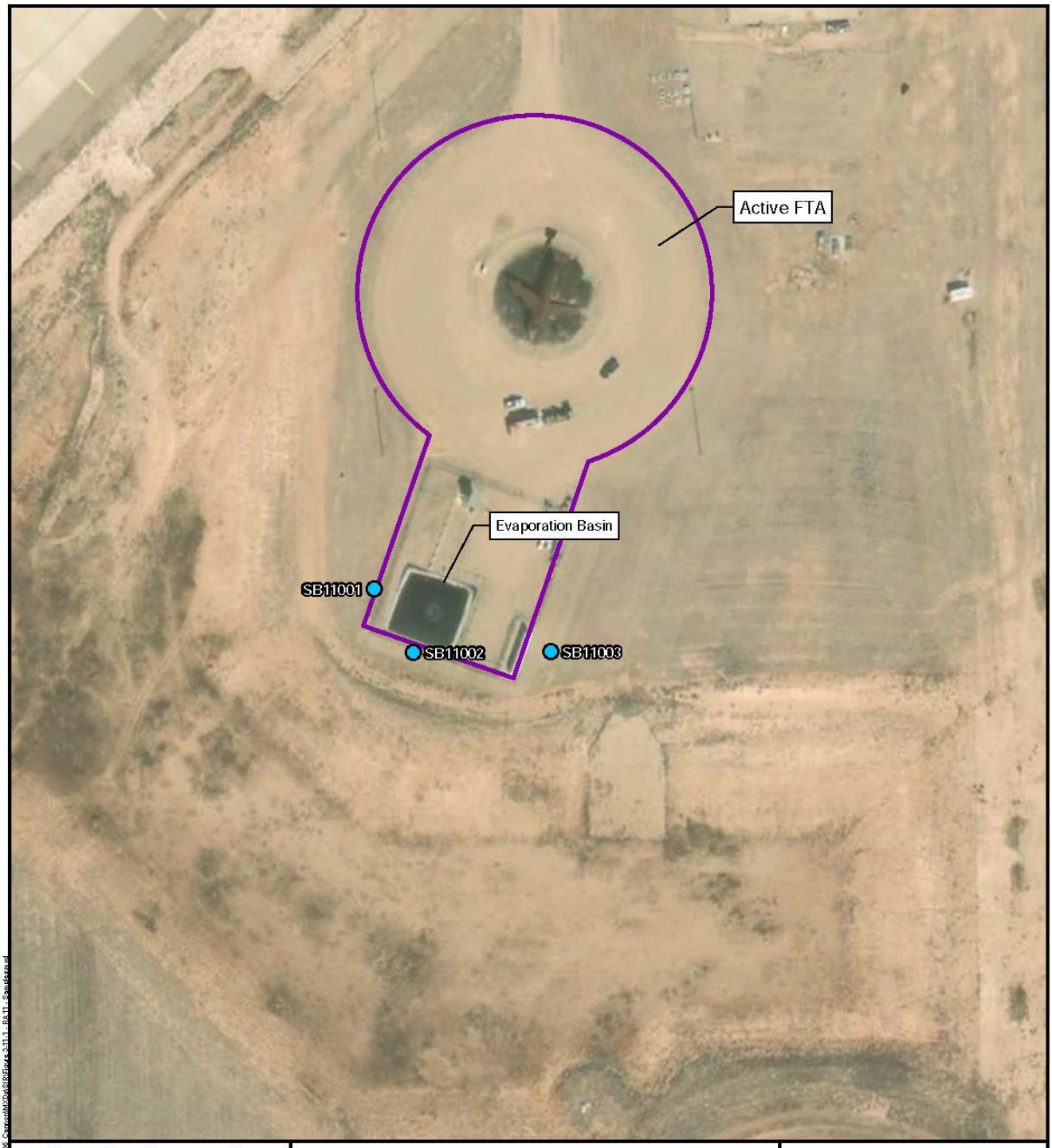
NMED PFAS INVESTIGATION, CANNON AFB

AFFF Release Area 10
Former Landfill No. 4

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Figure 28

P:_DB21-1060\Cannon Phase I\6-22\Figures\Word\F28_AFFF Area 10.docx



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Project: 775303101.0006
By: M.Vavra
Date: 8/9/2018

0 50 100 200 Feet

Symbol Key
Soil Boring
AFFF Release

FIGURE 3.11-1
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
Site Inspection Report

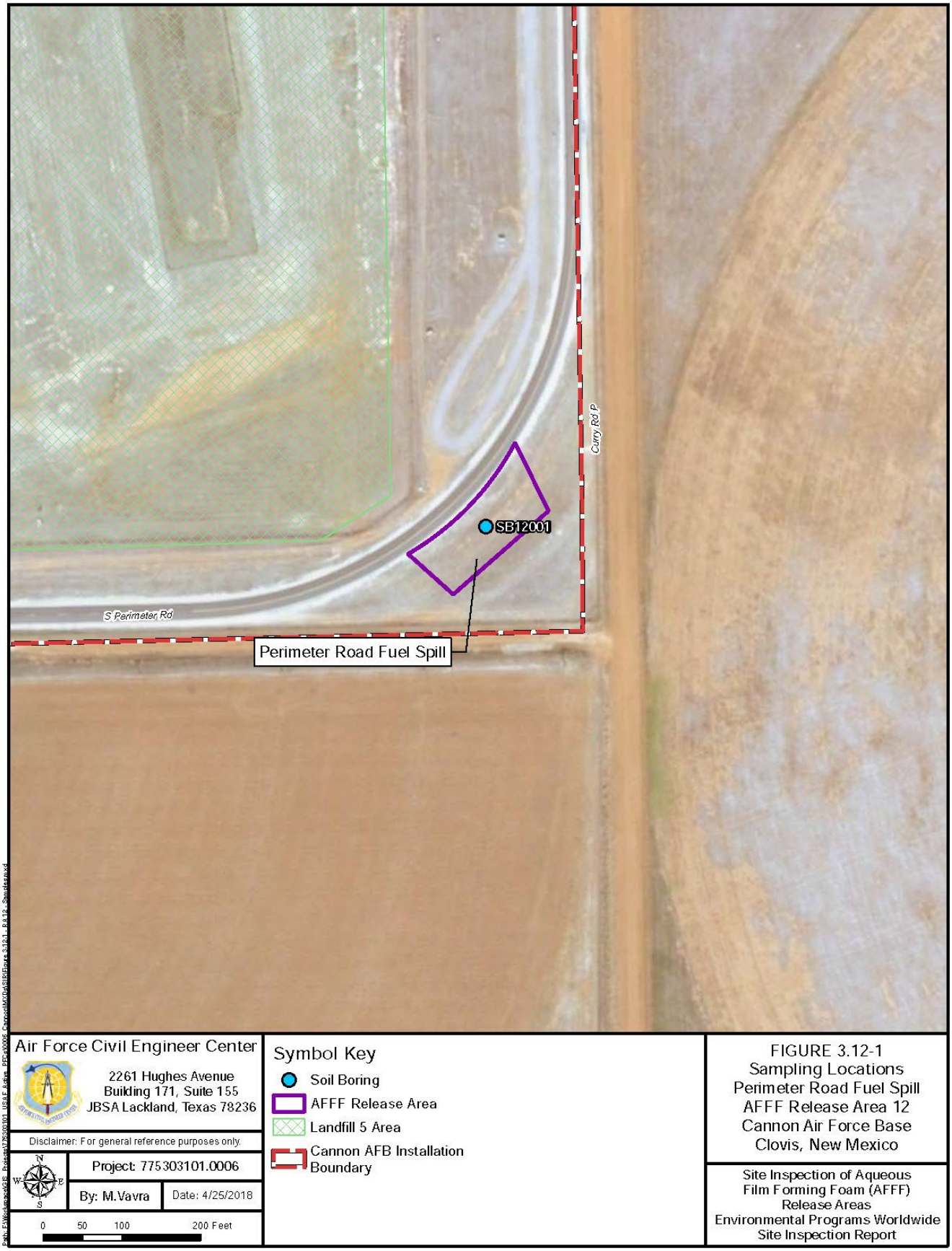
Source: AFW, 2018

NMED PFAS INVESTIGATION, CANNON AFB
AFFF Release Area 11
Active FTA

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Figure 29

P:_DB21-1060\Cannon Phase I\6-22\Figures\Word\F29_AFFF Area 11.docx



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Disclaimer: For general reference purposes only.

Project: 775303101.0006
By: M.Vavra
Date: 4/25/2018

0 50 100 200 Feet

Symbol Key
- Soil Boring
- AFFF Release Area
- Landfill 5 Area
- Cannon AFB Installation Boundary

FIGURE 3.12-1
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
Site Inspection Report

Source: AFW, 2018

NMED PFAS INVESTIGATION, CANNON AFB

AFFF Release Area 12
Perimeter Road Fuel Spill

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Figure 30

P:_DB21-1060\Cannon Phase I.6-22\Figures\Word\F30_AFFF Area 12.docx

P:_DB21-1060\Cannon Phase I.6-22\Figures\Word\F31_Selected PFAS in East Wells.docx

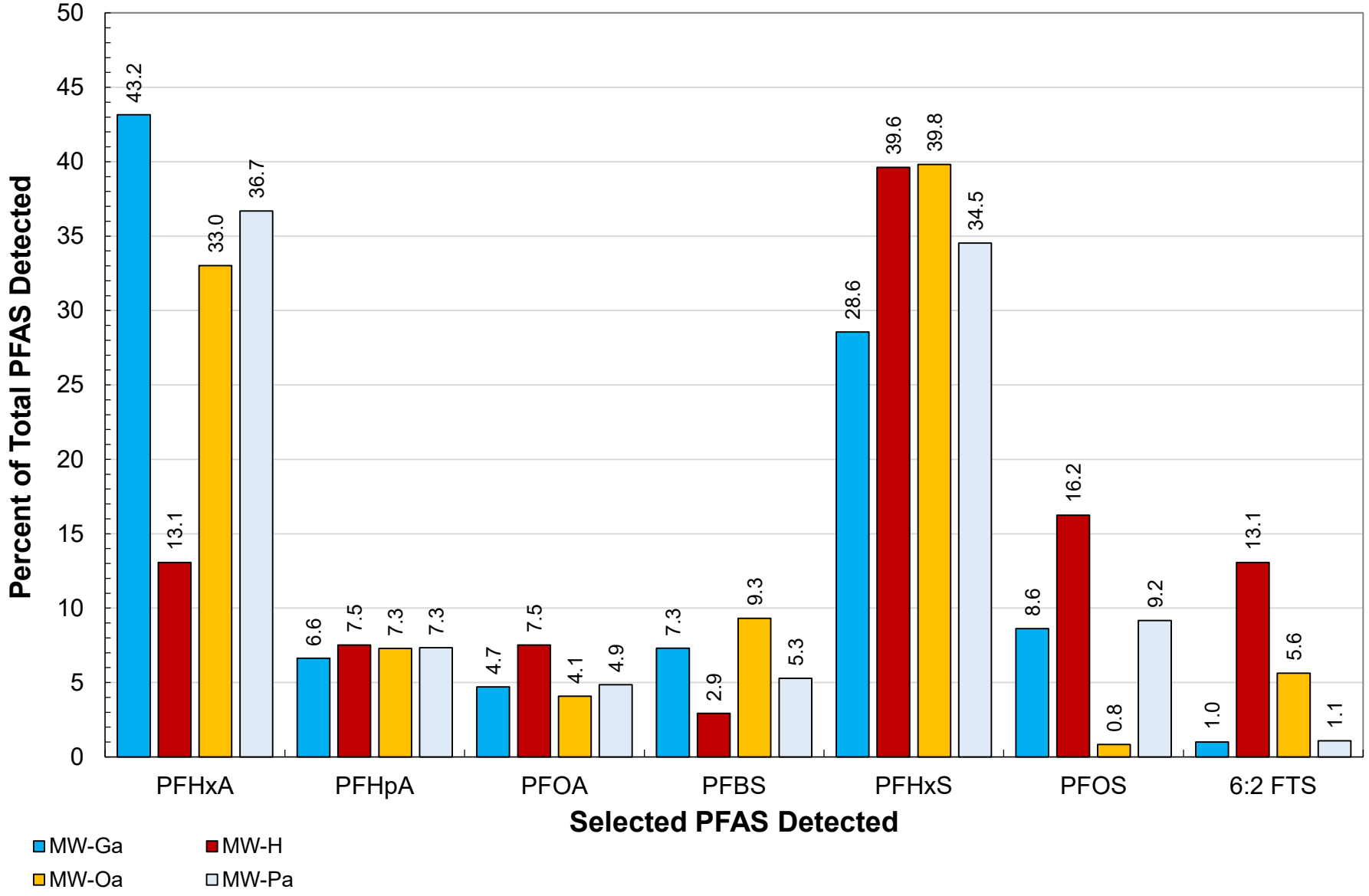


Figure 31

NMED PFAS INVESTIGATION, CANNON AFB

Proportions of Selected PFAS Detected in East Monitor Wells

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6/21/2022 DB21.1060

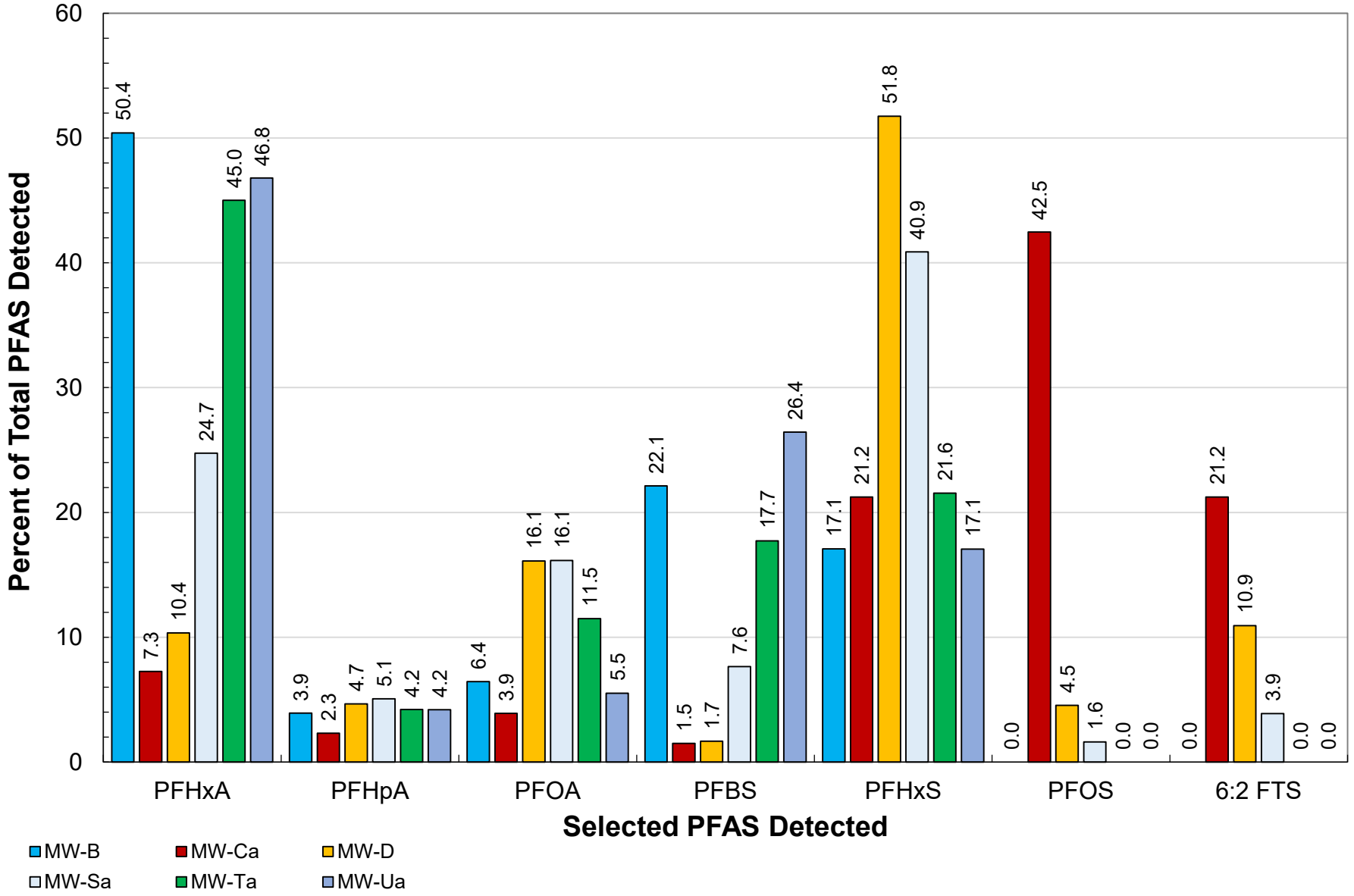


Figure 32a

NMED PFAS INVESTIGATION, CANNON AFB

Proportions of Selected PFAS Detected in the Southeast Monitor Wells

DBS&A
Daniel B. Stephens & Associates, Inc.

6/21/2022 DB21.1060

P:_DB21-1060\Cannon Phase I.6-22\Figures\Word\F32b_Selected PFAS in Slctd Southeast Wells.docx

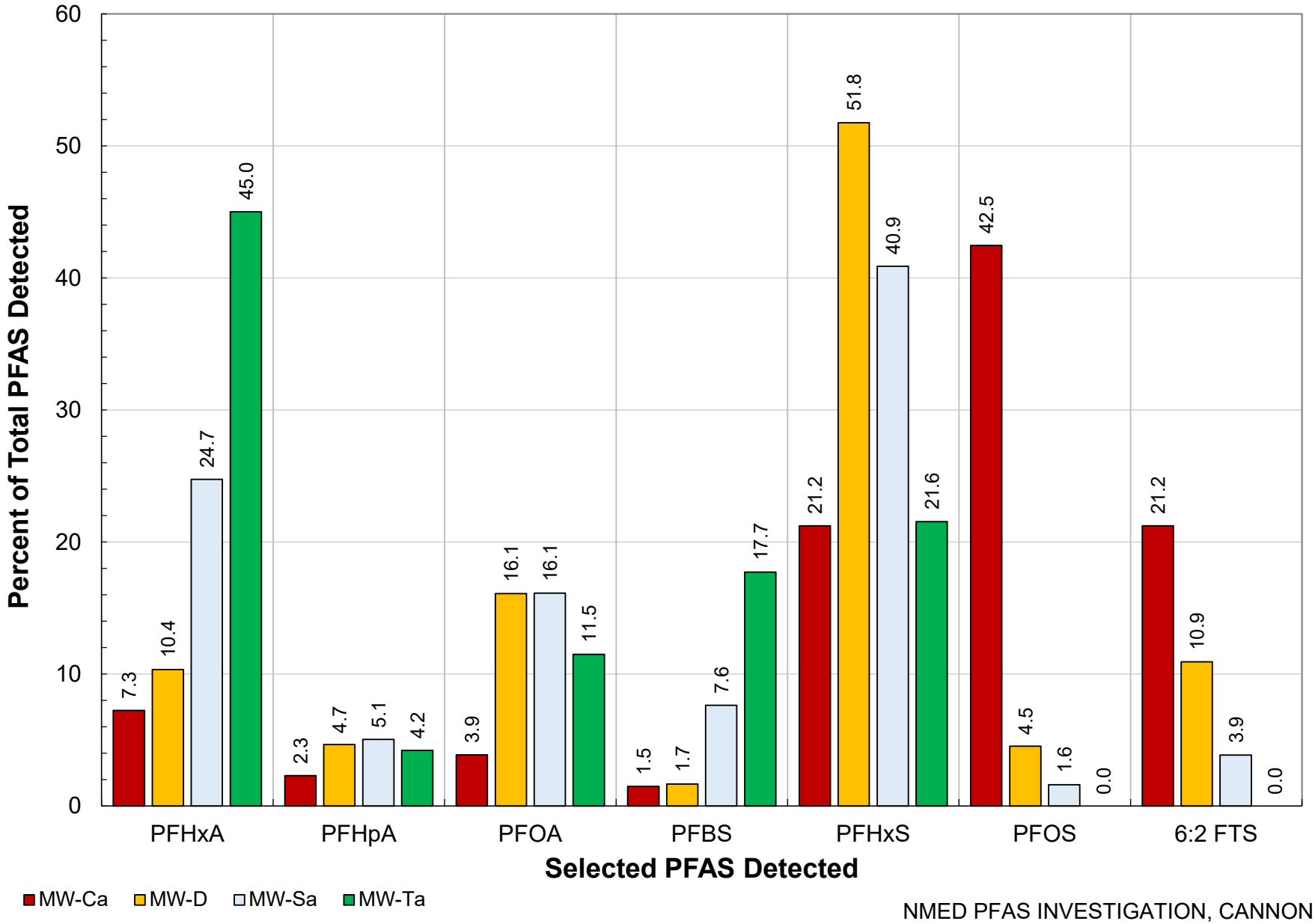


Figure 32b

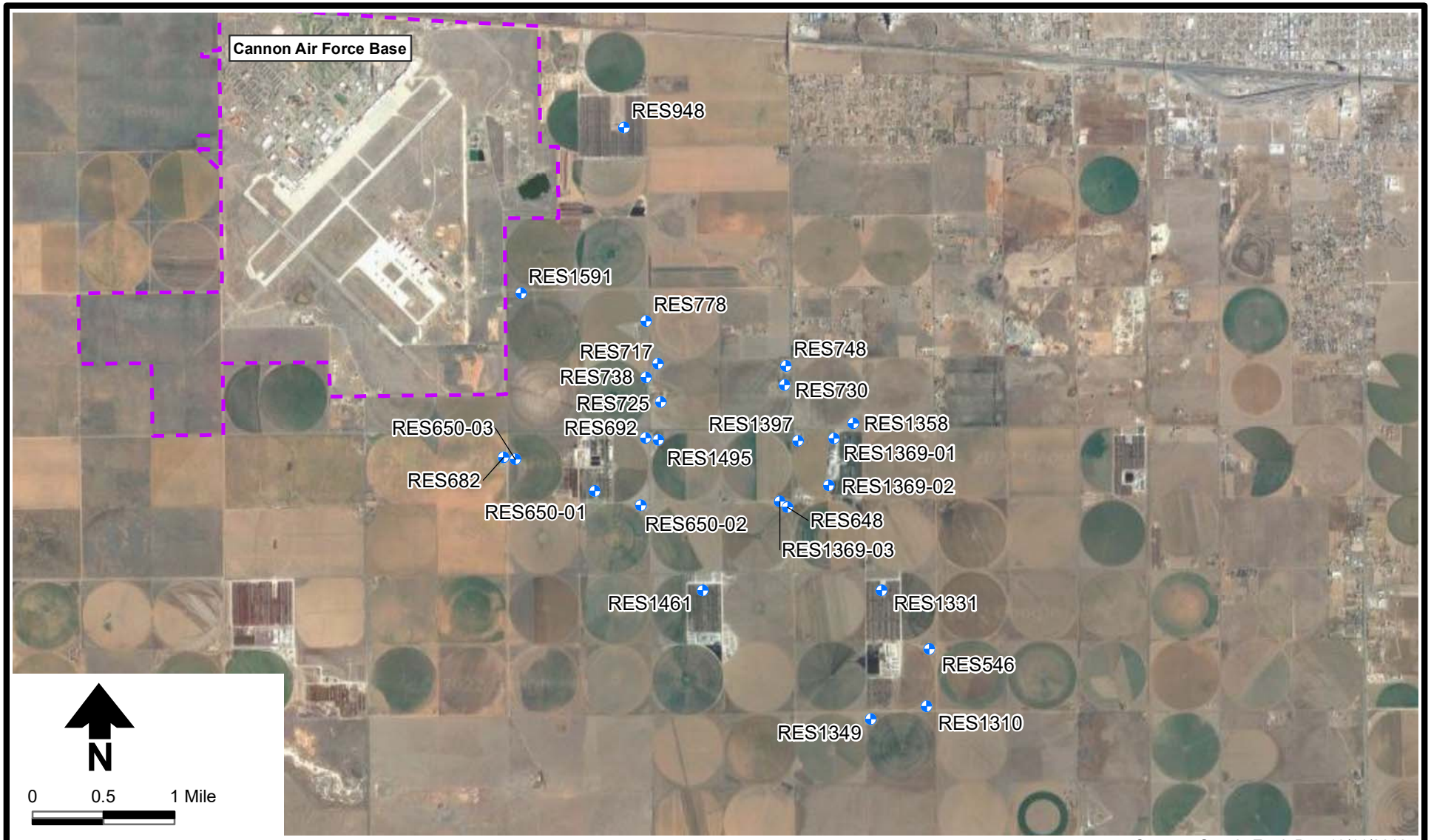
NMED PFAS INVESTIGATION, CANNON AFB

Proportions of Selected PFAS Detected in Selected Southeast Monitor Wells

DBS&A
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6/21/2022 DB21.1060

S:\PROJECTS\DB21.1060_NMED_PFAS_INVESTIGATIONS\GIS\MXDS\CANNON_REPORT\F33_OFF-BASE_WELLS_SAMPLED_BY_USAF_IN_2018_REV.MXD



Source: Google Earth Pro, 10/14/2016

Explanation

- Well

Figure 33

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6/16/2022
DB21.1060

NMED PFAS INVESTIGATION, CANNON AFB

Off-Base Wells Sampled by USAF in 2018

P:_DB21-1060\Cannon Phase I.6-22\Figures\Word\F34a_PFAS in Wwtr.docx

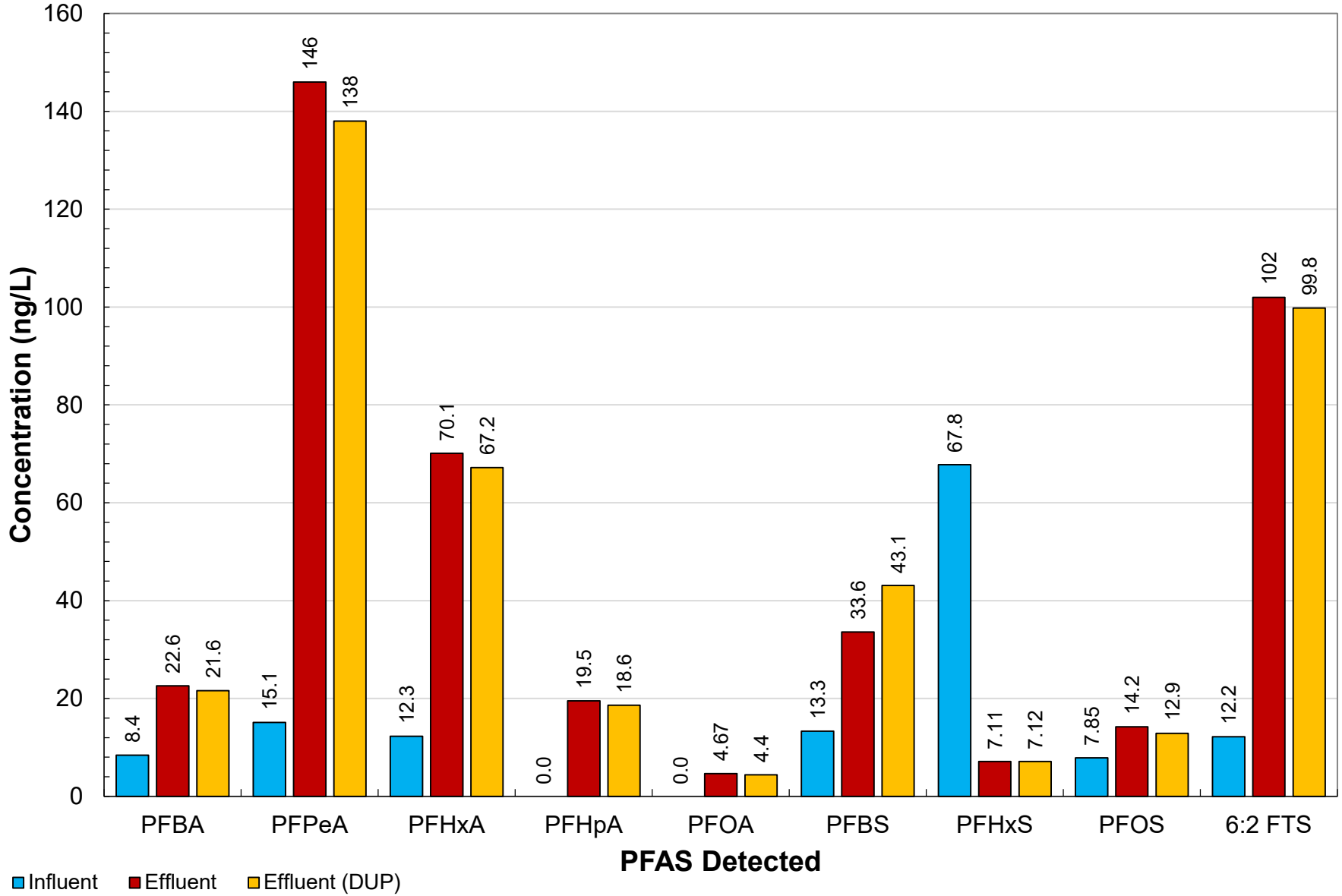


Figure 34a

NMED PFAS INVESTIGATION, CANNON AFB

Concentrations of PFAS Detected in Wastewater Samples, Cannon AFB

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6/21/2022 DB21.1060

P:_DB21-1060\Cannon Phase I.6-22\Figures\Word\F34b_PFAS in Wwtr.docx

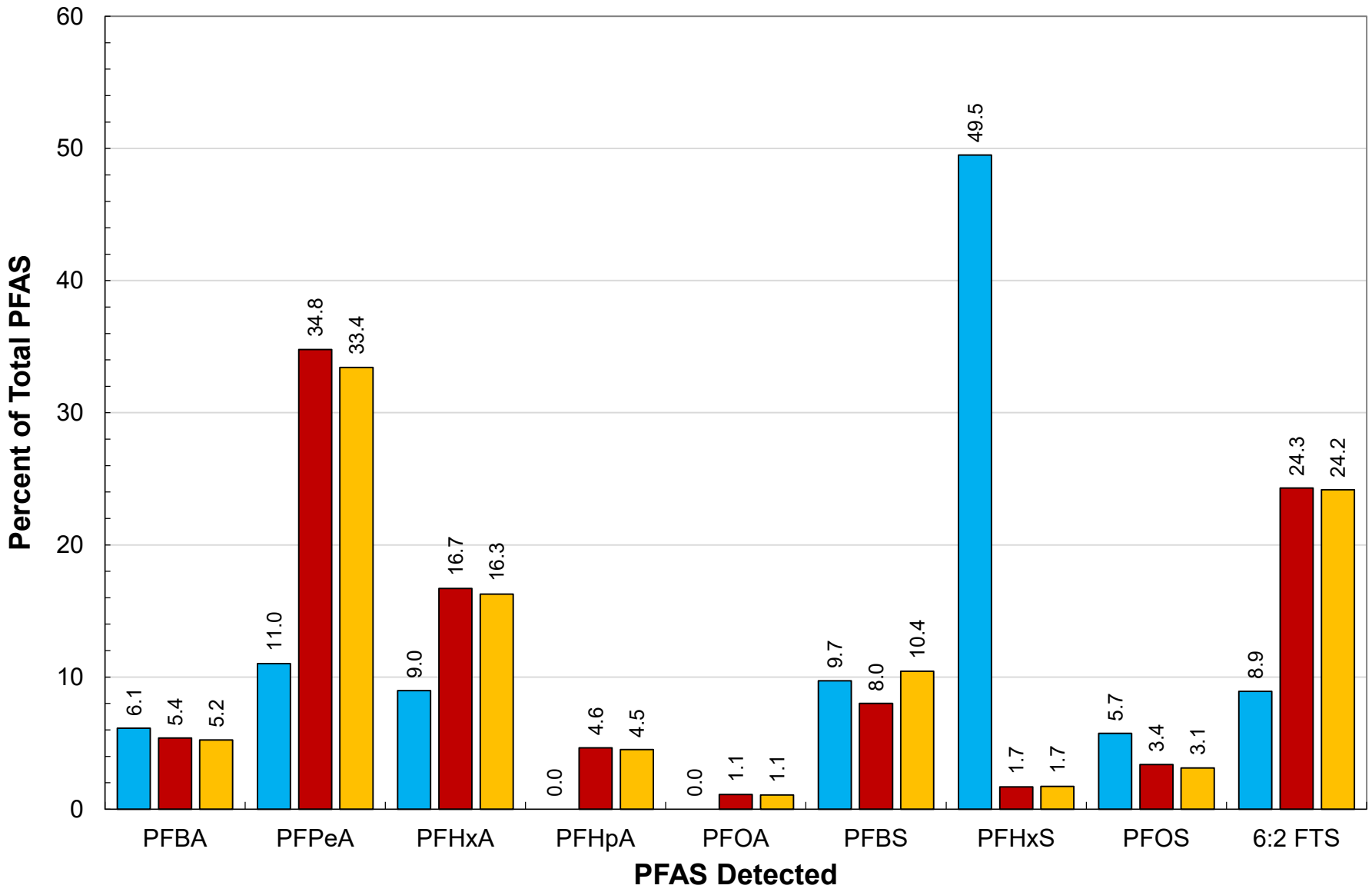


Figure 34b

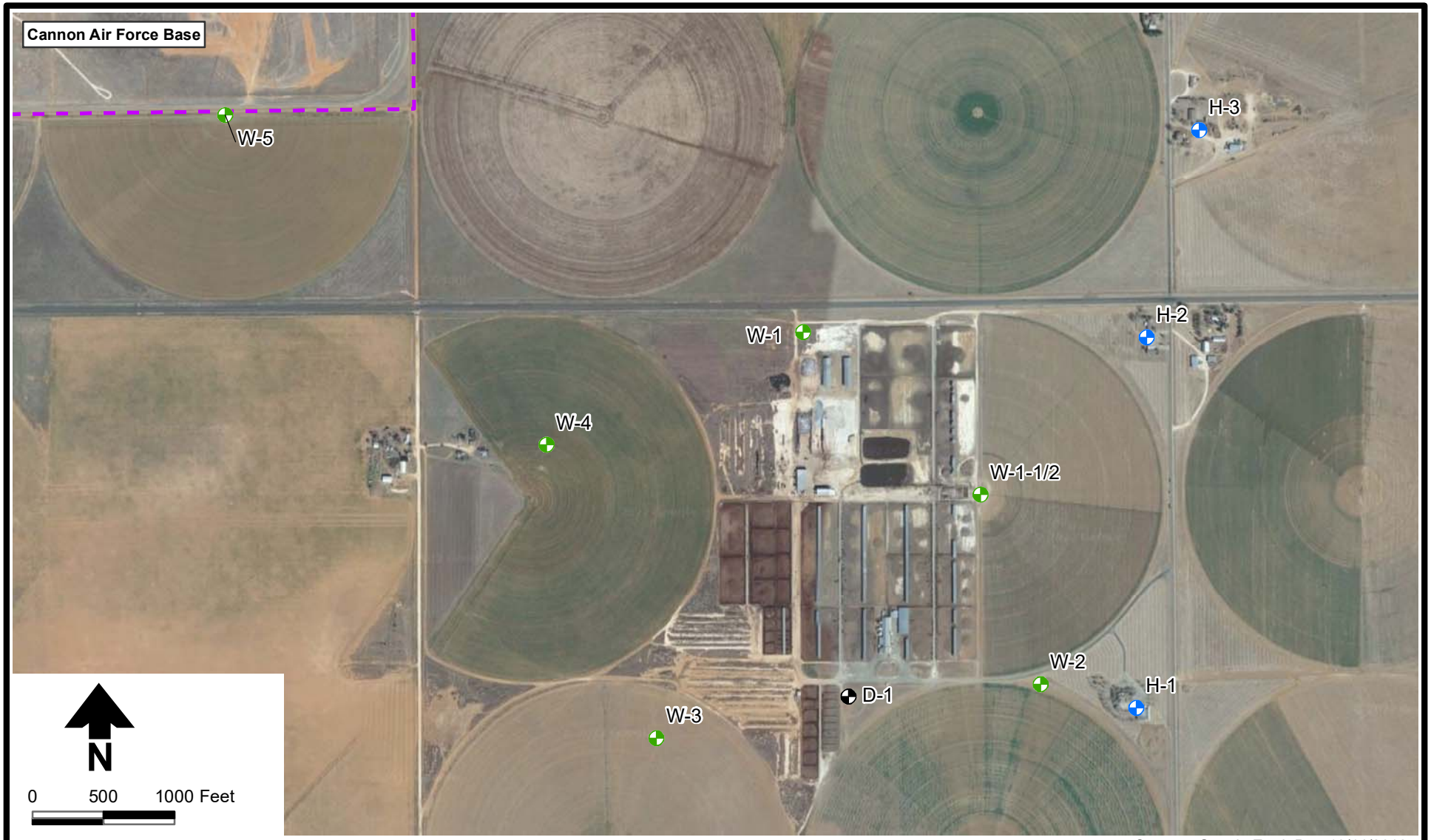
NMED PFAS INVESTIGATION, CANNON AFB

Proportions of Total PFAS Detected in Wastewater Samples, Cannon AFB

DBS&A
Daniel B. Stephens & Associates, Inc.

6/21/2022 DB21.1060

S:\PROJECTS\DB21.1060_NMED_PFAS_INVESTIGATIONS\GIS\MXDS\CANNON_REPORT\F35_WELLS_SAMPLED_BY_A_SCHAAP_IN_2018AMPLED_BY_USAF_IN_2018_REV.MXD



Source: Google Earth Pro, 10/14/2016

Explanation

- Dairy well
- Residential well
- Irrigation well

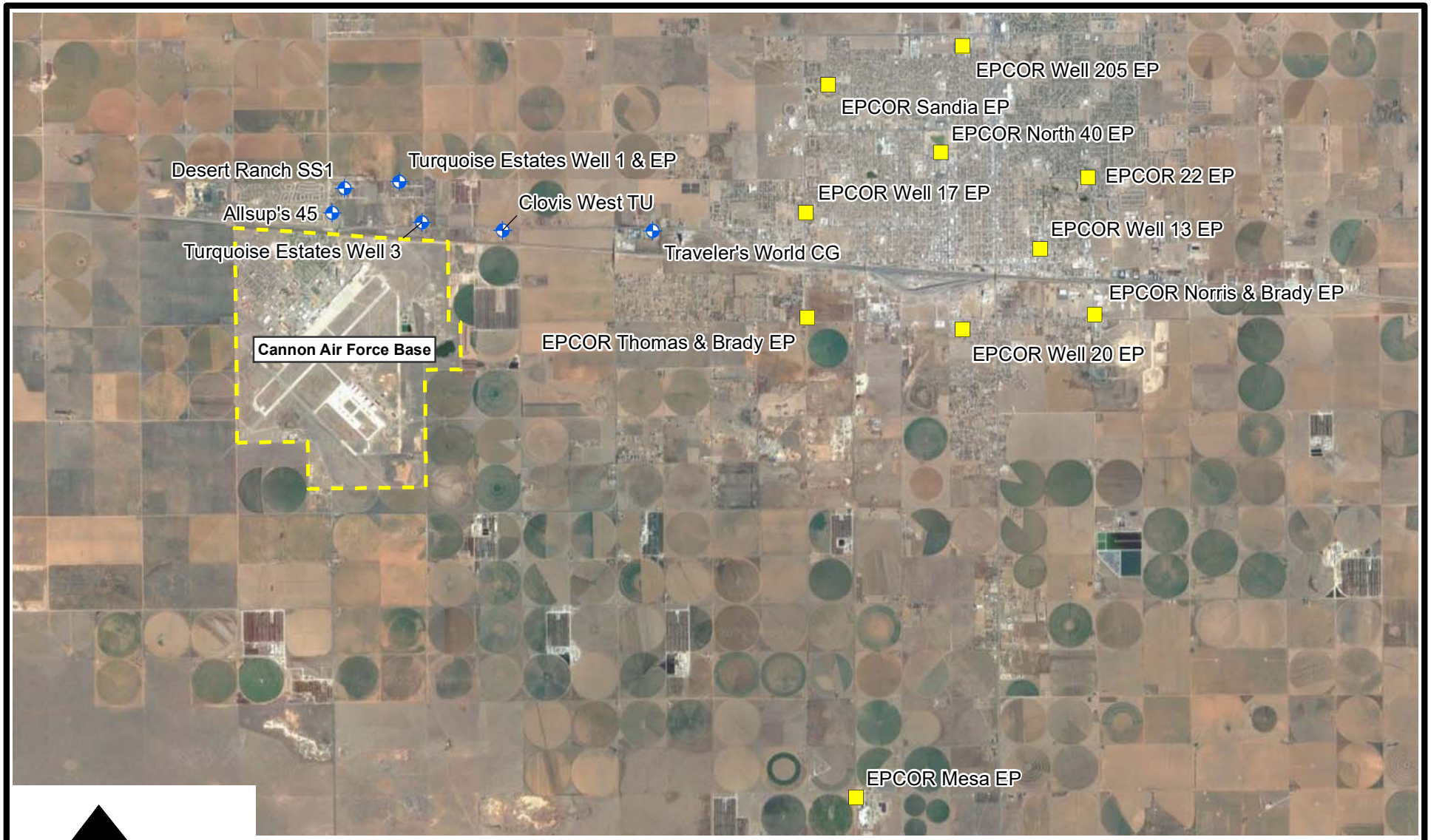
Figure 35

DBS&A
Daniel B. Stephens & Associates, Inc.
6/16/2022 DB21.1060

NMED PFAS INVESTIGATION, CANNON AFB

Wells Sampled by A. Schaap in 2018

S:\PROJECTS\DB21.1060_NMED_PFAS_INVESTIGATIONS\GIS\MXDS\CANNON_REPORT\F36_NMED_WATER_SAMPLE_LOCATIONS_2018-2019.MXD



Base image source: Google Earth Pro, 10/14/2016

N

0 0.75 1.5 Miles

Explanation

- Water supply well
- Water system entry point

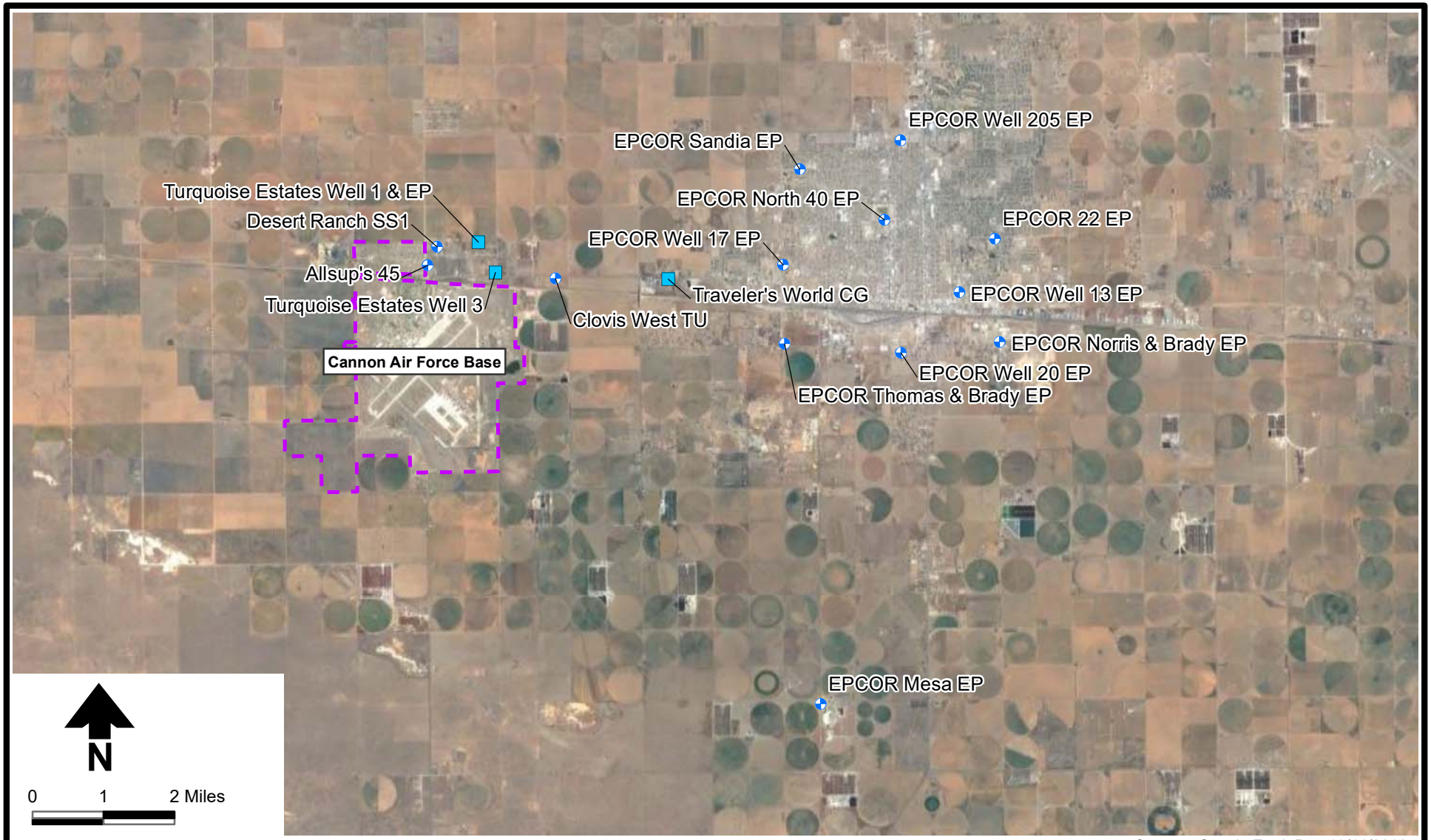
Figure 36

DBS&A
Daniel B. Stephens & Associates, Inc.
6/9/2022 DB21.1060

NMED PFAS INVESTIGATION, CANNON AFB

NMED Water Sample Locations, 2018-2019

S:\PROJECTS\DB21.1060_NMED_PFAS_INVESTIGATIONS\GIS\MXDS\CANNON_REPORT\F37_NMED_WATER_SAMPLE_LOCATIONS_2018-2019.MXD



Source: Google Earth Pro, 10/14/2016

Explanation

- Water supply well
- Water system distribution entry point

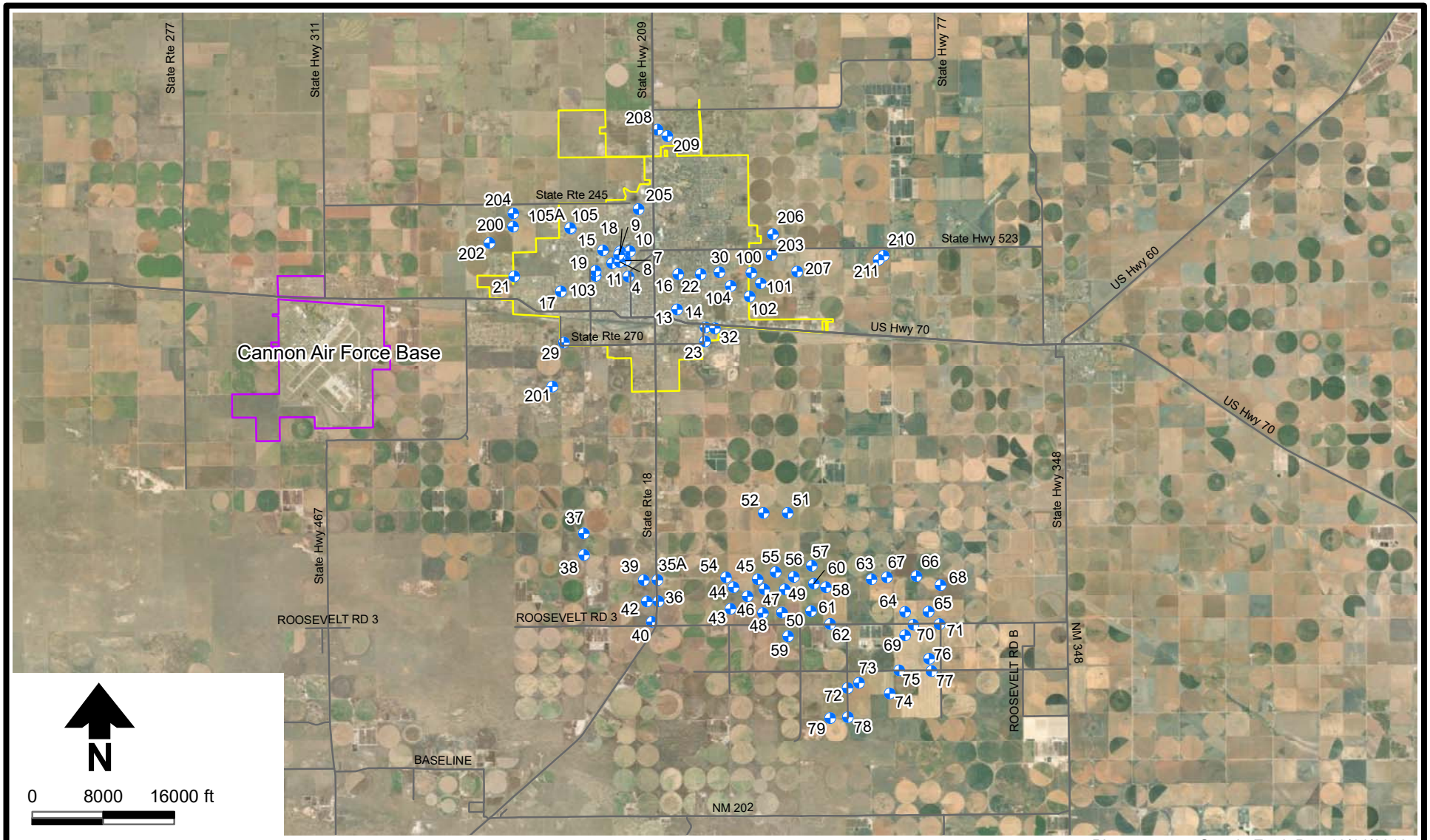
Figure 37

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6/16/2022
DB21.1060

NMED PFAS INVESTIGATION, CANNON AFB

NMED Water Sample Locations, 2018-2019

S:\PROJECTS\DB21.1060_NMED_PFAS_INVESTIGATIONS\GIS\MXDS\CANNON_REPORT\F02_LOCATIONS_OF_EPCOR_WATER_SUPPLY_WELLS.MXD



Explanation

- EPCOR well and number
- Cannon Air Force Base boundary
- City of Clovis boundary

Source: Well numbers and locations from Drinking Water Watch

Photo source: Google Earth Pro, 10/14/2016

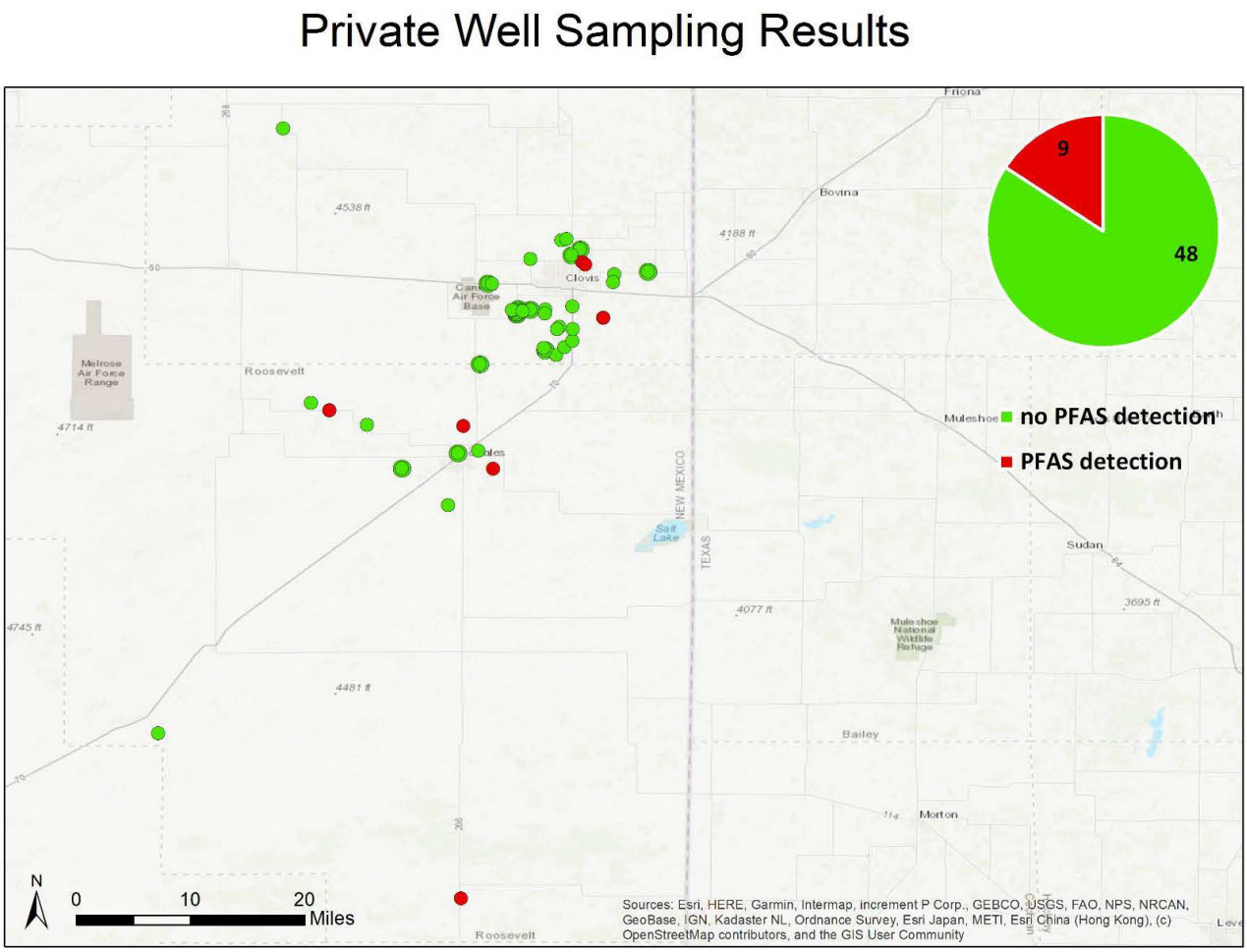
Figure 38

DBS&A
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5/11/2022 DB21.1060

NMED PFAS INVESTIGATION, CANNON AFB

Locations of EPCOR Water Supply Wells

Map 1. Samples with no PFAS detected (green dots) and samples with PFAS detected (red dots).



Source: NMED, 2021

NMED PFAS INVESTIGATION, CANNON AFB

Private Well Samples Collected by NMED

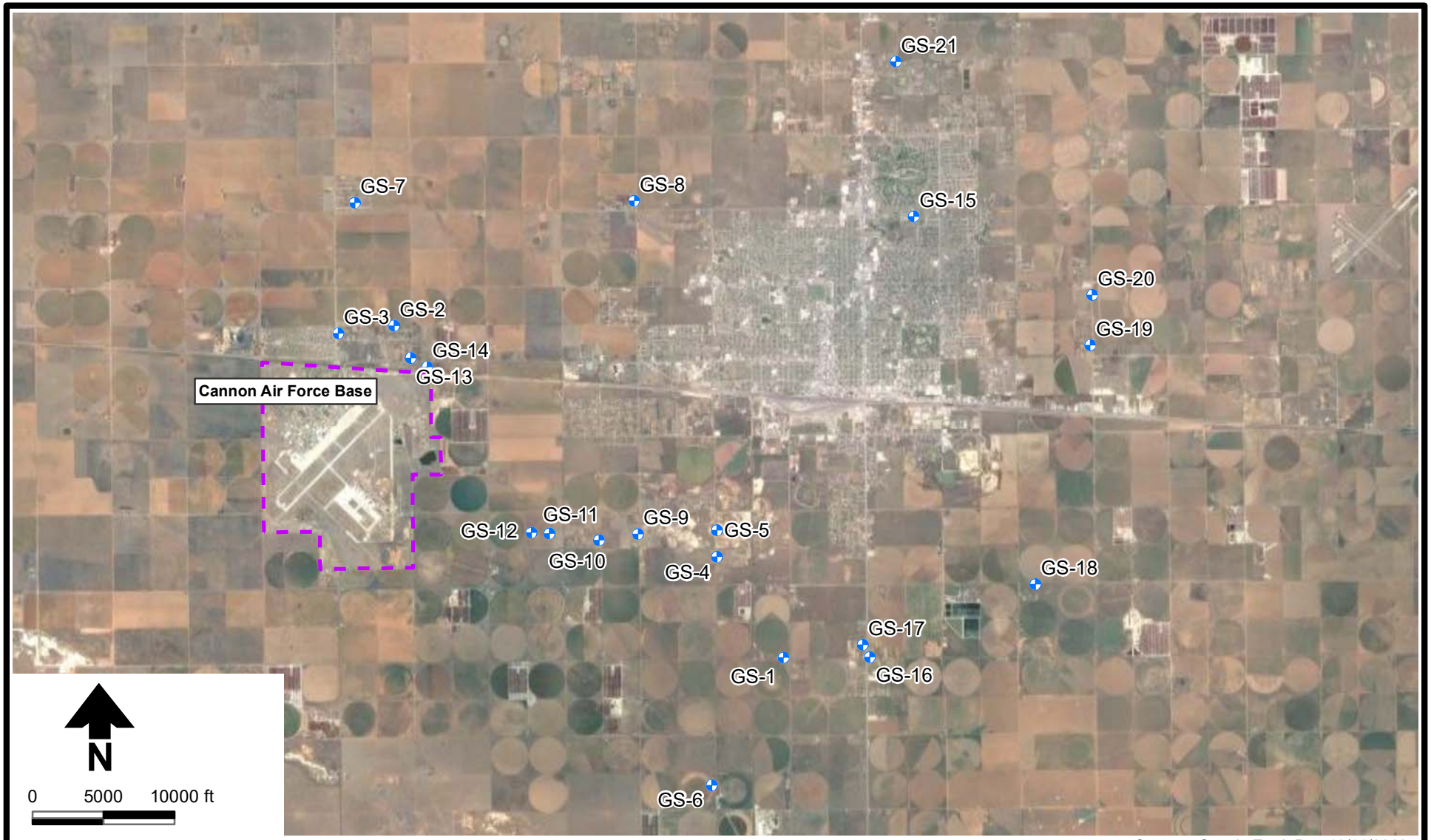
Figure 39

DBS&A Daniel B. Stephens & Associates, Inc.

6/21/2022 DB21.1060

P:_DB21-1060\Cannon Phase I.6-22\Figures\Word\F39_Private Wells Sampled by NMED.docx

S:\PROJECTS\DB21.1060_NMED_PFAS_INVESTIGATIONS\GIS\MXDS\CANNON_REPORT\F04_USGS-NMED_SAMPLE_LOCATIONS.MXD



Source: Google Earth Pro, 10/14/2016

Explanation

Well

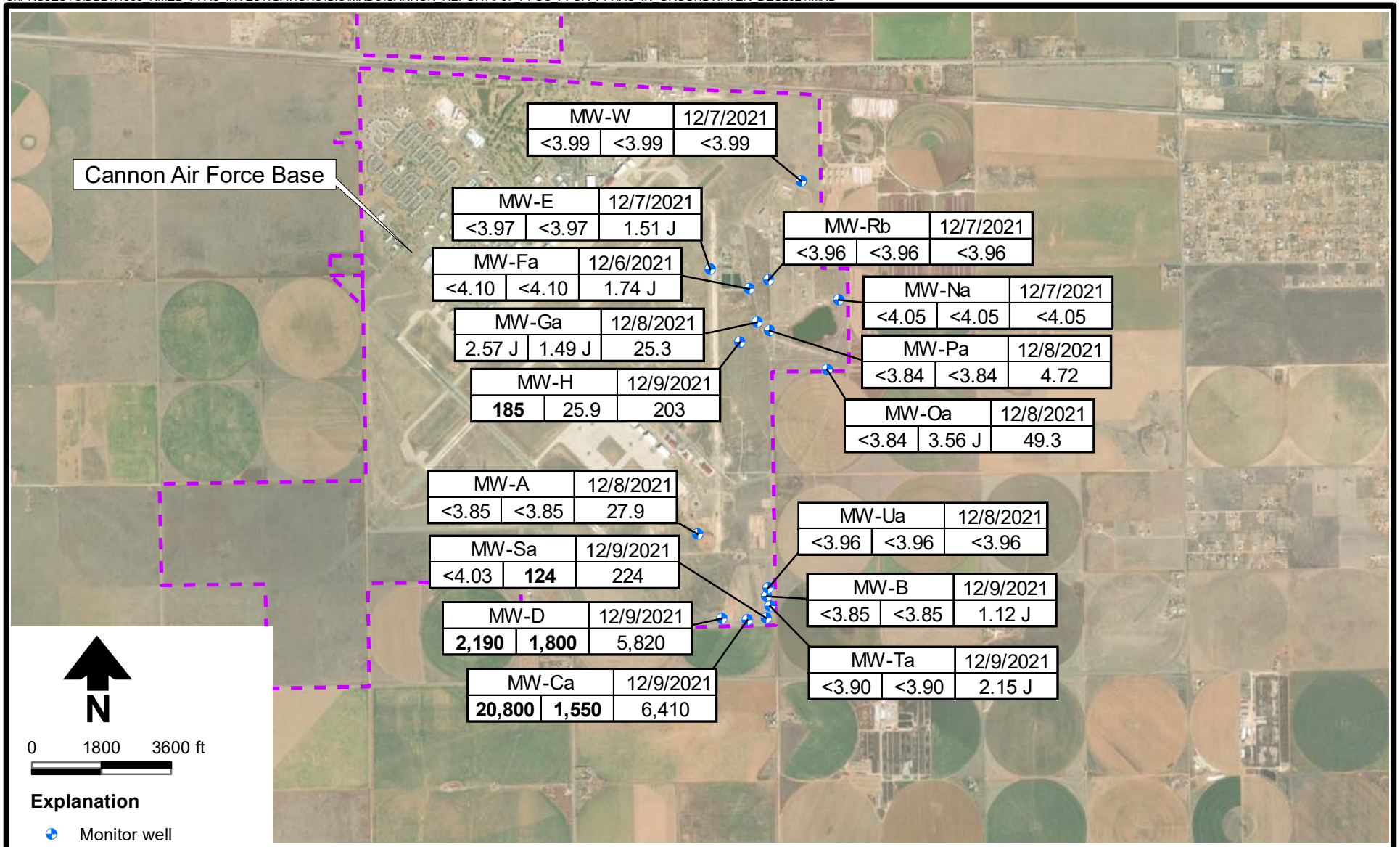
Figure 40

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4/11/2022
DB21.1060

NMED PFAS INVESTIGATION, CANNON AFB

Groundwater Samples Collected by USGS

S:\PROJECTS\DB21.1060_NMED_PFAS_INVESTIGATIONS\GIS\MXDS\CANNON_REPORT\F07_PFOS_PFOA_PFHXS_IN_GROUNDWATER_DEC2021.MXD



Base image source: Maxar, Vivid 2017-2018 composite

Notes:
1. All results are in nanograms per liter (ng/L)
2. J = Concentration below the reporting limit and is considered an estimate
3. **Bold** indicates concentration exceeds lifetime health advisory level of 70 ng/L

Location ID		Sample Date
PFOS	PFOA	PFHxS

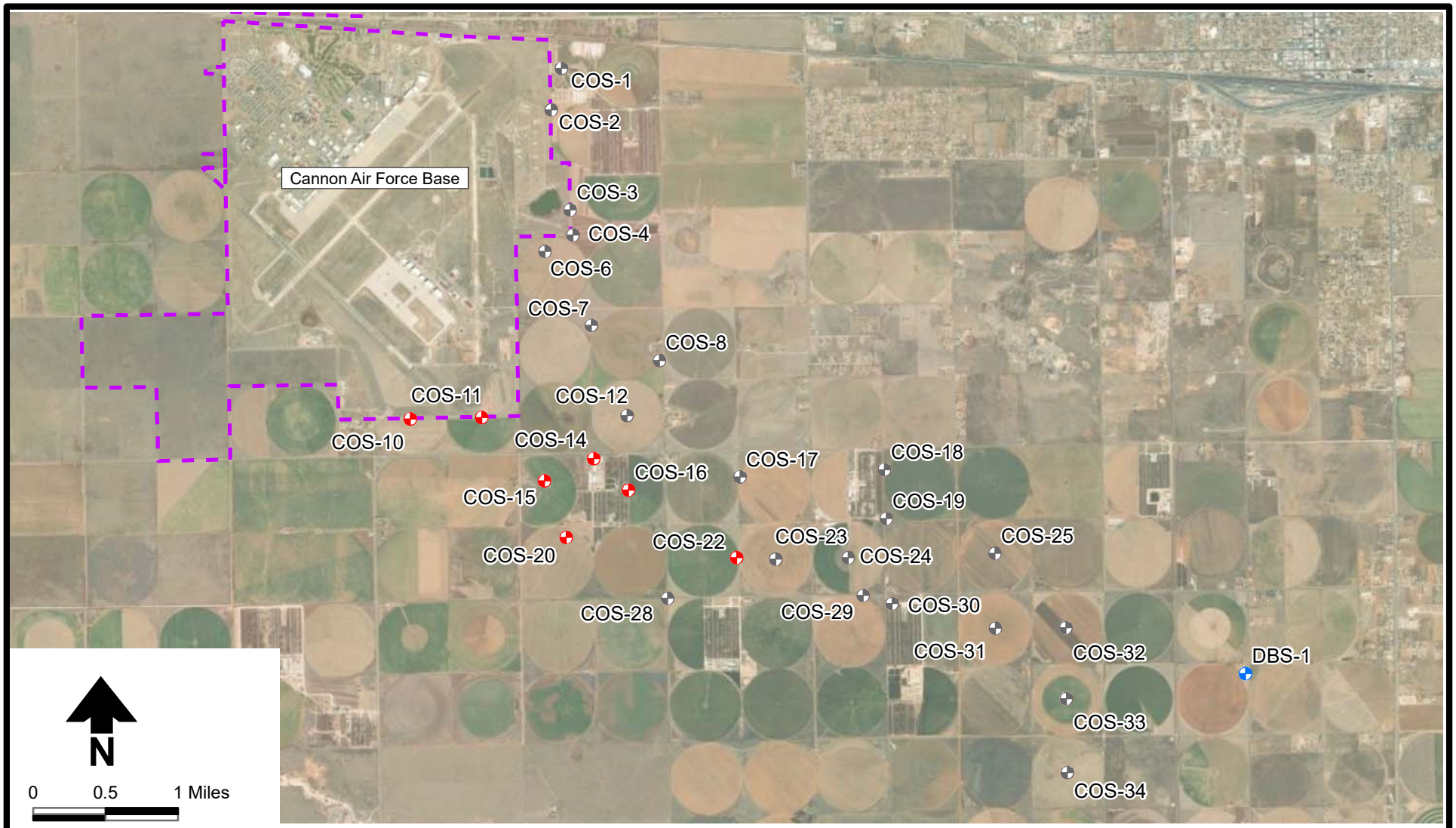
Figure 41

NMED PFAS INVESTIGATION, CANNON AFB

PFOS, PFOA, and PFHxS in DBS&A Groundwater Samples Cannon AFB, December 2021

DBS&A
Daniel B. Stephens & Associates, Inc.
4/13/2022 DB21.1060

S:\PROJECTS\DB21.1060_NMED_PFAS_INVESTIGATIONS\GIS\MXDS\CANNON_REPORT\OFFBASEWELLS_AND_NMED_MONITORINGWELL_SAMPLED_BY_DBS&A.MXD



Explanation

- DBS-1
- Off-base well
- Off-base (confidential)

Base image source: Maxar, Vivid 2017-2018 composite

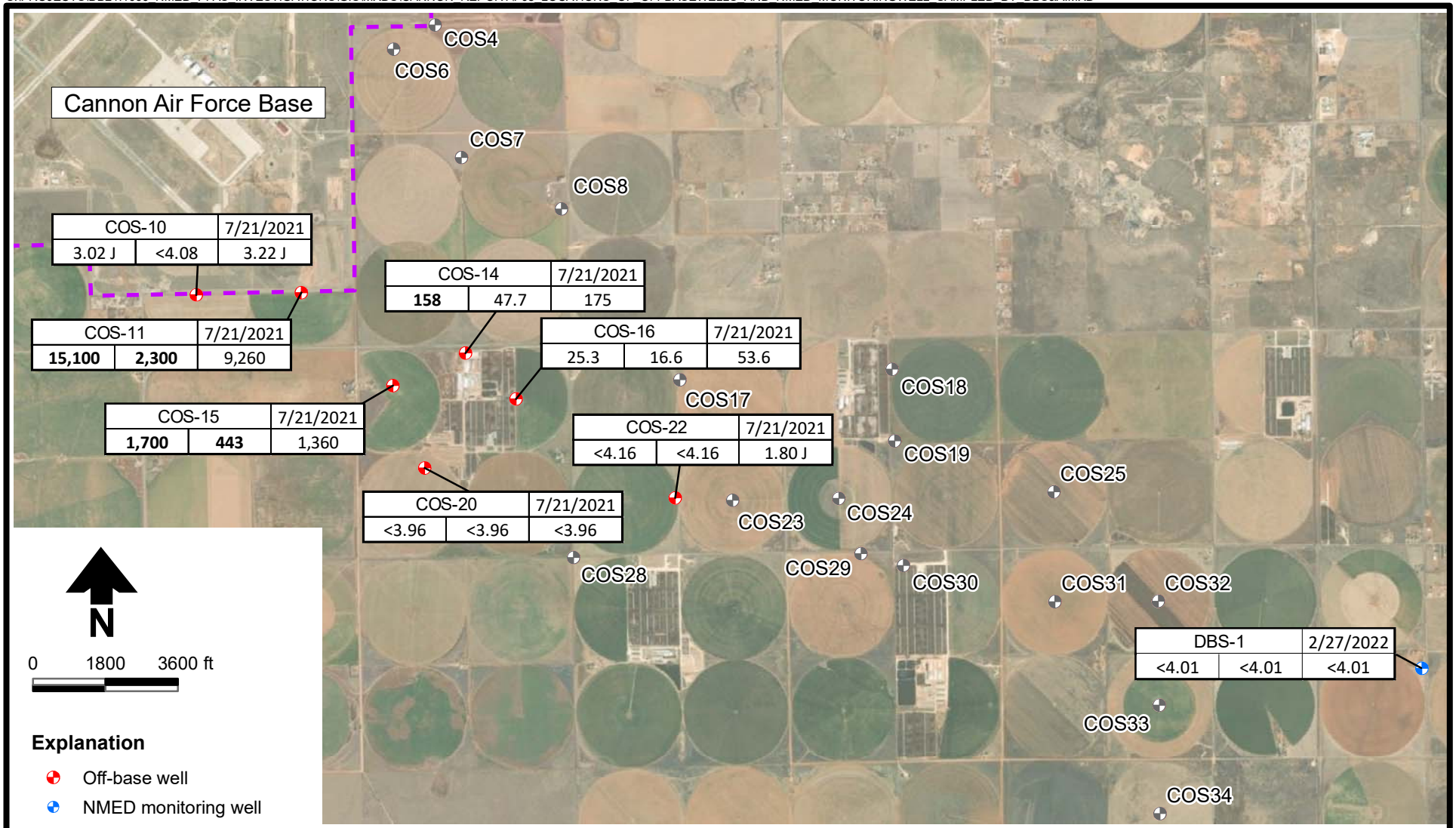
Figure 42

NMED PFAS INVESTIGATION, CANNON AFB

Off-Base Wells and NMED Monitor Well Sampled by DBS&A

DBS&A
Daniel B. Stephens & Associates, Inc.
6/9/2022 DB21.1060

S:\PROJECTS\DB21.1060_NMED_PFAS_INVESTIGATIONS\GIS\MXDS\CANNON_REPORT\F08_LOCATIONS_OF_OFFBASEWELLS_AND_NMED_MONITORINGWELL_SAMPLED_BY_DBS&A.MXD



Notes:
1. All results are in nanograms per liter (ng/L)
2. J = Concentration below the reporting limit and is considered an estimate
3. **Bold** indicates concentration exceeds lifetime health advisory level of 70 ng/L
4. Owner of Highland Dairy (red symbols) has given permission to publish results
5. Other property owners have not given permission to publish results (gray symbols)

Base image source: Maxar, Vivid 2017-2018 composite

Location ID		Sample Date
PFOS	PFOA	PFHxS

Figure 43

NMED PFAS INVESTIGATION, CANNON AFB

PFOS, PFOA, & PFHxS in Off-Base Wells and NMED Monitor Well Sampled by DBS&A

DBS&A
Daniel B. Stephens & Associates, Inc.
5/11/2022 DB21.1060

P:_DB21-1060\Cannon Phase I.6-22\Figures\Word\F44a_PFAS in Schaap Well W-5.docx

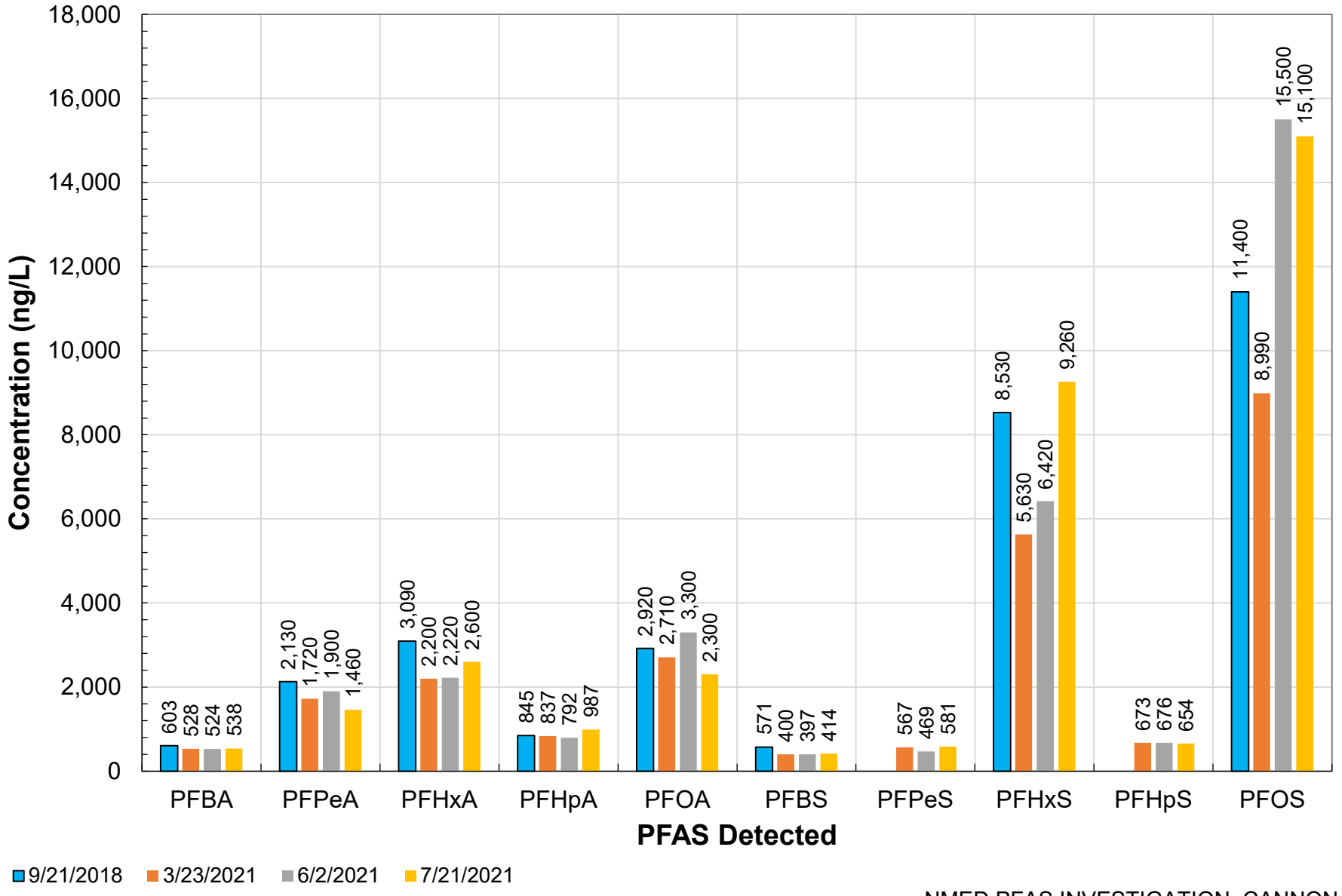


Figure 44a

NMED PFAS INVESTIGATION, CANNON AFB

Concentrations of Major PFCAs and PFSAs in Samples from Schaap Well W-5

DBS&A
Daniel B. Stephens & Associates, Inc.

6/21/2022 DB21.1060

P:_DB21-1060\Cannon Phase I.6-22\Figures\Word\F44b_PFAS in Schaap Well W-5.docx

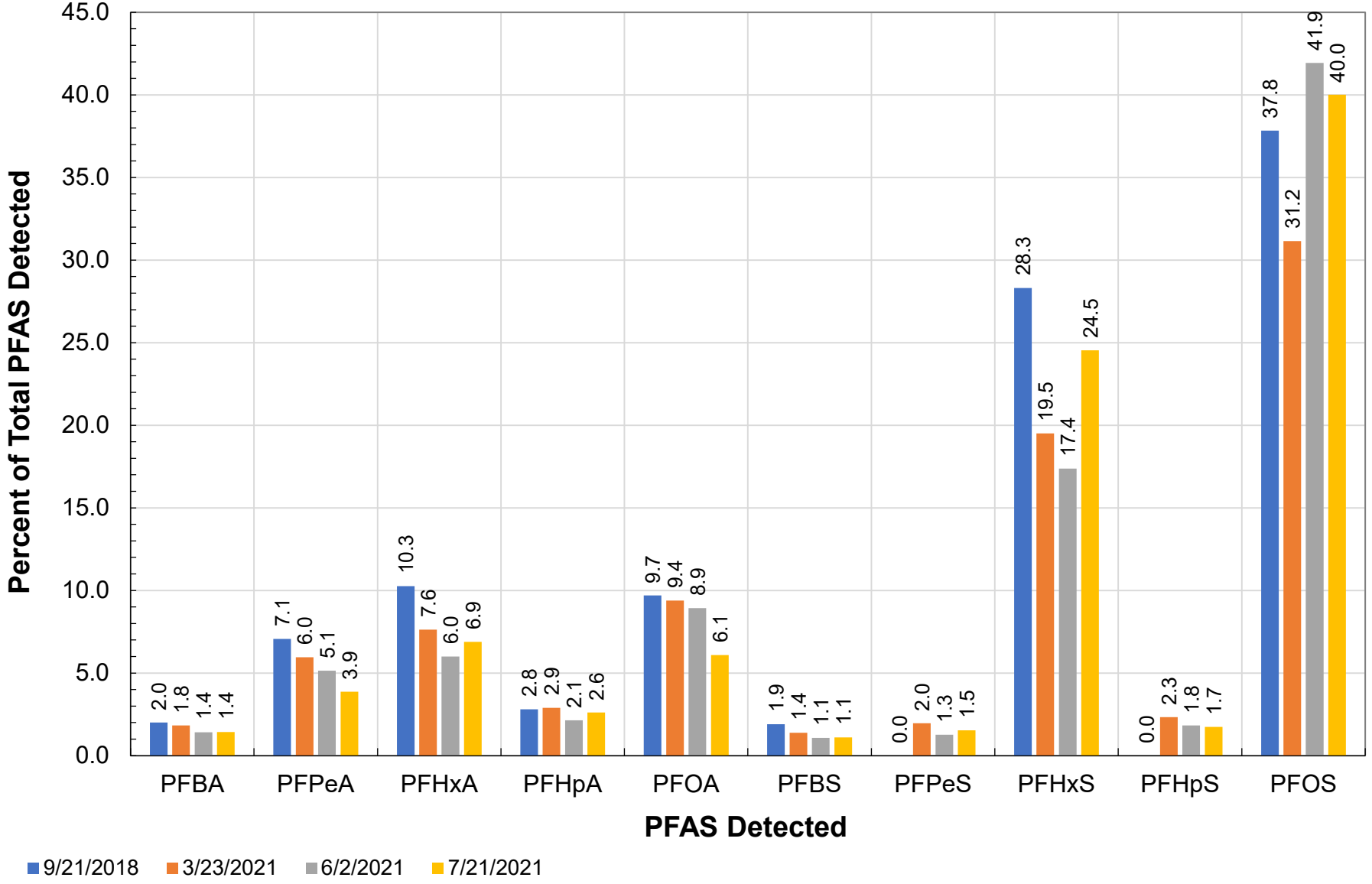


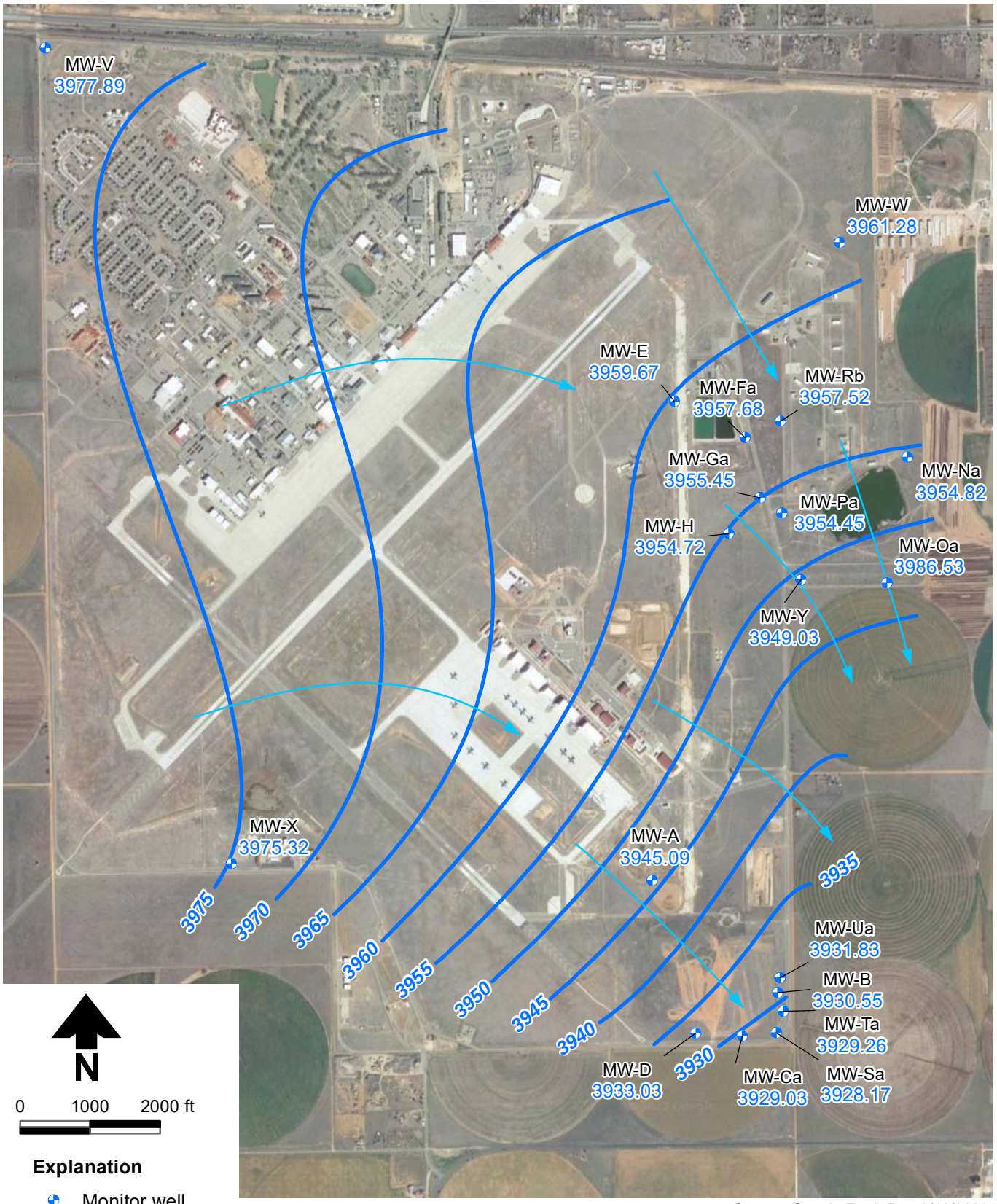
Figure 44b

NMED PFAS INVESTIGATION, CANNON AFB

Proportions of Major PFCAs and PFSAs in Samples from Schapp Well W-5

DBS&A
Daniel B. Stephens & Associates, Inc.

6/21/2022 DB21.1060



Source: Google Earth Pro, 2/16/2020

S:\PROJECTS\DB21.1060_NMED_PFAS_INVESTIGATIONS\GIS\MXDS\CANNON_REPORT\GROUNDWATER_ELEVATIONS_MAP.MXD

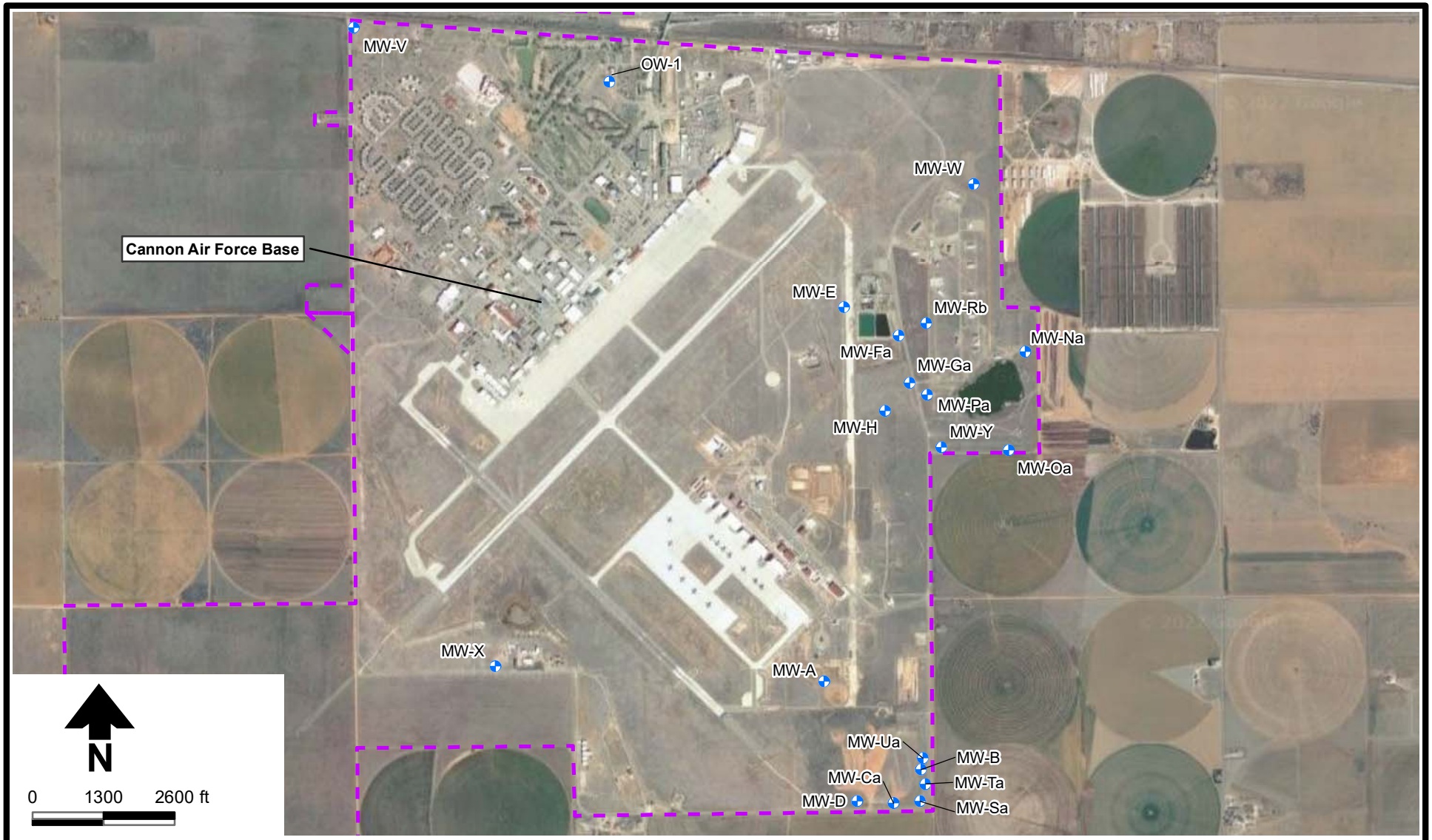
NMED PFAS INVESTIGATION, CANNON AFB

Potentiometric Surface Elevations
December 8 and 9, 2021

DBS&A
Daniel B. Stephens & Associates, Inc.
6/13/2022 DB21.1060

Figure 45

\\SS6ABQ\DATAS\PROJECTS\DB21.1060_NMED_PFAS_INVESTIGATIONS\GIS\MXDS\CANNON_REPORT\F46_MONITOR_WELL_LOCATIONS.MXD



Source: Google Earth Pro, 10/14/2016

Explanation

- Monitor well

Figure 46

NMED PFAS INVESTIGATION, CANNON AFB

Monitor Well Locations

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6/22/2022 DB21.1060

Tables

Table 1. Target Analytes
Page 1 of 2

PFAS Group	No. of Carbons	Acronym(s)	CAS No.	Chemical Name
PFCA	4	PFBA	375-22-4	Perfluorobutanoic acid
PFCA	5	PFPeA	2706-90-3	Perfluoropentanoic acid
PFCA	6	PFHxA	307-24-4	Perfluorohexanoic acid
PFCA	7	PFHpA	375-85-9	Perfluoroheptanoic acid
PFCA	8	PFOA	335-67-1	Perfluorooctanoic acid
PFCA	9	PFNA	375-95-1	Perfluorononanoic acid
PFCA	10	PFDA	335-76-2	Perfluorodecanoic acid
PFCA	11	PFUnA, PFUnDA	2058-94-8	Perfluoroundecanoic acid
PFCA	12	PFDoA, PFDoDA	307-55-1	Perfluorododecanoic acid
PFCA	13	PFTrDA, PFTriA, PFTrA	72629-94-8	Perfluorotridecanoic acid
PFCA	14	PFTeDA, PFTreA, PFTeA	376-06-7	Perfluorotetradecanoic acid
PFSA	4	PFBS	375-73-5	Perfluorobutane sulfonic acid
PFSA	5	PFPeS	2706-91-4	Perfluoropentane sulfonic acid
PFSA	6	PFHxS	355-46-4	Perfluorohexane sulfonic acid
PFSA	7	PFHpS	375-92-8	Perfluoroheptane sulfonic acid
PFSA	8	PFOS	1763-23-1	Perfluorooctane sulfonic acid
PFSA	9	PFNS	68259-12-1	Perfluorononane sulfonic acid
PFSA	10	PFDS	335-77-3	Perfluorodecane sulfonic acid
FOSA	8	PFOSA	754-91-6	Perfluorooctane sulfonamide
FTSA		4:2 FTS, 4:2 FTSA	757124-72-4	4:2 fluorotelomer sulphonic acid
FTSA	8	6:2 FTS, 6:2 FTSA	27619-97-2	6:2 Fluorotelomer sulphonic acid
FTSA	10	8:2 FTS, 8:2 FTSA	39108-34-4	8:2 Fluorotelomer sulphonic acid
FTSA		10:2 FTS	120226-60-0	10:2 Fluorotelomer sulphonic acid
FOSA	8	NMeFOSA	31506-32-8	N-methylperfluorooctanesulfonamide
FOSA	8	NEtFOSA	4151-50-2	N-ethylperfluorooctanesulfonamide
FASAA	11	NMeFOSAA, MeFOSAA	2355-31-9	N-methyl perfluorooctane sulfonamido acetic acid
FASAA	12	NEtFOSAA, NEtFOSA	2991-50-6	N-ethyl perfluorooctane sulfonamido acetic acid
	8	NMeFOSE	24448-09-7	N-methylperfluorooctanesulfonamido ethanol
	8	NEtFOSE	1691.99-2	N-ethylperfluorooctanesulfonamido ethanol

Notes are provided at the end of the table.

Table 1. Target Analytes
Page 2 of 2

PFAS Group	No. of Carbons	Acronym(s)	CAS No.	Chemical Name
PFECA		HFPO-DA (Gen X)	13252-13-6	Hexafluoropropylene oxide dimer acid
PFECA		PFMPA	377-73-1	Perfluoro-3-methoxypropanoic acid
PFECA		PFMBA	863090-89-5	Perfluoro-4-methoxybutanoic acid
PFECA		NFDHA	151772-58-6	Perfluoro-3,6-dioxaheptanoic acid
PFESA		11Cl-PF3OUdS	763051-92-9	11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid
PFESA		9Cl-PF3ONS	756426-58-1	9-chlorohexadecafluoro-3-oxanone-1-sulfonic acid
PFESA		PFEESA	113507-82-7	Perfluoro(2-ethoxyethane) sulfonic acid
PFEA		ADONA (Gen X)	919005-14-4	Ammonium 4,8-dioxa-3H-perfluorononanoate
		F-53B Major, 9Cl-PF3ONS	756426-58-1	9-chlorohexadecafluoro-3-oxanonane-1-sulfonate
		F-53B Minor, 11Cl-PF3OUdS	763051-92-9	11-chloroeicosafluoro-3-oxaundecane-1-sulfonate

Sources: ITRC, 2021, Table 4-1; U.S. EPA, 2021B
CAS = Chemical Abstract Service
PFCA = Perfluoroalkyl carboxylic acid
PFSA = Perfluoroalkane sulfonic acid
FOSA = Perfluoroalkane sulfonamide
FTSA = Fluorotelomer sulfonic acid
FASAA = Perfluorooctane sulfonamido acetic acid
PFECA = Perfluoroalkyl ether carboxylic acid
PFESA = Perfluoroalkyl ether sulfonic acid
PFEA = Polyfluoroalkyl ether acid

Table 2. Summary of PFAS Methods and Analytes
Page 1 of 2

Party	NMAWC	USAF	USAF	USAF	USAF	A. Schaap	NMED	NMED	NMDOH	EPCOR	NMED	USGS	DBS&A
Year	2015	2016	2017	2017-18	2019	2018	2018-2019	2019	2019	2021	2020-2021	2020-21	2021-22
EPA Test Method	537	537	537 M	537 M-ID	537-M	537	537	537-M	537 M-ID	PFAS-ID	NA	NA	533 & 537
Laboratory	NA	Eurofins	Maxxam	Vista	SGS	GEL	ANATek	TestAmerica	TestAmerica	Vista	NA	NA	Vista
Source	NMED, 2020 PF143a	NMED, 2019 PF143b	AFW, 2018 PF20	AFW, 2018 PF20	AFW, 2019 PF23	GEL, 2018 PF203	NMED, 2019 PF143b	NMED, 2019 PF143b	NMED, 2019 PF143b	Vista, 2021 PF110 & 204	NMED 2021 PF113	NWIS, 2022 PF396	HEAL, 2021 PF335 & 2022 PF336,339
PFBA					Yes	Yes			Yes	Yes	Yes	Yes	Yes
PFPeA					Yes	Yes			Yes	Yes	Yes	Yes	Yes
PFHxA			Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes
PFHpA	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
PFOA	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
PFNA	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
PFDA			Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes
PFUnA, PFUnDA			Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes
PFDoA, PFDoDA			Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes
PFTrDA, PFTriA, PFTrA			Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes
PFTeDA, PFTreA, PFTeA			Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes
PFBS	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
PFPeS										Yes	Yes	Yes	Yes
PFHxS	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
PFHpS								Yes	Yes	Yes	Yes	Yes	Yes
PFOS	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
PFNS										Yes	Yes	Yes	
PFDS					Yes	Yes			Yes	Yes	Yes	Yes	
PFOSA					Yes	Yes			Yes	Yes	Yes	Yes	
4:2 FTS, 4:2 FTSA										Yes	Yes	Yes	Yes
6:2 FTS, 6:2 FTSA			Yes	Yes	Yes				Yes	Yes	Yes	Yes	Yes
8:2 FTS, 8:2 FTSA			Yes	Yes	Yes				Yes	Yes	Yes	Yes	Yes
NMeFOSAA, MeFOSAA			Yes	Yes				Yes	Yes	Yes	Yes	Yes	Yes
NEtFOSAA, EtFOSAA			Yes	Yes				Yes	Yes	Yes	Yes	Yes	Yes
HFPO-DA (Gen X)											Yes	Yes	Yes
PFMPA													Yes
PFMBA													Yes
NFDHA													Yes
11Cl-PF3OUdS											Yes	Yes	Yes

Notes are provided at the end of the table.

Table 2. Summary of PFAS Methods and Analytes
Page 2 of 2

Party	NMAWC	USAF	USAF	USAF	USAF	A. Schaap	NMED	NMED	NMDOH	EPCOR	NMED	USGS	DBS&A
Year	2015	2016	2017	2017-18	2019	2018	2018-2019	2019	2019	2021	2020-2021	2020-21	2021-22
EPA Test Method	537	537	537 M	537 M-ID	537-M	537	537	537-M	537 M-ID	PFAS-ID	NA	NA	533 & 537
Laboratory	NA	Eurofins	Maxxam	Vista	SGS	GEL	ANATek	TestAmerica	TestAmerica	Vista	NA	NA	Vista
Source	NMED, 2020 PF143a	NMED, 2019 PF143b	AFW, 2018 PF20	AFW, 2018 PF20	AFW, 2019 PF23	GEL, 2018 PF203	NMED, 2019 PF143b	NMED, 2019 PF143b	NMED, 2019 PF143b	Vista, 2021 PF110 & 204	NMED 2021 PF113	NWIS, 2022 PF396	HEAL, 2021 PF335 & 2022 PF336,339
9Cl-PF3ONS											Yes	Yes	Yes
PFEESA													Yes
ADONA (Gen X)											Yes	Yes	Yes

Refer to Table 1 for explanation of PFAS acronyms
NMAWC = New Mexico American Water Company
USAF = United States Air Force
NMED = New Mexico Environment Department
NMDOH = New Mexico Department of Health
USGS = U.S. Geological Survey
DBS&A = Daniel B. Stephesn & Associates, Inc.
M = Modified
ID = Isotope dilution
NA = Not available

Table 3. PFAS in NMAWC UCMR3 Water Samples

Location ID	Sample Date	Concentration (ng/L)					
		PFOA	PFOS	PBFS	PFHpA	PFHxS	PFNA
#22 Entry Point	9/15/2013	<20	<40	<90	<10	<30	<20
#22 Entry Point	3/12/2014	<20	<40	<90	<10	<30	<20
Norris & Brady Entry Point	9/15/2013	<20	<40	<90	<10	<30	<20
Norris & Brady Entry Point	3/17/2014	<20	<40	<90	<10	<30	<20
North 40 Entry Point	9/16/2013	<20	<40	<90	<10	<30	<20
North 40 Entry Point	3/12/2014	<20	<40	<90	<10	<30	<20
Thomas & Brady Entry Point	9/17/2013	<20	<40	<90	<10	<30	<20
Thomas & Brady Entry Point	3/17/2014	<20	<40	<90	<10	<30	<20
Well #13	9/16/2013	<20	<40	<90	<10	<30	<20
Well #13	6/23/2014	<20	<40	<90	<10	<30	<20
Well #17	9/17/2013	<20	<40	<90	<10	<30	<20
Well #17	6/24/2014	<20	<40	<90	<10	<30	<20
Well #20	9/16/2013	<20	<40	<90	<10	<30	<20
Well #20	6/24/2014	<20	<40	<90	<10	<30	<20
Well #21	9/17/2013	<20	<40	<90	<10	<30	<20

Source: NMED, 2019B
All results converted to nanograms per liter (ng/L).
All locations are currently part of Clovis System (EPCOR NM Water, PWSID NM3527305).
Analysis performed using U.S. Environmental Protection Agency (EPA) method 537.
< = Analyte not detected at value posted

Table 4. Construction Information, Cannon AFB Supply Wells

Well ID	Date Completed	Measuring Point Elevation (feet msl)	Reported Depth (feet bgs)	As-Built Depth (feet bgs)	Drill Depth (feet bgs)	Well Depth (feet bgs)	Top of Grout (feet bgs)	Top of Screen (feet bgs)	Bottom of Screen (feet bgs)	Screen Length (feet)	Initial Static Water Level (feet)	Pumping Drawdown (feet)	Well Diameter [a] (inches)	Well Diameter [b] (inches)	Pump Capacity (gpm)	Average Pumping Rate (gpm)
Well #1A	Jan 1994	4,305.6	407	410	—	—	—	—	—	—	312	34	16	—	650	Inactive
Well #2	Dec 1977	4,307	371	380	385	383	20	288	373	85	285	26	16	16	450	Inactive
Well #3	Dec 1979	4,305.8	404	404	404	402	20	310	397	87	287	35	16	16	425	Inactive
Well #4	1958	4,309.8	421	410	410	389	—	303.2	354	51	300	20	25	14	600	Inactive
Well #4A	Sept 1987	4,321.4	385	420	460	420	20	351	411	60	316	—	16	16	200	250
Well #5	Apr 1977	4,293	402	402	402	400	20	283.7	390	106.3	273	38	13	12.75	425	200
Well #6	Feb 1964	4,269	—	365	365	365	—	—	—	—	217	—	6.625	16	250	Inactive
Well #7	July 1967	4,322.1	378	382	382	378	20	280	370	90	309	35	16	16	325	Inactive
Well #8	June 1969	4,321.2	415	411	416	415	20	301	401	100	314	26	16	16	680	225
Well #9	July 1969	—	408	408	—	—	280	320.6	370.6	50	318	—	11.875	—	—	300
Well #11	NA	—	—	—	—	—	—	—	—	—	—	—	—	—	—	Inactive
Well #12	NA	4311.9	407	—	440	410	20	350	400	50	312	37	16	16	700	350

Well information from the New Mexico Environment Department (NMED) Drinking Water Watch website (NMED 2020) unless otherwise indicated.
Average pump rates from Air Force (AF) Remedial Project Manager (Bristol, 2021).
Well #6 was plugged and abandoned in 2000
Well #9 was replaced in 2013; information presented is for the replacement well.
Records for Well #11 could be located; construction log for Well #12 could not be located.
[a] Information from well construction logs (New Mexico Office of the State Engineer [NM OSE] 2020).
[b] Information from Trinity (2012)
msl = Above mean sea level
bgs = Below ground surface
gpm = Gallons per minute
— = No information

Table 5. PFAS in USAF Water Samples from Cannon AFB Water Supply

Analyte	Concentration (ng/L)							
	CAFB Well 3	CAFB Well 4A	CAFB Well 8	CAFB Well 9	CAFB Well 9	CAFB Well 11 [a]	CAFB Well 12	CAFB Water Plant
Sample Date	8/24/2016	8/24/2016	8/24/2016	8/24/2016	8/24/2016	8/24/2016	8/24/2016	8/24/2016
Sample Media	Raw DW	DW	Raw DW	Raw DW	Treated DW	Treated DW	Raw DW	DW
PFHpA	ND	ND	ND	ND	ND	ND	ND	ND
PFOA	ND	ND	ND	ND	ND	ND	ND	ND
PFNA	ND	ND	ND	ND	ND	ND	ND	ND
PFBS	2.7	ND	ND	4.1	4.1	ND	4.6	5
PFHxS	3.1	ND	2.3	2.5	2.6	ND	2.6	3.1
PFOS	ND	ND	ND	ND	ND	ND	ND	ND
Total PFAS	5.8	0	2.3	6.6	6.7	0	7.2	8.1
PFOA+PFOS	0	0	0	0	0	0	0	0

Source: NMED, 2019c
Refer to Table 1 for PFAS names.
[a] Well CAFB is located on Melrose Air Force Range.
Samples analyzed by Eurofins using EPA method 537.
DW = Drinking water
ND = Not detected

Table 6. AFFF Release Sites at Cannon AFB
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AFFF Area No.	AFFF Area Name	Description
1 (Figure 19)	Former Fire Training Area (FTA) No. 2	Unlined FTA used twice per quarter from 1968 to 1974 with use of an unknown volume of AFFF likely from 1970 to 1974. Since about 1970, FTA procedures at Cannon AFB have been to "presaturate the ground surface with water, apply the starter fuel, ignite, preburn for 30 to 45 seconds, and extinguish with AFFF" (HGL, 2015 PF226).
2 (Figure 20)	Former FTA No. 3	Unlined FTA used twice per quarter from 1968 to 1974 with use of an unknown volume of AFFF likely from 1970 to 1974.
3 (Figure 21)	Former FTA No. 4	Unlined FTA used twice per quarter from 1974 through 1995 with use of an unknown volume of AFFF likely during that period. Prior to 1985, runoff from training exercises drained to an unlined pit. In 1985, a lined pit with an oil/water separator (OWS) was installed to handle runoff.
4 (Figure 22)	Hangars 119 and 133	A "large quantity" of AFFF was released from Hangar 119 during "multiple" accidental releases. Likely that releases reached grassy areas outside the hangars and storm drains on the flight ramp outside the bays that channel runoff "directly to the South Playa Lake." Two AFFF releases occurred from Hangar 133. In December 2000, several hundred gallons of AFFF entered a nearby storm drain, which likely routed to the South Playa Lake. In July 2001, approximately 200 gallons of AFFF was released. Some was washed to a floor trench and routed to the WWTP, and some was washed to nearby infield soil and allowed to disperse."
5 (Figure 23)	Former Sewage Lagoons	Two unlined surface impoundments were used from 1966 and 1998 to hold sanitary and industrial waste from the Base before the WWTP was constructed. Any AFFF that entered the sanitary sewer before 1998 went to the lagoons, such as the documented releases from the hangars.
6 (Figure 24)	North Playa Lake Outfall	This playa lake, which is likely unlined, received all sanitary and industrial waste from the Base from 1943 to 1966. It is unclear whether the North Playa Lake received any discharges from 1966 to 1998, but it currently receives treated effluent from the WWTP. Since the WWTP does not effectively remove PFAS from wastewater, the North Playa Lake continues to receive effluent containing PFAS.
7 (Figure 25)	South Playa Lake Outfall	Since 1943, any stormwater or wastewater containing AFFF that enters storm drains near the flightline is routed to the South Playa Lake. Several releases of AFFF from hangars entered nearby storm drains and were routed to the lake.

Sources: HGL, 2015 PF226; AFW, 2018 PF20

Table 6. AFFF Release Sites at Cannon AFB
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AFFF Area No.	AFFF Area Name	Description
8 (Figure 26)	Golf Course Outfall	Since 2002, treated effluent from the WWTP has been used to irrigate the golf course and fill two ponds on the course. As noted above, the WWTP does not effectively remove PFAS from the influent so the effluent contains PFAS. Sampling found PFAS in samples of WWTP influent and effluent in 2019.
9 (Figure 27)	Hangar 109	Recent release of AFFF inside the hangar/mechanical rooms escaped the building and drained to grassy areas outside the hangar.
10 (Figure 28)	Active FTA	Waste liquids from monthly training exercises at the active FTA are collected in a lined evaporation pond and allowed to evaporate. The pond has required repairs in the past, but any damage to the liner could result in AFFF being released to environment. An extreme flood event in May 2015 likely caused the evaporation pond with residual AFFF to overflow and infiltrate into surrounding soil.
11 (Figure 29)	Landfill No. 4	Located immediately north of North Playa Lake, the landfill cover was irrigated with water from North Playa Lake, which holds wastewater effluent from the WWTP containing PFAS.
12 (Figure 30)	Perimeter Road Fuel Spill	A large amount of AFFF was sprayed from crash fire trucks onto a fuel spill associated with an overturned tanker trunk on the southeast side of Perimeter Road. The response occurred over several days. Affected soils were reportedly excavated, but the extent of excavation is not known.
13	Flightline Crash Areas	An unknown amount of AFFF was released in response to three separate crashes along the flightline where AFFF was released during crash response activities.
14	Basewide Groundwater	According to AFW (2018 PF20), "groundwater was evaluated for all identified AFFF release areas." However, groundwater monitor wells have not been installed at most of the AFFF release sites. The USAF has identified a separate AFFF release area (Release Area 14) for evaluating the presence of PFAS in basewide groundwater.
—	Hangar 204	An accidental release of approximately 700 gallons of AFFF occurred inside this aircraft storage and maintenance hangar in May 2002. The AFFF release flowed onto the nearby concrete ramp and was left to disperse.

Sources: HGL, 2015; AFW, 2018

Table 7a. PFAS in USAF Soil Samples from AFFF Area 1
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	Concentration (µg/kg)			
Analyte	SB01001	SB01001	SB01002	SB01002
Sample ID	CANON01-SO-001	CANON01-SO-002	CANON01-SO-003	CANON01-SO-004
Sample Date	11/19/2017	11/19/2017	11/19/2017	11/19/2017
Depth (feet bgs)	0.0–0.5	28.0–30.0	0.0–0.5	28.0–30.0
Sample Type	N	N	N	N
PFHxA	1.7 B	0.55 B	<0.46	<0.50
PFHpA	<0.45	1.3	<0.46	<0.50
PFOA	1.3	35	<0.73	0.75 J
PFNA	<0.45	<0.47	0.29 J	<0.50
PFDA	0.29 J	<0.75	<0.73	<0.80
PFUnA	0.76 J	<0.75	<0.73	<0.80
PFDoA	2.1	<0.75	<0.73	<0.80
PFTrDA	<0.72	<0.75	<0.73	<0.80
PFTeDA	<0.72	<0.75	<0.73	<0.80
PFBS	<0.45	<0.47	<0.46	<0.50
PFHxS	5.1	150	0.26 J	4.5
PFOS	49	5.3	45	<0.80
6:2 FTS	<0.72	<0.75	<0.73	<0.80
8:2 FTS	<0.72	<0.75	<0.73	<0.80

Source: AFW, 2018, Table 3.1-1
Refer to Table 1 for PFAS names.
µg/kg = Micrograms per kilogram
bgs = Below ground surface
N = Normal environmental sample
B = Analyte also detected in an associated blank quality control (QC) sample
J = Result is considered an estimate

Table 7a. PFAS in USAF Soil Samples from AFFF Area 1
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	Concentration (µg/kg)			
Analyte	SB01001	SB01001	SB01002	SB01002
Sample ID	CANON01-SO-001	CANON01-SO-002	CANON01-SO-003	CANON01-SO-004
Sample Date	11/19/2017	11/19/2017	11/19/2017	11/19/2017
Depth (feet bgs)	0.0–0.5	28.0–30.0	0.0–0.5	28.0–30.0
Sample Type	N	N	N	N
NMeFOSAA	<0.72	<0.75	<0.73	<0.80
NEtFOSAA	<0.45	<0.47	<0.46	<0.50

Source: AFW, 2018, Table 3.1-1
Refer to Table 1 for PFAS names.
µg/kg = Micrograms per kilogram
bgs = Below ground surface
N = Normal environmental sample
B = Analyte also detected in an associated blank quality control (QC) sample
J = Result is considered an estimate

Table 7b. PFAS in USAF Soil Samples from AFFF Area 2
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Analyte	Concentration (µg/kg)				
	SB02001	SB02001	SB02001	SB02002	SB02002
Sample ID	CANON02-SO-001	CANON-FD-SO-001	CANON02-SO-002	CANON02-SO-003	CANON02-SO-004
Sample Date	11/14/2017	11/14/2017	11/14/2017	11/14/2017	11/14/2017
Depth (feet bgs)	0.0–0.5	0.0–0.5	28.0–30.0	0.0–0.5	28.0–30.0
Sample Type	N	FD	N	N	N
PFHxA	0.60 B	0.96 B	<0.50	<0.50	<0.50
PFHpA	0.39 J	0.37 J	<0.50	0.21 J	<0.50
PFOA	3.0	3.2	<0.80	1.7	<0.80
PFNA	2.6	2.1	<0.50	1.1	<0.50
PFDA	0.44 J	0.37 J	<0.80	5.1 J	<0.80
PFUnA	0.39 J	0.33 J	<0.80	<0.80	<0.80
PFDoA	<0.74	0.31 J	<0.80	<0.80	<0.80
PFTrDA	<0.73	<0.88	<0.80	<0.80	<0.80
PFTeDA	<0.74	<0.78	<0.80	<0.80	<0.80
PFBS	<0.47	<0.49	<0.50	<0.50	<0.50
PFHxS	5.5	6.7	<0.50	3.9	<0.50
PFOS	120	120	<0.80	240	<0.80
6:2 FTS	<0.74	<0.78	<0.80	<0.80	<0.80
8:2 FTS	<0.74	<0.78	<0.80	<0.80	<0.80

Source: AFW, 2018, Table 3.1-1
Refer to Table 1 for PFAS names.
µg/kg = Micrograms per kilogram
bgs = Below ground surface
N = Normal environmental sample
FD = Field duplicate
B = Analyte also detected in an associated blank quality control (QC) sample
J = Result is considered an estimate

Table 7b. PFAS in USAF Soil Samples from AFFF Area 2
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Analyte	Concentration (µg/kg)				
	SB02001	SB02001	SB02001	SB02002	SB02002
Sample ID	CANON02-SO-001	CANON-FD-SO-001	CANON02-SO-002	CANON02-SO-003	CANON02-SO-004
Sample Date	11/14/2017	11/14/2017	11/14/2017	11/14/2017	11/14/2017
Depth (feet bgs)	0.0–0.5	0.0–0.5	28.0–30.0	0.0–0.5	28.0–30.0
Sample Type	N	FD	N	N	N
NMeFOSAA	<0.74	<0.78	<0.80	<0.80	<0.80
NEtFOSAA	<0.47	<0.49	<0.50	<0.50	<0.50

Source: AFW, 2018, Table 3.1-1
Refer to Table 1 for PFAS names.
µg/kg = Micrograms per kilogram
bgs = Below ground surface
N = Normal environmental sample
FD = Field duplicate
B = Analyte also detected in an associated blank quality control (QC) sample
J = Result is considered an estimate

Table 7c. PFAS in USAF Soil Samples from AFFF Area 3
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Analyte	Concentration (µg/kg)						
	SB03001	SB03001	SB03001	SB03002	SB03002	SB03003	SB03003
Sample ID	CANON03-SO-001	CANON03-SO-007	CANON03-SO-002	CANON03-SO-003	CANON03-SO-004	CANON03-SO-005	CANON03-SO-006
Sample Date	11/15/2017	11/15/2017	11/15/2017	11/15/2017	11/15/2017	11/15/2017	11/15/2017
Depth (feet bgs)	0.0–0.5	23.0–24.0	40.0–41.0	0.0–0.5	48.0–50.0	0.0–0.5	48.0–50.0
Sample Type	N	N	N	N	N	N	N
PFHxA	<4.7	120	77	1.3 B	<0.45	<4.4	7.2
PFHpA	<4.7	13	13	0.87 J	<0.45	2.0 J	<0.44
PFOA	6.0 J	22	64	1.5	<0.72	<7.0	<0.70
PFNA	8.1 J	<0.49	<0.55	0.69 J	<0.45	<4.4	<0.44
PFDA	<7.4	<0.78	<0.88	5.0	<0.72	<7.0	<0.70
PFUnA	<7.4	<0.78	<0.88	0.99 J	<0.72	<7.0	<0.70
PFDoA	<7.4	<0.78	<0.88	<0.80	<0.72	<7.0	<0.70
PFTrDA	<7.0	<0.78	<0.88	<0.73	<0.80	<8.8	<0.69
PFTeDA	<7.4	<0.78	<0.88	<0.80	<0.72	<7.0	<0.70
PFBS	<4.7	39	33	<0.50	<0.45	<4.4	2.2 B
PFHxS	3.6 J	130	190	8.6	<0.45	<4.4	<0.44
PFOS	610	<0.78	<0.88	170	<0.80	320	<0.69
6:2 FTS	6.8 J	60	31	9.2	<0.72	2.7 J	<0.70

Source: AFW, 2018, Table 3.1-1
Refer to Table 1 for PFAS names.
µg/kg = Micrograms per kilogram
bgs = Below ground surface
N = Normal environmental sample
B = Analyte also detected in an associated blank quality control (QC) sample
J = Result is considered an estimate

Table 7c. PFAS in USAF Soil Samples from AFFF Area 3
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Analyte	Concentration (µg/kg)						
	SB03001	SB03001	SB03001	SB03002	SB03002	SB03003	SB03003
Sample ID	CANON03-SO-001	CANON03-SO-007	CANON03-SO-002	CANON03-SO-003	CANON03-SO-004	CANON03-SO-005	CANON03-SO-006
Sample Date	11/15/2017	11/15/2017	11/15/2017	11/15/2017	11/15/2017	11/15/2017	11/15/2017
Depth (feet bgs)	0.0–0.5	23.0–24.0	40.0–41.0	0.0–0.5	48.0–50.0	0.0–0.5	48.0–50.0
Sample Type	N	N	N	N	N	N	N
8:2 FTS	210	<0.78	<0.88	240	<0.72	490	<0.70
NMeFOSAA	<7.4	<0.78	<0.88	<0.80	<0.72	<7.0	<0.70
NEtFOSAA	<4.7	<0.49	<0.55	<0.50	<0.45	<4.4	<0.44

Source: AFW, 2018, Table 3.1-1
Refer to Table 1 for PFAS names.
µg/kg = Micrograms per kilogram
bgs = Below ground surface
N = Normal environmental sample
B = Analyte also detected in an associated blank quality control (QC) sample
J = Result is considered an estimate

Table 7d. PFAS in USAF Soil Samples from AFFF Area 4
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Analyte	Concentration (µg/kg)				
	SB04001	SB04001	SB04001	SB04002	SB04002
Sample ID	CANON04-SO-001	CANON04-SO-002	CANON-FD-SO-002	CANON04-SO-003	CANON04-SO-004
Sample Date	11/16/2017	11/16/2017	11/16/2017	11/16/2017	11/16/2017
Depth (feet bgs)	0.0-0.5	28.0-30.0	28.0-30.0	0.0-0.5	28.0-30.0
Sample Type	N	N	FD	N	N
PFHxA	2.3 B	0.39 B	0.40 B	0.38 B	2.9 B
PFHpA	0.47 J	0.23 J	0.31 J	1.8	<0.55
PFOA	3.0	0.80 J	1.6	6.0	<0.88
PFNA	2.7	<0.47	<0.55	11	<0.55
PFDA	4.3	<0.75	<0.88	2.9	<0.88
PFUnA	0.50 J	<0.75	<0.88	<0.79	<0.88
PFDoA	<0.80	<0.75	<0.88	<0.79	<0.88
PFTrDA	<0.77	<0.88	<0.80	<0.83	<0.80
PFTeDA	<0.80	<0.75	<0.88	<0.79	<0.88
PFBS	0.35 B	<0.47	<0.55	<0.50	0.91 B
PFHxS	7.0	1.8 Q	3.3 J	1.2 B	<0.55
PFOS	420	0.65 B	0.97 B	400	<0.80
6:2 FTS	100	11	13	0.29 B	<0.88

Source: AFW, 2018, Table 3.1-1
Refer to Table 1 for PFAS names.
µg/kg = Micrograms per kilogram
bgs = Below ground surface
N = Normal environmental sample
FD = Field duplicate
B = Analyte also detected in an associated blank quality control (QC) sample
J = Result is considered an estimate
Q = Analyte is both B qualified because of blank detection and J qualified due to an additional QC issue

Table 7d. PFAS in USAF Soil Samples from AFFF Area 4
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Analyte	Concentration (µg/kg)				
	SB04001	SB04001	SB04001	SB04002	SB04002
Sample ID	CANON04-SO-001	CANON04-SO-002	CANON-FD-SO-002	CANON04-SO-003	CANON04-SO-004
Sample Date	11/16/2017	11/16/2017	11/16/2017	11/16/2017	11/16/2017
Depth (feet bgs)	0.0-0.5	28.0-30.0	28.0-30.0	0.0-0.5	28.0-30.0
Sample Type	N	N	FD	N	N
8:2 FTS	37	<0.75	<0.88	180	<0.88
NMeFOSAA	<0.80	<0.75	<0.88	<0.79	<0.88
NEtFOSAA	<0.50	<0.47	<0.55	<0.50	<0.55

Source: AFW, 2018, Table 3.1-1
Refer to Table 1 for PFAS names.
µg/kg = Micrograms per kilogram
bgs = Below ground surface
N = Normal environmental sample
FD = Field duplicate
B = Analyte also detected in an associated blank quality control (QC) sample
J = Result is considered an estimate
Q = Analyte is both B qualified because of blank detection and J qualified due to an additional QC issue

Table 7e. PFAS in USAF Soil Samples from AFFF Area 5

Analyte	Concentration (µg/kg)										
	SB05001	SB05001	SB05002	SB05002	SB05003	SB05003	SB05003	SB05004	SB05004	SB05005	SB05005
Sample ID	CANON05-SO-001	CANON05-SO-002	CANON05-SO-003	CANON05-SO-004	CANON05-SO-005	CANON05-SO-006	CANON-FD-SO-003	CANON05-SO-007	CANON05-SO-008	CANON05-SO-009	CANON05-SO-010
Sample Date	11/18/2017	11/18/2017	11/18/2017	11/18/2017	11/18/2017	11/18/2017	11/18/2017	11/18/2017	11/18/2017	11/18/2017	11/18/2017
Depth (feet bgs)	4.0–5.0	9.0–10.0	4.0–5.0	9.0–10.0	4.0–5.0	8.0–9.0	8.0–9.0	4.0–5.0	9.0–10.0	4.0–5.0	9.0–10.0
Sample Type	N	N	N	N	N	N	FD	N	N	N	N
PFHxA	5.3 B	12	3.2 B	1.5 B	2.9 B	5.6 Q	3.3 Q	6.9	9.6	2.2 B	32
PFHpA	1.9	1.9	1.3	0.82 J	0.95 J	2.7 J	1.3 J	6.7	10	0.85	15
PFOA	3.1	3.0	1.5	0.51 J	1.2	4.1 J	1.5 J	11	19	1.4	23
PFNA	<0.46	<0.55	<0.55	<0.45	<0.49	0.64 J	<0.44	1.4	2.4	<0.43	3.9
PFDA	<0.73	<0.88	<0.88	<0.71	<0.78	<0.79	<0.70	1.5	2.9	<0.68	3.9
PFUnA	<0.73	<0.88	<0.88	<0.71	<0.78	<0.79	<0.70	0.60 J	1.0	<0.68	0.89 J
PFDoA	<0.73	<0.88	<0.88	<0.71	<0.78	<0.79	<0.70	0.32 J	0.71 J	<0.68	0.97
PFTrDA	<0.73	<0.88	<0.88	<0.71	<0.78	<0.79	<0.70	0.39 J	0.49 J	<0.68	0.32 J
PFTeDA	<0.73	<0.88	<0.88	<0.71	<0.78	<0.79	<0.70	<0.68	<0.70	<0.68	<0.76
PFBS	0.91 B	1.7 B	<0.55	<0.45	0.19 B	0.37 B	0.21 B	0.63 B	0.89 B	<0.43	0.61 B
PFHxS	2.1	7.4	3.9	1.4	1.2	2.9 J	1.5 J	12	17	2.3	12
PFOS	22	42	8.1	5.7	8.2	41 J	13 J	260	290	8.6	250
6:2 FTS	3.6	3.7	1.9	1.9	<0.78	1.2	1.2	5.3	17	2.5	14
8:2 FTS	8.0 J	11	<0.88	<0.71	<0.78	0.62 J	<0.70	7.4	14	<0.68	12
NMeFOSAA	2.2	1.6	<0.88	0.27 J	<0.78	1.8 J	0.59 J	13	7.9	<0.68	23
NEtFOSAA	1.1	0.95 J	<0.55	0.29 J	3.0 J	2.1 J	0.53 J	8.0	5.9	0.34 J	12

Source: AFW, 2018, Table 3.1-1
Refer to Table 1 for PFAS names.

µg/kg = Micrograms per kilogram
bgs = Below ground surface
N = Normal environmental sample
FD = Field duplicate

B = Analyte also detected in an associated blank quality control (QC) sample
J = Result is considered an estimate
Q = Analyte is both B qualified because of blank detection and J qualified due to an additional QC issue

Table 7f. PFAS in USAF Soil Samples from AFFF Area 7

Analyte	Concentration (µg/kg)								
	SB07001	SB07001	SB07002	SB07002	SB07003	SB07003	SB07004	SB07004	SB07004
Sample ID	CANON07-SO-001	CANON07-SO-002	CANON07-SO-003	CANON07-SO-004	CANON07-SO-005	CANON07-SO-006	CANON07-SO-007	CANON07-SO-008	CANON-FD-SO-004
Sample Date	11/29/2017	11/29/2017	11/29/2017	11/29/2017	11/29/2017	11/29/2017	11/28/2017	11/29/2017	11/29/2017
Depth (feet bgs)	0.0–0.5	23.0–25.0	0.0–0.5	23.0–25.0	0.0–0.5	23.0–25.0	0.0–0.5	23.0–25.0	23.0–25.0
Sample Type	N	N	N	N	N	N	N	N	FD
PFHxA	<0.50	<0.55	2.6 B	0.44 B	<0.46	<0.49	4.2 B	0.94 B	0.87 B
PFHpA	<0.50	<0.55	0.68 J	0.28 J	<0.46	<0.49	2.8	2.1	1.6
PFOA	<0.80	<0.88	0.57 J	0.49 J	<0.74	<0.78	2.2	<0.80	0.6 J
PFNA	<0.50	<0.55	<0.50	<0.55	<0.46	<0.49	2.0	0.38 J	<0.47
PFDA	<0.80	<0.88	<0.80	<0.88	<0.74	<0.78	5.2	<0.80	<0.75
PFUnA	<0.80	<0.88	<0.80	<0.88	<0.74	<0.78	5.1	<0.80	<0.75
PFDoA	0.54 J	<0.88	0.71 J	<0.88	<0.74	<0.78	3.9	<0.80	<0.75
PFTrDA	<0.80	<0.88	0.42 J	<0.88	<0.74	<0.78	<10	<0.80	<0.75
PFTeDA	<0.80	<0.88	0.66 J	<0.88	<0.74	<0.78	<10	<0.80	<0.75
PFBS	<0.50	<0.55	<0.50	<0.55	<0.46	<0.49	<0.65	<0.50	<0.47
PFHxS	<0.50	<0.55	1.4	<0.55	1.2	0.42 J	6.0	4.0	3.2
PFOS	1.3	<0.88	5.8	18	1.5	2.0	85	18	15
6:2 FTS	<0.80	<0.88	6.9	6.3	<0.74	<0.78	5.9	4.3 J	2.5 J
8:2 FTS	<0.80	<0.88	2.7	8.4	<0.74	0.61 J	8.8	0.95 J	0.81 J
NMeFOSAA	<0.80	<0.88	<0.80	<0.88	<0.74	<0.78	<1.0	<0.80	<0.75
NEtFOSAA	<0.50	<0.55	<0.50	<0.55	<0.46	<0.49	<0.65	<0.50	<0.47

Source: AFW, 2018, Table 3.1-1
Refer to Table 1 for PFAS names.
µg/kg = Micrograms per kilogram
bgs = Below ground surface
N = Normal environmental sample
FD = Field duplicate
B = Analyte also detected in an associated blank quality control (QC) sample
J = Result is considered an estimate

Table 7g. PFAS in USAF Soil Samples from AFFF Area 9
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Analyte	Concentration (µg/kg)				
	SB09001	SB09001	SB09001	SB09002	SB09002
Sample ID	CANON09-SO-001	CANON-FD-SO-005	CANON09-SO-002	CANON09-SO-003	CANON09-SO-004
Sample Date	11/16/2017	11/16/2017	11/16/2017	11/17/2017	11/17/2017
Depth (feet bgs)	0.0-0.5	0.0-0.5	28.0-30.0	0.0-0.5	28.0-30.0
Sample Type	N	FD	N	N	N
PFHxA	460	410	0.64 B	6.1 B	<0.50
PFHpA	18	12	1.4	1.8	<0.50
PFOA	27 J	16 J	<0.88	5.9	<0.80
PFNA	6.1	4.7 J	<0.55	12	<0.50
PFDA	9.9	7.6 J	<0.88	24	<0.80
PFUnA	2.2	<7.0	<0.88	5.2	<0.80
PFDoA	4.0	<7.0	<0.88	4.0	<0.80
PFTrDA	<0.80	<7.0	<0.88	0.41 J	<0.88
PFTeDA	1.2 J	<7.0J	<0.88	0.86 J	<0.80
PFBS	0.23 B	<4.4	<0.55	<0.45	<0.50
PFHxS	6.5	5.7 J	0.97 B	1.3	0.75 J
PFOS	170	230	<0.88	58	<0.88
6:2 FTS	3,900	2,500	<0.88	49	<0.88

Source: AFW, 2018, Table 3.1-1
Refer to Table 1 for PFAS names.
µg/kg = Micrograms per kilogram
bgs = Below ground surface
N = Normal environmental sample
FD = Field duplicate
B = Analyte also detected in an associated blank quality control (QC) sample
J = Result is considered an estimate

Table 7g. PFAS in USAF Soil Samples from AFFF Area 9
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Analyte	Concentration (µg/kg)				
	SB09001	SB09001	SB09001	SB09002	SB09002
Sample ID	CANON09-SO-001	CANON-FD-SO-005	CANON09-SO-002	CANON09-SO-003	CANON09-SO-004
Sample Date	11/16/2017	11/16/2017	11/16/2017	11/17/2017	11/17/2017
Depth (feet bgs)	0.0-0.5	0.0-0.5	28.0-30.0	0.0-0.5	28.0-30.0
Sample Type	N	FD	N	N	N
8:2 FTS	120	100	<0.88	58	<0.80
NMeFOSAA	<0.80	<7.0	<0.88	<0.72	<0.80
NEtFOSAA	<0.50	<4.4	<0.55	<0.45	<0.50

Source: AFW, 2018, Table 3.1-1
Refer to Table 1 for PFAS names.
µg/kg = Micrograms per kilogram
bgs = Below ground surface
N = Normal environmental sample
FD = Field duplicate
B = Analyte also detected in an associated blank quality control (QC) sample
J = Result is considered an estimate

Table 7h. PFAS in USAF Soil Samples from AFFF Area 11
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Analyte	Concentration (µg/kg)					
	SB11001	SB11001	SB11002	SB11002	SB11003	SB11003
Sample ID	CANON11-SO-001	CANON11-SO-002	CANON11-SO-003	CANON11-SO-004	CANON11-SO-005	CANON11-SO-006
Sample Date	11/17/2017	11/17/2017	11/17/2017	11/17/2017	11/17/2017	11/17/2017
Depth (feet bgs)	0.0-0.5	23.0-25.0	0.0-0.5	23.0-25.0	0.0-0.5	23.0-25.0
Sample Type	N	N	N	N	N	N
PFHxA	1.9 B	<0.42	<4.7	<0.43	<4.6	<0.55
PFHpA	2.8	<0.42	<4.7	<0.43	<4.6	<0.55
PFOA	0.011	<0.66	<7.5	<0.68	<7.4	<0.88
PFNA	0.26 J	<0.42	<4.7	<0.43	<4.6	<0.55
PFDA	<0.75	<0.66	<7.5	<0.68	<7.4	<0.88
PFUnA	<0.75	<0.66	<7.5	<0.68	<7.4	<0.88
PFDoA	<0.75	<0.66	<7.5	<0.68	<7.4	<0.88
PFTrDA	<0.75	<0.66	<7.5	<0.68	<7.4	<0.88
PFTeDA	<0.75	<0.66	<7.5	<0.68	<7.4	<0.88
PFBS	<0.47	<0.42	<4.7	<0.43	<4.6	<0.55
PFHxS	35	<0.42	4.7 J	<0.43	2.9 J	<0.55
PFOS	79	<0.66	1,100	0.63 B	1,100	<0.88
6:2 FTS	26	<0.66	10 B	<0.68	<7.4	<0.88

Source: AFW, 2018, Table 3.1-1
Refer to Table 1 for PFAS names.
µg/kg = Micrograms per kilogram
bgs = Below ground surface
N = Normal environmental sample
FD = Field duplicate

B = Analyte also detected in an associated blank quality control (QC) sample
J = Result is considered an estimate

Table 7h. PFAS in USAF Soil Samples from AFFF Area 11
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Analyte	Concentration (µg/kg)					
	SB11001	SB11001	SB11002	SB11002	SB11003	SB11003
Sample ID	CANON11-SO-001	CANON11-SO-002	CANON11-SO-003	CANON11-SO-004	CANON11-SO-005	CANON11-SO-006
Sample Date	11/17/2017	11/17/2017	11/17/2017	11/17/2017	11/17/2017	11/17/2017
Depth (feet bgs)	0.0-0.5	23.0-25.0	0.0-0.5	23.0-25.0	0.0-0.5	23.0-25.0
Sample Type	N	N	N	N	N	N
8:2 FTS	<0.75	<0.66	<7.5	<0.68	<7.4	<0.88
NMeFOSAA	<0.75	<0.66	<7.5	<0.68	<7.4	<0.88
NEtFOSAA	<0.47	<0.42	<4.7	<0.43	<4.6	<0.55

Source: AFW, 2018, Table 3.1-1
Refer to Table 1 for PFAS names.
µg/kg = Micrograms per kilogram
bgs = Below ground surface
N = Normal environmental sample
FD = Field duplicate
B = Analyte also detected in an associated blank quality control (QC) sample
J = Result is considered an estimate

Table 7i. PFAS in USAF Soil Samples from AFFF Area 12
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Analyte	Concentration (µg/kg)	
	SB12001	SB12001
Sample ID	CANON12-SO-001	CANON12-SO-002
Sample Date	11/18/2017	11/18/2017
Depth (feet bgs)	8.0-10.0	28.0-30.0
Sample Type	N	N
PFHxA	<0.43	<0.48
PFHpA	<0.43	<0.48
PFOA	<0.69	<0.77
PFNA	<0.43	<0.48
PFDA	<0.69	<0.77
PFUnA	<0.69	<0.77
PFDoA	<0.69	<0.77
PFTrDA	<0.69	<0.77
PFTeDA	<0.69	<0.77
PFBS	<0.43	<0.48
PFHxS	<0.43	<0.48
PFOS	<0.69	<0.77
6:2 FTS	<0.69	<0.77
8:2 FTS	<0.69	<0.77

Source: AFW, 2018, Table 3.1-1
Refer to Table 1 for PFAS names.
µg/kg = Micrograms per kilogram
bgs = Below ground surface
N = Normal environmental sample

Table 7i. PFAS in USAF Soil Samples from AFFF Area 12
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Analyte	Concentration (µg/kg)	
	SB12001	SB12001
Sample ID	CANON12-SO-001	CANON12-SO-002
Sample Date	11/18/2017	11/18/2017
Depth (feet bgs)	8.0-10.0	28.0-30.0
Sample Type	N	N
NMeFOSAA	<0.69	<0.77
NEtFOSAA	<0.43	<0.48

Source: AFW, 2018, Table 3.1-1
Refer to Table 1 for PFAS names.
µg/kg = Micrograms per kilogram
bgs = Below ground surface
N = Normal environmental sample

Table 8. PFAS in USAF Sediment Samples from AFFF Areas 6 and 8
Page 1 of 2

Analyte	Concentration (µg/kg)				
	AFFF Area 6. N. Playa Lake		AFFF Area 8. Golf Course Outfall		
	SD/SW06001	SD/SW06002	SD/SW08001	SD/SW08001	SD/SW08002
Sample ID	CANON06-SD-001	CANON06-SD-002	CANON08-SD-001	CANON-FD-SD-001	CANON08-SD-002
Sample Date	11/30/2017	11/30/2017	11/30/2017	11/30/2017	11/30/2017
Depth (feet bgs)	0.0–0.5	0.0–0.5	0.0–0.5	0.0–0.5	0.0–0.5
Sample Type	N	N	N	FD	N
PFHxA	<6.0	<0.80	0.57 B	0.66 B	1.3 B
PFHpA	0.50 J	<0.80	0.69 J	0.67 J	0.73 J
PFOA	<9.6	<1.3	<1.3	<1.2	<0.96
PFNA	<6.0	<0.80	3.0	2.6	<0.60
PFDA	<9.6	<1.3	1.2 J	0.53 J	<0.96
PFUnA	<9.6	<1.3	0.80 J	<1.2	0.50 J
PFDoA	<9.6	<1.3	<1.3	<1.2	0.63 J
PFTrDA	<9.6	<1.3	<13	<1.2	<9.6
PFTeDA	<9.6	<1.3	<13	<1.2	<9.6
PFBS	<0.60	<0.80	<0.80	<0.75	<0.60
PFHxS	0.58 J	0.39 J	3.1	2.9	1.3
PFOS	39	9.8	77	76	12
6:2 FTS	<9.6	<1.3	<1.3	<1.2	<0.96

Source: AFW, 2018, Table 3.1-3
Refer to Table 1 for PFAS names.
µg/kg = Micrograms per kilogram
bgs = Below ground surface
N = Normal environmental sample
FD = Field duplicate
B = Analyte also detected in an associated blank quality control (QC) sample
J = Result is considered an estimate

Table 8. PFAS in USAF Sediment Samples from AFFF Areas 6 and 8
Page 2 of 2

Analyte	Concentration (µg/kg)				
	AFFF Area 6. N. Playa Lake		AFFF Area 8. Golf Course Outfall		
	SD/SW06001	SD/SW06002	SD/SW08001	SD/SW08001	SD/SW08002
Sample ID	CANON06-SD-001	CANON06-SD-002	CANON08-SD-001	CANON-FD-SD-001	CANON08-SD-002
Sample Date	11/30/2017	11/30/2017	11/30/2017	11/30/2017	11/30/2017
Depth (feet bgs)	0.0–0.5	0.0–0.5	0.0–0.5	0.0–0.5	0.0–0.5
Sample Type	N	N	N	FD	N
8:2 FTS	<0.96	<1.3	<1.3	<1.2	<0.96
NMeFOSAA	<0.96	<1.3	<1.3	<1.2	<0.96
NEtFOSAA	<0.60	<0.80	<0.80	<0.75	<0.60

Source: AFW, 2018, Table 3.1-3
Refer to Table 1 for PFAS names.
µg/kg = Micrograms per kilogram
bgs = Below ground surface
N = Normal environmental sample
FD = Field duplicate
B = Analyte also detected in an associated blank quality control (QC) sample
J = Result is considered an estimate

Table 9. PFAS in USAF Surface Water Samples from AFFF Areas 6 and 8
Page 1 of 2

Analyte	Concentration (ng/L)			
	AFFF Area 6. N. Playa Lake		AFFF Area 8. Golf Course Outfall	
	SD/SW06001	SD/SW06002	SD/SW08001	SD/SW08001
Sample ID	CANON06-SW-001	CANON06-SW-002	CANON08-SW-001	CANON-FD-SW-001
Sample Date	11/30/2017	11/30/2017	11/28/2017	11/28/2017
Sample Type	N	N	N	FD
PFHxA	110 B	250 Q	<10	<10
PFHpA	57	120 J	<15	<15
PFOA	13	27 J	<10	<10
PFNA	<18	<18 J	<18	<18
PFDA	<15	<15 J	<15	<15
PFUnA	<10	<10 J	<10	<10
PFDoA	<10	<10 J	<10	<10
PFTrDA	<10	<100 J	<10	<10
PFTeDA	<10	<100 J	<10	<10
PFBS	24 B	49 Q	<15	<15
PFHxS	19 J	88 J	<15	<15
PFOS	110	72 J	41	29
6:2 FTS	43	58 J	<15	<15
8:2 FTS	<15	<15 J	<15	<15

Source: AFW, 2018, Table 3.1-4
Refer to Table 1 for PFAS names.
ng/L = Nanograms per liter
N = Normal environmental sample
FD = Field duplicate
B = Analyte also detected in an associated blank quality control (QC) sample
J = Result is considered an estimate
Q = Analyte is both B qualified because of blank detection and J qualified due to an additional QC issue

Table 9. PFAS in USAF Surface Water Samples from AFFF Areas 6 and 8
Page 2 of 2

	Concentration (ng/L)			
	AFFF Area 6. N. Playa Lake		AFFF Area 8. Golf Course Outfall	
Analyte	SD/SW06001	SD/SW06002	SD/SW08001	SD/SW08001
Sample ID	CANON06-SW-001	CANON06-SW-002	CANON08-SW-001	CANON-FD-SW-001
Sample Date	11/30/2017	11/30/2017	11/28/2017	11/28/2017
Sample Type	N	N	N	FD
NMeFOSAA	<10	<10 J	<10	<10
NEtFOSAA	<10	<10 J	<10	<10

Source: AFW, 2018, Table 3.1-4
Refer to Table 1 for PFAS names.
ng/L = Nanograms per liter
N = Normal environmental sample
FD = Field duplicate
B = Analyte also detected in an associated blank quality control (QC) sample
J = Result is considered an estimate
Q = Analyte is both B qualified because of blank detection and J qualified due to an additional QC issue

Table 10. Construction Information for CAFB Monitor Wells

Well ID	Install Date	Well Depth (feet bgs)	Screen Interval (feet bgs)	Screen Material	Screen Length (feet)
MW-A	1/7/1985	340.13	325.13-340.13	PVC	15
MW-B	11/30/1984	362.9	347.9-362.9	PVC	15
MW-CA	8/16/2017	350	329.7-349.7	SS	20
MW-D	12/16/1984	355	340-355	PVC	15
MW-E	11/17/1985	349.09	334.09-349.09	—	15
MW-FA	8/21/2017	350	314.7-349.7	SS	35
MW-GA	8/27/2017	355.5	320.2-355.2	SS	35
MW-H	11/18/1985	349.8	324.8-344.8	—	20
MW-NA	12/16/2004	355.81	291.9-351.9	—	60
MW-OA	2/29/2004	366.2	301.2-361.2	—	60
MW-PA	2/21/2004	361.54	296.54-356.54	—	60
MW-RB	10/4/2012	331.39	301.39-331.39	—	30
MW-SA	8/16/2017	362	321.7-361.7	SS	40
MW-TA	8/8/2017	362.4	327.4-362.4	SS	35
MW-UA	8/19/2017	361.3	321-361	SS	40
MW-V	8/8/2001	370.11	305.11-365.11	—	60
MW-W	6/1/2002	365.94	300.94-360.94	—	60
MW-X	2/26/2004	336.64	291.64-331.64	—	40
MW-Y	2/6/2019	357	316.4–356.4	SS	40

Sources: AFW, 2018 , Table 3.0-1 and AFW, 2019, Table 3.0-1
All wells are 4 inch diameter with PVC casing and 0.01-inch slotted screen.
bgs = Below ground surface
PVC = Polyvinyl chloride
SS = Stainless steel
— = Unknown

Table 11a. Monitor Wells at Cannon AFB with Low to No Detections of PFAS
Page 1 of 2

Analyte	Concentration (ng/L)							
	MW-A	MW-E	MW-FA	MW-NA	MW-RB	MW-V	MW-W	MW-X
Sample Date	12/6/2017	12/2/2017	12/12/2017	12/3/2017	12/3/2017	11/30/2017	12/1/2017	11/30/2017
DTW (feet bgs)	314.45	321.75	320.98	313.84	317.92	349.74	338.70	287.78
Sample Depth (feet bgs)	321.0–321.0	341.0–341.0	341.0–341.0	341.0–341.0	326.0–326.0	361.0–361.0	361.0–361.0	321.0–321.0
Sample Type	N	N	N	N	N	N	N	N
PFHxA	18 B	<10	19 B	<10	26 B	<10	<10	<10
PFHpA	<15	<15	<15	<15	<15	<15	<15	<15
PFOA	<10	<10	<10	<10	<10	<10	<10	<10
PFNA	<18	<18	<18	<18	<18	<18	<18	<18
PFDA	<15	<15	<15	<15	<15	<15	<15	<15
PFUnA	<10	<10	<10	<10	<10	<10	<10	<10
PFDoA	<10	<10	<10	<10	<10	<10	<10	<10
PFTrDA	<10	<10	<10	<10	<10	<10	<10	<10
PFTeDA	<10	<10	<10	<10	<10	<10	<10	<10
PFBS	6.2 B	<15	<15	<15	<15	<15	<15	<15
PFHxS	<15	<15	26	<15	<15	<15	<15	<15
PFOS	<15	<15	<15	<15	<15	<15	<15	<15
6:2 FTS	<15	<15	<15	<15	<15	<15	<15	<15
8:2 FTS	<15	<15	<15	<15	<15	<15	<15	<15

Source: AFW, 2018, Table 3.1-5
Refer to Table 1 for PFAS names.
ng/L = Nanograms per liter
DTW = Depth to water
bgs = Below ground surface
N = Normal environmental sample

Table 11a. Monitor Wells at Cannon AFB with Low to No Detections of PFAS
Page 2 of 2

Analyte	Concentration (ng/L)							
	MW-A	MW-E	MW-FA	MW-NA	MW-RB	MW-V	MW-W	MW-X
Sample Date	12/6/2017	12/2/2017	12/12/2017	12/3/2017	12/3/2017	11/30/2017	12/1/2017	11/30/2017
DTW (feet bgs)	314.45	321.75	320.98	313.84	317.92	349.74	338.70	287.78
Sample Depth (feet bgs)	321.0–321.0	341.0–341.0	341.0–341.0	341.0–341.0	326.0–326.0	361.0–361.0	361.0–361.0	321.0–321.0
Sample Type	N	N	N	N	N	N	N	N
N-EtFOSAA	<10	<10	<10	<10	<10	<10	<10	<10
N-MeFOSAA	<10	<10	<10	<10	<10	<10	<10	<10

Source: AFW, 2018, Table 3.1-5
Refer to Table 1 for PFAS names.
ng/L = Nanograms per liter
DTW = Depth to water
bgs = Below ground surface
N = Normal environmental sample

Table 11b. PFAS in USAF Samples from East Monitor Wells
Page 1 of 2

Analyte	Concentration (ng/L)				
	MW-GA	MW-H	MW-OA	MW-PA	MW-PA DUP
Sample Date	12/6/2017	12/5/2017	12/5/2017	12/4/2017	12/4/2017
DTW (feet bgs)	323.43	351.80	325.98	317.82	
Sample Depth (feet bgs)	341.0–341.0	341.0–341.0	346.0–346.0	346.0–346.0	346.0–346.0
Sample Type	N	N	N	N	FD
PFHxA	650	33 B	340	340 J	370 J
PFHpA	100	19 J	75	68 J	70 J
PFOA	71	19 J	42	45 J	42 J
PFNA	<18	<18	<18	<18	<18
PFDA	<15	<15	<15	<15	<15
PFUnA	<10	<10	<10	<10	<10
PFDoA	<10	<10	<10	<10	<10
PFTrDA	<10	<10	<10	<10	<10
PFTeDA	<10	<10	<10	<10	<10
PFBS	110 B	7.4 B	96 B	49 Q	46 Q
PFHxS	430	100	410	320	350
PFOS	130	41	8.6	85 J	87 J
6:2 FTS	15 J	33	58	10 J	9.9 J
8:2 FTS	<15	<15	<15	<15	<15

Source: AFW, 2018, Table 3.1-5
Refer to Table 1 for PFAS names.

ng/L = Nanograms per liter
DTW = Depth to water
bgs = Below ground surface
N = Normal environmental sample
FD = Field duplicate
B = Analyte also detected in an associated blank quality control (QC) sample
J = Result is considered an estimate
Q = Analyte is both B qualified because of blank detection and J qualified due to an additional QC issue

Table 11b. PFAS in USAF Samples from East Monitor Wells
Page 2 of 2

Analyte	Concentration (ng/L)				
	MW-GA	MW-H	MW-OA	MW-PA	MW-PA DUP
Sample Date	12/6/2017	12/5/2017	12/5/2017	12/4/2017	12/4/2017
DTW (feet bgs)	323.43	351.80	325.98	317.82	
Sample Depth (feet bgs)	341.0–341.0	341.0–341.0	346.0–346.0	346.0–346.0	346.0–346.0
Sample Type	N	N	N	N	FD
N-EtFOSAA	<10	<10	<10	5.7 J	<10
N-MeFOSAA	<10	<10	<10	3.9 J	<10

Source: AFW, 2018, Table 3.1-5
Refer to Table 1 for PFAS names.

ng/L = Nanograms per liter
DTW = Depth to water
bgs = Below ground surface
N = Normal environmental sample
FD = Field duplicate
B = Analyte also detected in an associated blank quality control (QC) sample
J = Result is considered an estimate
Q = Analyte is both B qualified because of blank detection and J qualified due to an additional QC issue

Table 11c. PFAS in USAF Samples from Southeast Monitor Wells
Page 1 of 2

Analyte	Concentration (ng/L)						
	MW-B	MW-CA	MW-D	MW-D (DUP)	MW-SA	MW-TA	MW-UA
Sample Date	12/13/2017	12/14/2017	12/13/2017	12/13/2017	12/14/2017	12/13/2017	12/13/2017
DTW (feet bgs)	330.82	334.62	328.37	328.37	332.62	331.63	331.12
Sample Depth (feet bgs)	341.0–341.0	346.0–346.0	341.0–341.0	341.0–341.0	356.0–356.0	356.0–356.0	346.0–346.0
Sample Type	N	N	N	FD	N	N	N
PFHxA	180 B	4,100	1,800	1,900	2,300	940	85 B
PFHpA	14 J	1,300	810	890	470	88	7.6 J
PFOA	23	2,200	2,800	3,100	1,500	240	10 J
PFNA	<18	64 J	<90	<36	<18	<18	<18
PFDA	<15	<75	<75	<30	<15	<15	<15
PFUnA	<10	<50	<50	<20	<10	<10	<10
PFDoA	<10	<50	<50	<20	<10	<10	<10
PFTrDA	<10	<50	<50	<20	<10	<10	<10
PFTeDA	<10	<50	<50	<20	<10	<10	<10
PFBS	79 B	840	290	280	710	370	48 B
PFHxS	61	12,000	9,000	9,900	3,800	450	31 B
PFOS	<15	24,000	790	750	150 B	<15	<15
6:2 FTS	<15	12,000	1,900	2,000	360 B	<15	<15
8:2 FTS	<15	<75	<75	<30	<15	<15	<15

Source: AFW, 2018, Table 3.1-5
Refer to Table 1 for PFAS names.

ng/L = Nanograms per liter
DTW = Depth to water
bgs = Below ground surface
N = Normal environmental sample
FD = Field duplicate
B = Analyte also detected in an associated blank quality control (QC) sample
J = Result is considered an estimate

Table 11c. PFAS in USAF Samples from Southeast Monitor Wells
Page 2 of 2

Analyte	Concentration (ng/L)						
	MW-B	MW-CA	MW-D	MW-D (DUP)	MW-SA	MW-TA	MW-UA
Sample Date	12/13/2017	12/14/2017	12/13/2017	12/13/2017	12/14/2017	12/13/2017	12/13/2017
DTW (feet bgs)	330.82	334.62	328.37	328.37	332.62	331.63	331.12
Sample Depth (feet bgs)	341.0–341.0	346.0–346.0	341.0–341.0	341.0–341.0	356.0–356.0	356.0–356.0	346.0–346.0
Sample Type	N	N	N	FD	N	N	N
N-EtFOSAA	<10	<50	<50	<20	<10	<10	<10
N-MeFOSAA	<10	<50	<50	<20	3.6 J	<10	<10

Source: AFW, 2018, Table 3.1-5
Refer to Table 1 for PFAS names.
ng/L = Nanograms per liter
DTW = Depth to water
bgs = Below ground surface
N = Normal environmental sample
FD = Field duplicate
B = Analyte also detected in an associated blank quality control (QC) sample
J = Result is considered an estimate

Table 12. PFAS in USAF Confirmation Groundwater Samples

Analyte	Concentration (ng/L)														
	MW-Ca			MW-D		MW-Sa		MW-Ta		MW-Ga		MW-Pa		MW-Y	MW-Y DUP
Sample Date	12/14/2017	10/27/2018	10/27/2018	12/13/2017	10/27/2018	12/14/2017	10/24/2018	12/13/2017	10/23/2018	12/6/2017	10/22/2018	12/4/2017	10/23/2018	2/13/2019	2/13/2019
DTW (feet bgs)	334.62			328.37		332.62		331.63		323.43		317.82			
Sample Depth (feet bgs)	346.0-346.0			341.0-341.0		356.0-356.0		356.0-356.0		341.0-341.0		346.0-346.0			
Sample Type	N	N	FD	N	N	N	N	N	N	N	N	N	N	N	FD
PFHxA	4,100	3,600	3,700	1,800	1,500	2,300	2,800	940	1,400	650	580	340 J	190	309	332
PFHpA	1,300	1,100	1,100	810	730	470	450	88	110	100	81	68 J	34	102	109
PFOA	2,200	2,000	2,000	2,800	2,800	1,500	1,600	240	340	71	56	45 J	24	56.7	61.7
PFNA	64 J	<90	<180	<90	<36	<18	<18	<18	<18	<18	<18	<18	<18	<7.7	<7.7
PFDA	<75	<75	<15	<75	<30	<15	<15	<15	<15	<15	<15	<15	<15	<7.7	<7.7
PFUnA	<50	<50	<10	<50	<20	<10	<10	<10	<10	<10	<10	<10	<10	<7.7	<7.7
PFDoA	<50	<50	<10	<50	<20	<10	<10	<10	<10	<10	<10	<10	<10	<7.7	<7.7
PFTrDA	<50	<50	<10	<50	<20	<10	<10	<10	<10	<10	<10	<10	<10	<7.7	<7.7
PFTeDA	<50	<50	<10	<50	<20	<10	<10	<10	<10	<10	<10	<10	<10	<7.7	<7.7
PFBS	840	650	660	290	180	710	970	370	540	110 B	100	49 Q	23	57.5	60.6
PFHxS	12,000	8,900	9,500	9,000	8,500	3,800	3,100	450	620	430	360	320	160	358	375
PFOS	24,000	22,000	25,000	790	960	150 B	81	<15	<15	130	130	85 J	51	123	130
6:2 FTS	12,000	8,500	8,700	1,900	1,700	360 B	180	<15	<15	15 J	<15	10 J	<15	249	268
8:2 FTS	<75	<75	<15	<75	<30	<15	<15	<15	<15	<15	<15	<15	<15	<31	<31
N-EtFOSAA	<50	<50	<10	<50	<20	<10	<10	<10	<10	<10	<10	5.7 J	<10	<31	<31
N-MeFOSAA	<50	<50	<10	<50	<20	3.6 J	<10	<10	<10	<10	<10	3.9 J	<10	<31	<31

Source: AFW, 2018, Table 3.1-5 and AFW, 2019, Table 3.1-1
Refer to Table 1 for explanation of PFAS acronyms

ng/L = Nanograms per liter
DTW = Depth to water
bgs = Below ground surface
N = Normal environmental sample
FD = Field duplicate
B = Analyte also detected in an associated blank quality control (QC) sample
J = Result is considered an estimate
Q = Analyte is both B qualified because of blank detection and J qualified due to an additional QC issue

Table 13. PFAS in USAF Groundwater Samples from Off-Site Wells

Analyte	Concentration (ng/L)													
	RES546-01-SP	RES648-01-SP	RES650-01-SP	RES650-02-SP	RES650-03-SP	RES682-01-SP	RES692-01-SP	RES717-01-SP	FD-02	RES725-01-SP	RES730-01-SP	RES738-01-SP	RES748-01-SP	FD-01
Sample Date	8/26/2018	8/30/2018	8/29/2018	8/29/2018	8/29/2018	8/29/2018	8/29/2018	8/29/2018	8/29/2018	8/29/2018	8/28/2018	8/28/2018	8/28/2018	8/28/2018
Note	*2*		*1*	*3*	*1*		*1,3*		*1*		*1*	*1*		*1*
PFHxA	<4.27	26.5	700	—	<4.42	<4.20	—	22.8	23.1	25.2	<4.13	81.7	<4.35	<4.31
PFHpA	<4.27	5.93 J	176	—	<4.42	<4.20	<4.27	<4.20	<4.17	<4.10	<4.13	<4.63	<4.35	<4.31
PFOA	<4.27	15.5	539	267	<4.42	<4.20	<4.27	<4.20	<4.17	<4.10	<4.13	<4.63	<4.35	<4.31
PFNA	<4.27	<8.31	<4.39	<5.98	<4.42	<4.20	<4.27	<4.20	<4.17	<4.10	<4.13	<4.63	<4.35	<4.31
PFDA	<4.27	<8.31	<4.39	<5.98	<4.42	<4.20	<4.27	<4.20	<4.17	<4.10	<4.13	<4.63	<4.35	<4.31
PFUnA	<4.27	<8.31	<4.39	<5.98	<4.42	<4.20	<4.27	<4.20	<4.17	<4.10	<4.13	<4.63	<4.35	<4.31
PFDoA	<4.27	<8.31	<4.39	<5.98	<4.42	<4.20	<4.27	<4.20	<4.17	<4.10	<4.13	<4.63	<4.35	<4.31
PFTrDA	<4.27	<8.31	<4.39	<5.98	<4.42	<4.20	<4.27	<4.20	<4.17	<4.10	<4.13	<4.63	<4.35	<4.31
PFTeDA	<4.27	<8.31	<4.39	<5.98	<4.42	<4.20	<4.27	<4.20	<4.17	<4.10	<4.13	<4.63	<4.35	<4.31
PFBS	<4.27	10.3	210	137	<4.42	<4.20	<4.27	16.4	14.7	14.5	<4.13	11.1	<4.35	<4.31
PFHxS	<4.27	56.7	1700	—	<4.42	<4.20	—	14.7	1.15	18.9	<4.13	11.6	<4.35	<4.31
PFOS	<4.27	10.0	1110	404	<4.42	<4.20	<4.27	<4.20	<4.17	<4.10	<4.13	<4.63	<4.35	<4.31
6:2 FTS	<4.27	7.34 J	718	331	<4.42	<4.20	<4.27	<4.20	<4.17	<4.10	<4.13	<4.63	<4.35	<4.31
8:2 FTS	<4.27	<8.31	<4.39	<5.98	<4.42	<4.20	<4.27	<4.20	<4.17	<4.10	<4.13	<4.63	<4.35	<4.31
N-EtFOSAA	<4.27	<8.31	<4.39	<5.98	<4.42	<4.20	<4.27	<4.20	<4.17	<4.10	<4.13	<4.63	<4.35	<4.31
N-MeFOSAA	<4.27	<8.31	<4.39	<5.98	<4.42	<4.20	<4.27	<4.20	<4.17	<4.10	<4.13	<4.63	<4.35	<4.31

Source: AFW, 2018, Table 3.1-5 and AFW, 2019, Table 3.1-1
Refer to Table 1 for explanation of PFAS acronyms
1 PDF of the laboratory data sheet is corrupted and difficult to read; best effort was made to transcribe information.
2 PDF of the laboratory data sheet is corrupted; some results may be incorrect
3 PDF of the laboratory data sheet is corrupted and some results are illegible and were not posted (—)
ng/L = Nanograms per liter J = Result is considered an estimate

Table 13. PFAS in USAF Groundwater Samples from Off-Site Wells

Analyte	Concentration (ng/L)													
	RES778-01-SP	RES948-01-SP	RES1310-01-SP	RES1331-01-WH	RES1349-01-WH	RES1358-01-SP	RES1369-01-SP	RES1369-02-WH	RES1369-03-WH	RES1397-01-SP	RES1461-01-SP	RES1495-01-SP	RES-DUP-01	RES1591-01-SP
Sample Date	8/28/2018	8/28/2018	8/27/2018	8/26/2018	8/26/2018	8/28/2018	8/30/2018	8/30/2018	8/30/2018	8/30/2018	8/30/2018	8/25/2018	8/25/2018	8/26/2018
Note			*2*	*2*	*2*	*1*	*1*	*1*			*1*	*1*	*2*	*1,3*
PFHxA	4.17 J	270	<4.13	<4.13	<4.13	<4.35	<4.24	<4.31	5.14	<4.13	<4.17	<4.20	<4.17	---
PFHpA	<4.39	77.5	<4.13	<4.13	<4.13	<4.35	<4.24	<4.31	<4.10	<4.13	<4.17	<4.20	<4.17	<4.17
PFOA	<4.39	50.6	<4.13	<4.13	<4.13	<4.35	<4.24	<4.31	<4.10	<4.13	<4.17	<4.20	<4.17	7.93 J
PFNA	<4.39	5.86	<4.13	<4.13	<4.13	<4.35	<4.24	<4.31	<4.10	<4.13	<4.17	<4.20	<4.17	<4.17
PFDA	<4.39	<4.46	<4.13	<4.13	<4.13	<4.35	<4.24	<4.31	<4.10	<4.13	<4.17	<4.20	<4.17	<4.17
PFUnA	<4.39	<4.46	<4.13	<4.13	<4.13	<4.35	<4.24	<4.31	<4.10	<4.13	<4.17	<4.20	<4.17	<4.17
PFDoA	<4.39	<4.46	<4.13	<4.13	<4.13	<4.35	<4.24	<4.31	<4.10	<4.13	<4.17	<4.20	<4.17	<4.17
PFTrDA	<4.39	<4.46	<4.13	<4.13	<4.13	<4.35	<4.24	<4.31	<4.10	<4.13	<4.17	<4.20	<4.17	<4.17
PFTeDA	<4.39	<4.46	<4.13	<4.13	<4.13	<4.35	<4.24	<4.31	<4.10	<4.13	<4.17	<4.20	<4.17	<4.17
PFBS	<4.39	64.1	<4.13	<4.13	<4.13	<4.35	<4.24	<4.31	<4.10	<4.13	<4.17	<4.20	<4.17	8.62
PFHxS	<4.39	398	<4.13	<4.13	<4.13	<4.35	<4.24	<4.31	9.2	<4.13	<4.17	<4.20	<4.17	13
PFOS	<4.39	95.3	<4.13	<4.13	<4.13	<4.35	<4.24	<4.31	<4.10	<4.13	<4.17	<4.20	<4.17	<4.17
6:2 FTS	<4.39	157	<4.13	<4.13	<4.13	<4.35	<4.24	<4.31	<4.10	<4.13	<4.17	<4.20	<4.17	<4.17
8:2 FTS	<4.39	<4.46	<4.13	<4.13	<4.13	<4.35	<4.24	<4.31	<4.10	<4.13	<4.17	<4.20	<4.17	<4.17
N-EtFOSAA	<4.39	<4.46	<4.13	<4.13	<4.13	<4.35	<4.24	<4.31	<4.10	<4.13	<4.17	<4.20	<4.17	<4.17
N-MeFOSAA	<4.39	<4.46	<4.13	<4.13	<4.13	<4.35	<4.24	<4.31	<4.10	<4.13	<4.17	<4.20	<4.17	<4.17

Source: AFW, 2018, Table 3.1-5 PF20 and AFW, 2019, Table 3.1-1 & lab data sheets PF23
Refer to Table 1 for explanation of PFAS acronyms
1 PDF of the laboratory data sheet is corrupted and difficult to read; best effort was made to transcribe information.
2 PDF of the laboratory data sheet is corrupted; some results may be incorrect
3 PDF of the laboratory data sheet is corrupted and some results are illegible and were not posted (—)
ng/L = Nanograms per liter J = Result is considered an estimate

Table 14. PFAS in Wastewater Samples, Cannon AFB

Analyte	Concentration (ng/L)		
	WWTP Influent	WWTP Effluent	WWTP Effluent (Duplicate)
Sample Date	8/29/2019	8/29/2019	8/29/2019
PFBA	8.4 J	22.6	21.6
PFPeA	15.1	146	138
PFHxA	12.3	70.1	67.2
PFHpA	<4.2	19.5	18.6
PFOA	<4.2	4.67 J	4.4 J
PFNA	<4.2	<4.2	<4.2
PFDA	<42	<4.2	<4.2
PFUnA	<42	<4.2	<4.2
PFDoA	<42	<4.2	<4.2
PFTriA	<42	<4.2	<4.2
PFTeA	<42	<4.2	<4.2
PFBS	13.3	33.6	43.1
PFHxS	67.8	7.11 J	7.12 J
PFOS	7.85 J	14.2	12.9
PFDS	<4.2	<4.2	<4.2
PFOSA	<4.2	<4.2	<4.2
6:2 FTS	12.2 J	102	99.8
8:2 FTS	<83	<8.3	<8.3

Source: EA, 2019
Refer to Table 1 for list of PFAS names.
ng/L = Nanograms per liter
J = Estimated value

Table 15. PFAS in Water Samples Collected by Arthur Schaap

Analyte	Concentration (ng/L)											
	D1	*W-1*	*W-2*	*W 1-2*	*W-3*	*W-4*	*W-5*	*H-1*	*H-2*	*H-3*	*Milk Tank 1*	*Milk Tank 2*
Sample Date	*9/21/2018*	*9/21/2018*	*9/21/2018*	*9/21/2018*	*9/21/2018*	*9/21/2018*	*9/21/2018*	*9/21/2018*	*9/21/2018*	*9/21/2018*	*9/21/2018*	*9/21/2018*
Sample Type	*GW*	*GW*	*GW*	*GW*	*GW*	*GW*	*GW*	*DW*	*DW*	*DW*	*DW*	*DW*
PFBA	181	7.00	171	16.4	<1.81	87.7	603	107	0.772 J	9.41	NT	NT
PFPeA	563	14.7	572	44.2	<1.81	292	2,130	315	1.92	20.6	NT	NT
PFHxA	837	11.7	737	60.8	<1.81	367	3,090	369	2.76	26.7	NT	NT
PFHpA	190	<1.87	172	10.0	<1.81	118	845	103	<1.79	1.32 J	NT	NT
PFOA	504	<1.87	494	31.3	<1.81	357	2,920	302	<1.79	1.32 J	21	13.4 J
PFNA	3.01	<1.87	2.03	<1.73	<1.81	1.93	<184	1.07 J	<1.79	<1.77	NT	NT
PFDA	<2.24	<1.87	<1.82	<1.73	<1.81	<1.85	<1.84	<1.80	<1.79	<1.77	NT	NT
PFUdA	<2.24	<1.87	<1.82	<1.73	<1.81	<1.85	<1.84	<1.80	<1.79	<1.77	NT	NT
PFDoA	<2.24	<1.87	<1.82	<1.73	<1.81	<1.85	<1.84	<1.80	<1.79	<1.77	NT	NT
PFTrDA	<2.24	<1.87	<1.82	<1.73	<1.81	<1.85	<1.84	<1.80	<1.79	<1.77	NT	NT
PFTeDA	<2.24	<1.87	<1.82	<1.73	<1.81	<1.85	<1.84	<1.80	<1.79	<1.77	NT	NT
PFBS	208	8.12	193	22.3	<1.61	115	571	127	0.802 J	15.4	NT	NT
PFHxS	1,810	1.96	1580	79.4	<1.65	883	8,530	872	1.39 J	22.3	NT	NT
PFOS	1,120	0.817	1040	19.4	<1.81	798	11,400	424	<1.79	0.955 J	675	416
PFDS	<2.18	<1.81	<1.77	<1.68	<1.76	<1.79	<1.78	<1.75	<1.73	<1.72	NT	NT
PFOSA	<2.09	<1.74	0.966	<1.61	<1.69	2.69	36.9	<1.67	<1.66	<1.65	NT	NT
PFOA + PFOS	1624	0.817	0.966	0	0	2.69	36.9	0	0	2.275	696	429.4

Source: GEL Laboratories, LLC Sample Delivery Group 459957
Refer to Table 1 for PFAS names.
Results provided by and published with permission of Art Schaap, landowner.
ng/L = Nanograms per liter
GW = Groundwater
DW = Drinking water
J = Concentration is below the reporting limit and is considered an estimate
NT = Analyte was not tested for

Table 16. PFAS in NMED Water Samples from Cannon AFB Water Supply

Analyte	Concentration (ng/L)					
	CAFB Entry Point 1	CAFB Entry Point 4	CAFB Well 3	CAFB Well 8	CAFB Well 9	CAFB Well 12
Sample Date	11/6/2018	11/6/2018	3/7/2019	3/7/2019	3/7/2019	3/7/2019
Sample Media	DW	DW	GW	GW	GW	GW
PFHxA	NT	NT	23	ND	ND	17
PFHpA	ND	ND	3.9	ND	ND	3
PFOA	ND	ND	ND	ND	ND	ND
PFNA	ND	ND	ND	ND	ND	ND
PFDA	NT	NT	ND	ND	ND	ND
PFUnA	NT	NT	ND	ND	ND	ND
PFDoA	NT	NT	ND	ND	ND	ND
PFTriA	NT	NT	ND	ND	ND	ND
PFTeA	NT	NT	ND	ND	ND	ND
PFBS	ND	ND	9.3	ND	ND	6.5
PFHxS	ND	ND	8.4	ND	ND	7
PFHpS	NT	NT	ND	ND	ND	ND
PFOS	ND	ND	ND	ND	ND	ND
NMeFOSAA	NT	NT	ND	ND	ND	ND
NEtFOSAA	NT	NT	ND	ND	ND	ND
Total PFAS	0	0	44.6	0	0	33.5
PFOA+PFOS	0	0	0	0	0	0

Source: NMED, 2019c
Refer to Table 1 for PFAS names.
2018 samples analyzed by AnaTek using EPA method 537; 2019 samples analyzed by TestAmerica using EPA method 537 modified (M)
ng/L = Nanograms per liter
DW = Drinking water
GW = Groundwater
NT = Not tested
ND = Not detected

Table 17. PFAS in NMED Water Samples from Clovis Area, November 2018

Location	Matrix	Sample Date	Concentration (ng/L)					
			PFHpA	PFOA	PFNA	PFBS	PFHxS	PFOS
Allsups 45 Treat Plant 1	DW	11/5/2018	ND	ND	ND	ND	ND	ND
Clovis West Treat Unit 1	DW	11/5/2018	ND	ND	ND	ND	ND	ND
Desert Ranch MDWCA SS1	DW	11/5/2018	ND	ND	ND	ND	ND	ND
Travelers World CG Well 1	DW	11/5/2018	ND	ND	ND	ND	ND	ND
Turquoise Estates Water Co-op Well 1	DW	11/5/2018	ND	ND	ND	ND	9.21	ND
Turquoise Estates Water Co-op Well 1 retest	DW	11/5/2018	ND	ND	ND	ND	7.15	ND
Turquoise Estates Water Co-op Well 3	DW	11/5/2018	ND	ND	ND	ND	ND	ND
EPCOR 22 EP	DW	11/7/2018	ND	ND	ND	ND	ND	ND
EPCOR Norris & Brady EP	DW	11/7/2018	ND	ND	ND	ND	ND	ND
EPCOR N 40 ep	DW	11/7/2018	ND	ND	ND	ND	ND	ND
EPCOR Thomas & Brady EP	DW	11/7/2018	ND	ND	ND	ND	ND	ND
EPCOR Well 13 EP	DW	11/7/2018	ND	ND	ND	ND	ND	ND
EPCOR Well 17 EP	DW	11/7/2018	ND	ND	ND	ND	ND	ND
EPCOR Well 20 EP	DW	11/7/2018	ND	ND	ND	ND	ND	ND
EPCOR Well 205 EP	DW	11/7/2018	ND	ND	ND	ND	ND	ND
EPCOR Mesa EP	DW	11/7/2018	ND	ND	ND	ND	ND	ND
EPCOR Sandia EP	DW	11/7/2018	ND	ND	ND	ND	ND	ND

Source: NMED, 2019c
Refer to Table 1 for PFAS names.
ng/L = Nanograms per liter
DW = Drinking water
ND = Not detected

Table 18. PFAS in NMDOH Water Samples from Clovis Area, February 2019

Analyte	Concentration (ng/L)				
	TEWC Distribution	Domestic Well CL1	Domestic Well CL2	Domestic Well CL4	Domestic Well CL5
Matrix	*DW*	*GW*	*GW*	*GW*	*GW*
Sample Date	*2/27/2019*	*2/27/2019*	*2/27/2019*	*2/27/2019*	*2/27/2019*
PFBA	9.1	ND	10	ND	ND
PFPeA	16	ND	25	ND	ND
PFHxA	21	ND	27	ND	ND
PFHpA	2.4	ND	ND	ND	ND
PFOA	ND	ND	ND	ND	ND
PFNA	ND	ND	ND	ND	ND
PFDA	ND	ND	ND	ND	ND
PFUnA	ND	ND	ND	ND	ND
PFDoA	ND	ND	ND	ND	ND
PFTriA	ND	ND	ND	ND	ND
PFTeA	ND	ND	ND	ND	ND
PFBS	5.3	ND	14	ND	ND
PFHxS	9.6	ND	11	ND	ND
PFHpS	ND	ND	ND	ND	ND
PFOS	ND	ND	ND	ND	ND
PFDS	ND	ND	ND	ND	ND
PFOSA	ND	ND	ND	ND	ND
6:2 FTS	ND	ND	ND	ND	ND
8:2 FTS	ND	ND	ND	ND	ND
NMeFOSAA	ND	ND	ND	ND	ND
NEtFOSAA	ND	ND	ND	ND	ND
Total PFAS	63	0	87	0	0

Refer to Table 1 for list of PFAS names.
ng/L = Nanograms per liter
ND = Not detected

Table 19. PFAS in Water Samples from EPCOR System

Location ID	Sample Date	Concentration (ng/L)	
		PFOS + PFOA	Total PFAS
EPDS North 40	8/21/2019	2.2	4.4
EPDS North 40	9/16/2019	4.7	7.2
EPDS Well 20	8/21/2019	ND	40
EPDS Well 20	9/16/2019	ND	47.2
EPDS Well 205	8/21/2019	ND	6.3
EPDS Well 205	9/16/2019	ND	3.5
Well 10	10/9/2019	19.9	29.8
Well 10	11/14/2019	13.1	13.1
Well 103	10/9/2019	7.4	16.6
Well 103	11/14/2019	7.7	17.4
Well 11	11/14/2019	ND	ND
Well 15	11/14/2019	ND	ND
Well 18	10/9/2019	2.2	2.2
Well 18	11/14/2019	ND	ND
Well 19	10/9/2019	9.8	26.4
Well 19	11/14/2019	11	26.5
Well 201	10/9/2019	10	10
Well 201	11/14/2019	ND	ND
Well 37	10/9/2019	2.5	2.5
Well 37	11/14/2019	ND	ND
Well 4	11/14/2019	ND	ND
Well 7	10/9/2019	5.5	21.1
Well 7	11/14/2019	7.1	19.4
Well 8	10/9/2019	ND	ND
Well 8	11/14/2019	ND	ND
Well 9	11/14/2019	7.9	12.2

Source: PBS, 2020
Refer to Table 1 for list of PFAS names.
ng/L = Nanograms per liter
ND = Not detected

Table 20. PFAS in USGS Groundwater Samples
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Analyte	Concentration (ng/L)											
	GS-1	GS-2	GS-2	GS-3	GS-3	GS-4	GS-5	GS-6	GS-7	GS-7	GS-8	GS-9
Sample Date	*5/19/2021*	*1/12/2021*	*10/14/2021*	*2/8/2021*	*5/12/2021*	*5/19/2021*	*5/19/2021*	*5/19/2021*	*2/10/2021*	*5/12/2021*	*5/13/2021*	*5/18/2021*
Sample Type	*N*	*N*	*N*	*N*	*N*	*N*	*N*	*N*	*N*	*N*	*N*	*N*
PFBA	<3.8	7.4	5.5	<4.0	<3.6	<3.8	<3.8	<3.6	<3.6	<4.3	<3.6	<3.7
PFPeA	<1.9	13	9.4	<2.0	<1.8	<1.9	<1.9	<1.8	<1.8	<2.2	<1.8	<1.9
PFHxA	<1.9	10	7	<2.0	<1.8	<1.9	<1.9	<1.8	<1.8	<2.2	<1.8	<1.9
PFHpA	<1.9	<1.9	<1.8	<2.0	<1.8	<1.9	<1.9	<1.8	<1.8	<2.2	<1.8	<1.9
PFOA	<1.9	<1.9	<1.8	<2.0	<1.8	<1.9	<1.9	<1.8	<1.8	<2.2	<1.8	<1.9
PFNA	<1.9	<1.9	<1.8	<2.0	<1.8	<1.9	<1.9	<1.8	<1.8	<2.2	<1.8	<1.9
PFDA	<1.9	<1.9	<1.8	<2.0	<1.8	<1.9	<1.9	<1.8	<1.8	<2.2	<1.8	<1.9
PFUnDA	<1.9	<1.9	<1.8	<2.0	<1.8	<1.9	<1.9	<1.8	<1.8	<2.2	<1.8	<1.9
PFDoDA	<1.9	<1.9	<1.8	<2.0	<1.8	<1.9	<1.9	<1.8	<1.8	<2.2	<1.8	<1.9
PFTrDA	<1.9	<1.9	<1.8	<2.0	<1.8	<1.9	<1.9	<1.8	<1.8	<2.2	<1.8	<1.9
PFTeDA	<1.9	<1.9	<1.8	<2.0	<1.8	<1.9	<1.9	<1.8	<1.8	<2.2	<1.8	<1.9
PFBS	<1.9	6.5	4.2	<2.0	<1.8	<1.9	<1.9	<1.8	<1.8	<2.2	<1.8	<1.9
PFPeS	<1.9	1.5	1.2	<2.0	<1.8	<1.9	<1.9	<1.8	<1.8	<2.2	<1.8	<1.9
PFHxS	<1.9	2.9	1.5	<2.0	<1.8	<1.9	<1.9	<1.8	<1.8	<2.2	<1.8	<1.9
PFHpS	<1.9	<1.9	<1.8	<2.0	<1.8	<1.9	<1.9	<1.8	<1.8	<2.2	<1.8	<1.9
PFOS	<1.9	<1.9	<1.8	<2.0	<1.8	<1.9	<1.9	<1.8	<1.8	<2.2	<1.8	<1.9
PFNS	<1.9	<1.9	<1.8	<2.0	<1.8	<1.9	<1.9	<1.8	<1.8	<2.2	<1.8	<1.9
PFDS	<1.9	<1.9	<1.8	<2.0	<1.8	<1.9	<1.9	<1.8	<1.8	<2.2	<1.8	<1.9
PFOSA	<3.8	<3.8	<3.6	<4.0	<3.6	<3.8	<3.8	<3.6	<3.6	<4.3	<3.6	<3.7
4:2 FTS	<7.7	<7.7	<7.1	<8.0	<7.1	<7.7	<7.7	<7.1	<7.1	<8.7	<7.1	<7.4
6:2 FTS	<7.7	<7.7	<7.1	<8.0	<7.1	<7.7	<7.7	<7.1	<7.1	<8.7	<7.1	<7.4
8:2 FTS	<7.7	<7.7	<7.1	<8.0	<7.1	<7.7	<7.7	<7.1	<7.1	<8.7	<7.1	<7.4
N-MeFOSAA	<3.8	<3.8	<3.6	<4.0	<3.6	<3.8	<3.8	<3.6	<3.6	<4.3	<3.6	<3.7
N-EtFOSAA	<3.8	<3.8	<3.6	<4.0	<3.6	<3.8	<3.8	<3.6	<3.6	<4.3	<3.6	<3.7
HFPO-DA	<3.8	<3.8	<3.6	<4.0	<3.6	<3.8	<3.8	<3.6	<3.6	<4.3	<3.6	<3.7
11Cl-PF3OUdS	<7.7	<7.7	<7.1	<8.0	<7.1	<7.7	<7.7	<7.1	<7.1	<8.7	<7.1	<7.4
9Cl-PF3ONS	<7.7	<7.7	<7.1	<8.0	<7.1	<7.7	<7.7	<7.1	<7.1	<8.7	<7.1	<7.4
ADONA	<7.7	<7.7	<7.1	<8.0	<7.1	<7.7	<7.7	<7.1	<7.1	<8.7	<7.1	<7.4

Source: USGS, 2022 (Data extracted from National Water Information System (NWIS), accessed Feb 7, 2022)
Refer to Table 1 for PFAS names.
ng/L = Nanograms per liter
N = Primary environmental sample

Table 20. PFAS in USGS Groundwater Samples
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Analyte	Concentration (ng/L)											
	GS-10	GS-11	GS-12	GS-13	GS-13	GS-14	GS-15	GS-16	GS-17	GS-18	GS-19	GS-20
Sample Date	*5/18/2021*	*5/19/2021*	*5/17/2021*	*1/12/2021*	*10/14/2021*	*5/18/2021*	*5/13/2021*	*5/19/2021*	*5/19/2021*	*5/19/2021*	*6/3/2021*	*5/18/2021*
Sample Type	*N*	*N*	*N*	*N*	*N*	*N*	*N*	*N*	*N*	*N*	*N*	*N*
PFBA	<3.6	<4.0	<3.7	<4.3	<3.6	<4.0	<3.6	<3.7	<3.8	<3.7	<3.6	<3.6
PFPeA	<1.8	<2.0	<1.9	5	4.5	<2.0	1.5	<1.9	<1.9	2.4	<1.8	<1.8
PFHxA	<1.8	<2.0	<1.9	5.4	5.3	<2.0	0.9	<1.9	<1.9	1.6	<1.8	<1.8
PFHpA	<1.8	<2.0	<1.9	<2.2	<1.8	<2.0	<1.8	<1.9	<1.9	<1.9	<1.8	<1.8
PFOA	<1.8	<2.0	<1.9	<2.2	<1.8	<2.0	<1.8	<1.9	<1.9	<1.9	<1.8	<1.8
PFNA	<1.8	<2.0	<1.9	<2.2	<1.8	<2.0	<1.8	<1.9	<1.9	<1.9	<1.8	<1.8
PFDA	<1.8	<2.0	<1.9	<2.2	<1.8	<2.0	<1.8	<1.9	<1.9	<1.9	<1.8	<1.8
PFUnDA	<1.8	<2.0	<1.9	<2.2	<1.8	<2.0	<1.8	<1.9	<1.9	<1.9	<1.8	<1.8
PFDoDA	<1.8	<2.0	<1.9	<2.2	<1.8	<2.0	<1.8	<1.9	<1.9	<1.9	<1.8	<1.8
PFTrDA	<1.8	<2.0	<1.9	<2.2	<1.8	<2.0	<1.8	<1.9	<1.9	<1.9	<1.8	<1.8
PFTeDA	<1.8	<2.0	<1.9	<2.2	<1.8	<2.0	<1.8	<1.9	<1.9	<1.9	<1.8	<1.8
PFBS	<1.8	<2.0	<1.9	2	1.6	<2.0	1.2	<1.9	<1.9	<1.9	<1.8	<1.8
PFPeS	<1.8	<2.0	<1.9	<2.2	<1.8	<2.0	<1.8	<1.9	<1.9	<1.9	<1.8	<1.8
PFHxS	<1.8	<2.0	<1.9	3.4	5.1	<2.0	<1.8	<1.9	<1.9	<1.9	<1.8	<1.8
PFHpS	<1.8	<2.0	<1.9	<2.2	<1.8	<2.0	<1.8	<1.9	<1.9	<1.9	<1.8	<1.8
PFOS	<1.8	<2.0	<1.9	<2.2	<1.8	<2.0	<1.8	<1.9	<1.9	<1.9	<1.8	<1.8
PFNS	<1.8	<2.0	<1.9	<2.2	<1.8	<2.0	<1.8	<1.9	<1.9	<1.9	<1.8	<1.8
PFDS	<1.8	<2.0	<1.9	<2.2	<1.8	<2.0	<1.8	<1.9	<1.9	<1.9	<1.8	<1.8
PFOSA	<3.6	<4.0	<3.7	<4.3	<3.6	<4.0	<3.6	<3.7	<3.8	<3.7	<3.6	<3.6
4:2 FTS	<7.1	<8.0	<7.4	<8.7	<7.1	<8.0	<7.1	<7.4	<7.7	<7.4	<7.1	<7.1
6:2 FTS	<7.1	<8.0	<7.4	<8.7	<7.1	<8.0	<7.1	<7.4	<7.7	<7.4	<7.1	<7.1
8:2 FTS	<7.1	<8.0	<7.4	<8.7	<7.1	<8.0	<7.1	<7.4	<7.7	<7.4	<7.1	<7.1
N-MeFOSAA	<3.6	<4.0	<3.7	<4.3	<3.6	<4.0	<3.6	<3.7	<3.8	<3.7	<3.6	<3.6
N-EtFOSAA	<3.6	<4.0	<3.7	<4.3	<3.6	<4.0	<3.6	<3.7	<3.8	<3.7	<3.6	<3.6
HFPO-DA	<3.6	<4	<3.7	<4.3	<3.6	<4	<3.6	<3.7	<3.8	<3.7	<3.6	<3.6
11Cl-PF3OUdS	<7.1	<8.0	<7.4	<8.7	<7.1	<8.0	<7.1	<7.4	<7.7	<7.4	<7.1	<7.1
9Cl-PF3ONS	<7.1	<8.0	<7.4	<8.7	<7.1	<8.0	<7.1	<7.4	<7.7	<7.4	<7.1	<7.1
ADONA	<7.1	<8.0	<7.4	<8.7	<7.1	<8.0	<7.1	<7.4	<7.7	<7.4	<7.1	<7.1

Source: USGS, 2022 (Data extracted from National Water Information System (NWIS), accessed Feb 7, 2022)
Refer to Table 1 for PFAS names.
ng/L = Nanograms per liter
N = Primary environmental sample

Table 21. General Chemistry of USGS Groundwater Samples
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Analyte	Units	GS-1	GS-2	GS-2	GS-3	GS-3	GS-4	GS-5	GS-6	GS-7	GS-7	GS-8	GS-9	GS-9
Date		*5/19/2021*	*1/12/2021*	*10/14/2021*	*2/8/2021*	*5/12/2021*	*5/19/2021*	*5/19/2021*	*5/19/2021*	*2/10/2021*	*5/12/2021*	*5/13/2021*	*5/18/2021*	*6/1/2021*
Temperature	°C	19.1	18	18.4	16.9	17.9	18.5	18.1	18.2	18.6	18.5	18	17.4	18.8
Specific conductance	µS/cm @ 25°C	1,080	717	742	916	938	539	451	687	466	490	439	499	527
Hydrogen ion (calc)	mg/L	0.00005	0.00006	0.0001	0.00002	0.00003	0.00003	0.00004	0.00003	0.00002	0.00002	0.00002	0.00003	0.00002
Dissolved oxygen	mg/L	7.5	9.2	9.4	7.8	8	7.9	7.8	8.2	8.2	8.3	8	6.8	7.8
Dissolved oxygen	% of saturation	NA	113	NA	NA	NA	NA	NA	NA	103	NA	NA	84	98
pH (field)	pH units	7.3	7.3	7	7.8	7.5	7.6	7.5	7.5	7.8	7.7	7.7	7.5	7.6
pH (lab)	pH units	NA	8.4	NA	8.3	8.2	NA	NA	NA	8.4	NA	NA	NA	8.4
Carbon dioxide	mg/L	NA	31	NA	4.7	8.5	NA	NA	NA	6.5	7.2	NA	NA	8.3
Carbonate (field)	mg/L	NA	0.7	NA	0.3	0.2	NA	NA	NA	0.5	0.8	NA	NA	0.5
Bicarbonate (field)	mg/L	NA	353	NA	182	178	NA	NA	NA	230	224	NA	NA	213
Ammonia (diss)	mg/L as N	NA	<0.02	NA	NA	<0.02	NA	NA	NA	NA	<0.02	NA	NA	NA
Nitrite (diss)	mg/L as N	NA	<0.001	NA	NA	<0.001	NA	NA	NA	NA	<0.001	NA	NA	NA
Nitrate (diss)	mg/L as N	NA	8.29	NA	NA	4.97	NA	NA	NA	NA	2.23	NA	NA	NA
Nitrate + nitrite (diss)	mg/L as N	NA	8.29	NA	NA	4.97	NA	NA	NA	NA	2.23	NA	NA	NA
Orthophosphate	mg/L	NA	0.027	NA	NA	0.025	NA	NA	NA	NA	0.033	NA	NA	NA
Orthophosphate (diss)	mg/L as P	NA	0.009	NA	NA	0.008	NA	NA	NA	NA	0.011	NA	NA	NA
Organic carbon (diss)	mg/L	NA	0.65	NA	NA	0.67	NA	NA	NA	NA	0.42	NA	NA	NA
Hardness	mg/L as $CaCO_3$	NA	334	NA	325	343	NA	NA	NA	172	NA	NA	NA	180
Noncarb hardness (diss)	mg/L as $CaCO_3$	NA	43	NA	175	197	NA	NA	NA	NA	NA	NA	NA	5
Calcium (diss)	mg/L	NA	53.8	NA	52.2	56.1	NA	NA	NA	27.3	NA	NA	NA	28.2
Magnesium (diss)	mg/L	NA	48.4	NA	47.2	49.2	NA	NA	NA	25.3	NA	NA	NA	26.6
Sodium (diss)	mg/L	NA	36.3	NA	51	54.8	NA	NA	NA	36.3	NA	NA	NA	40.5
SAR	ratio	NA	0.87	NA	1.23	1.29	NA	NA	NA	1.2	NA	NA	NA	1.31
Sodium (frac of cations)	percent	NA	19	NA	25	25	NA	NA	NA	30	NA	NA	NA	32
Potassium (diss)	mg/L	NA	10.1	NA	9.16	9.67	NA	NA	NA	7.13	NA	NA	NA	7.68
Chloride (diss)	mg/L	NA	30.1	NA	123	129	NA	NA	NA	19.7	NA	NA	NA	31.5
Sulfate (diss)	mg/L	NA	53	NA	114	121	NA	NA	NA	29.6	NA	NA	NA	39.6
Fluoride (diss)	mg/L	NA	1.26	NA	1.78	1.96	NA	NA	NA	2.21	NA	NA	NA	2.27
Arsenic (diss)	µg/L	NA	2.3	NA	2.9	3.1	NA	NA	NA	4.4	NA	NA	NA	4.1
Barium (diss)	µg/L	NA	135	NA	43.2	44.7	NA	NA	NA	88.5	NA	NA	NA	65.9
Beryllium (diss)	µg/L	NA	<0.010	NA	<0.010	<0.010	NA	NA	NA	<0.010	NA	NA	NA	<0.010
Boron (diss)	µg/L	NA	115	NA	154	156	NA	NA	NA	136	NA	NA	NA	NA
Cadmium (diss)	µg/L	NA	<0.030	NA	<0.030	<0.030	NA	NA	NA	<0.030	NA	NA	NA	0.056

Notes are provided at the end of the table.

Table 21. General Chemistry of USGS Groundwater Samples
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Analyte	Units	GS-1	GS-2	GS-2	GS-3	GS-3	GS-4	GS-5	GS-6	GS-7	GS-7	GS-8	GS-9	GS-9
Date		*5/19/2021*	*1/12/2021*	*10/14/2021*	*2/8/2021*	*5/12/2021*	*5/19/2021*	*5/19/2021*	*5/19/2021*	*2/10/2021*	*5/12/2021*	*5/13/2021*	*5/18/2021*	*6/1/2021*
Chromium (diss)	µg/L	NA	<0.50	NA	<0.50	<0.50	NA	NA	NA	1.4	NA	NA	NA	0.98
Copper (diss)	µg/L	NA	4.7	NA	2.1	1.6	NA	NA	NA	<0.40	NA	NA	NA	0.97
Iron (diss)	µg/L	NA	<5.0	NA	<5.0	5.1	NA	NA	NA	<5.0	NA	NA	NA	7.3
Lead (diss)	µg/L	NA	0.743	NA	<0.040	0.024	NA	NA	NA	0.518	NA	NA	NA	0.043
Manganese (diss)	µg/L	NA	0.36	NA	1.63	1.07	NA	NA	NA	0.2	NA	NA	NA	1.47
Molybdenum (diss)	µg/L	NA	1.43	NA	4.02	4	NA	NA	NA	5.5	NA	NA	NA	7.71
Nickel (diss)	µg/L	NA	<0.20	NA	0.27	<0.20	NA	NA	NA	<0.20	NA	NA	NA	<0.20
Silver (diss)	µg/L	NA	<1.00	NA	<2.00	<1.00	NA	NA	NA	<1.00	NA	NA	NA	<1.00
Vanadium (diss)	µg/L	NA	14	NA	16.2	16.5	NA	NA	NA	19.2	NA	NA	NA	20.1
Zinc (diss)	µg/L	NA	9.7	NA	16	9.2	NA	NA	NA	9.9	NA	NA	NA	132
Antimony (diss)	µg/L	NA	<0.060	NA	<0.060	0.065	NA	NA	NA	<0.060	NA	NA	NA	<0.060
Aluminum (diss)	µg/L	NA	<3	NA	<3	<3	NA	NA	NA	<3	NA	NA	NA	<3
Selenium (diss)	µg/L	NA	2	NA	11	11.4	NA	NA	NA	2.4	NA	NA	NA	4.2
Tritium	pCi/L	NA	7.9	NA	2.01	NA	NA	NA	NA	R 0.14	NA	NA	NA	NA
Uranium (diss)	µg/L	NA	13.5	NA	6.14	5.72	NA	NA	NA	6.68	NA	NA	NA	6.02
Alkalinity	mg/L as $CaCO_3$	NA	291	NA	150	146	NA	NA	NA	190	185	NA	NA	176
Dissolved solids (dried at 180°C)	mg/L	NA	450	NA	563	575	NA	NA	NA	294	NA	NA	NA	316
Dissolved solids (sum)	mg/L	NA	444	NA	489	532	NA	NA	NA	261	NA	NA	NA	282
Dissolved solids	tons/acre-ft	NA	0.61	NA	0.77	0.78	NA	NA	NA	0.4	NA	NA	NA	0.43
Ammonia (diss)	mg/L	NA	<0.026	NA	NA	<0.026	NA	NA	NA	NA	<0.026	NA	NA	NA
Nitrate (diss)	mg/L	NA	36.7	NA	NA	22	NA	NA	NA	NA	9.86	NA	NA	NA
Nitrite (diss)	mg/L as NO2	NA	<0.003	NA	NA	<0.003	NA	NA	NA	NA	<0.003	NA	NA	NA
delta H2/H1	per mil	–47.2	–42.9	NA	–46.7	–46.8	–43.4	–46.6	–44.6	–46.4	–47.2	–47	–49.1	NA
delta O-18/O-16	per mil	–6.61	–6.48	NA	–6.73	–6.73	–6.35	–6.78	–6.29	–6.87	–6.8	–7.11	–7.03	NA
Specific conductance (lab, unfilt)	µS/cm @ 25°C	NA	762	NA	926	933	NA	NA	NA	478	NA	NA	NA	530
ANC (fixed end pt lab)	mg/L as $CaCO_3$	NA	281	NA	149	150	NA	NA	NA	187	NA	NA	NA	184

Notes are provided at the end of the table.

Table 21. General Chemistry of USGS Groundwater Samples
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Analyte	Units	GS–10	GS–11	GS–12	GS–13	GS–13	GS–14	GS–15	GS–16	GS–17	GS–18	GS–19	GS–20	GS–21
Date		*5/18/2021*	*5/19/2021*	*5/17/2021*	*1/12/2021*	*10/14/2021*	*5/18/2021*	*5/13/2021*	*5/19/2021*	*5/19/2021*	*5/19/2021*	*6/3/2021*	*5/18/2021*	*5/13/2021*
Temperature	°C	18	18.5	18.2	18.8	19.4	18	18.3	17.8	19.7	16.5	18.8	18.4	18
Specific conductance	µS/cm @ 25°C	590	690	709	690	721	823	515	644	759	657	454	415	438
Hydrogen ion (calc)	mg/L	0.00002	0.00005	0.00002	0.00003	0.00002	0.00005	0.00002	0.00003	0.00005	0.00005	0.00002	0.00002	0.00002
Dissolved oxygen	mg/L	8	8	8	7.3	7	7.8	8	7.4	8.2	7.1	8	7.6	7.8
Dissolved oxygen	% of saturation	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ph (field)	pH units	7.6	7.3	7.8	7.5	7.7	7.3	7.6	7.6	7.3	7.3	7.6	7.7	7.7
Ph (lab)	pH units	8.3	NA	NA	8.3	NA	8.5	NA	NA	NA	NA	NA	8.4	NA
Carbon dioxide	mg/L	6.8	NA	NA	10	NA	17	NA	NA	NA	NA	NA	8.2	NA
Carbonate (field)	mg/L	0.5	NA	NA	0.6	NA	0.5	NA	NA	NA	NA	NA	0	NA
Bicarbonate (field)	mg/L	182	NA	NA	191	NA	199	NA	NA	NA	NA	NA	226	NA
Ammonia (diss)	mg/L as N	<0.02	NA	NA	<0.02	NA	<0.02	NA	NA	NA	NA	NA	<0.02	NA
Nitrite (diss)	mg/L as N	<0.001	NA	NA	0.001	NA	<0.001	NA	NA	NA	NA	NA	<0.001	NA
Nitrate (diss)	mg/L as N	2.03	NA	NA	8.02	NA	7.71	NA	NA	NA	NA	NA	2.6	NA
Nitrate + nitrite (diss)	mg/L as N	2.03	NA	NA	8.02	NA	7.71	NA	NA	NA	NA	NA	2.6	NA
Orthophosphate	mg/L	0.034	NA	NA	0.021	NA	0.03	NA	NA	NA	NA	NA	0.024	NA
Orthophosphate (diss)	mg/L as P	0.011	NA	NA	0.007	NA	0.01	NA	NA	NA	NA	NA	0.008	NA
Organic carbon (diss)	mg/L	0.34	NA	NA	0.55	NA	0.63	NA	NA	NA	NA	NA	<0.23	NA
Hardness	mg/L as $CaCO_3$	214	NA	NA	263	NA	319	NA	NA	NA	NA	NA	NA	NA
Noncarb hardness (diss)	mg/L as $CaCO_3$	64	NA	NA	106	NA	155	NA	NA	NA	NA	NA	166	NA
Calcium (diss)	mg/L	34.3	NA	NA	43.9	NA	52.5	NA	NA	NA	NA	NA	27.3	NA
Magnesium (diss)	mg/L	31.2	NA	NA	37.2	NA	45.6	NA	NA	NA	NA	NA	23.8	NA
Sodium (diss)	mg/L	43	NA	NA	45.2	NA	50.2	NA	NA	NA	NA	NA	29.8	NA
SAR	ratio	1.28	NA	NA	1.21	NA	1.22	NA	NA	NA	NA	NA	1.01	NA
Sodium (frac of cations)	percent	29	NA	NA	26	NA	25	NA	NA	NA	NA	NA	27	NA
Potassium (diss)	mg/L	7.89	NA	NA	8.32	NA	9.65	NA	NA	NA	NA	NA	6.94	NA
Chloride (diss)	mg/L	57.5	NA	NA	81.8	NA	92.9	NA	NA	NA	NA	NA	9.21	NA
Sulfate (diss)	mg/L	48.2	NA	NA	60.4	NA	106	NA	NA	NA	NA	NA	16	NA
Fluoride (diss)	mg/L	2.18	NA	NA	2.01	NA	1.89	NA	NA	NA	NA	NA	2.63	NA
Arsenic (diss)	µg/L	3.7	NA	NA	2.4	NA	3	NA	NA	NA	NA	NA	3.5	NA
Barium (diss)	µg/L	64.9	NA	NA	72.4	NA	114	NA	NA	NA	NA	NA	128	NA
Beryllium (diss)	µg/L	<0.010	NA	NA	<0.010	NA	<0.010	NA	NA	NA	NA	NA	<0.010	NA
Boron (diss)	µg/L	139	NA	NA	144	NA	156	NA	NA	NA	NA	NA	118	NA
Cadmium (diss)	µg/L	<0.030	NA	NA	<0.030	NA	<0.030	NA	NA	NA	NA	NA	<0.030	NA

Notes are provided at the end of the table.

Table 21. General Chemistry of USGS Groundwater Samples
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Analyte	Units	GS–10	GS–11	GS–12	GS–13	GS–13	GS–14	GS–15	GS–16	GS–17	GS–18	GS–19	GS–20	GS–21
Date		*5/18/2021*	*5/19/2021*	*5/17/2021*	*1/12/2021*	*10/14/2021*	*5/18/2021*	*5/13/2021*	*5/19/2021*	*5/19/2021*	*5/19/2021*	*6/3/2021*	*5/18/2021*	*5/13/2021*
Chromium (diss)	µg/L	0.66	NA	NA	<0.50	NA	0.59	NA	NA	NA	NA	NA	0.8	NA
Copper (diss)	µg/L	1.9	NA	NA	3.2	NA	1.3	NA	NA	NA	NA	NA	2.7	NA
Iron (diss)	µg/L	9.6	NA	NA	71.9	NA	<5.0	NA	NA	NA	NA	NA	5.6	NA
Lead (diss)	µg/L	0.389	NA	NA	0.09	NA	<0.020	NA	NA	NA	NA	NA	0.194	NA
Manganese (diss)	µg/L	0.98	NA	NA	22.8	NA	0.21	NA	NA	NA	NA	NA	0.64	NA
Molybdenum (diss)	µg/L	5.13	NA	NA	3.29	NA	3.37	NA	NA	NA	NA	NA	3.86	NA
Nickel (diss)	µg/L	0.25	NA	NA	0.37	NA	<0.20	NA	NA	NA	NA	NA	<0.20	NA
Silver (diss)	µg/L	<1.00	NA	NA	<1.00	NA	<1.00	NA	NA	NA	NA	NA	<1.00	NA
Vanadium (diss)	µg/L	19.2	NA	NA	10.3	NA	15.4	NA	NA	NA	NA	NA	24.8	NA
Zinc (diss)	µg/L	139	NA	NA	132	NA	13.8	NA	NA	NA	NA	NA	48.1	NA
Antimony (diss)	µg/L	<0.060	NA	NA	<0.060	NA	<0.060	NA	NA	NA	NA	NA	<0.060	NA
Aluminum (diss)	µg/L	<3	NA	NA	<3	NA	<3	NA	NA	NA	NA	NA	<3	NA
Selenium (diss)	µg/L	6.2	NA	NA	5.1	NA	7.7	NA	NA	NA	NA	NA	1.1	NA
Tritium	pCi/L	0.29	NA	NA	3.5	NA	2.15	NA	NA	NA	NA	NA	0.31	NA
Uranium (diss)	µg/L	4.83	NA	NA	5.96	NA	6.85	NA	NA	NA	NA	NA	5.8	NA
Alkalinity	mg/L as $CaCO_3$	150	NA	NA	157	NA	164	NA	NA	NA	NA	NA	186	NA
Dissolved solids (dried at 180°C)	mg/L	365	NA	NA	419	NA	528	NA	NA	NA	NA	NA	256	NA
Dissolved solids (sum)	mg/L	324	NA	NA	409	NA	491	NA	NA	NA	NA	NA	239	NA
Dissolved solids	tons/acre-ft	0.5	NA	NA	0.57	NA	0.72	NA	NA	NA	NA	NA	0.35	NA
Ammonia (diss)	mg/L	<0.026	NA	NA	<0.026	NA	<0.026	NA	NA	NA	NA	NA	<0.026	NA
Nitrate (diss)	mg/L	8.97	NA	NA	35.5	NA	34.1	NA	NA	NA	NA	NA	11.5	NA
Nitrite (diss)	mg/L as NO2	<0.003	NA	NA	0.005	NA	<0.003	NA	NA	NA	NA	NA	<0.003	NA
delta H2/H1	per mil	–47.6	–47.4	–47.1	–42.2	NA	–46.8	–46.6	–48.6	–46.5	–45.1	–47.3	–44.2	–47.5
delta O-18/O-16	per mil	–6.84	–6.71	–6.74	–5.98	NA	–6.7	–6.97	–6.73	–6.71	–6.55	–7.24	–6.57	–7.16
Specific conductance (lab, unfilt)	µS/cm @ 25°C	610	NA	NA	732	NA	848	NA	NA	NA	NA	NA	436	NA
ANC (fixed end pt lab)	mg/L as $CaCO_3$	172	NA	NA	158	NA	168	NA	NA	NA	NA	NA	192	NA

µS/cm = Microsiemens per centimeter
mg/L = Milligrams per liter
µg/L = Micrograms per liter
NA = Not analyzed

Table 22. PFAS in Selected Off-Base DBS&A Water Samples

Analyte	Concentration (ng/L)									
	COS-10	*COS-11*	*COS-11 DUP*	*COS-14*	*COS-15*	*COS-15 DUP*	COS-16	COS-20	COS-22	DBS-1
Sample Date	*7/21/2021*	*7/21/2021*	*7/21/2021*	*7/21/2021*	*7/21/2021*	*7/21/2021*	7/21/2021	7/21/2021	7/21/2021	2/27/2022
PFBA	<4.08	538	539	18.4	116	118	10.6	<3.96	<4.16	2.18 J
PFPeA	1.50 J	1,460	1,900	59.8	412	410	38.7	<3.96	<4.16	<4.01
PFHxA	1.57 J	2,600	2,490	60.3	461	463	30.7	<3.96	<4.16	<4.01
PFHpA	<4.08	987	982	21.5	173	167	5.17	<3.96	<4.16	<4.01
PFOA	<4.08	2,300	2,030	47.7	443	418	16.6	<3.96	<4.16	<4.01
PFNA	<4.08	25.8	22.6	<4.04	6.54	6.62	<4.21	<3.96	<4.16	<4.01
PFDA	<4.08	<3.97	<3.81	<4.04	<4.13	<4.06	<4.21	<3.96	<4.16	<4.01
PFUnA	<4.08	<3.97	<3.81	<4.04	<4.13	<4.06	<4.21	<3.96	<4.16	<4.01
PFDoA	<4.08	<3.97	<3.81	<4.04	<4.13	<4.06	<4.21	<3.96	<4.16	<4.01
PFTrDA	<4.08	<3.97	<3.81	<4.04	<4.13	<4.06	<4.21	<3.96	<4.16	<4.01
PFTeDA	<4.08	<3.97	<3.81	<4.04	<4.13	<4.06	<4.21	<3.96	<4.16	<4.01
PFBS	<4.08	414	373	19.6	104	108	9.56	<3.96	<4.16	<4.01
PFPeS	<4.08	581	540	15.0	137	131	6.99	<3.96	<4.16	<4.01
PFHxS	3.22 J	9,260	11,400	175	1,360	1,370	53.6	<3.96	1.80 J	<4.01
PFHpS	<4.08	654	624	4.59	51.6	57.6	<4.21	<3.96	<4.16	<4.01
PFOS	3.02 J	15,100	13,500	158	1700	1,790	25.3	<3.96	<4.16	<4.01
4:2 FTS	<4.08	64.1	68.6	2.17 J	19.1	21.8	<4.21	<3.96	<4.16	<4.01
6:2 FTS	<4.08	3740	3,580	82.6	772	754	15.6	<3.96	<4.16	<4.01
8:2 FTS	<4.08	8.97	7.67	<4.04	<4.13	<4.06	<4.21	<3.96	<4.16	<4.01
NMeFOSAA	<4.08	<3.97	<3.81	<4.04	<4.13	<4.06	<4.21	<3.96	<4.16	<4.01
NEtFOSAA	<4.08	<3.97	<3.81	<4.04	<4.13	<4.06	<4.21	<3.96	<4.16	<4.01
HFPO-DA	<4.08	<3.97	<3.81	<4.04	<4.13	<4.06	<4.21	<3.96	<4.16	<4.01
PFMPA	<4.08	<3.97	<3.81	<4.04	<4.13	<4.06	<4.21	<3.96	<4.16	<4.01
PFMBA	<4.08	<3.97	<3.81	<4.04	<4.13	<4.06	<4.21	<3.96	<4.16	<4.01
NFDHA	<4.08	<3.97	<3.81	<4.04	<4.13	<4.06	<4.21	<3.96	<4.16	<4.01
11Cl-PF3OUdS	<4.08	<3.97	<3.81	<4.04	<4.13	<4.06	<4.21	<3.96	<4.16	<4.01
9Cl-PF3ONS	<4.08	<3.97	<3.81	<4.04	<4.13	<4.06	<4.21	<3.96	<4.16	<4.01
PFEESA	<4.08	<3.97	<3.81	<4.04	<4.13	<4.06	<4.21	<3.96	<4.16	<4.01
ADONA	<4.08	<3.97	<3.81	<4.04	<4.13	<4.06	<4.21	<3.96	<4.16	<4.01

Source: Vista Laboratory
Refer to Table 1 for PFAS names
ng/L = Nanograms per liter
J = Concentration above the level of detection (LOD), but below the level of quantitation (LOQ); value is considered an estimate

Table 23. General Chemistry of Selected DBS&A Water Samples
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Analyte	Analytical Method	Concentration (mg/L [a])										
		NMWQCC Standard	COS-10	COS-11	COS-11 DUP	COS-14	COS-15	COS-15 DUP	COS-16	COS-20	COS-22	DBS-1
Date			*7/21/2021*	*7/21/2021*	*7/21/2021*	*7/21/2021*	*7/21/2021*	*7/21/2021*	*7/21/2021*	*7/21/2021*	*7/21/2021*	*2/22/2022*
Aluminum (dissolved)	EPA 200.7	5.0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.020
Antimony (dissolved)	EPA 200.8		NT	NT	NT	NT	NT	NT	NT	NT	NT	<0.001
Arsenic (dissolved)	EPA 200.8	0.01	0.0065	0.0049	0.0048	0.0043	0.0055	0.0053	0.011	0.006	0.0046	0.0023
Barium (dissolved)	EPA 200.7	2.0	0.045	0.079	0.08	0.026	0.036	0.038	0.052	0.056	0.045	0.053
Beryllium (dissolved)	EPA 200.7		NT	NT	NT	NT	NT	NT	NT	NT	NT	<0.0020
Cadmium (dissolved)	EPA 200.7		NT	NT	NT	NT	NT	NT	NT	NT	NT	<0.0020
Calcium (dissolved)	EPA 200.7	—	32	35	34	40	40	40	41	41	53	62
Chromium (dissolved)	EPA 200.7	0.05	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.0060
Cobalt (dissolved)	EPA 200.7	0.05	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.0060
Copper (dissolved)	EPA 200.8	1.0	<0.001	<0.001	<0.001	<0.001	0.011	0.0013	0.0022	0.0013	<0.001	0.001
Iron (dissolved)	EPA 200.7	1.0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.046	<0.02	<0.02	<0.020
Lead (dissolved)	EPA 200.8	0.015	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Magnesium (dissolved)	EPA 200.7	—	31	35	34	39	40	42	40	39	50	59
Manganese (dissolved)	EPA 200.7	0.2	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.39	<0.002	<0.002	0.23 *
Molybdenum (dissolved)	EPA 200.7	1.0	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	NT
Nickel (dissolved)	EPA 200.7	0.2	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Potassium (dissolved)	EPA 200.7	—	5.8	6.6	6.6	7.3	6.8	7.3	24	7.2	7.7	9.8
Selenium (dissolved)	EPA 200.8	0.05	0.0046	0.0012	0.0016	0.0058	0.0057	0.0049	0.0053	0.0057	0.0077	0.012
Sodium (dissolved)	EPA 200.7	—	48	53	52	59	56	61	60	58	61	68
Uranium (dissolved)	EPA 200.8	0.03	0.0057	0.0092	0.0093	0.0067	0.0067	0.0067	0.0058	0.0056	0.0061	NT
Vanadium (dissolved)	EPA 200.7	—	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Zinc (dissolved)	EPA 200.7	10	0.020	0.014	<0.010	0.013	0.015	0.012	0.032	0.031	0.025	0.3
Mercury (total)			NT	NT	NT	NT	NT	NT	NT	NT	NT	<0.0002
Total Organic Carbon	SM5310B	—	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	6.4	<1.0	<1.0	17
Fluoride	EPA 300.0	1.6	**2.5**	**2.1**	**2.1**	**2.5**	**2.5**	**2.5**	**2.5**	**2.2**	**2.4**	2.1
Chloride	EPA 300.0	250	46	16	16	51	57	58	62	78	100	120
Bromide	EPA 300.0	—	0.3	0.11	0.11	0.34	0.35	0.35	<0.50	0.46	0.6	0.65
Phosphorus, Orthophosphate (as P)	EPA 300.0	—	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2.5
Sulfate	EPA 300.0	600	57	40	40	110	90	90	110	100	160	200
Nitrate+Nitrite as N	EPA 300.0	—	2.1	1.9	1.9	1.6	2.7	2.7	1.1	3.3	4.9	4.8
Total Kjeldahl Nitrogen	SM4500		NT	NT	NT	NT	NT	NT	NT	NT	NT	<1.0

Notes are provided at the end of the table.

Table 23. General Chemistry of Selected DBS&A Water Samples
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Analyte	Analytical Method	Concentration (mg/L [a])										
		NMWQCC Standard	COS-10	COS-11	COS-11 DUP	COS-14	COS-15	COS-15 DUP	COS-16	COS-20	COS-22	DBS-1
Date			*7/21/2021*	*7/21/2021*	*7/21/2021*	*7/21/2021*	*7/21/2021*	*7/21/2021*	*7/21/2021*	*7/21/2021*	*7/21/2021*	*2/22/2022*
Conductivity (µS/cm)	SM2510B	—	610	620	620	750	740	750	810	780	950	1,100
Bicarbonate (as CaCO3)	SM2320B	—	164	262.9	261.9	175.5	179.7	179.8	209.1	148.6	137.7	141.6
Carbonate (as CaCO3)	SM2320B	—	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Alkalinity (as CaCO3)	SM2320B	—	164	262.9	261.9	175.5	179.7	179.8	209.1	148.6	137.7	141.6
Total Dissolved Solids	SM2540C	1,000	368	358	374	436	422	432	474	474	566	650 *HD

Bold indicates that value exceeds the New Mexico Water Quality Control Commission (NMWQCC) standard (for groundwater of 10,000 mg/L TDS or less).

[a] Unless otherwise noted.

mg/L = Milligrams per liter

µS/cm = Microsiemens per centimeter

NT = Not tested

Table 24. Final Water Quality Field Parameters, Cannon AFB Monitor Wells, December 2021
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Location ID	Sample Date	Sample Type	Well Depth (feet btoc)	Depth to Water (feet btoc)	pH (s.u.)	Temperature (°C)	Specific Conductance (µS/cm)	Dissolved Oxygen (mg/L)	Oxidation/ Reduction Potential (mV)	Turbidity (NTU)
MW-A	12/8/2021	Groundwater	343	322.63	7.73	17.14	357	7.01	120	6.6
MW-B	12/9/2021	Groundwater	364.5	336.25	7.5	17.2	814	6.0	143	6.0
MW-Ca	12/9/2021	Groundwater	350	340.29	7.33	17.4	688	4.40	138.0	1.3
MW-D	12/8/2021	Groundwater	357	333.87 [a]	NR	NR	NR	NR	NR	NR
MW-E	12/7/2021	Groundwater	370	325.29	6.25	11.83	913	9.58	258	1.3
MW-Fa	12/7/2021	Groundwater	350	324.12	6.50	11.54	754	8.15	214	0.0
MW-Ga	12/8/2021	Groundwater	360	326.43	6.91	16.3	880	7.67	66	25.6
MW-H	12/8/2021	Groundwater	375	326.46	NR	NR	NR	NR	NR	NR
MW-Na	12/7/2021	Groundwater	358	315.69	6.79	15.62	693	8.98	111	21.9
MW-Oa	12/8/2021	Groundwater	365	327.43	6.64	14.83	826	6.36	251	0.3
MW-Pa	12/8/2021	Groundwater	360	320.28	7.03	16.53	827	6.01	145	0.7
MW-Rb	12/7/2021	Groundwater	350	320.21	7.31	16.12	659	8.63	159	4.9
MW-Sa	12/9/2021	Groundwater	362	338.13	7.37	17.11	877	4.5	100	413
MW-Ta	12/8/2021	Groundwater	366	337.22	NR	NR	NR	NR	NR	NR
MW-Ua	12/8/2021	Groundwater	366	336.61	7.04	16.61	739	6.87	95	182

Well depths from Bristol (2021)
Water level readings were made on 12/8/21, except well MW-V, which was measured 12/9/2021
Field parameters and water level measurements were collected by Bristol personnel and shared with DBS&A
[a] Bristol field notes indicate that meauring point elevation at MW-D is "suspect."

btoc = Below top of casing
s.u. = Standard units
µS/cm = Microsiemens per centimeter
mg/L = Milligrams per liter
mV = Millivolts
NTU = Nephelometric turbidity units
NR = Not recorded
NS = No sample collected at this location

Table 24. Final Water Quality Field Parameters, Cannon AFB Monitor Wells, December 2021
Page 2 of 2

Location ID	Sample Date	Sample Type	Well Depth (feet btoc)	Depth to Water (feet btoc)	pH (s.u.)	Temperature (°C)	Specific Conductance (µS/cm)	Dissolved Oxygen (mg/L)	Oxidation/ Reduction Potential (mV)	Turbidity (NTU)
MW-V	12/8/2021	Water Level Only	370	352.01	NS	NS	NS	NS	NS	NS
MW-W	12/7/2021	Groundwater	368	340.94	7.5	15.73	1200	8.51	158	0.3
MW-X	12/8/2021	Groundwater	365	293.91	NS	NS	NS	NS	NS	NS
MW-Y	12/8/2021	Water Level Only	357	325.07	NS	NS	NS	NS	NS	NS

Well depths from Bristol (2021)
Water level readings were made on 12/8/21, except well MW-V, which was measured 12/9/2021
Field parameters and water level measurements were collected by Bristol personnel and shared with DBS&A
[a] Bristol field notes indicate that meauring point elevation at MW-D is "suspect."

btoc = Below top of casing
s.u. = Standard units
µS/cm = Microsiemens per centimeter
mg/L = Milligrams per liter
mV = Millivolts
NTU = Nephelometric turbidity units
NR = Not recorded
NS = No sample collected at this location

Table 25a. PFAS in DBS&A Groundwater Samples from East and Southeast Monitor Wells

Analyte	Concentration (ng/L)																	
	MW-A	MW-B	MW-Ca	MW-D	MW-D (DUP)	MW-E	MW-Fa	MW-Ga	MW-H	MW-Na	MW-Oa	MW-Pa	MW-Rb	MW-Sa	MW-Ta	MW-Ua	MW-Ua DUP	MW-W
Sample Date	*12/8/2021*	*12/9/2021*	*12/9/2021*	*12/9/2021*	*12/9/2021*	*12/7/2021*	*12/6/2021*	*12/8/2021*	*12/9/2021*	*12/7/2021*	*12/8/2021*	*12/8/2021*	*12/7/2021*	*12/9/2021*	*12/9/2021*	*12/8/2021*	*12/8/2021*	*12/7/2021*
Sample Type	*N*	*N*	*N*	*N*	*FD*	*N*	*N*	*N*	*N*	*N*	*N*	*N*	*N*	*N*	*N*	*N*	*FD*	*N*
PFBA	17.3	25.4	711	346	358	14.3	2.33 J	15.2	41.5	<4.05	6.27	1.31 J	11.9	141	17.4	14.5	14.1	<3.99
PFPeA	22.9	32.9	2,630	1,200	1,190	24.1	2.79 J	37.6	152	<4.05	19.1	3.11 J	25.7	321	24.5	17.6	16.6	<3.99
PFHxA	18.9	35.9	2,810	1,260	1,220	13.5	7.12	19.6	91.2	<4.05	26.9	2.34 J	15.3	388	27.0	15.3	14.5	<3.99
PFHpA	8.27	<3.85	836	561	583	<3.97	<4.10	1.57 J	41.2	<4.05	3.58 J	<3.84	<3.96	29.3	<3.90	<3.96	<3.91	<3.99
PFOA	<3.85	<3.85	1,550	1,800	1,740	<3.97	<4.10	1.49 J	25.9	<4.05	3.56 J	<3.84	<3.96	124	<3.90	<3.96	<3.91	<3.99
PFNA	<3.85	<3.85	36.3	28.1	27.3	<3.97	<4.10	<3.88	2.47 J	<4.05	<3.84	<3.84	<3.96	<4.03	<3.90	<3.96	<3.91	<3.99
PFDA	<3.85	<3.85	<4.02	<3.89	<4.00	<3.97	<4.10	<3.88	<3.98	<4.05	<3.84	<3.84	<3.96	<4.03	<3.90	<3.96	<3.91	<3.99
PFUnA	<3.85	<3.85	<4.02	<3.89	<4.00	<3.97	<4.10	<3.88	<3.98	<4.05	<3.84	<3.84	<3.96	<4.03	<3.90	<3.96	<3.91	<3.99
PFDoA	<3.85	<3.85	<4.02	<3.89	<4.00	<3.97	<4.10	<3.88	<3.98	<4.05	<3.84	<3.84	<3.96	<4.03	<3.90	<3.96	<3.91	<3.99
PFTrDA	<3.85	<3.85	<4.02	<3.89	<4.00	<3.97	<4.10	<3.88	<3.98	<4.05	<3.84	<3.84	<3.96	<4.03	<3.90	<3.96	<3.91	<3.99
PFTeDA	<3.85	<3.85	<4.02	<3.89	<4.00	<3.97	<4.10	<3.88	<3.98	<4.05	<3.84	<3.84	<3.96	<4.03	<3.90	<3.96	<3.91	<3.99
PFBS	7.15	27.4	526	162	159	6.39	2.25 J	6.39	22.6	<4.05	10.3	1.05 J	4.76	148	16.1	18.3	18.4	<3.99
PFPeS	29.6	3.94	573	285	289	<3.97	<4.10	2.35 J	18.2	<4.05	8.28	<3.84	<3.96	86.6	4.00	1.60 J	1.60 J	<3.99
PFHxS	27.9	1.12 J	6,410	5,820	5,790	1.51 J	1.74 J	25.3	203	<4.05	49.3	4.72	<3.96	224	2.15 J	<3.96	<3.91	<3.99
PFHpS	<3.85	<3.85	1,190	102	110	<3.97	<4.10	<3.88	5.27	<4.05	<3.84	<3.84	<3.96	<4.03	<3.90	<3.96	<3.91	<3.99
PFOS	<3.85	<3.85	20,800	2,190	2,250	<3.97	<4.10	2.57 J	185	<4.05	<3.84	<3.84	<3.96	<4.03	<3.90	<3.96	<3.91	<3.99
6:2 FTS	<3.85	<3.85	5,160	1620	1,580	<3.97	<4.10	<3.88	68.6	<4.05	14.9	<3.84	<3.96	5.45	<3.90	<3.96	<3.91	<3.99
8:2 FTS	<3.85	<3.85	44.3	<3.89	<4.00	<3.97	<4.10	<3.88	<3.98	<4.05	<3.84	<3.84	<3.96	<4.03	<3.90	<3.96	<3.91	<3.99
MeFOSAA	<3.85	<3.85	<4.02	<3.89	<4.00	<3.97	<4.10	<3.88	<3.98	<4.05	<3.84	<3.84	<3.96	<4.03	<3.90	<3.96	<3.91	<3.99
EtFOSAA	<3.85	<3.85	<4.02	<3.89	<4.00	<3.97	<4.10	<3.88	<3.98	<4.05	<3.84	<3.84	<3.96	<4.03	<3.90	<3.96	<3.91	<3.99
HFPO-DA	<3.85	<3.85	<4.02	<3.89	<4.00	<3.97	<4.10	<3.88	<3.98	<4.05	<3.84	<3.84	<3.96	<4.03	<3.90	<3.96	<3.91	<3.99
PFMPA	<3.85	<3.85	<4.02	<3.89	<4.00	<3.97	<4.10	<3.88	<3.98	<4.05	<3.84	<3.84	<3.96	<4.03	<3.90	<3.96	<3.91	<3.99
PFMBA	<3.85	<3.85	<4.02	<3.89	<4.00	<3.97	<4.10	<3.88	<3.98	<4.05	<3.84	<3.84	<3.96	<4.03	<3.90	<3.96	<3.91	<3.99
NFDHA	<3.85	<3.85	<4.02	<3.89	<4.00	<3.97	<4.10	<3.88	<3.98	<4.05	<3.84	<3.84	<3.96	<4.03	<3.90	<3.96	<3.91	<3.99
4:2 FTS	<3.85	<3.85	56	26.6	23.8	<3.97	<4.10	<3.88	<3.98	<4.05	<3.84	<3.84	<3.96	7.15	<3.90	<3.96	<3.91	<3.99
11Cl-PF3OUdS	<3.85	<3.85	<4.02	<3.89	<4.00	<3.97	<4.10	<3.88	<3.98	<4.05	<3.84	<3.84	<3.96	<4.03	<3.90	<3.96	<3.91	<3.99
9Cl-PF3ONS	<3.85	<3.85	<4.02	<3.89	<4.00	<3.97	<4.10	<3.88	<3.98	<4.05	<3.84	<3.84	<3.96	<4.03	<3.90	<3.96	<3.91	<3.99
PFEESA	<3.85	<3.85	<4.02	<3.89	<4.00	<3.97	<4.10	<3.88	<3.98	<4.05	<3.84	<3.84	<3.96	<4.03	<3.90	<3.96	<3.91	<3.99
ADONA	<3.85	<3.85	<4.02	<3.89	<4.00	<3.97	<4.10	<3.88	<3.98	<4.05	<3.84	<3.84	<3.96	<4.03	<3.90	<3.96	<3.91	<3.99
PFOA + PFOS	0	0	1,716	124	124	0	0	4.06	27.87	0	3.56	0	0	124	0	0	0	0

Source: Vista, 2022, Sample Delivery Group 2112792
Refer to Table 1 for PFAS names.

ng/L = Nanograms per liter
N = Primary environmental sample
FD = Field duplicate sample
J = Concentration below the reporting limit and is considered an estimate

Table 25b. General Chemistry of DBS&A Water Samples from East and Southeast Monitor Wells

Analyte	Analytical Method	Concentration (mg/L [a])								
		MW-A	MW-B	MW-Ca	MW-D	MW-D (DUP)	MW-Sa	MW-Ta	MW-Ua	MW-Ua (DUP)
Date		*12/8/2021*	*12/9/2021*	*12/9/2021*	*12/9/2021*	*12/9/2021*	*12/9/2021*	*12/9/2021*	*12/8/2021*	*12/8/2021*
Calcium (dissolved)	EPA 200.7	21	46	38	27	27	51	43	40	39
Iron (dissolved)	EPA 200.7	<0.020	<0.020	<0.020	<0.020	<0.020	0.051	<0.020	0.047	0.042
Magnesium (dissolved)	EPA 200.7	20	42	36	26	26	48	39	37	35
Manganese (dissolved)	EPA 200.7	0.0071	<0.0020	0.0058	<0.0020	<0.0020	0.053	<0.0020	0.028	0.028
Potassium (dissolved)	EPA 200.7	4.1	6.5	6	5.2	5.3	7	6.5	6.2	6.1
Sodium (dissolved)	EPA 200.7	23	57	50	41	42	60	55	58	54
Organic Carbon, Total	SM5310B	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Fluoride	EPA 300.0	6.8	2.7	2	2.8	2.8	2.1	2.7	2.7	2.7
Chloride	EPA 300.0	0.68	62	23	12	12	79	39	69	69
Sulfate	EPA 300.0	19	150	36	32	32	120	170	110	110
Nitrate+Nitrite as N	EPA 300.0	<1.0	1.1	2.4	1.5	1.5	1.1	1.0	1.3	1.2
Specific Conductivity (µS/cm)	SM2510B	360	820	690	510	510	890	790	750	750
Total Alkalinity (as $CaCO_3$)	SM2320B	151.2	155.7	288.6	202	208.8	229.3	160.8	166.8	162.7
Total Dissolved Solids	SM2540C	216	486	392	280	300	490	462	448	452

[a] Unless otherwise noted.
mg/L = Milligrams per liter
µS/cm = Microsiemens per centimeter

Appendix A

Notice to Proceed

NEW MEXICO
ENVIRONMENT DEPARTMENT

Ground Water Quality Bureau

1190 St. Francis Drive / PO Box 5469
Santa Fe, NM 87502-5469
Phone (505) 827-2900 Fax (505) 827-2965
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Michelle Lujan Grisham
Governor

Howie C. Morales
Lieutenant Governor

James C. Kenney
Cabinet Secretary

Jennifer J. Pruett
Deputy Secretary

February 9, 2021

Mr. John R. Bunch, PG
Daniel B. Stephens & Associates, Inc.
6020 Academy Road NE, Suite 100
Albuquerque, NM 87109
Sent via email: jbunch@geo-logic.com

Re: Notice to Proceed – Phase I Remedial Investigation in the Vicinity of Cannon Air Force Base, Curry County, and Holloman Air Force Base, Otero County, New Mexico Contract #21-667-1210-00002

Dear Mr. Bunch:

The New Mexico Environment Department (NMED) has reviewed the Technical and Cost Proposal submitted by Daniel B. Stephens & Associates, Inc., dated January 28, 2021 for the completion of a Phase I Remedial Investigation (RI) in the vicinity of Cannon Air Force Base, Curry County, and Holloman Air Force Base, Otero County, New Mexico. NMED approves the Technical and Cost Proposal for this project as follows:

Task and Cost Summary for Cannon Air Force Base

Task No.	Description	Cost
1	Site Data Review and Site Visit	$12,528.00
2	Planning Documents	$18,310.00
3	Sampling Existing Water Supply Wells	$14,231.00
4	Drilling and Well Installation	$266,944.62
5	One Year of Quarterly GW Monitoring	$62,260.00
6	Phase 1 Progress Report	$19,950.00
7	Modeling	$9,051.25
	Subtotal:	$403,274.87
	New Mexico Gross Receipts Tax @ 7.8750%	$31,757.90
	Total:	**$435,032.77**

Task and Cost Summary for Holloman Air Force Base

Task No.	Description	Cost
1	Site Data Review and Site Visit	$12,470.00
2	Planning Documents	$18,310.00
3	Sampling Existing Water Supply Wells and Surface Water	$9,840.00
4	Drilling and Well Installation	$156,212.00
5	One Year of Quarterly GW Monitoring	$38,852.00
6	Phase 1 Progress Report	$19,950.00
7	Modeling	$9,051.25
8	Waterfowl and Small Mammal Survey	$185,800.00
	Subtotal:	$450,485.25
	New Mexico Gross Receipts Tax @ 7.8750%	$35,475.72
	Total:	**$485,960.97**

NMED has assigned work order # DBSA-PFAS to this work. This work order is approved based on a time and materials cost not to exceed the amount shown in the above Cost Summary. Enclosed is a copy of the approved work order for your files. The total budget approved for this work order shall not exceed $921,000.00 including New Mexico Gross Receipts Tax. This work will be completed by June 30, 2021, however, uncompleted work tasks may continue during State of New Mexico fiscal years (FY) 2022, 2023, 2024, and 2025, if approved by the New Mexico Legislature.

Prior approval from the NMED project manager is required before budget may be moved from between tasks or different labor categories. The use of any staff or subcontractors not specified in the approved Contractor Fee Schedule must be pre-approved in writing by NMED. Additional costs due to changes in the written technical proposal or task assignment must be approved by NMED in writing before the additional work commences.

Prior to submitting an invoice, Daniel B. Stephens & Associates, Inc. must first submit a summary of tasks performed or deliverables produced during the billing period. NMED will issue an acceptance of this summary and request for an invoice for the costs incurred for the reported tasks or deliverables. Each summary and invoice must identify the work order number, NMED subaccount code, activity code, and contract number.

Any activities performed or completed pursuant to this Notice to Proceed must comply with any and all applicable federal, state, or local laws, including but not limited to any orders issued in relation to any Public Health Orders in relation to the COVID-19 virus.

Please contact Dr. Patrick Longmire at (505) 699-9015 or patrick.longmire@state.nm.us if you have any questions about this request.

Sincerely,

Michelle Hunter

Digitally signed by Michelle Hunter
Date: 2021.02.09 15:43:46 -07'00'

Michelle Hunter, Bureau Chief
Ground Water Quality Bureau

cc: Patrick Longmire, GWQB
Stephanie Stringer, Director, RPD
Chris Catechis, Deputy Director, RPD
Miquella Lopez, Financial Manager, RPD
GWQB Reading File

Appendix B

Mapping the Base of the Ogallala Aquifer

DBS&A
Daniel B. Stephens & Associates, Inc.

Appendix B. Delineation of the Base of the Ogallala Aquifer

B-1. Introduction

NMED tasked DBS&A with mapping the elevation of the unconformity between the Ogallala Formation and the underlying redbeds of the Chinle Group to identify paleochannels eroded into the redbeds. As described in Section 3.2 of the Phase 1 Report, regional uplifting that occurred at the end of the Cretaceous resulted in the exposure and erosion of the Triassic sediments on the Southern High Plains. Braided streams emanating from the Rocky Mountains in central New Mexico filled deep channels in the exposed bedrock surface with coarse sands and gravels. In general, the sediments of the Ogallala Formation become finer-grained with distance from the source areas, but also vertically. The fine-grained redbeds of the Chinle Group form the base of the Ogallala Aquifer. The channels eroded into the redbeds are thought to generally control or influence the direction of groundwater flow in the Ogallala Aquifer, particularly as water levels in the Ogallala have declined through overpumping.

B-2. Previous Work

The following subsection describes the maps prepared by other investigators showing the elevation of the base of the Ogallala Formation (i.e., the top of the redbeds).

B-2.1 Cronin

Cronin (1969) mapped the elevation of the base of the Ogallala aquifer in the southern High Plains of west Texas and eastern New Mexico. A portion of Cronin's Plate 1 showing the elevation of the base of the aquifer in the area west of Clovis is included as Figure B-1. Mapping was done using a 50-foot contour interval and data points are not shown. The map shows a channel at the base of the aquifer that extends northwest from the Clovis Highway near the northeast corner of T35E, R1N, and crosses the ATSF rail line approximately 7 miles west of Clovis between Portair and Greer.

B-2.2 Hart and McAda

Hart and McAda (1985) updated the mapping of Cronin. A portion of Hart and McAda's map showing the elevation of the base of the aquifer in the area west of Clovis is shown on Figure B-2. Again, mapping was done using a 50-foot contour interval and data points are not shown. The contours in the area of interest are quite similar to Cronin's. The base map, however, includes the outline of Cannon Air Force Base (AFB) and major roads. The northwest-trending channel at the base of the Ogallala, highlighted on Figure 2, passes beneath the 90-degree corner at the intersection of Highway 467 (Curry Road North) and County Road 7, crosses into CAFB south of the North Playa Lake, exits CAFB at the south end of Highway 311, and continues northwest. Beneath CAFB there is a minor (short) channel segment that extends west across the base.

B-2.3 Akin and Jones

Akin and Jones (1979, as cited by Musharrafieh and Logan, 1999) reportedly mapped the base of the Ogallala on a regional basis, including the area around Cannon AFB using drilling records compiled in the OSE's database (Musharrafieh and Logan, 1999). A map from this unpublished report prepared for the New Mexico Interstate Stream Commission was used by Musharrafieh and Logan (1999) to show the configuration of the base of the Ogallala Formation and is provided as Figure B-3a. The contours from the Cannon AFB area of that regional map were digitized by Trinity (2012). The resulting figure was presented in Trinity's water sustainability report and is reproduced here as Figure B-3b. The data points for Figure B-3a are not shown, and the contour interval is 50 feet, too large to show any significant detail.

B-2.4 Trinity

For their 2012 water sustainability report, Trinity (2012) prepared a map of the elevation at the top of the redbeds. Trinity's Figure 3-25 is reproduced here as Figure B-4. Trinity's report includes a well construction table for 367 wells that they examined as part of their study. The Trinity table lists the depth to the redbed contact in feet below ground surface and notes whether the contact was inferred or known. The table lists known depth to the top of redbed for 43 wells, including the following:

- 10 production wells, 3 monitor wells (of 28 monitor wells existing at that time), and 2 geothermal (GTW) wells at Cannon AFB.
- One deep soil boring (EB-1) and one deep observation well (OW-1) installed by Trinity.

- A total of 26 off-site private wells.

The Trinity table also lists the inferred top of the redbed for 7 wells (6 monitor wells and 1 geothermal well).

Trinity (2012) determined the depth to the top of the redbed from lithologic logs and drilling reports that noted the intersection of the redbed. Personnel with the USGS, which installed some of the early monitor wells at the Base, indicated that 11 of those wells intersected the redbed (USGS, 2006). If not verified by the drilling log, Trinity used that information as "inferred." Trinity ran geophysical logs (natural gamma and induction) in 5 monitor wells (MW-F, Oa, V, W, and X) which show the top of the fine-grained redbeds to be present in wells Oa, W, and X. Trinity's geophysical logs are included as Appendix N to their report.

Ground surface elevations were derived by merging topographic data derived from a 2005 LIDAR survey of Cannon AFB. The 2005 survey, which extended approximately ½ mile to 1 mile beyond the Base boundary, had a vertical accuracy of less than 1 foot. Land surface elevations for data points outside of the survey area, were obtained from the USGS's Seamless Data Warehouse using the 1/3 arc-second National Elevation Dataset (NED). This dataset has a stated vertical accuracy of approximately 8 feet NAVD88. Except for the locations of wells on-base, which had been surveyed, the locations of most private wells were based on coordinates or descriptions in the databases, such as the OSE New Mexico Water Rights Reporting System (NMWRRS) or the USGS NWIS.

The elevation of the top of the redbeds (bottom of Ogallala) mapped by Trinity (Figure B-4) (Trinity, 2012) covered a rectangular area that extended approximately 3 miles to the north and south of the base, and approximately 5 miles to the east and west. However, for nearly 90 percent of the data points on the map, Trinity assumed every well intersected the redbeds and used the well depth as the top of the redbeds for nearly 85 percent (43 of 299) of the data points on the map.

Trinity's Table 3-30 indicates that top of redbed elevations were determined for 299 data points and ranged from 3,787 to 4,077 feet relative to the North American Vertical Datum of 1988 (NAVD88). The map shows two southeasterly trending channels beneath Cannon AFB, the axes of which are highlighted on Figure B-5. One generally trends southeast and enters the north end of Cannon AFB, then turns more southerly near the WWTP and intersects the second channel. The second channel also trends southeast towards the base, but turns east and traverses beneath the base to intersect with the north channel. The combined channel exits the

southeast side of the base and turns south parallel to the east side of the base. A minor channel intersects the combined channel where it exits the base. At the southeast corner of the base, the combined channel resumes a southeasterly path. The lowest point in this channel is approximately 3,787 feet NAVD88 near the southeast corner of the map.

B-2.5 AECOM

AECOM (2020) mapped the elevation of the top of the Dockum Group (the redbeds) in preparing a technical memorandum describing the conceptual site model for Cannon AFB. AECOM cited previous mapping by Gustavson and Holliday (1985), but the map in that report was compiled from Knowles et al. (1982) and Cronin (1969), with contours for New Mexico coming from the latter. AECOM used data from a total of 111 wells to contour the top of the redbeds, including data from the OSE NMWRRS and environmental investigations at Cannon AFB, but provide few details about the mapping effort or the wells evaluated. The map developed by AECOM is reproduced here as Figure B-5. The AECOM map does not include well identifiers or elevations, and the program used to contour the data shows channels extending to areas without any supporting data.

B-3. Current Effort

DBS&A has prepared a map showing the elevation at the base of Ogallala Aquifer in the project area, which is presented as Plate B-1. The mapped area includes Cannon AFB and extends about 1 mile to the north and south of the base, but is primarily focused on the area of the base and off-site to the east and southeast. A list of wells from which the depth to the base of Ogallala Aquifer (top of the redbed) was obtained is provided as Table B-1. The table includes well location, ground surface elevation, depth to the top of the redbed, and elevation at the top of the redbed.

B-3.1 Data Sources

The main sources of well information are hydrogeologic reports for Cannon AFB and well records in the OSE NMWRRS. Other sources of information used to prepare the map include well records and geophysical logs compiled by Trinity (2012) and deep soil borings and geophysical logs by the USGS (2020). These sources are described in the following section.

The New Mexico OSE maintains a database, the NMWRRS, that includes information on water rights and points-of-diversion (PODs) with links to drilling permits and well records and logs of exploratory borings, monitor wells, and water wells in the State of New Mexico. A variety of reports can be generated from this system, including a list of wells for which the OSE has received a well log. DBS&A queried a list of all wells in Curry County for which well logs were available. The list includes the POD number, public land survey system (PLSS) location (Section, Township, and Range), northing and easting coordinates in Universal Transverse Mercator (UTM), drill dates, well depth, and driller's name and license number. DBS&A used the PLSS information to focus the list to locations within Townships 1 and 2 North, and portions of Ranges 34, 35, and 36 East. Of the 258 logs obtained from the OSE database, all but 3 are from wells drilled after the 1980s.

Boring logs and geophysical logs for some of the production wells and monitor wells on Cannon AFB were obtained from the 2012 Trinity report. Logs for monitor wells at the base were also obtained from a 1987 compliance Inspection report (PRC and Versar, 1987), the 1995 monitoring well management plan (Unknown, 1995), the 2017 well abandonment report (FPM, 2017), and the addendum to the PFAS site inspection report (AFW, 2019). The boring logs for monitor wells at Cannon AFB that could be located are compiled in Appendix C.

The USGS conducted downhole geophysical logging of 21 existing monitor wells and 4 deep borings drilled by the USGS at Cannon AFB in April and May 2019 (USGS, 2020). Copies of the geophysical logs (see Appendix D) were submitted to NMED in February 2020 and were identified by DBS&A in the Hazardous Waste Bureau document repository for Cannon AFB. DBS&A also located an e-mail to NMED that explained the logging program and included a map showing the locations of the four deep borings (NMED, 2019). The 4 deep boring locations were selected by Cannon AFB to test the location of the paleochannel. DBS&A contacted the USGS to request lithologic logs for the 4 deep soil borings and learned that the USGS did not log the lithologies of the borings (Gebhardt, 2022).

B-3.2 Depths to the Base of Ogallala

Information on the depth to the bottom of the Ogallala Formation was obtained primarily from lithologic descriptions of borehole samples. For wells outside of Cannon AFB, Well Record & Log forms filed with the OSE by licensed drilling contractors were used. For wells and deep borings inside Cannon AFB, lithologic logs prepared by geologic consultants to the USAF and licensed drilling contractors were used. Logs for borings and wells on-base were compiled from various reports, but the most complete records, including some downhole geophysical logs,

were found in appendices to the Trinity (2012) report. DBS&A reviewed the geophysical logs from Trinity (2012) and USGS (2020) to identify logs showing significant increases in natural gamma curves indicating the presence of fine-grained sediments (i.e., the redbeds) beneath the Ogallala Formation. The geophysical logs and accurate lithologic logs that do not intersect the redbeds, particularly locations on Cannon AFB, were used to estimate the maximum elevation of the base of the aquifer.

DBS&A used the OSE POD Locations Online Mapping Tool in the NMWRRS to locate each of the locations of interest and to obtain and download OSE Well Records & Log forms (or similar driller's report forms) from the OSE files. The logs were then examined and where reported by the driller, the depth to the top of the redbed was noted. The assumption was made that the reported depth was accurate.

B-3.3 Well Locations

The locations for most (about 75 percent) of the wells in file downloaded from the OSE NMWRRS were estimated by the OSE based on the PLSS description provided in the driller's report. Those locations with estimated locations on Plate 1 are shown with a muted yellow and black well symbol. The lack of known well locations is a significant limiting factor in accurately mapping the base of the Ogallala Formation (top of the underlying redbeds). Ground truthing the well locations could be done, but would be time consuming and success would not be assured.

B-3.4 Ground Surface Elevation

Ground surface elevations for deep borings and wells on Cannon AFB were obtained from Table 3-20 Well Construction Summary, prepared by Trinity (2012). Those elevations were compared to elevations in Table 3.0-1, Monitoring Well Construction Details, prepared by AFW (2018) and the differences were 7 inches or less. Because Trinity provided more extensive information, those elevations were used to calculate the elevation of the base of the Ogallala on Cannon AFB. A number of wells have been installed at Cannon AFB since the Trinity report was completed. Elevations for those locations were taken from the 2018 AFW report.

Ground surface elevations for wells whose records were downloaded from the OSE were originally obtained from the USGS's National Map 3D Elevation Program (3DEP) Downloadable Data Collection with 1/3 arc-second (10 meter [m]) resolution. The spatial reference for these data is Universal Transverse Mercator (UTM) in units of meters, and in conformance with the

North American Datum of 1983 (NAD83). All ground surface elevation values are in meters and are referenced to the North American Vertical Datum of 1988 (NAVD88).

In early 2022, a 1-m DEM became available. The ground surface elevations for the 1-m and 10-m DEM were compared and the differences were negligible. Only 14 of 267 elevation values (5 percent) differed by more than 6 inches and the average difference was less than 1 inch (0.01 foot).

As a final check, elevations for deep borings, active monitor wells, geothermal wells, and several production wells at Cannon AFB were determined using the 1-m and 10-m DEMs and compared to surveyed elevations reported by Trinity (2012). Except for four locations (MW-Y, GTW-1, GTW-3, and CAFB-9) the difference between the two values range from -0.57 foot and 0.40 foot, and average 0.03 foot. The information reviewed indicate that the elevations from the DEMs are accurate for the intended use. Given the limiting factors described below, recalculating and recontouring the data using the surface elevations from the 1-m DEM would not significantly affect the results.

B-3.5 Creating the Map

Table 1 shows the well identifications and location information for 312 wells compiled from the sources described above. Also shown are the date completed, drill depth, and depth to the redbeds reported on well logs and geophysical logs. The ground surface elevation derived from the 10-m DEM and the calculated elevation of the top of the redbeds (the base of the Ogallala Formation) are also shown. The elevations at the base of the Ogallala Aquifer (i.e., the top of the Chinle Group redbeds) are shown on Plate B-1.

The well identifiers and calculated elevation to the top of the redbeds were plotted on Plate B-1. The well identifier for most locations is the POD number assigned by the OSE. To save space on the map, the prefix CC (for Curry County) was omitted from the map labels, and the acronym POD is abbreviated as P. Elevations were rounded to the nearest foot. The elevations were then contoured by hand at a 10-foot interval using linear interpolation and professional judgment.

B-3.6 Limiting Factors

The ability to accurately map the base of the Ogallala Aquifer is limited by the following:

- The depths to the base of the Ogalla Aquifer, most often provided as the depth to the top of the redbeds of the underlying Chinle Group, are estimated by drillers. The estimates are

likely based on drilling conditions, drill rig reaction, and years of experience, and may be accurate to within a few feet. Geophysical logs, particularly natural gamma, provide a more accurate indication of the contact, but relatively few wells are logged in this manner.

- The locations for most of the wells in the OSE NMWRRS are estimated based on the Section, Township, and Range provided on the Well Record forms submitted to OSE by the drilling companies. These estimates can be hundreds of feet off.
- Most of the irrigation and residential wells are not surveyed to accurately determine the elevation of the ground surface. While the DEMs appear to be accurate, individual points could vary by a few feet.

B-4. Conclusions

Plate B-1 is generally similar to previous efforts to map the base of the Ogallala Aquifer. The main feature is the channel that enters the north side of the Base near production well CAFB-8, trends south-southeast to the southeast corner of the Base, and eventually turns east-southeast. Previous maps show this channel leaves the Base along the east boundary rather than at the southeast corner. Previous maps also show a significant channel trending east across the southern portion of the Base and intersection with the main southeast channel. While this channel is still evident, it is not as well defined as in maps by other parties. The top of the redbeds on the west side of the base is similar to the water table surface.

There are currently no wells at the southeast corner of the base that penetrate through the Ogallala Aquifer and intersect the underlying Chinle redbeds. However, the USAF is in the process of installing up to 12 new wells on-site, mostly located along the south and east boundaries of the base. Each of these wells will reportedly intersect the top of the redbeds. The OSE database indicates that some of these wells have been completed and several boring logs have very recently been made available.

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Appendix B Figures

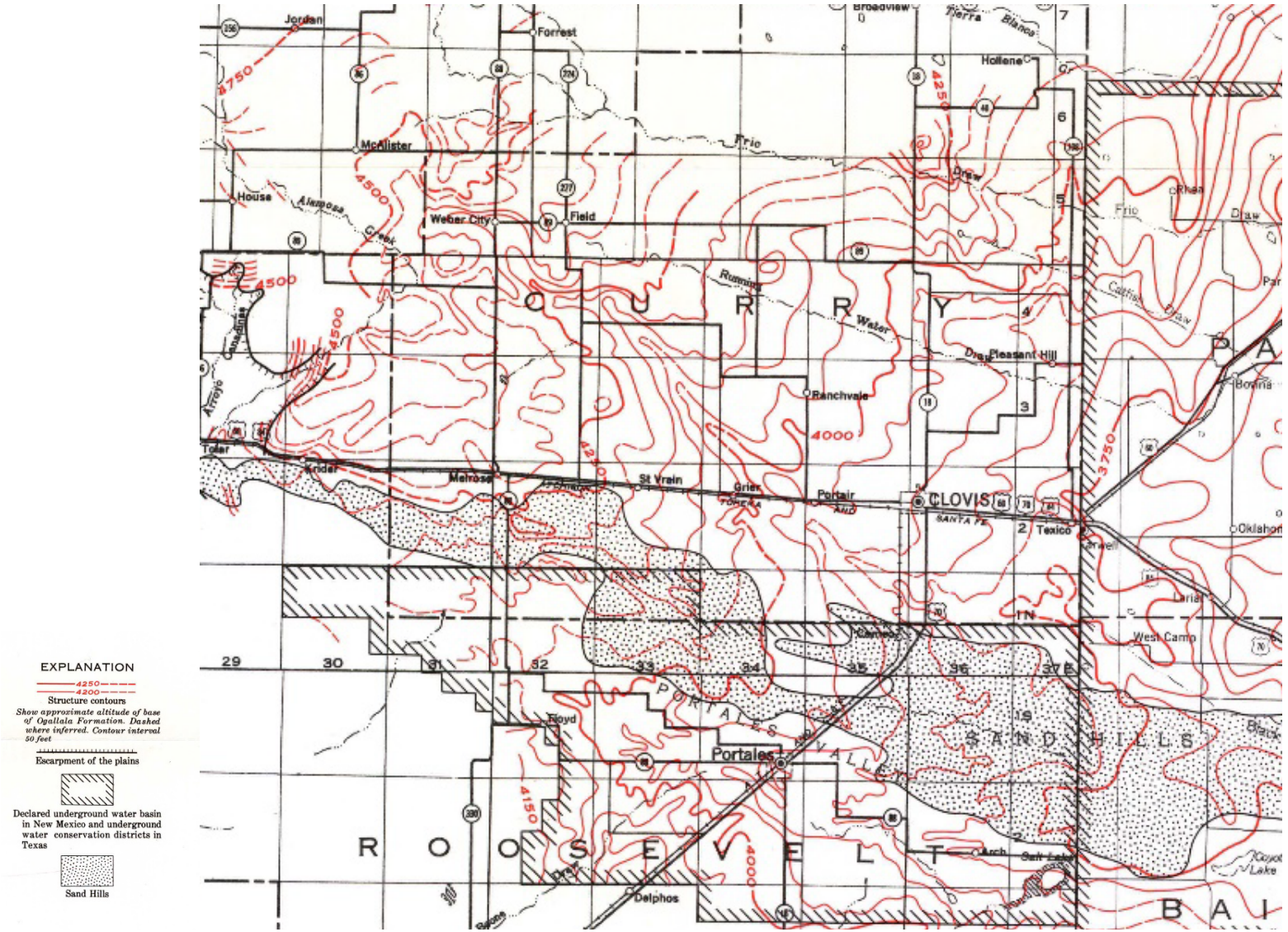


Figure B-1

NMED PFAS INVESTIGATION, CANNON AFB

Base of Ogallala Aquifer
Cronin (1969)

DBS&A
Daniel B. Stephens & Associates, Inc.

6/29/2022 DB21.1065

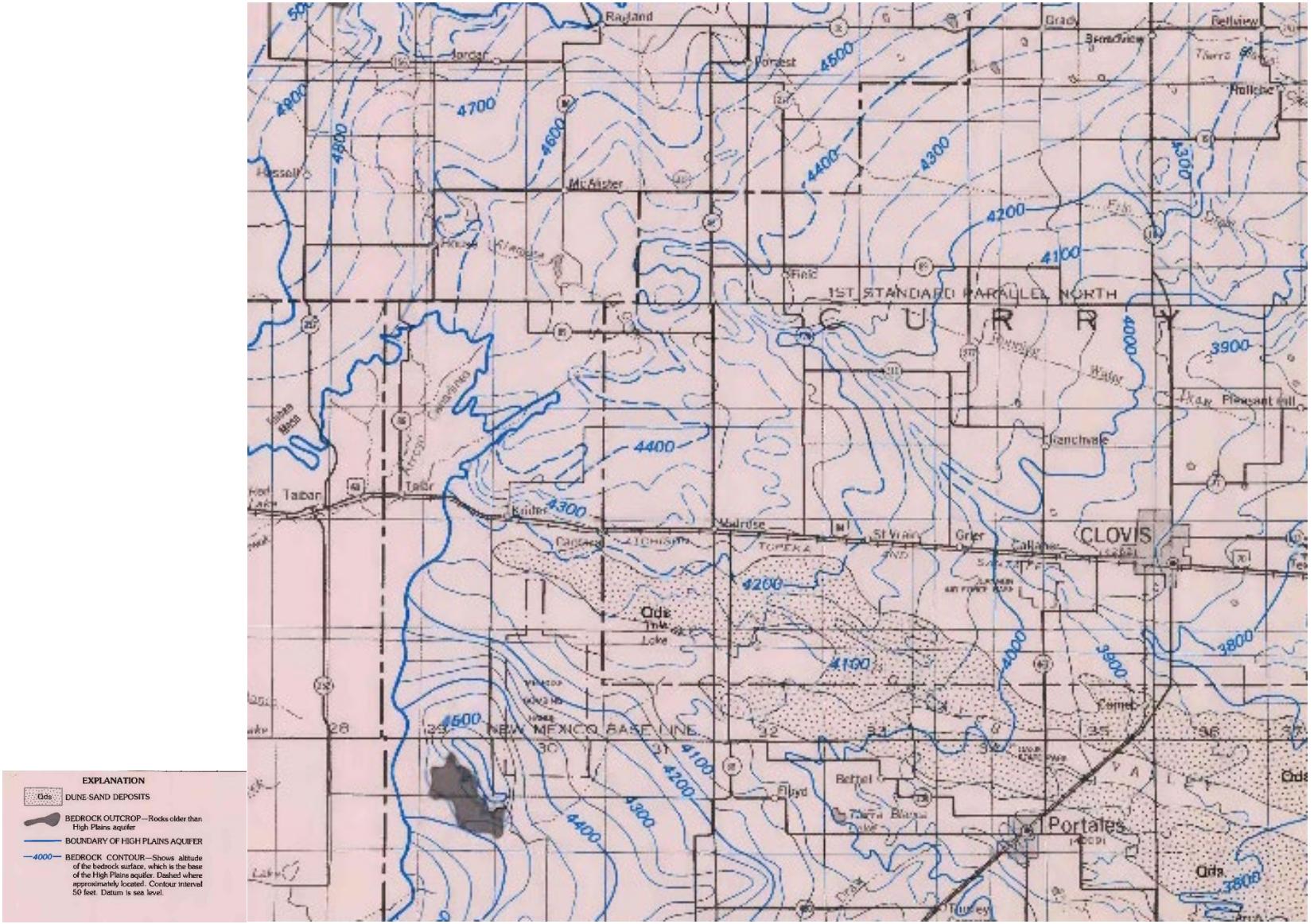


Figure B-2

NMED PFAS INVESTIGATION, CANNON AFB

Base of Ogallala Aquifer
Hart and McAda (1985)

DBS&A
Daniel B. Stephens & Associates, Inc.

6/29/2022 DB21.1060

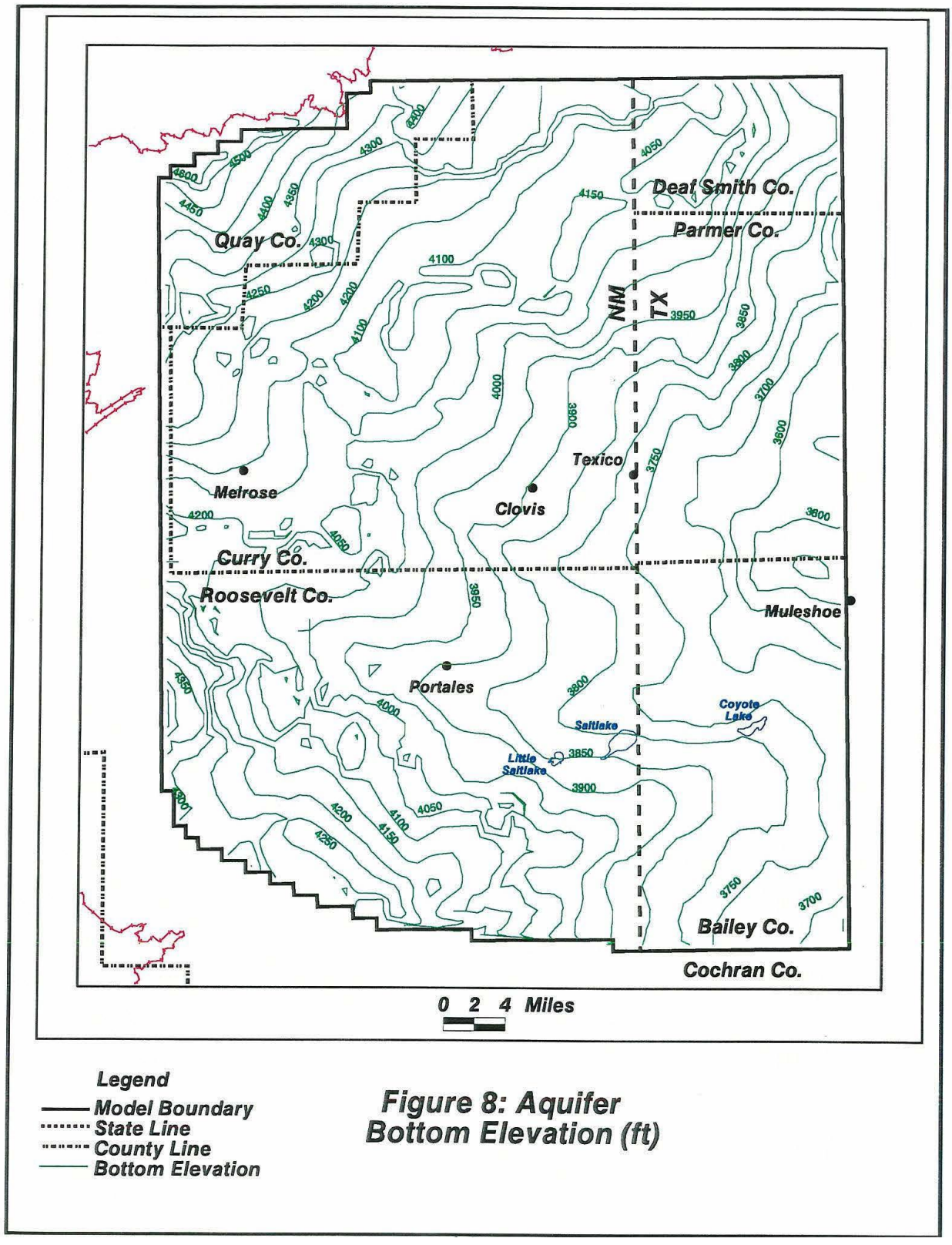


Figure 8: Aquifer Bottom Elevation (ft)

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NMED PFAS INVESTIGATION, CANNON AFB

Elevation Base of Ogallala Aquifer Musharrafieh and Logan (1999)

DBS&A Daniel B. Stephens & Associates, Inc.

6/29/2022 DB21.1060

Figure B-3a

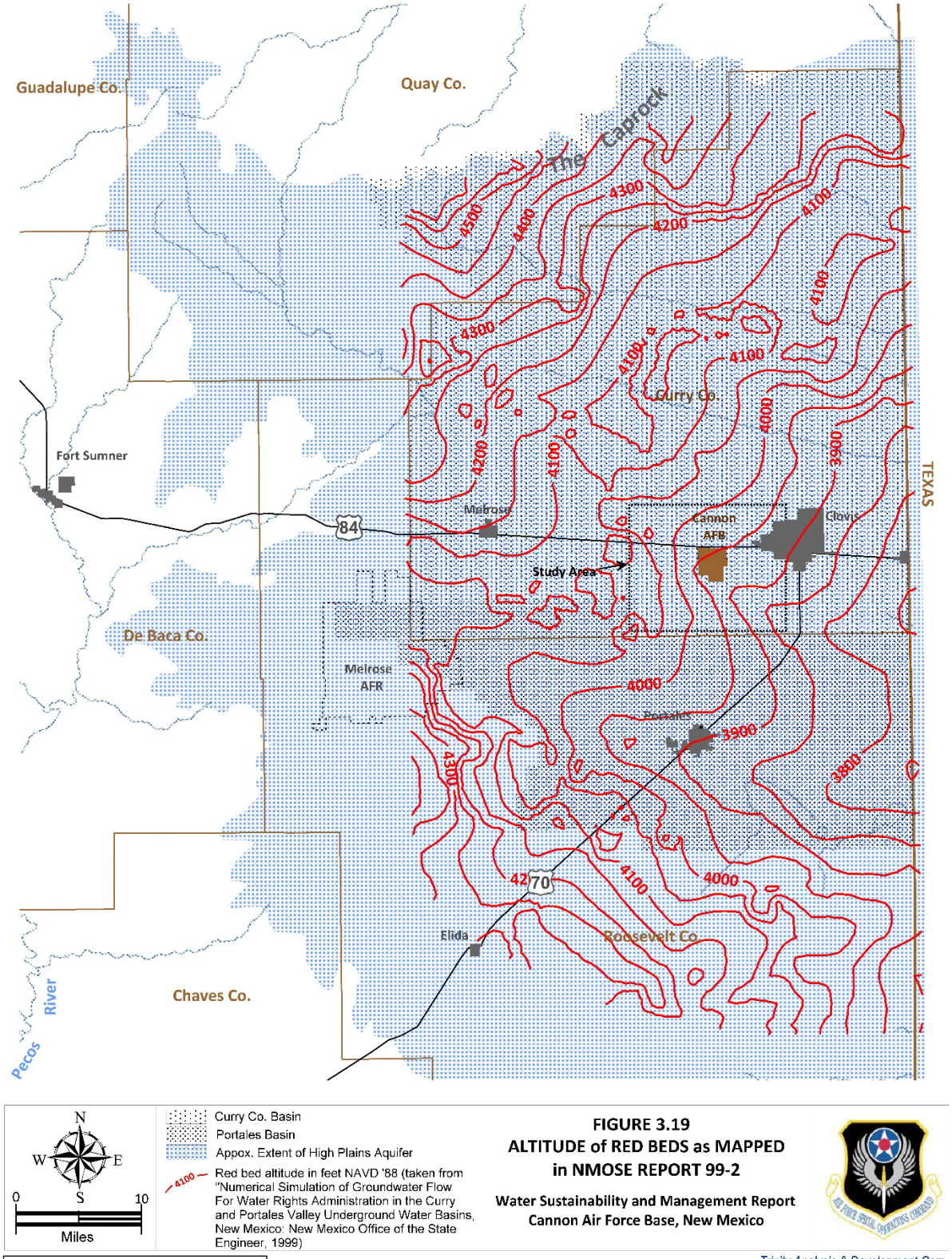


FIGURE 3.19
ALTITUDE of RED BEDS as MAPPED in NMOSE REPORT 99-2

Water Sustainability and Management Report
Cannon Air Force Base, New Mexico

Trinity Analysis & Development Corp.

Source: Trinity, 2012

NMED PFAS INVESTIGATION, CANNON AFB

Elevation Base of Ogallala Aquifer Musharrafieh and Logan (1999)

DBS&A
Daniel B. Stephens & Associates, Inc.

6/29/2022 DB21.1060

Figure B-3b

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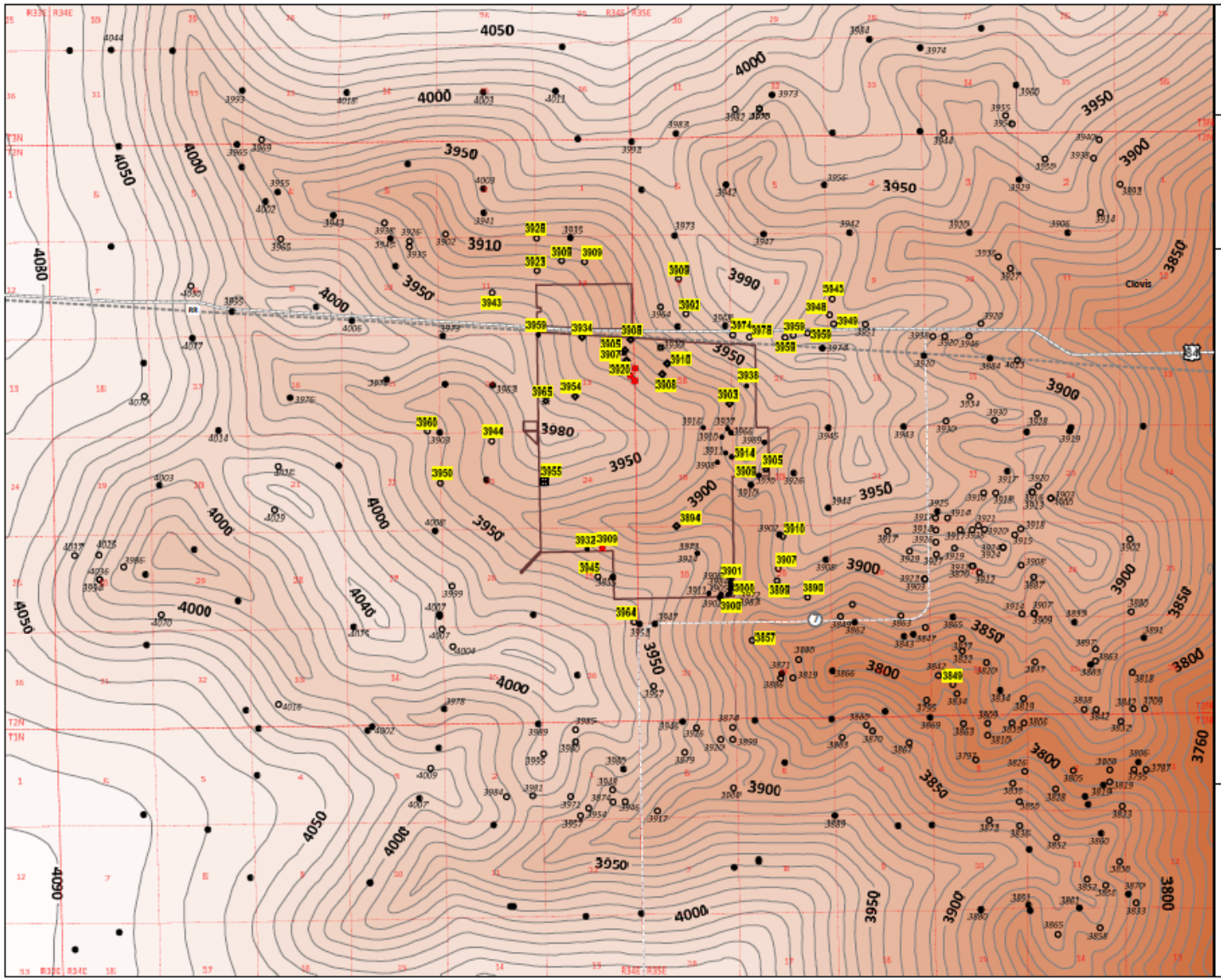


Figure B-4

NMED PFAS INVESTIGATION, CANNON AFB

Elevation at Base of Ogallala Aquifer Trinity (2012)

DBS&A
Daniel B. Stephens & Associates, Inc.

6/29/2022 DB21.1060

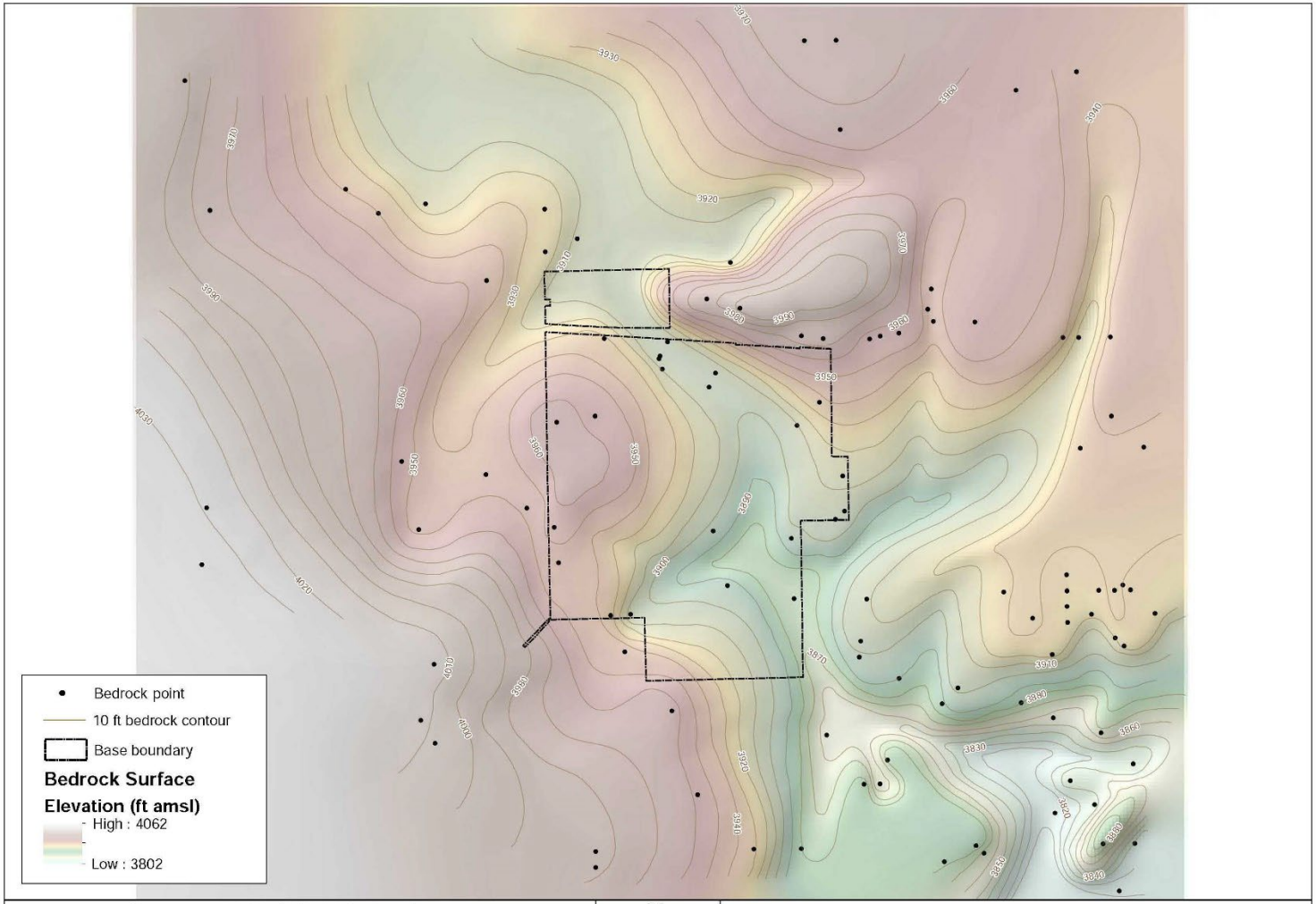


Figure B-5

NMED PFAS INVESTIGATION, CANNON AFB

Base of Ogallala Aquifer

AECOM, 2020

Appendix B Table

Table B-1. Information Related to the Top of Chinle Redbeds in the Project Area

Location id	Alternate id	Easting (UTM)	Northing (UTM)	Section	Township	Range	Location Source [1]	Ground Surface Elevation (10m DEM) [2]	Date Completed[3]	Depth Drilled[3]	Depth Top of Redbed[3]	Elevation Top of Redbed[2]	Comments
CAFB-2A	PW-2	653591.79	3808278.81	13	02N	34E	Trinity	4307.00	12/3/1977	383	374	3933	from geophysical log (Trinity, 2012)
CAFB-3	PW-3	654924.99	3807665.36	13	02N	34E	Trinity	4305.80	11/14/1979	404	398	3908	from lithologic log (Trinity 2012)
CAFB-4	PW-4; CC-00903	654330.76	3807891.72	13	02N	34E	Trinity	4309.80	May 1958	410	400	3910	from geophysical log (Trinity, 2012)
CAFB-4A	PW-4A	654303.75	3808059.42	13	02N	34E	Trinity	4321.40	Sept. 1987	460	419	3902	from lithologic log (Trinity 2012)
CAFB-5	PW-5	656043.55	3807176.71	18	02N	35E	Trinity	4293.00	Apr. 1977	402	390	3903	from lithologic log (Trinity 2012)
CAFB-6	PW-6; CC-00906	653928.36	3804777.07	25	02N	34E	Trinity	4269.00	Feb. 1964	365	360	3909	from lithologic log (Trinity 2012)
CAFB-7	PW-7	653476.10	3807296.02	13	02N	34E	Trinity	4322.10	Sept. 1967	378	368	3954	from lithologic log (Trinity 2012)
CAFB-8	PW-8	654398.09	3808237.63	13	02N	34E	Trinity	4321.20	6/24/1969	416	414	3907	from geophysical log (Trinity, 2012)
CAFB-9	PW-9; CC-909	655160.61	3805141.05	19	02N	35E	Trinity	4271.60	na	385	379	3893	from geophysical log (Trinity, 2012)
CAFB-9A	CC 00909 POD2	655071	3805580	19	02N	35E	Trinity	4275.66	7/26/2013	410	395	3881	from OSE Well Record
CAFB-12	PW-12; CC-909 POD2	655006.54	3807842.12	18	02N	35E	Trinity	4311.90	na	440	403	3909	from geophysical log (Trinity, 2012)
GTW-1	CC-02311 POD1	652990.00	3807219.00	13	02N	34E	Trinity	4319.9	9/25/2009	402	355	3965	from lithologic log (Trinity 2012)
GTW-2	CC-02311 POD2	656648.00	3806087.00	20	02N	35E	Trinity	4270.1	10/15/2015	405	365	3905	from lithologic log (Trinity 2012)
GTW-3	CC-02311 POD36	654898.00	3808108.00	18	02N	35E	Trinity	4319.3	11/12/2015	389	>389	<3930	from lithologic log (Trinity 2012)
OW-1	CC-02231	654290.55	3808026.22	13	02N	34E	Trinity	4318.8	10/26/2011	421	414	3905	from lithologic log (Trinity 2012)
EB-1	CC-02235	652958.47	3805883.47	24	02N	34E	Trinity	4290.3	11/7/2011	378	335	3955	from lithologic log (Trinity 2012)
BH-1	CC-02535 POD1	654727	3806001	19	02N	35E	OSE	4273.87	na	385.0	372	3902	from geophysical log (USGS 2019)
BH-2	CC-02535 POD2	654779	3805071	30	02N	35E	OSE	4270.36	na	391.3	386	3884	from geophysical log (USGS 2019)
BH-3	CC-02535 POD3	655970	3805742	19	02N	35E	OSE	4273.97	na	381.7	373	3901	from geophysical log (USGS 2019)
BH-4	CC-02535 POD4	656004	3804975	30	02N	35E	OSE	4270.36	na	397.9	392	3878	from geophysical log (USGS 2019)
MW-A		655509.60	3804689.70	30	02N	35E	Trinity	4267.0	1/7/1985	365	>365	<3902	from lithologic log
MW-B		656055.93	3804200.27	30	02N	35E	Trinity	4265.8	11/30/1984	365	>365	<3901	from lithologic log
MW-C		655902.16	3804012.24	30	02N	35E	Trinity	4266.9	1/10/1985	362	>362	<3905	from lithologic log
MW-C-B		na	na	30	02N	35E	na	na	na	na	>360	na	from geophysical log (USGS 2019)
MW-Ca	CC-02474 POD1	655902.16	3804012.24	30	02N	35E	AFW	4266.32	8/15/2017	350	>350	<3916	from lithologic log
MW-D		655699.10	3804023.15	30	02N	35E	Trinity	4265.8	12/16/1984	367.5	>367.5	<3898	from lithologic log
MW-E		655607.42	3806775.85	18	02N	35E	Trinity	4283.0	11/17/1985	373	>373	<3910	from lithologic log
MW-F		655914.52	3806619.74	18	02N	35E	Trinity	4279.4	11/19/1985	375	>375	<3904	from lithologic log
MW-Fa	CC-02474 POD2	655978.71	3806357.44	18	02N	35E	AFW	4280.0	8/20/2017	350	>350	<3930	from lithologic & geophysical logs
MW-G		655978.71	3806357.44	18	02N	35E	Trinity	4280.0	11/10/1985	372	>372	<3908	from lithologic log
MW-Ga	CC-02474 POD3	655978.10	3806357.44	18	02N	35E	AFW	4279.37	8/26/2017	360	>360	<3919	from lithologic log
MW-H		655841.78	3806200.63	18	02N	35E	Trinity	4279.60	11/18/1985	375	>375	<3905	from lithologic log
MW-I		656057.01	3804084.87	30	02N	35E	Trinity	4265.0	8/12/1988	305	>305	<3960	from lithologic log
MW-J		656016.34	3804003.93	30	02N	35E	Trinity	4264.2	8/16/1988	305	>305	<3959	from lithologic log
MW-L		656067.31	3804148.10	30	02N	35E	Trinity	4265.0	6/2/1992	291	>272	<3993	from lithologic log
MW-M		656064.79	3804115.64	30	02N	35E	Trinity	4264.9	2/2/1992	287.3	>287.3	<3978	from lithologic log
MW-N		656624.45	3806533.82	20	2N	35E	Trinity	4269.9	12/13/1994	299	>299	<3971	from lithologic log
MW-Na		656621.11	3806534.23	20	2N	35E	Trinity	4269.8	12/16/2004		354	3916	from geophysical log (USGS 2019)
MW-O		656535.54	3805981.96	20	2N	35E	Trinity	4273.0	10/30/1994	304.3	>304.3	<3969	from lithologic log
MW-Oa		656531.27	3805984.72	20	2N	35E	Trinity	4273.0	2/29/2004		363	3910	from geophysical log (Trinity 2012)
MW-P		656080.56	3806287.92	18	02N	35E	Trinity	4273.7	7/12/1995	300	>300	<3974	from lithologic log
MW-Pa		656074.74	3806290.62	18	02N	35E	Trinity	4274.0	2/21/2004		>360	<3914	from lithologic log
MW-Q		655509.09	3804690.92	30	02N	35E	Trinity	4267.0	2/24/1996	295+	na	na	

Table B-1. Information Related to the Top of Chinle Redbeds in the Project Area

Location id	Alternate id	Easting (UTM)	Northing (UTM)	Section	Township	Range	Location Source [1]	Ground Surface Elevation (10m DEM) [2]	Date Completed[3]	Depth Drilled[3]	Depth Top of Redbed[3]	Elevation Top of Redbed[2]	Comments
MW-Rb	CC-02284	656068.71	3806690.66	19	02N	35E	Trinity	4275.41	10/4/2012	350	>350	<3925	from lithologic log
MW-S		656050.12	3804025.09	30	02N	35E	Trinity	4264.7	12/6/1998	365	na	na	
MW-Sa	CC-02474 POD4	656050.12	3844025.09	30	02N	35E	AFW	4263.9	8/5/2017	362	>362	<3902	from lithologic log
MW-T		656079.96	3804119.85	30	02N	35E	Trinity	4264.7	12/10/1998	365	365	3900	
MW-Ta	CC-02474 POD5	656079.96	3804119.85	30	02N	35E	AFW	4263.9	8/8/2017	366	>360	<3904	from lithologic log
MW-U		656065.79	3804265.69	30	02N	35E	Trinity	4266.0	12/13/1998	365	na	na	
MW-Ua	CC-02474 POD6	656065.79	3804265.69	30	02N	35E	AFW	4265.5	8/18/2017	366	>361	<3904	from lithologic & geophysical logs
MW-V		652864.38	3808316.90	13	02N	34E	Trinity	4327.8	8/8/2001	370	>369	<3959	
MW-W		656325.83	3807469.58	17	02N	35E	Trinity	4299.8	6/1/2002	382	362	3938	from geophysical log (Trinity 2012)
MW-X		653675.89	3804760.62	25	02N	34E	Trinity	4268.0	2/26/2004	340	334	3934	from geophysical log (Trinity 2012 & USGS 2019)
MW-Y	CC-02474 POD7	656157.13	3805999.08	20	2N	35E	AFW	4268.02	2/2/2019	357	>357	<3911.	from lithologic log; USGS geophysical log shows no redbed
CC 00015 POD5		658838	3806435	21	02N	35E	OSE	4267.26	10/17/2013	338	318	3949	
CC 00044 S		662129	3803101	35	02N	35E	OSE Est.	4222.14	8/31/1990	330	330	3892	
CC 00044 S2		662129	3802901	35	02N	35E	OSE Est.	4218.55	3/16/1993	360	355	3864	
CC 00060 POD2		662142	3802096	35	02N	35E	OSE Est.	4206.48	9/14/1993	367	367	3839	
CC 00060 POD3		661942	3802096	35	02N	35E	OSE Est.	4211.18	6/3/2006	373	368	3843	
CC 00069 POD2		660899	3811348	02	02N	35E	OSE	4328.78	11/8/2014	385	374	3955	
CC 00078 A		667072	3802412	32	02N	36E	OSE	4175.37	9/11/2019	320	310	3865	
CC 00082		663012	3798482	13	01N	35E	OSE Est.	4168.26	2/3/1992	320	315	3853	
CC 00082 S		663317	3798589	13	01N	35E	OSE Est.	4166.31	2/29/1996	320	320	3846	
CC 00100 POD4		664200	3801046	01	01N	35E	OSE Est.	4174.14	10/17/2017	380	375	3799	
CC 00100 S		664180	3800917	01	01N	35E	OSE Est.	4173.48	12/11/2002	396	377	3796	
CC 00100 S2		663941	3799651	06	01N	35E	OSE	4167.91	3/10/2009	361	358	3810	
CC 00120 S4	CC-120 EXPL	667002	3801367	05	01N	36E	OSE Est.	4170.73	5/22/1992	345	340	3831	
CC 00120 S5		667606	3801381	05	01N	36E	OSE	4171.11	7/29/1993	335	335	3836	
CC 00120 S6		666903	3801468	05	01N	36E	OSE Est.	4170.10	9/13/1994	340	340	3830	
CC 00142 S		659933	3801862	03	01N	35E	OSE Est.	4226.69	6/16/2000	366	346	3881	
CC 00142 S2		660140	3801260	03	01N	35E	OSE Est.	4211.22	7/18/2001	417	397	3814	
CC 00143 S2		659031	3801544	04	01N	35E	OSE Est.	4231.96	8/24/2004	399	358	3874	
CC 00145 S3		657484	3803835	29	02N	35E	OSE Est.	4259.71	2/12/1994	375	370	3890	
CC 00145 S4		656869	3804224	29	02N	35E	OSE Est.	4261.45	7/14/1996	368	363	3898	
CC 00145 S5		656764	3804527	29	02N	35E	OSE Est.	4265.53	4/14/2001	360	358	3908	
CC 00157 S2		667145	3799255	08	01N	36E	OSE Est.	4176.03	10/27/1994	396	390	3786	
CC 00157 S3		666937	3799457	08	01N	36E	OSE Est.	4182.48	9/17/1994	406	400	3782	
CC 00164		656478	3803213	32	02N	35E	OSE Est.	4263.31	3/7/1996	410	407	3856	
CC 00194 AS		663331	3803523	36	02N	35E	OSE Est.	4226.47	10/9/1993	344	340	3886	
CC 00194 POD9		662948	3802108	36	02N	35E	OSE Est.	4194.54	9/2/2005	490	350	3845	
CC 00194 S		662741	3802711	36	02N	35E	OSE Est.	4208.08	8/25/2005	395	355	3853	
CC 00194 S5		662748	3802108	36	02N	35E	OSE Est.	4196.00	5/30/1995	359	359	3837	
CC 00229 S		661480	3799970	11	01N	35E	OSE Est.	4186.12	4/27/1999	335	335	3851	
CC 00240 S		664641	3797901	18	01N	36E	OSE Est.	4153.89	5/23/1996	313	313	3841	

Table B-1. Information Related to the Top of Chinle Redbeds in the Project Area

Location id	Alternate id	Easting (UTM)	Northing (UTM)	Section	Township	Range	Location Source [1]	Ground Surface Elevation (10m DEM) [2]	Date Completed[3]	Depth Drilled[3]	Depth Top of Redbed[3]	Elevation Top of Redbed[2]	Comments
CC 00240 S2		664849	3797908	18	01N	36E	OSE Est.	4138.81	4/26/2000	340	320	3819	
CC 00240 S5		665037	3798714	18	01N	36E	OSE Est.	4161.52	1/28/2002	356	335	3827	
CC 00240 S6		665049	3797908	18	01N	36E	OSE Est.	4132.97	12/12/2002	321	300	3833	
CC 00280 S2		659669	3805277	22	02N	35E	OSE Est.	4251.35	3/8/2007	334	330	3921	
CC 00280 POD6	CC 00280 S	659469	3805277	22	02N	35E	OSE Est.	4247.63	4/10/1998	330	320	3928	
CC 00280 POD8	CC 280-A-S5	660270	3805693	22	02N	35E	OSE Est.	4252.61	3/10/2007	341	336	3917	
CC 00280 POD9	CC 280-A-S6	660470	3805693	22	02N	35E	OSE Est.	4250.70	4/17/2007	330	327	3924	
CC 00293		659517	3802660	34	02N	35E	OSE Est.	4250.55	5/19/1999	411	408	3843	
CC 00293 A		659813	3803165	34	02N	35E	OSE Est.	4258.75	6/8/1994	395	390	3869	
CC 00293-A (CLW)		659907	3803272	34	02N	35E	OSE Est.	4258.75	10/22/2004	429	408	3851	
CC 00293 POD11		659913	3803069	34	02N	35E	OSE Est.	4256.69	8/14/2010	433	413	3844	
CC 00293 POD7		659321	3802251	33	02N	35E	OSE Est.	4241.88	10/29/2006	450	430	3812	
CC 00293 S5		659826	3802360	34	02N	35E	OSE Est.	4241.05	5/22/1999	409	403	3838	
CC 00298 POD1	CC 298	667232	3799965	08	01N	36E	OSE Est.	4182.04	11/11/1996	400	396	3786	
CC 00298 POD4	CC 298-S3	666522	3800255	08	01N	36E	OSE Est.	4178.67	2/16/1996	375	370	3809	
CC 00298 POD5		666830	3799758	08	01N	36E	OSE Est.	4179.11	5/20/2010	430	406	3773	
CC 00303 POD3	CC 303-A	658421	3801739	04	01N	35E	OSE Est.	4244.36	12/15/1996	375	375	3869	
CC 00303 S2		657917	3801632	04	01N	35E	OSE Est.	4241.20	6/25/1999	379	360	3881	
CC 00303 S3		658320	3801838	04	01N	35E	OSE Est.	4245.37	9/28/2000	386	360	3885	
CC 00316		662300	3799176	11	01N	35E	OSE Est.	4182.31	3/16/1990	327	325	3857	
CC 00316 POD3		662531	3799571	11	01N	35E	OSE	4168.20	8/15/2007	336	326	3842	
CC 00316 S		661991	3799277	11	01N	35E	OSE Est.	4184.56	11/23/2001	334	324	3861	
CC 00318 S		655898	3801598	06	01N	35E	OSE Est.	4237.35	6/12/2002	316	308	3929	
CC 00318 S2		656098	3801598	06	01N	35E	OSE Est.	4237.20	6/14/2002	339	331	3906	
CC 00318 S5		655494	3801792	06	01N	35E	OSE Est.	4237.02	4/22/2003	312	305	3932	
CC 00318 S6		655298	3801383	06	01N	35E	OSE Est.	4230.00	11/10/2006	353	331	3899	
CC 00358 POD3	CC 358	662970	3801099	01	01N	35E	OSE Est.	4179.99	4/6/2010	394	374	3806	
CC 00358 S		662770	3801099	01	01N	35E	OSE Est.	4179.93	8/19/2002	386	380	3800	
CC 00364 S		658892	3803655	28	02N	35E	OSE Est.	4257.82	6/5/2003	395	275	3983	
CC 00366	CC 366-A	660754	3800869	03	01N	35E	OSE Est.	4208.68	8/4/2004	410	395	3814	
CC 00366 S3		661468	3800776	02	01N	35E	OSE Est.	4188.14	1/25/1995	363	363	3825	
CC 00366 S6		660337	3801868	03	01N	35E	OSE Est.	4221.70	1/28/1999	414	394	3828	
CC 00366 S7		660940	3801873	03	01N	35E	OSE Est.	4218.27	1/21/1999	408	388	3830	
CC 00366 S8		661761	3801081	02	01N	35E	OSE Est.	4189.07	1/14/1999	388	368	3821	
CC 00366 S9		660869	3800166	10	01N	35E	OSE Est.	4199.42	1/16/1999	359	340	3859	
CC 00397 S		667063	3797744	17	01N	36E	OSE Est.	4149.71	4/16/1997	370	369	3781	
CC 00397 S2		666660	3797737	17	01N	36E	OSE Est.	4150.50	1/13/1997	364	360	3791	
CC 00397 S3		667465	3797750	17	01N	36E	OSE Est.	4150.36	10/11/2002	363	358	3792	
CC 00403 A		657193	3802925	32	02N	35E	OSE Est.	4259.13	5/15/1992	380	377	3882	
CC 00403 POD8	CC 403	657097	3802622	32	02N	35E	OSE Est.	4258.52	5/21/2004	440	400	3859	
CC 00463 S		658571	3802273	33	02N	35E	OSE	4244.83	11/7/2008	386	383	3862	
CC 00503		654860	3797258	18	01N	35E	OSE Est.	4161.97	11/18/1989	205	200	3962	

Table B-1. Information Related to the Top of Chinle Redbeds in the Project Area

Location id	Alternate id	Easting (UTM)	Northing (UTM)	Section	Township	Range	Location Source [1]	Ground Surface Elevation (10m DEM) [2]	Date Completed[3]	Depth Drilled[3]	Depth Top of Redbed[3]	Elevation Top of Redbed[2]	Comments
CC 00520		666045	3798737	17	01N	36E	OSE Est.	4174.84	6/15/1995	406	387	3788	
CC 00526 POD2		662896	3810867	01	02N	35E	OSE	4305.51	11/15/2013	380	370	3936	
CC 00526 POD3		662850	3810874	01	02N	35E	OSE	4305.33	9/4/2014	371	367	3938	
CC 00558		661291	3811238	02	02N	35E	OSE Est.	4322.23	11/14/1989	380	380	3942	
CC 00563		657900	3808973	09	02N	35E	OSE Est.	4331.46	12/4/1989	388	388	3943	
CC 00574 S		663890	3806156	24	02N	35E	OSE Est.	4244.38	9/24/1993	338	338	3906	
CC 00575		662805	3798885	12	01N	35E	OSE Est.	4176.50	6/17/1990	310	307	3870	
CC 00575 S		663107	3799187	12	01N	35E	OSE Est.	4165.50	11/13/2008	343	340	3826	
CC 00581 POD4		662367	3801093	02	01N	35E	OSE	4181.95	12/11/2008	380	375	3807	
CC 00581 S		662367	3800893	02	01N	35E	OSE Est.	4178.57	12/10/1992	368	368	3811	
CC 00590 B		664775	3802140	31	02N	36E	OSE Est.	4182.92	4/27/1993	327	320	3863	
CC 00590 S		664462	3802233	31	02N	36E	OSE Est.	4202.56	5/29/1996	317	315	3888	
CC 00591		663541	3803127	36	02N	35E	OSE Est.	4213.68	9/18/1992	323	320	3894	
CC 00591 S		663937	3803337	36	02N	35E	OSE Est.	4215.48	9/11/1992	320	315	3900	
CC 00619 S2		663856	3802422	36	02N	35E	OSE Est.	4192.52	6/15/2000	366	346	3847	
CC 00623		654995	3808221	18	02N	35E	OSE Est.	4320.60	7/5/1990	383	374	3947	
CC 00629		660715	3809421	10	02N	35E	OSE Est.	4325.04	6/28/1990	400	398	3927	
CC 00630		662212	3810351	02	02N	35E	OSE Est.	4315.33	7/15/1990	405	403	3912	
CC 00636		662097	3811251	02	02N	35E	OSE Est.	4324.09	10/2/1991	390	390	3934	
CC 00644 S		664925	3799420	07	01N	36E	OSE Est.	4177.20	9/17/1993	367	367	3810	
CC 00646 POD2	CC-646-S	667158	3798449	17	01N	36E	OSE Est.	4163.74	11/2/1994	386	380	3784	
CC 00649		661159	3807013	14	02N	35E	OSE Est.	4280.37	6/18/1990	353	352	3928	
CC 00666		665310	3805773	19	02N	36E	OSE Est.	4237.13	1/31/1991	341	339	3898	
CC 00677		665779	3802353	31	02N	36E	OSE Est.	4178.02	8/17/1990	305	303	3875	
CC 00711 S2		662205	3798471	14	01N	35E	OSE Est.	4176.19	2/24/1993	319	319	3857	
CC 00711 S3		661505	3798360	14	01N	35E	OSE Est.	4184.09	2/2/1995	318	318	3866	
CC 00711 S4		662327	3797565	14	01N	35E	OSE Est.	4165.97	2/9/1995	299	299	3867	
CC 00738		664368	3801729	06	01N	36E	OSE Est.	4181.18	5/16/1991	321	320	3861	
CC 00741		665011	3800324	07	01N	36E	OSE Est.	4183.19	5/28/1991	347	345.5	3838	
CC 00743		654781	3802484	31	02N	35E	OSE Est.	4249.64	5/31/1991	292	290.5	3959	
CC 00745		660512	3809615	10	02N	35E	OSE Est.	4326.46	6/18/1991	395	394	3932	
CC 00749		665535	3799226	07	01N	36E	OSE Est.	4183.79	7/8/1992	395	389	3795	
CC 00751 POD8	CC 751-S6	664506	3805558	19	02N	36E	OSE Est.	4207.65	10/11/1991	330	327	3881	
CC 00757		657410	3808260	17	02N	35E	OSE Est.	4312.24	9/25/1991	357	355	3957	
CC 00763		660863	3800568	03	01N	35E	OSE Est.	4195.03	12/24/1991	341	340	3855	
CC 00792		660201	3804372	27	02N	35E	OSE Est.	4242.02	7/1/1992	332	317	3925	
CC 00802		660283	3805088	27	02N	35E	OSE Est.	4246.30	8/13/1992	324	323	3923	
CC 00819		664568	3801929	06	01N	36E	OSE Est.	4182.46	2/22/1993	332	331	3851	
CC 00856		659476	3804875	27	02N	35E	OSE Est.	4249.26	3/26/1993	324	322	3927	
CC 00865		658108	3808771	09	02N	35E	OSE Est.	4328.22	4/26/1993	373	370	3958	
CC 00873		655693	3808731	07	02N	35E	OSE Est.	4320.47	5/24/1993	339	335	3985	
CC 00875		656202	3808240	17	02N	35E	OSE Est.	4313.00	4/22/1993	350	340	3973	
CC 00877 S		665464	3803255	31	02N	36E	OSE Est.	4193.48	6/29/1993	324	324	3869	

Table B-1. Information Related to the Top of Chinle Redbeds in the Project Area

Location id	Alternate id	Easting (UTM)	Northing (UTM)	Section	Township	Range	Location Source [1]	Ground Surface Elevation (10m DEM) [2]	Date Completed[3]	Depth Drilled[3]	Depth Top of Redbed[3]	Elevation Top of Redbed[2]	Comments
CC 00877 S2		665764	3802960	31	02N	36E	OSE Est.	4188.82	7/31/2003	338	319	3870	
CC 00878 POD4	CC 878 CLW	666768	3798032	17	01N	36E	OSE Est.	4156.68	4/15/2003	375	368	3789	
CC 00878 S		666353	3798436	17	01N	36E	OSE Est.	4172.35	6/18/1993	380	375	3797	
CC 00879		665710	3800643	06	01N	36E	OSE Est.	4178.30	6/15/1993	395	389	3789	
CC 00883 S	Boersma A&T Dairy NW Well P-3	661216	3797453	14	01N	35E	OSE Est.	4159.58	10/22/2004	333	291	3869	
CC 00884		663426	3804423	25	02N	35E	OSE Est.	4215.14	3/4/1995	334	328	3887	
CC 00909 POD2		655071	3805580	19	02N	35E	OSE	4275.66	7/26/2013	410	395	3880.66	
CC 00914		659483	3804673	27	02N	35E	OSE Est.	4250.37	1/10/1994	325	323	3927	
CC 00950		661178	3805807	23	02N	35E	OSE Est.	4250.75	5/10/1994	326	324	3927	
CC 00951		660592	3804787	27	02N	35E	OSE Est.	4249.61	5/4/1994	326	324	3926	
CC 00981		660886	3805094	27	02N	35E	OSE Est.	4239.95	11/8/1994	321	320	3920	
CC 00993		662722	3803719	25	02N	35E	OSE Est.	4230.60	2/28/1995	351	349	3882	
CC 00997		665542	3804369	30	02N	36E	OSE Est.	4219.09	5/8/1995	327	327	3892	
CC 01002		660787	3804995	27	02N	35E	OSE Est.	4243.48	6/30/1999	330	328	3915	
CC 01016		660592	3804787	27	02N	35E	OSE Est.	4249.61	9/20/1995	326	326	3924	
CC 01016 POD2		660183	3805148	27	02N	35E	OSE	4248.84	7/21/2008	325	320	3929	
CC 01036		665981	3802360	32	02N	36E	OSE Est.	4175.65	4/17/1996	308	308	3868	
CC 01041		660224	3808508	10	02N	35E	OSE Est.	4326.06	12/14/1996	404	400	3926	
CC 01042		665772	3802757	31	02N	36E	OSE Est.	4184.95	5/11/1996	312	310	3875	
CC 01049 S2		656110	3800793	06	01N	35E	OSE Est.	4222.58	3/17/1997	317	312	3911	
CC 01050		659623	3808293	15	02N	35E	OSE Est.	4318.66	6/21/1996	401	400	3919	
CC 01057		665993	3801435	05	01N	36E	OSE	4172.46	8/8/1996	351	350	3822	
CC 01057 POD2		665993	3801435	05	01N	36E	OSE	4172.46	3/9/2009	356	350	3822	
CC 01069		657806	3808469	09	02N	35E	OSE Est.	4322.23	10/9/1996	373	373	3949	
CC 01070		656894	3802615	32	02N	35E	OSE Est.	4258.77	10/19/1996	373	371	3888	
CC 01071		655158	3797366	18	01N	35E	OSE Est.	4158.72	10/24/1996	210	208	3951	
CC 01072		657806	3808669	09	02N	35E	OSE Est.	4328.07	10/18/1992	378	378	3950	
CC 01073		666666	3797534	17	01N	36E	OSE Est.	4152.35	11/28/1996	364	360	3792	
CC 01089 POD2		662537	3810819	01	02N	35E	OSE	4308.21	9/14/2006	421	378	3930	
CC 01105 POD5		653485	3801760	01	01N	34E	OSE Est.	4235.83	7/10/2006	252	247	3989	
CC 01105 POD6		653403	3800649	01	01N	34E	OSE Est.	4206.67	7/8/2006	240	235	3972	
CC 01105 POD7		653485	3801560	01	01N	34E	OSE Est.	4230.29	7/27/2007	252	248	3982	
CC 01105 POD8		653702	3800457	02	01N	34E	OSE	4204.10	7/17/2008	255	250	3954	
CC 01105 POD9		653566	3800332	02	01N	34E	OSE	4202.13	12/8/2008	248	243	3959	
CC 01105 POD11		652773	3800664	02	01N	34E	OSE	4212.10	4/8/2004	230	225	3987	
CC 01105 POD12		652336	3800647	02	01N	34E	OSE	4206.52	4/9/2008	224	219	3988	
CC 01105 POD13		652953	3801360	02	01N	34E	OSE	4226.02	8/1/2007	232	227	3999	
CC 01105 POD18		652759	3801856	02	01N	34E	OSE	4238.70	8/28/2013	247	242	3997	
CC 01110		662574	3800490	02	01N	35E	OSE Est.	4170.21	4/23/1997	347	343	3827	
CC 01121 S		663871	3801616	01	01N	35E	OSE Est.	4184.59	5/23/1998	420	410	3775	
CC 01123		665730	3799435	07	01N	36E	OSE Est.	4195.82	7/1/1997	389	387	3809	
CC 01127		667418	3800570	05	01N	36E	OSE Est.	4178.77	10/1/1997	364	364	3815	

Table B-1. Information Related to the Top of Chinle Redbeds in the Project Area

Location id	Alternate id	Easting (UTM)	Northing (UTM)	Section	Township	Range	Location Source [1]	Ground Surface Elevation (10m DEM) [2]	Date Completed[3]	Depth Drilled[3]	Depth Top of Redbed[3]	Elevation Top of Redbed[2]	Comments
CC 01131		666197	3801353	05	01N	36E	OSE Est.	4170.65	9/16/1997	345	342	3829	
CC 01139		665823	3799737	07	01N	36E	OSE Est.	4191.30	1/8/1998	395	387	3804	
CC 01142		660026	3808300	15	02N	35E	OSE Est.	4319.82	3/31/1998	375	375	3945	
CC 01182		659785	3804775	27	02N	35E	OSE Est.	4240.82	7/28/1998	325	320	3921	
CC 01210		665802	3801144	06	01N	36E	OSE Est.	4172.56	4/10/1999	380	379	3794	
CC 01214		661386	3805606	23	02N	35E	OSE Est.	4232.12	5/14/1999	327	324	3908	
CC 01239		665795	3801347	06	01N	36E	OSE Est.	4171.88	9/21/1999	345	340	3832	
CC 01244		665728	3805174	30	02N	36E	OSE Est.	4224.29	9/9/1999	340	330	3894	
CC 01249		664217	3798902	12	01N	35E	OSE Est.	4162.96	2/2/2004	336	332	3831	
CC 01264		660079	3805081	27	02N	35E	OSE Est.	4245.42	2/2/2000	304	302	3943	
CC 01265		667279	3808227	17	02N	36E	OSE Est.	4234.78	2/15/2000	380	378	3857	
CC 01286 POD2		663910	3804948	25	02N	35E	OSE Est.	4236.85	8/3/2000	363	348	3889	
CC 01287		665787	3801749	06	01N	36E	OSE Est.	4173.97	5/4/2000	333	331	3843	
CC 01287 POD2		665676	3802012	06	01N	36E	OSE	4175.40	2/8/2013	344	333	3842	
CC 01289		663554	3802320	36	02N	35E	OSE Est.	4192.68	6/4/2002	326	325	3868	
CC 01291		665385	3801742	06	01N	36E	OSE Est.	4175.61	5/9/2000	375	373	3803	
CC 01308		661122	3802888	35	02N	35E	OSE Est.	4244.40	3/12/2002	395	388	3856	
CC 01320 S		660316	3802876	34	02N	35E	OSE Est.	4246.20	9/15/2000	426	410	3836	
CC 01326		659879	3805081	27	02N	35E	OSE Est.	4246.22	11/27/2000	326	321	3925	
CC 01333		660954	3801069	03	01N	35E	OSE Est.	4204.36	2/3/2001	373.6	371	3833	
CC 01335		660364	3800258	10	01N	35E	OSE Est.	4212.54	12/1/2000	340	336	3877	
CC 01339		655397	3808027	18	02N	35E	OSE Est.	4321.40	1/4/2001	360	359	3962	
CC 01364 S		667418	3800570	05	01N	36E	OSE Est.	4178.77	2/18/2004	402	395	3784	
CC 01379		655358	3797366	18	01N	35E	OSE Est.	4158.17	4/30/2001	205	196	3962	
CC 01419		666584	3802167	32	02N	36E	OSE Est.	4173.23	10/23/2001	318	315	3858	
CC 01423 POD4		664619	3804850	30	02N	36E	OSE Est.	4230.18	9/22/2017	334	329	3901	
CC 01431		660893	3804492	27	02N	35E	OSE Est.	4244.40	2/4/2002	332	327	3917	
CC 01438		665989	3801755	05	01N	36E	OSE Est.	4173.25	7/23/2002	328	320	3853	
CC 01439		665930	3805180	29	02N	36E	OSE Est.	4222.93	2/15/2002	350	348	3875	
CC 01443		665981	3802160	32	02N	36E	OSE Est.	4174.79	3/7/2002	309	302	3873	
CC 01452		662191	3811558	02	02N	35E	OSE Est.	4327.44	8/22/2002	390	386	3941	
CC 01457		665787	3801749	06	01N	36E	OSE Est.	4173.97	5/27/2002	326	320	3854	
CC 01476 POD4	CC 1476 Explore	657888	3803641	28	02N	35E	OSE Est.	4260.12	9/23/2004	410	370	3890	
CC 01476 S		658088	3803841	28	02N	35E	OSE Est.	4262.03	2/13/2003	370	355	3907	
CC 01477 POD3		660906	3803686	27	02N	35E	OSE Est.	4239.19	11/14/2008	325	322	3917	
CC 01482		663305	3804934	25	02N	35E	OSE Est.	4231.65	3/2/2003	328	322	3910	
CC 01499		659476	3805075	27	02N	35E	OSE Est.	4245.03	3/28/2003	332	322	3923	
CC 01508 POD3		663874	3800398	12	01N	35E	OSE	4172.12	3/5/2009	336	333	3839	
CC 01520 S		660933	3802277	34	02N	35E	OSE Est.	4225.82	6/27/2003	406	386	3840	
CC 01538		659643	3806887	15	02N	35E	OSE Est.	4282.58	10/10/2003	350	345	3938	
CC 01540 POD1	CC 1540	666146	3802045	05	01N	36E	OSE	4173.54	7/22/2003	314	310	3864	
CC 01540 POD2		666148	3802072	05	01N	36E	OSE	4173.44	11/25/2008	312	305	3868	
CC 01542		660086	3804479	27	02N	35E	OSE Est.	4238.04	7/11/2003	370	350	3888	

Table B-1. Information Related to the Top of Chinle Redbeds in the Project Area

Location id	Alternate id	Easting (UTM)	Northing (UTM)	Section	Township	Range	Location Source [1]	Ground Surface Elevation (10m DEM) [2]	Date Completed[3]	Depth Drilled[3]	Depth Top of Redbed[3]	Elevation Top of Redbed[2]	Comments
CC 01547		665787	3801949	06	01N	36E	OSE Est.	4174.55	8/13/2003	324	316	3859	
CC 01549		665989	3801955	05	01N	36E	OSE Est.	4173.44	9/22/2003	328	324	3849	
CC 01551 POD2		656591	3810936	05	02N	35E	OSE	4361.87	6/13/2013	415	395	3967	
CC 01558		660450	3806899	15	02N	35E	OSE Est.	4288.36	10/3/2003	355	350	3938	
CC 01564		664157	3802126	36	02N	35E	OSE Est.	4186.84	11/13/2003	370	355	3832	
CC 01574		655182	3809025	07	02N	35E	OSE Est.	4323.92	2/17/2004	410	405	3919	
CC 01610		659423	3808293	15	02N	35E	OSE Est.	4318.01	2/5/2004	383	378	3940	
CC 01644		664137	3803537	36	02N	35E	OSE Est.	4210.60	3/18/2004	332	326	3885	
CC 01705 POD1		666492	3801407	05	01N	36E	OSE	4168.92	1/21/2011	357	350	3819	
CC 01710		654759	3797357	18	01N	35E	OSE Est.	4161.64	8/4/2004	220	217	3945	
CC 01719		664576	3801526	06	01N	36E	OSE Est.	4180.02	8/24/2004	390	384	3796	
CC 01728		666189	3801755	05	01N	36E	OSE Est.	4172.68	9/9/2004	332	322	3851	
CC 01735		666012	3800549	05	01N	36E	OSE Est.	4175.72	9/22/2004	390	389	3787	
CC 01737		665177	3802346	31	02N	36E	OSE Est.	4179.36	9/22/2004	313	308	3871	
CC 01746		661103	3804295	26	02N	35E	OSE Est.	4240.98	11/16/2005	350	330	3911	
CC 01753		665177	3802146	31	02N	36E	OSE Est.	4179.14	1/22/2005	310	307	3872	
CC 01788		662702	3804927	25	02N	35E	OSE Est.	4235.50	2/4/2005	335	325	3911	
CC 01855		660040	3807295	15	02N	35E	OSE Est.	4302.39	11/7/2005	365	360	3942	
CC 01857		657007	3808253	17	02N	35E	OSE Est.	4306.70	4/27/2005	352	348	3959	
CC 01864		658671	3805061	28	02N	35E	OSE Est.	4255.64	6/21/2005	338	327	3929	
CC 01868		659301	3803459	33	02N	35E	OSE Est.	4258.68	6/14/2005	411	402	3857	
CC 01914 POD1	CC 1914	666592	3801762	05	01N	36E	OSE Est.	4170.86	4/4/2006	330	325	3846	
CC 01915 POD1	CC 1915	662552	3801898	02	01N	35E	OSE Est.	4196.83	6/29/2006	370	358	3839	
CC 01942 POD1	CC 1942	666392	3801762	05	01N	36E	OSE Est.	4170.77	9/8/2006	325	314	3857	
CC 01959 POD2	CC 1959	665628	3802442	31	02N	36E	OSE	4178.84	2/21/2007	315	309	3870	
CC 01995		657095	3808294	17	02N	35E	OSE	4307.77	1/11/2008	355	350	3958	
CC 01998 POD1	CC 1998	664284	3801968	06	01N	36E	OSE	4185.61	1/3/2008	358	355	3831	
CC 02014 POD1	CC 2014	659036	3804725	28	02N	35E	OSE	4254.17	8/28/2008	326	323	3931	
CC 02093 POD1	MW-12	658113	3805646	21	02N	35E	OSE	4252.19	6/9/2009	340	328	3924	
CC 02094 POD1	MW-13	659258	3806066	21	02N	35E	OSE	4261.25	6/12/2009	336	333	3928	
CC 02095 POD1	MW-14	659264	3805696	21	02N	35E	OSE	4243.04	6/26/2009	337	330	3913	
CC 02143 POD1		665938	3802790	32	02N	36E	OSE	4185.69	6/29/2010	318	313	3873	
CC 02160 POD2	CC 2160-POD1	656664	3808238	17	02N	35E	OSE	4305.75	11/29/2010	348	330	3976	
CC 02177 POD1		664623	3800276	07	01N	36E	OSE	4179.74	3/17/2011	348	320	3860	
CC 02191 POD1		655026	3808813	07	02N	35E	OSE	4329.46	6/16/2011	366	354	3975	
CC 02208 POD1		666358	3802187	32	02N	36E	OSE	4174.73	8/3/2011	315	310	3865	
CC 02222 POD1		659639	3808156	15	02N	35E	OSE	4316.59	10/13/2011	398	380	3937	
CC 02223 POD1		667453	3800123	08	01N	36E	OSE	4178.90	9/20/2011	393	387	3792	
CC 02232 POD1		659554	3808161	15	02N	35E	OSE	4316.91	10/11/2011	380	370	3947	
CC 02238 POD1		660076	3802891	34	02N	35E	OSE	4254.14	12/15/2011	415	412	3842	
CC 02295 POD1		665128	3805114	30	02N	36E	OSE	4226.19	1/13/2014	330	318	3908	
CC 02322 POD1	SW Cheese	663811	3798780	13	01N	35E	OSE	4162.63	9/10/2013	315	313	3850	
CC 02322 POD2	SW Cheese	663873	3798726	13	01N	35E	OSE	4162.10	9/12/2013	315	313	3849	

Table B-1. Information Related to the Top of Chinle Redbeds in the Project Area

Location id	Alternate id	Easting (UTM)	Northing (UTM)	Section	Township	Range	Location Source [1]	Ground Surface Elevation (10m DEM) [2]	Date Completed[3]	Depth Drilled[3]	Depth Top of Redbed[3]	Elevation Top of Redbed[2]	Comments
CC 02330 POD1		662540	3799381	11	01N	35E	OSE	4176.11	12/18/2013	326	321.5	3855	
CC 02335 POD1		658084	3805723	21	02N	35E	OSE	4245.89	10/17/2013	338	318	3928	
CC 02359 POD1		659522	3803504	34	02N	35E	OSE	4257.84	2/4/2015	418	405	3853	
CC 02399 POD1		662639	3804839	25	02N	35E	OSE	4234.08	5/26/2016	332	320	3914	
CC 02450 POD1		657882	3802255	4	1N	35E	OSE	4248.85	12/13/2016	380	>380	<3869	
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CC 02453 POD1		664976	3799538	07	01N	36E	OSE	4176.50	2/26/2017	360	350	3827	
CC 02458 POD1		666157	3802156	32	02N	36E	OSE	4174.25	5/16/2017	315	305	3869	
CC 02472 POD1		658827	3811436	04	02N	35E	OSE	4351.53	8/22/2017	405	395	3957	
CC 02502 POD1		660738	3806741	22	02N	35E	OSE	4281.55	3/27/2018	360	350	3932	
CC 02512 POD1		666296	3801640	05	01N	36E	OSE	4170.77	9/26/2018	345	325	3846	
CC 02530 POD1		659828	3805127	27	02N	35E	OSE	4249.34	4/15/2019	330	320	3929	
CC 02547 POD1	CC 2547	667486	3802438	32	02N	36E	OSE	4178.41	9/6/2019	330	320	3858	
CC 02575 POD1		666520	3802141	32	02N	36E	OSE	4173.20	10/14/2020	315	305	3868	
CC 02577 POD1		654650	3802790	31	02N	35E	OSE	4254.43	10/21/2020	305	295	3959	

Notes:
Information sources: Trinity (2102), AFW (2019, 2019), New Mexico Office of the State Engineer (OSE), New Mexico Water Rights Reporting System (NMWRRS), accessed February 12, 2021
1 Surveyed location data from Trinity (2012) and AFW (2018, 2019). Location data from OSE is estimated (OSE Est.) where indicated.
2 Ground surface elevations as reported in Trinity (2012) or AFW (2018, 2019); otherwise determined using 10-m Digital Elevation Model (DEM). All elevations are in feet relative to the North American Vertical Datum of 1988 (NAVD88)
3 Information from driller's report on-file with OSE
Depths are in feet below ground surface
POD = Point of diversion
UTM = Universal Transverse Mercator
PLSS = Public land survey system
> = Boring did not intersect redbed; depth to top of redbed is greater than bottom of boring
< = Boring did not intersect redbed; elevation at top of redbed is lower than bottom of boring
na = Not available

Appendix B Plate

S:\PROJECTS\DB21.1060_NMED_PFAS_INVESTIGATIONS\GIS\MXDS\CANNON_REPORT\P01_ELEVATION_AT_BASE_OF_THE_OGALLALA_AQUIFER_CONTOURS_20220621.MXD

City of Clovis

Curry County
Roosevelt County

Inset A

Inset B

N
0 1250 2500 ft

Base image source: Maxar, Vivid 11/14/2017
Depth to base of Ogallala sediments obtained from well logs available on-line from New Mexico Office of State Engineer

Explanation

- Supply well
- DBS-1
- Monitor well
- Soil boring
- Geothermal well
- Cannon Air Force Base
- Inferred channel
- Base of Ogallala Aquifer elevation isocontour (feet NAVD 1988)
- 02014 P1 Well designation
- 3,931 Base of Ogallala Aquifer (feet NAVD 1988)

Note: Elevations derrived from U.S. Geological Survey
USGS NED 1/3 arc-second n35w103 1 x 1 degree IMG 2019
raster digital data
Publication date: 20190916
Elevations are in feet relative to the North American Vertical Datum (NAVD) of 1988.

DBS&A
Daniel B. Stephens & Associates, Inc.
6/27/2022 DB21.1060

NMED PFAS INVESTIGATION, CANNON AFB

Elevation at Base of the Ogallala Aquifer

Plate B-1

Attachment B-1

OSE Well Records

DBS&A
Daniel B. Stephens & Associates, Inc.

This attachment is provided as a separate file on the report CD.

Appendix C

Cannon AFB Well Logs

DBS&A
Daniel B. Stephens & Associates, Inc.

This appendix is provided as a separate file on the report CD.

Appendix D

Geophysical Logs

DBS&A
Daniel B. Stephens & Associates, Inc.

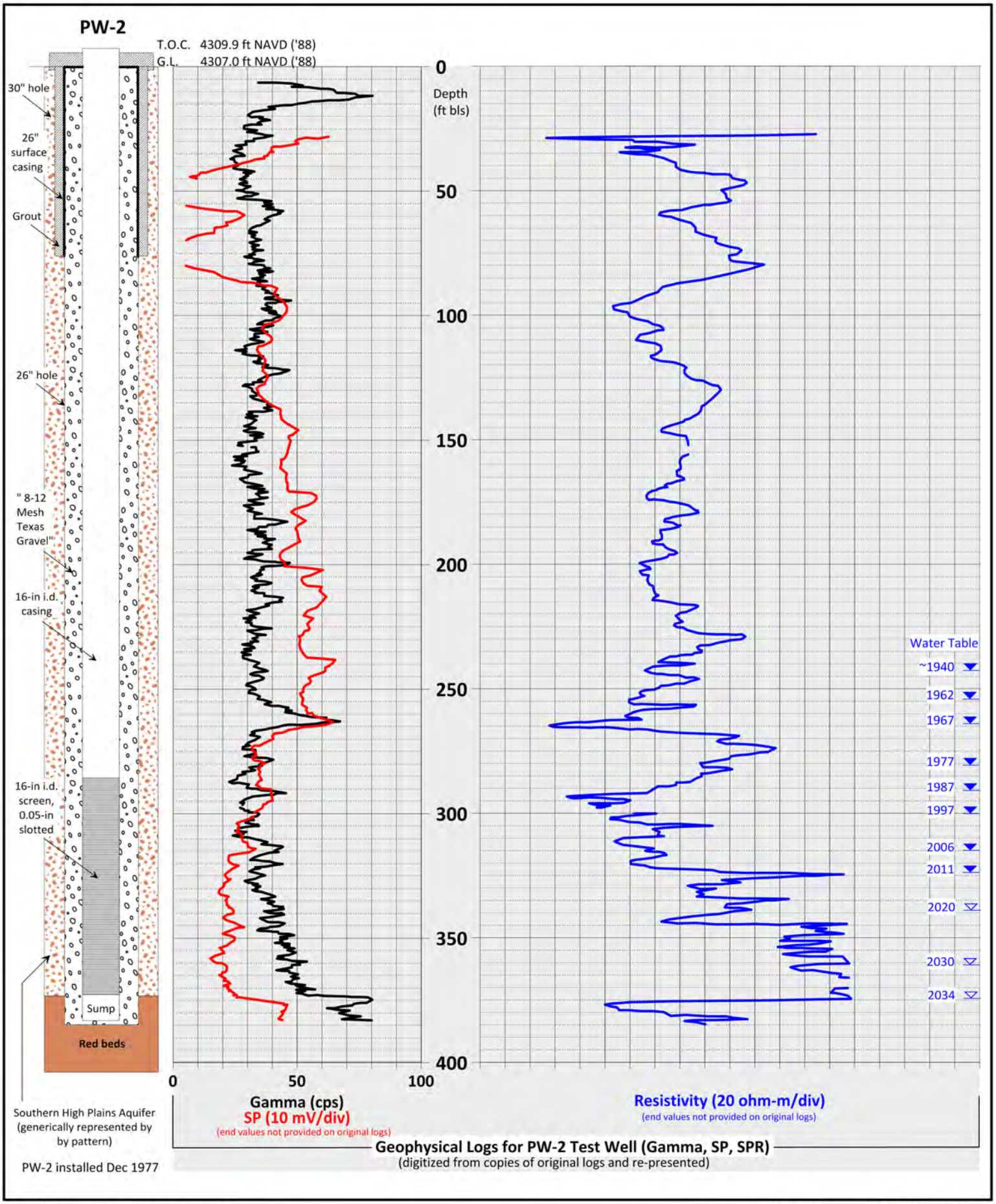
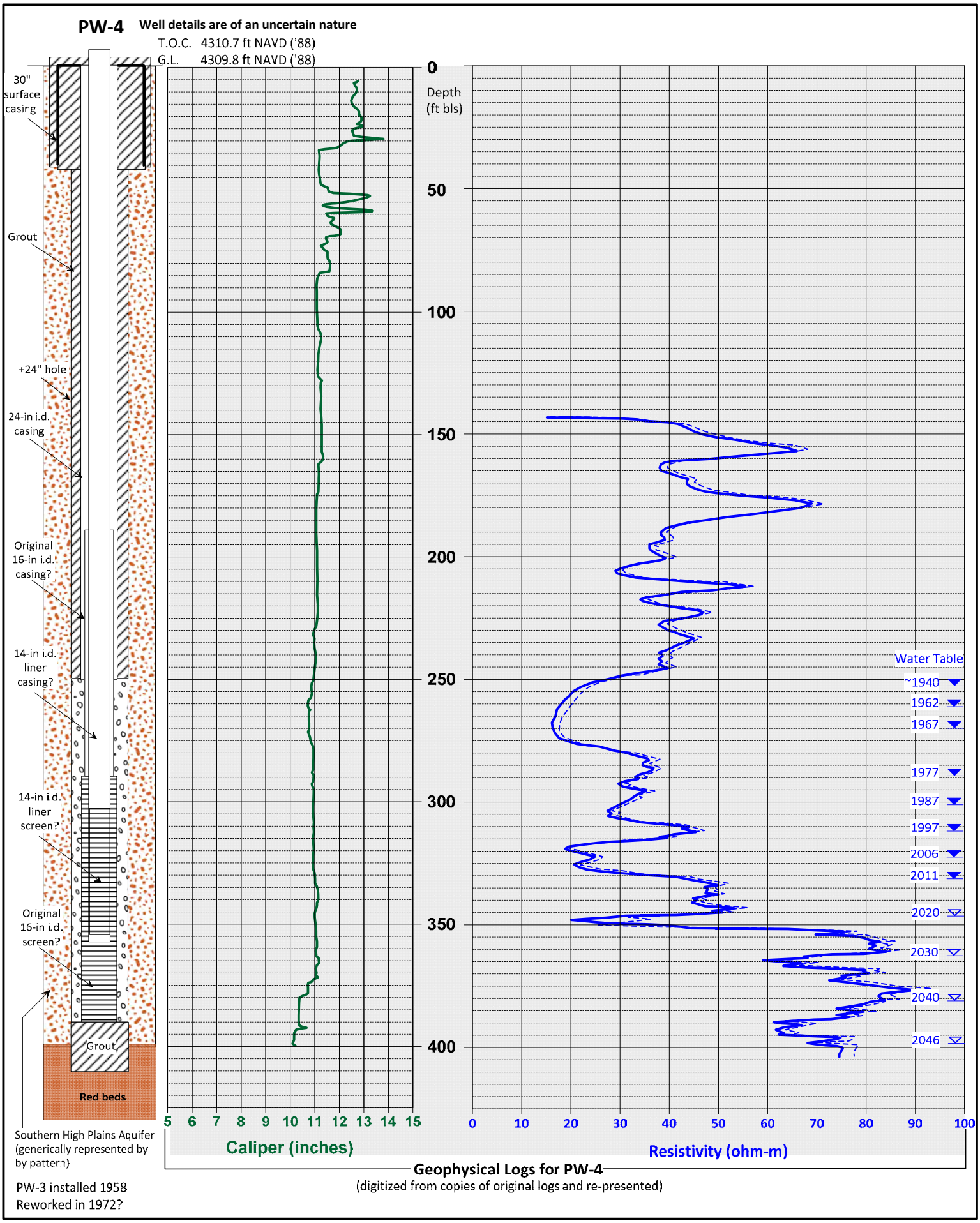


FIGURE 3.79 PRODUCTION WELL DETAIL, PW-2



Geophysical Logs for PW-4
(digitized from copies of original logs and re-presented)

FIGURE 3.83 PRODUCTION WELL DETAIL, PW-4

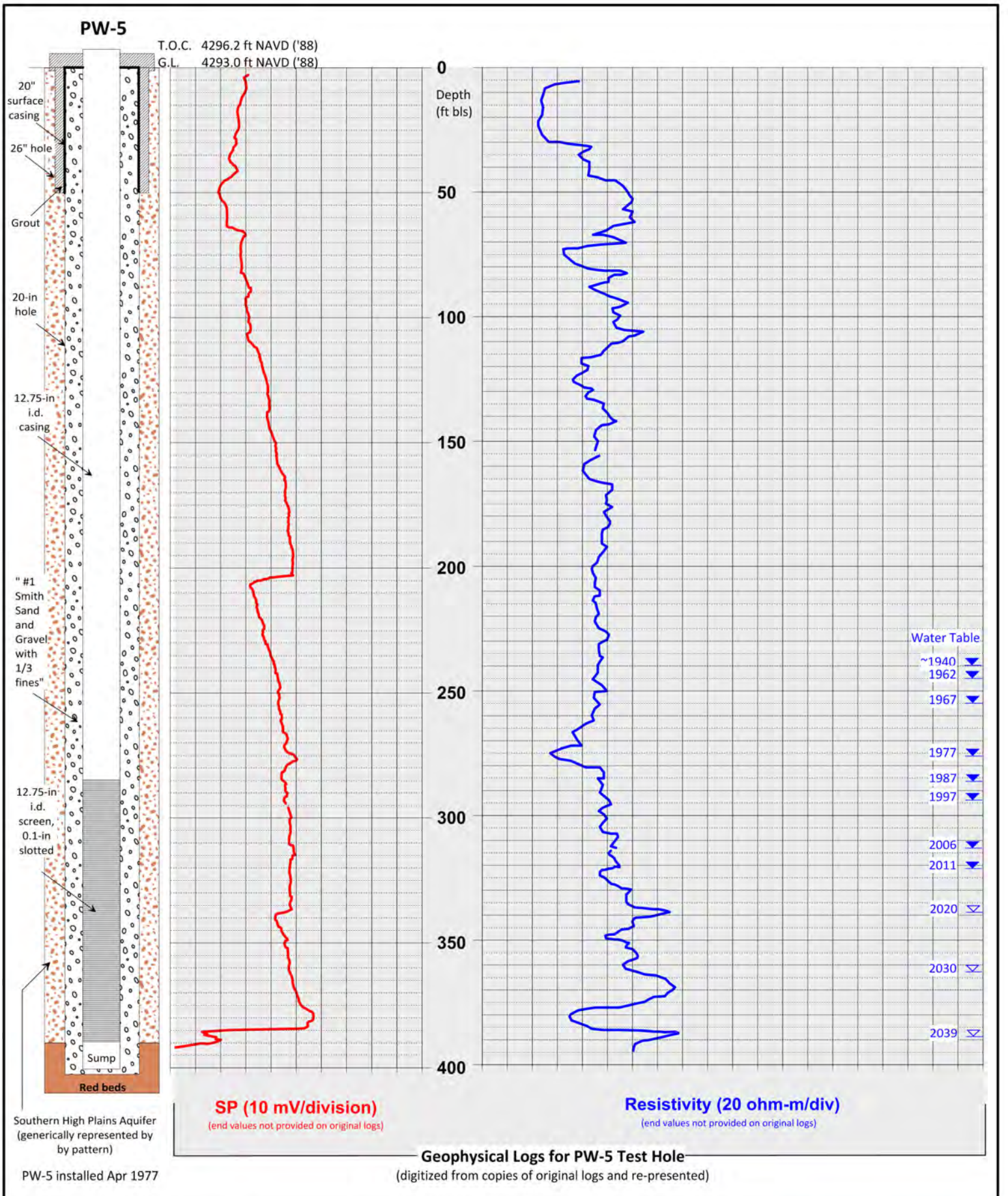


FIGURE 3.87 PRODUCTION WELL DETAIL, PW-5

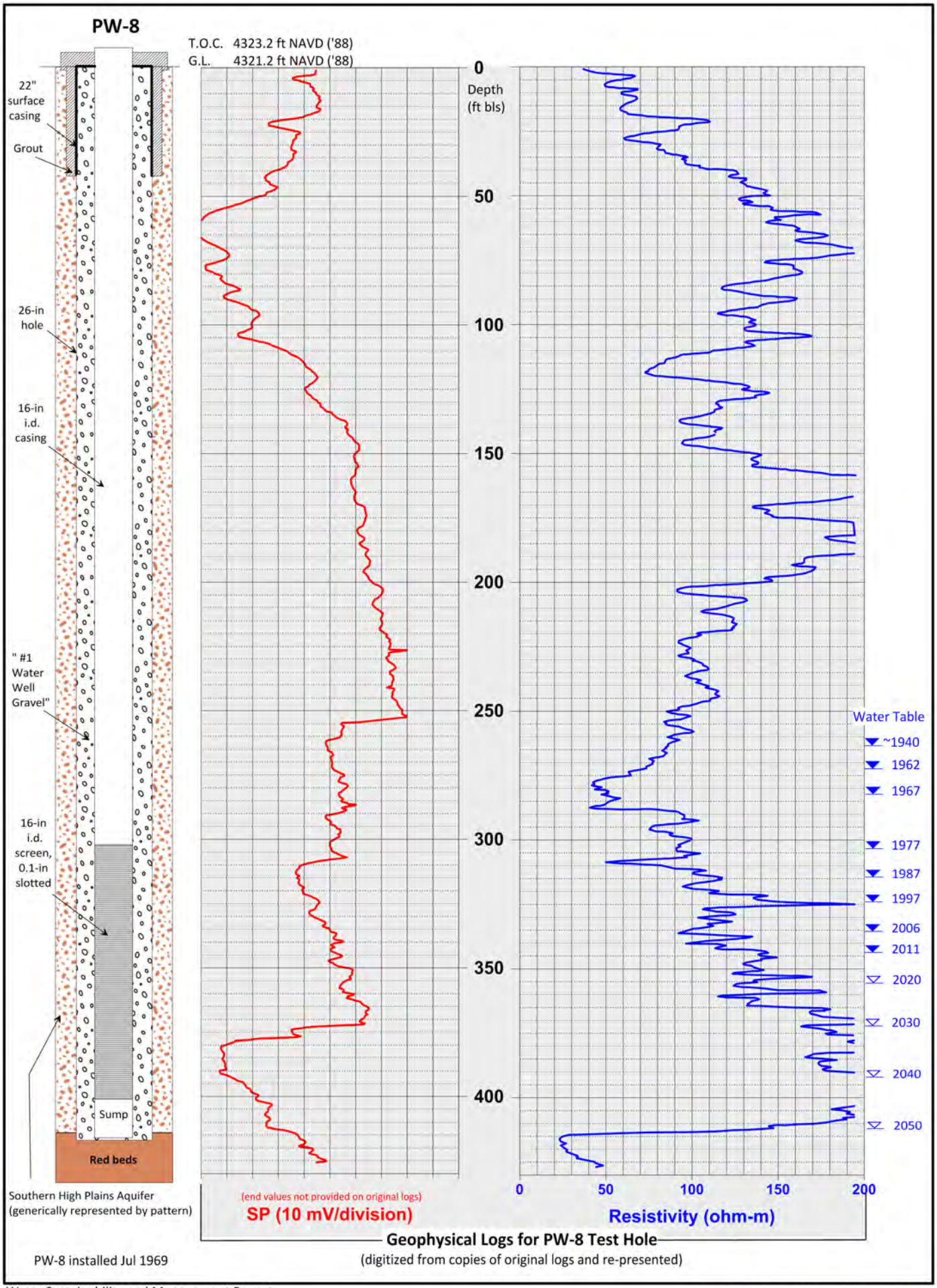
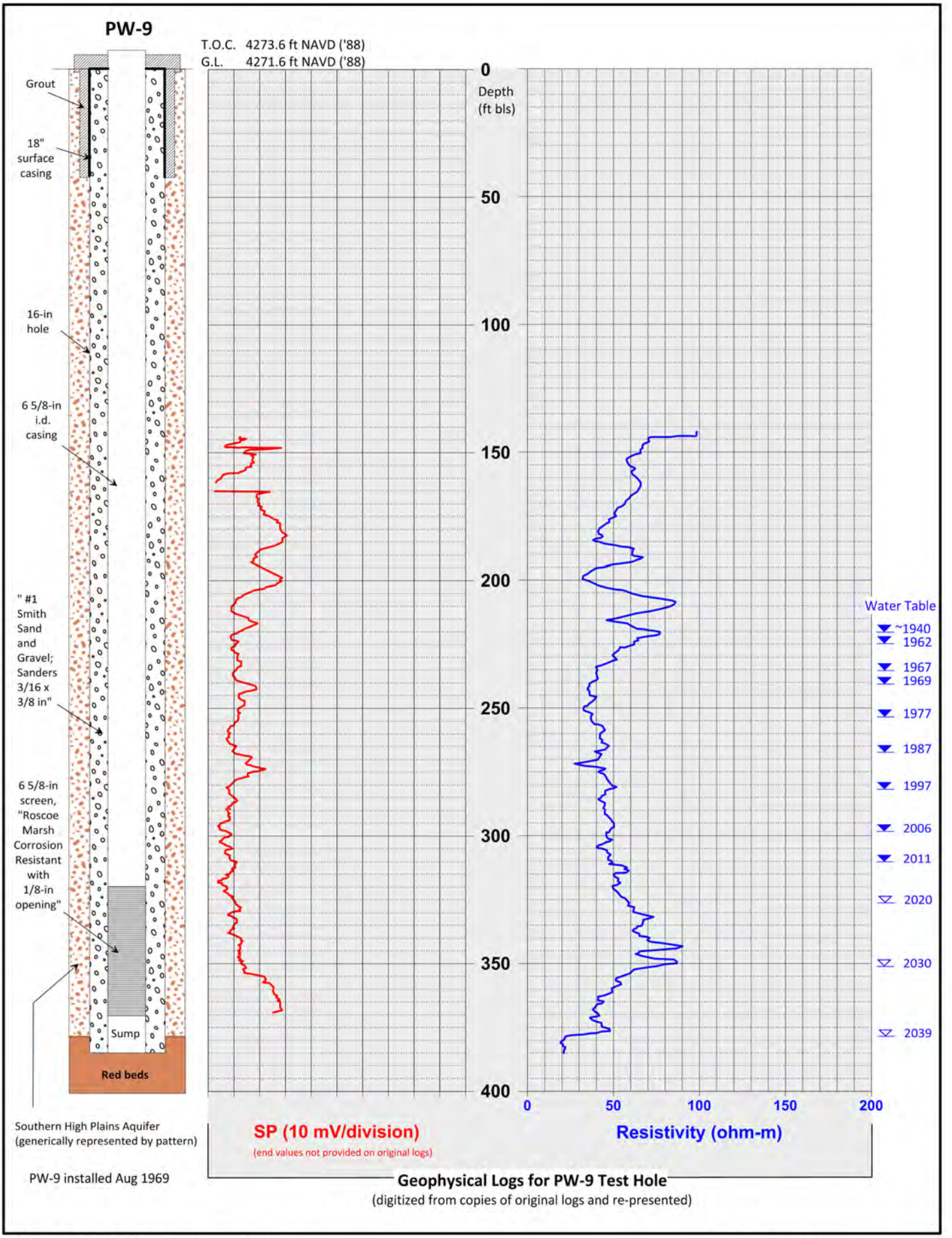
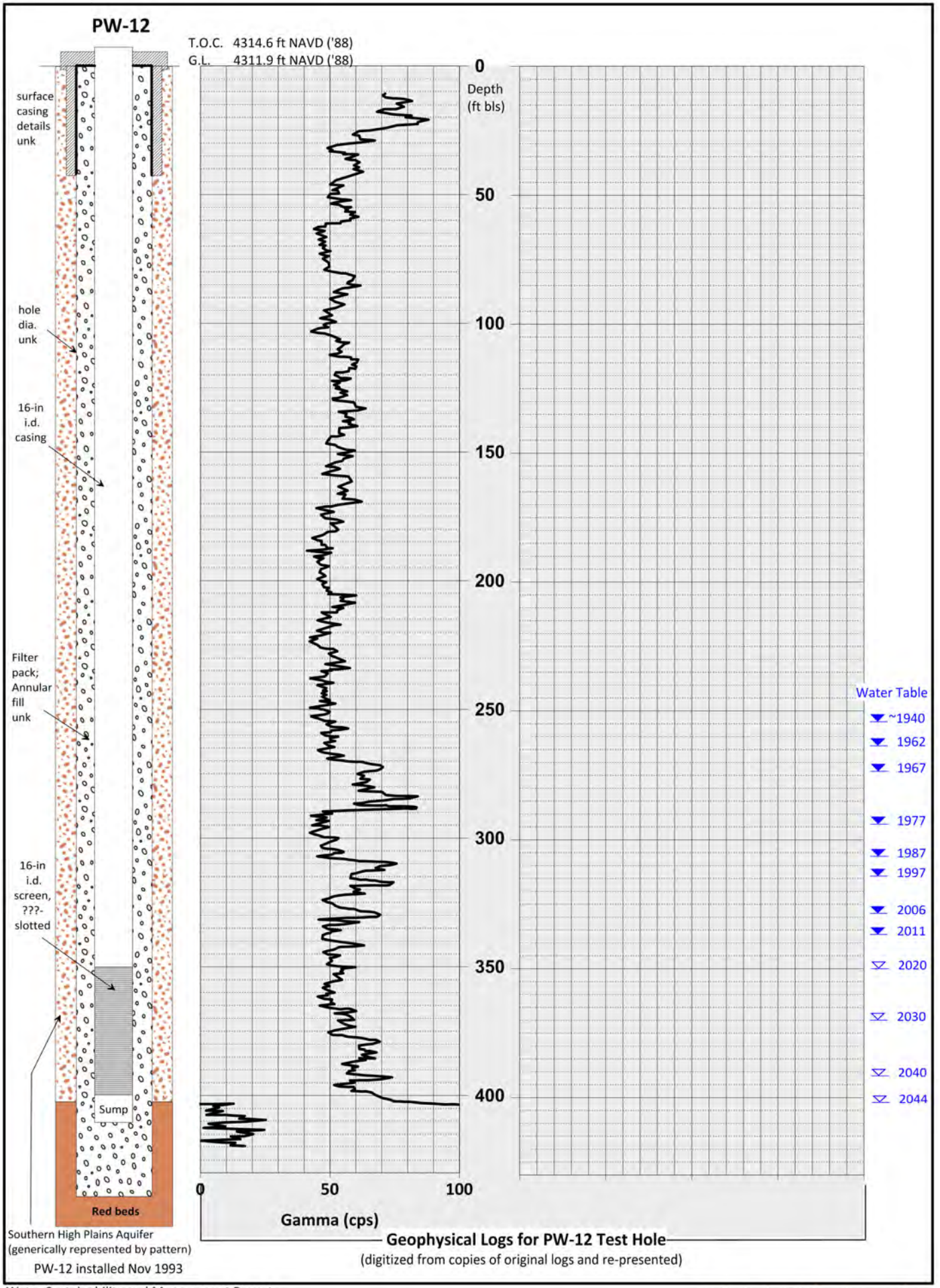


FIGURE 3.91 PRODUCTION WELL DETAIL, PW-8



Geophysical Logs for PW-9 Test Hole
(digitized from copies of original logs and re-presented)

FIGURE 3.93 PRODUCTION WELL DETAIL, PW-9

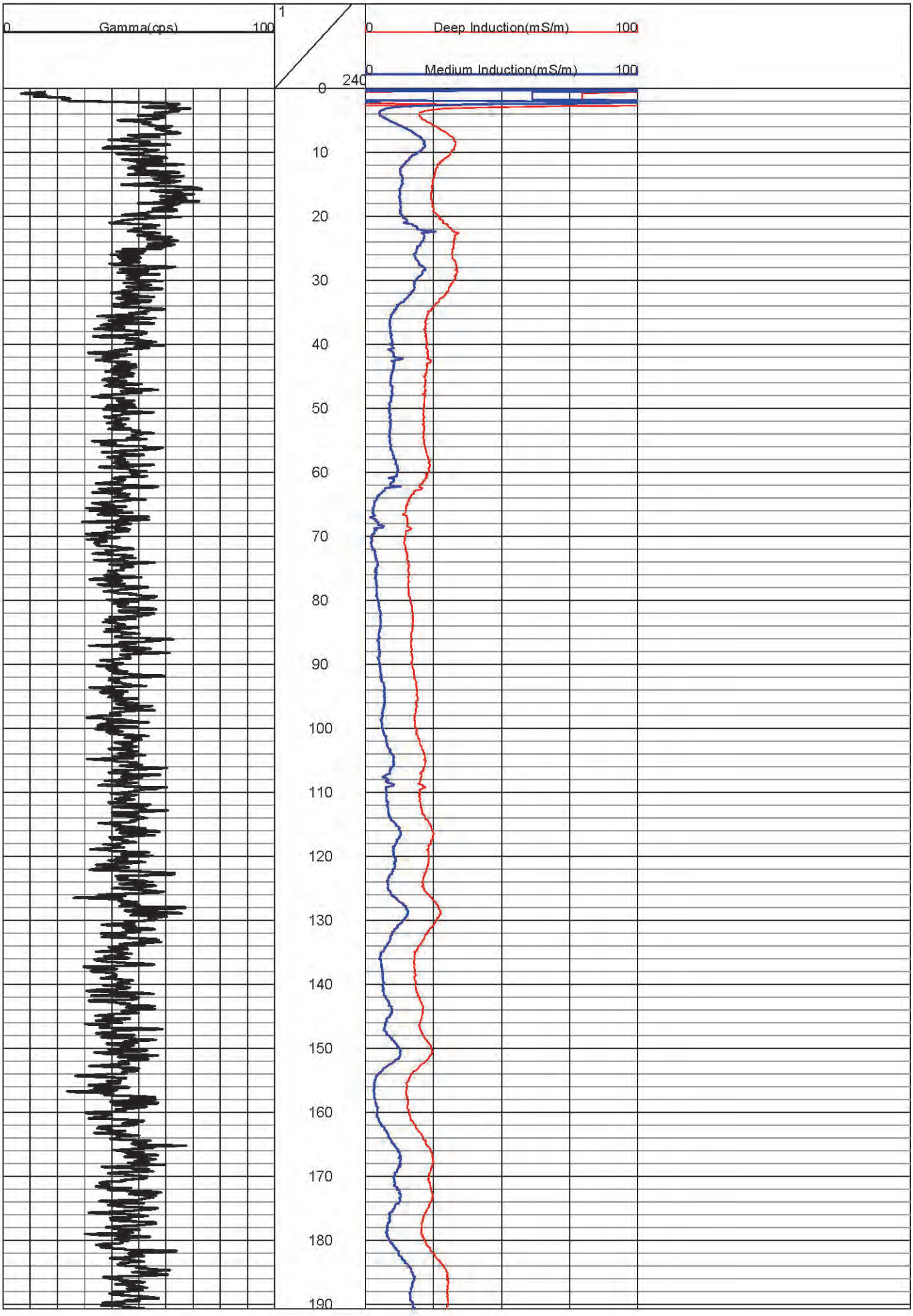


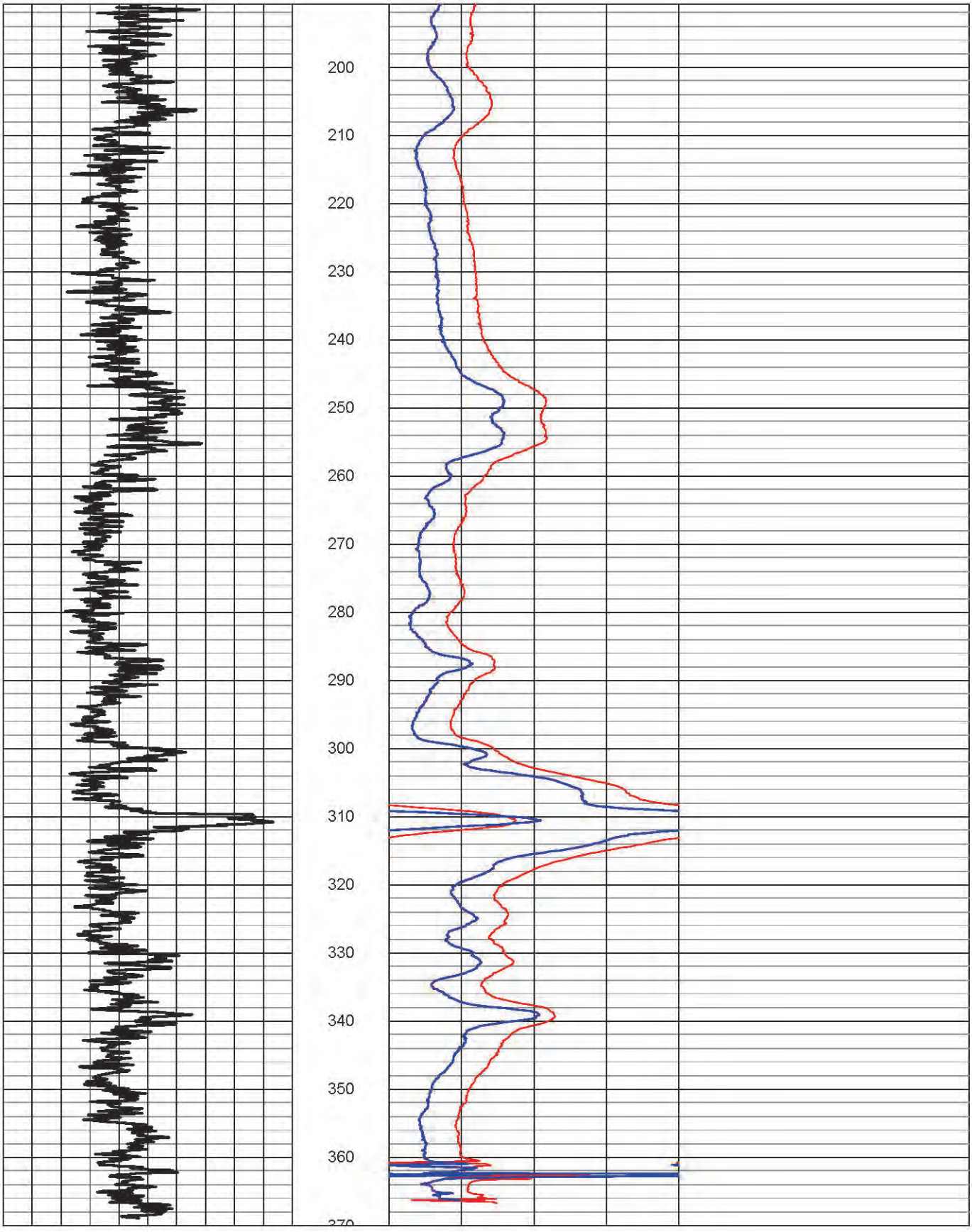
Water Sustainability and Management Report
Cannon AFB, New Mexico

Trinity Analysis & Development Corp

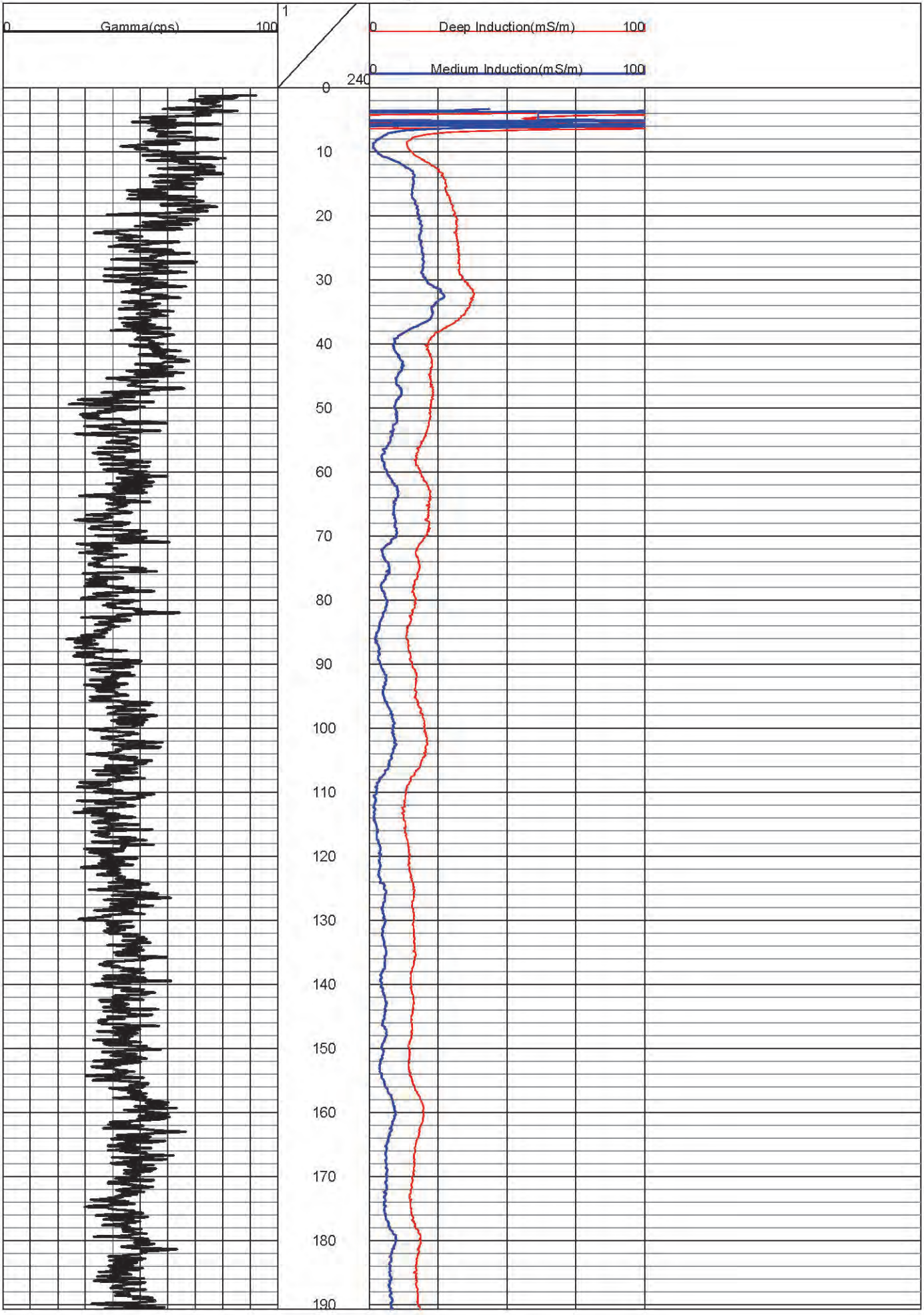
FIGURE 3.95 PRODUCTION WELL DETAIL, PW-12

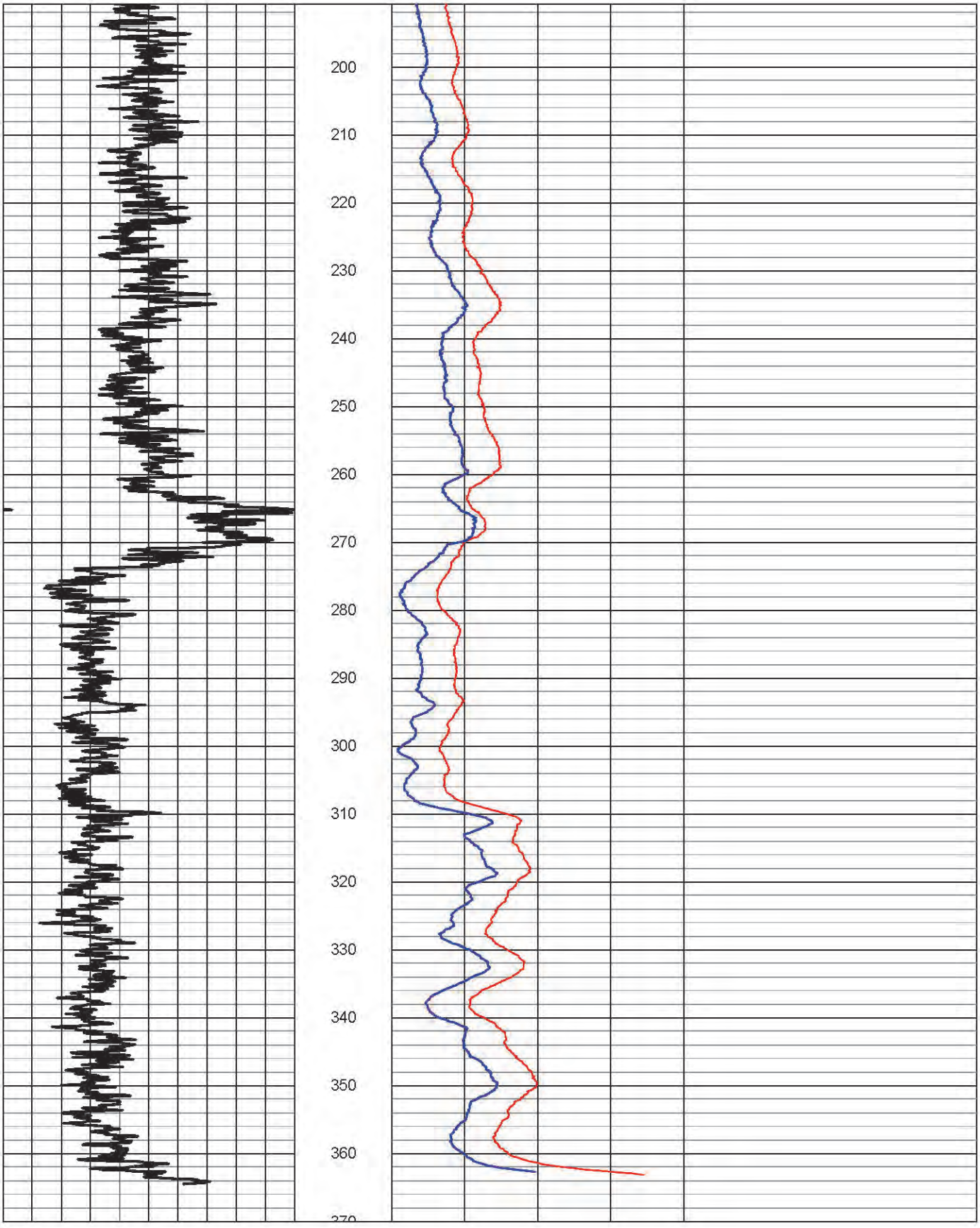
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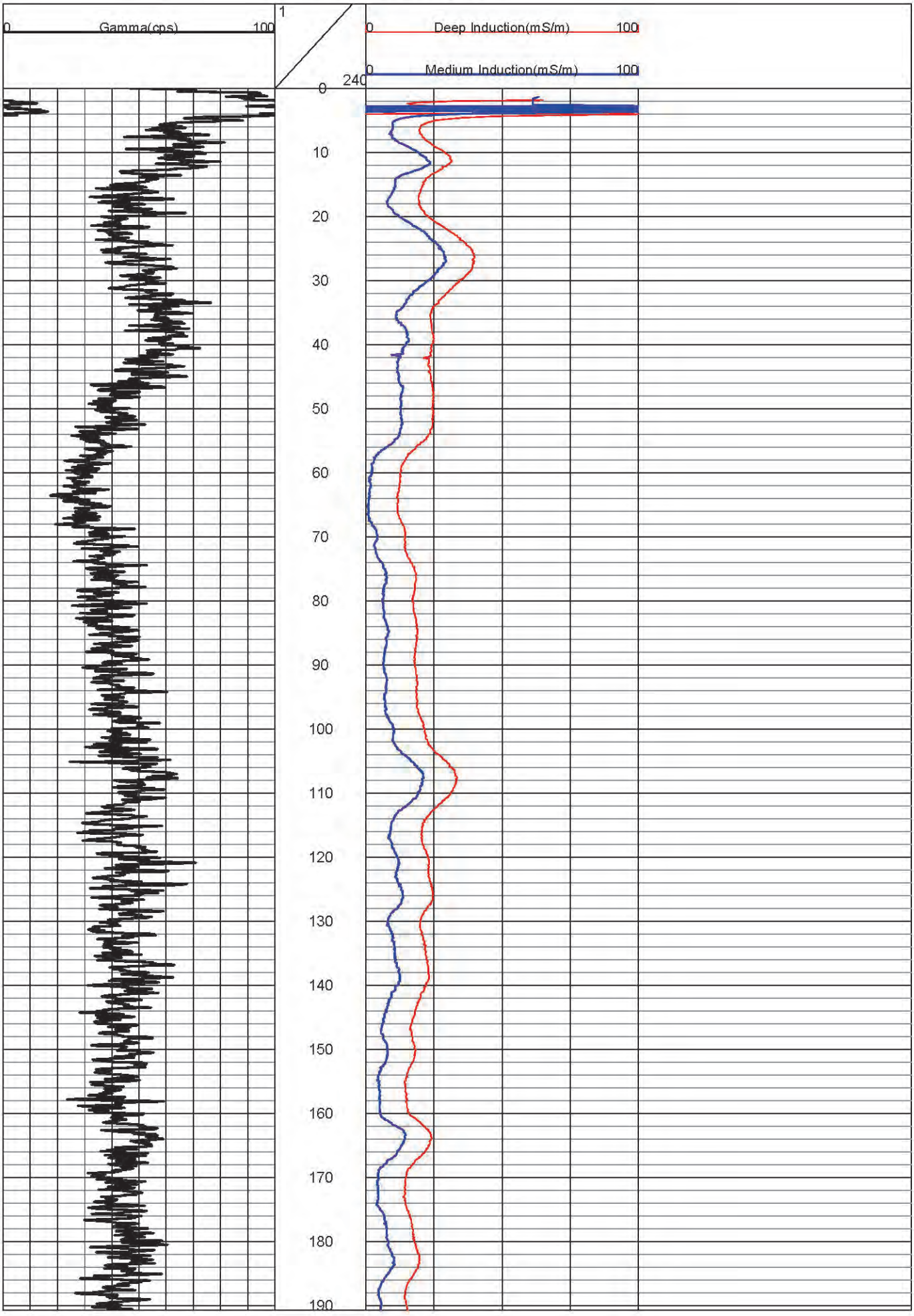

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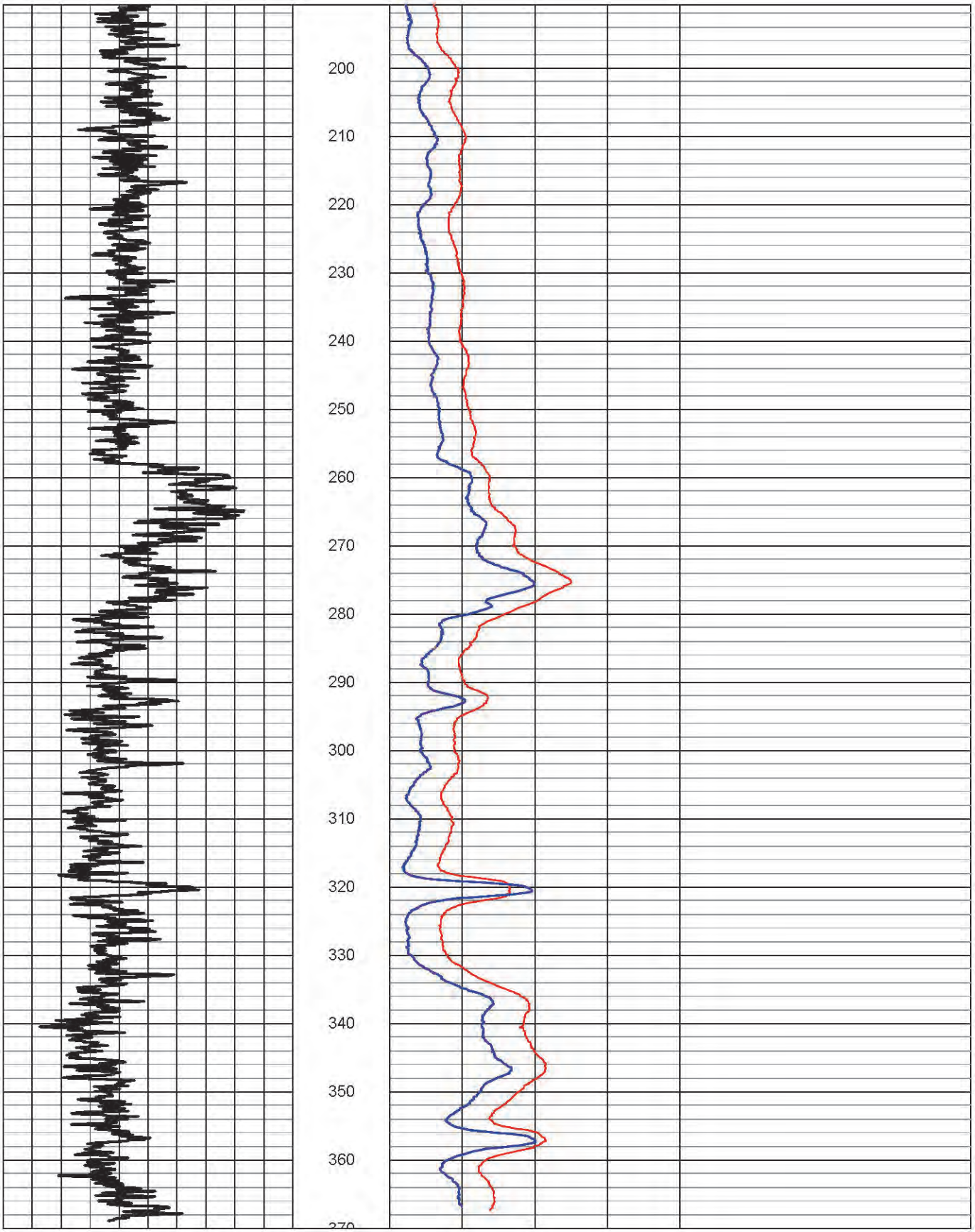
Monitoring Well MW-Oa



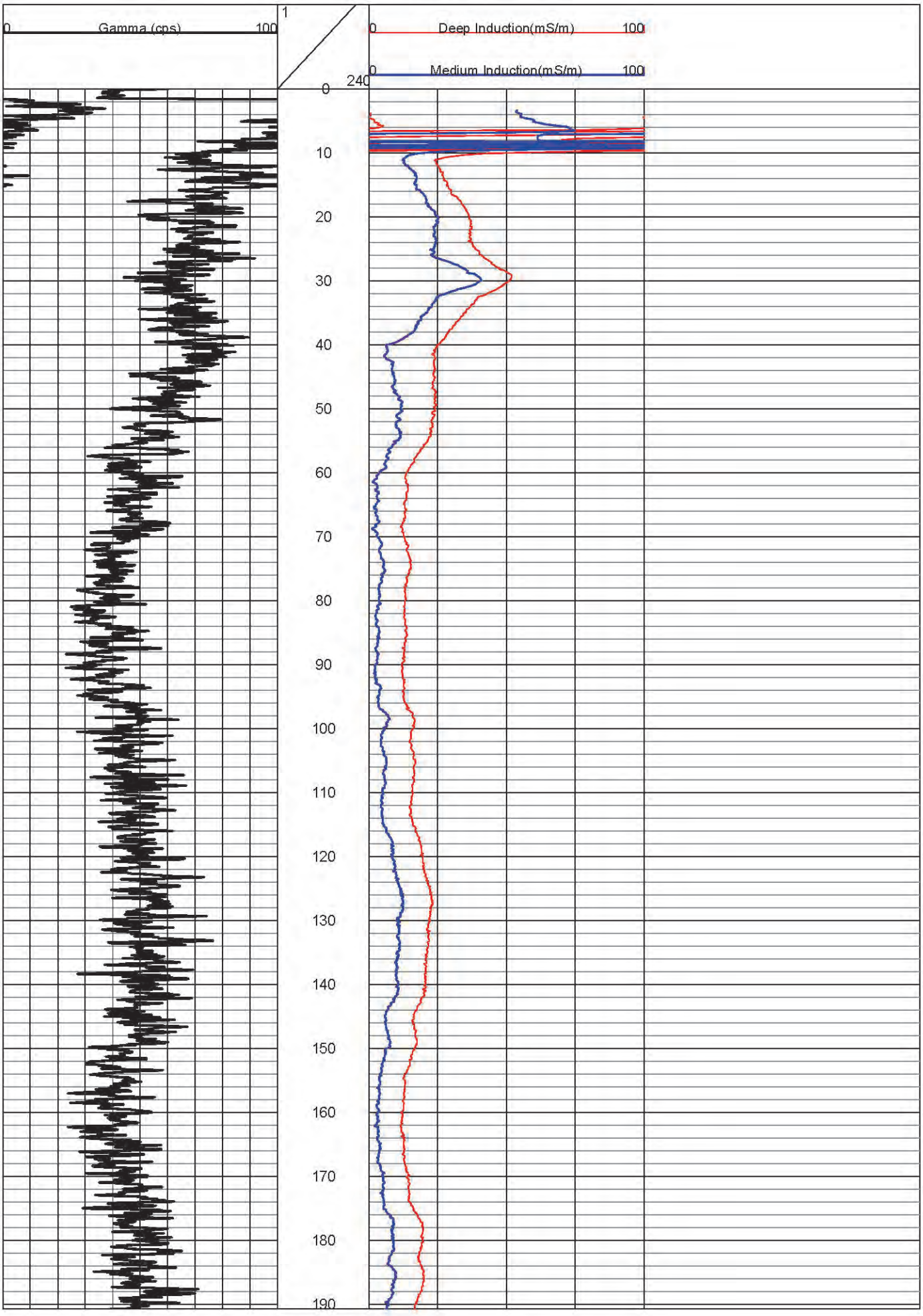

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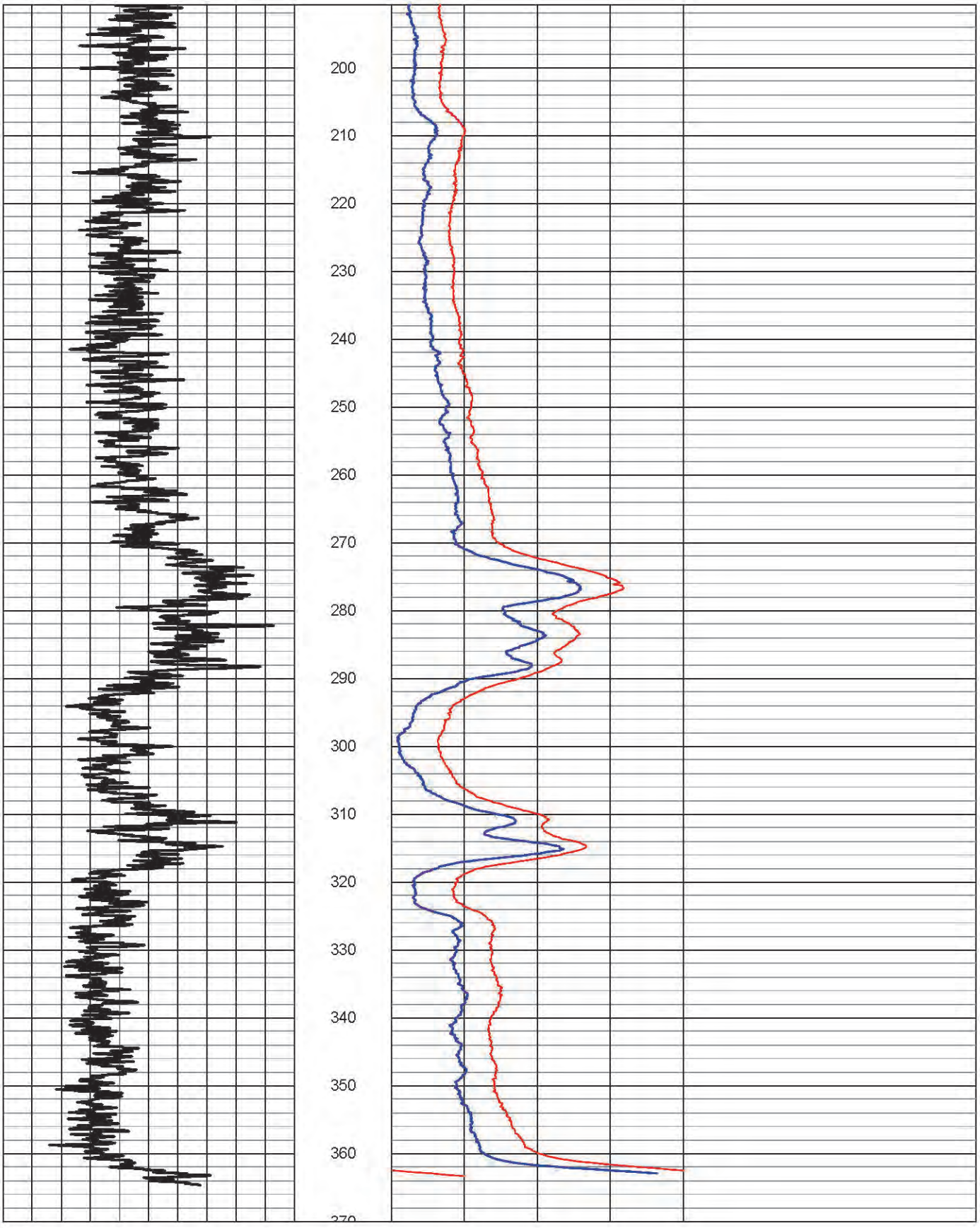
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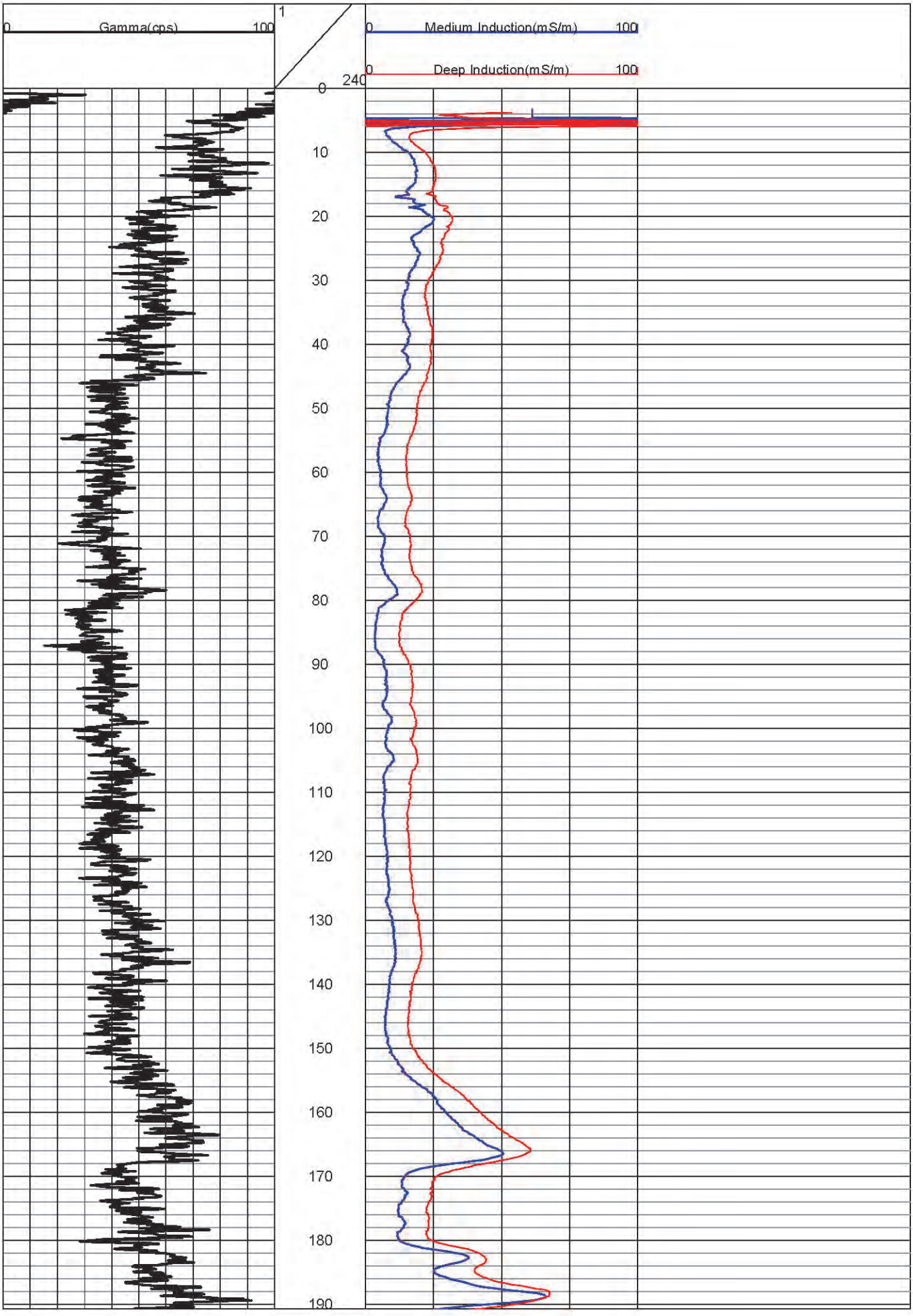

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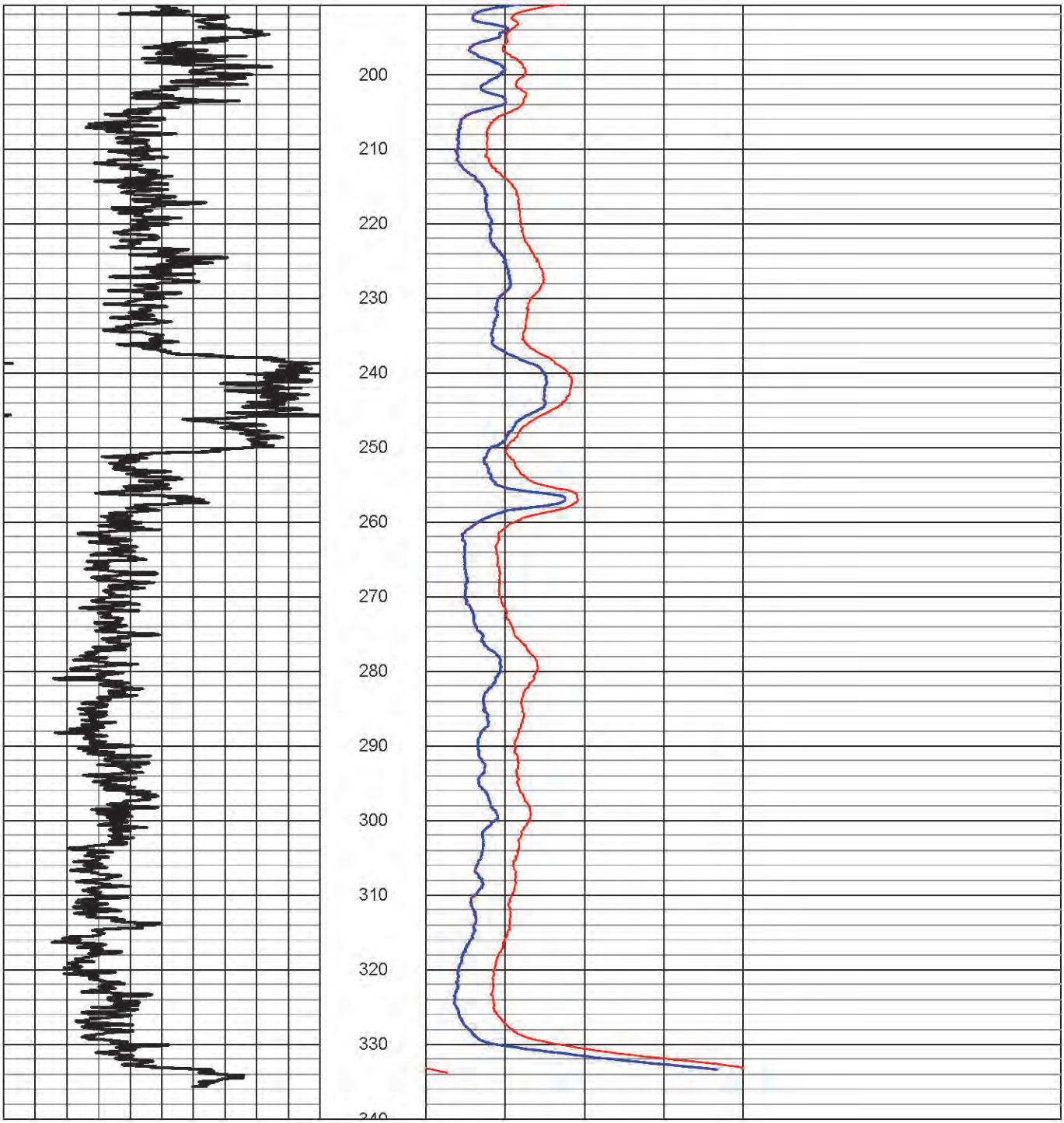
Monitoring Well MW-W




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Monitoring Well MW-X




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DEPARTMENT OF THE AIR FORCE
AIR FORCE CIVIL ENGINEER CENTER

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NMED
Hazardous Waste
Bureau

February 7, 2020

Christipher N. Gierke
Remedial Project Manager
AFCEC/CZO
506 N. Air Commando Way
Cannon AFB, NM 88103

Mr. Kevin Pierard
Chief, Hazardous Waste Bureau
New Mexico Environment Department
2905 Rodeo Park Drive East, Bldg. 1
Santa Fe NM 87505-6313

RE: *USGS Subsurface Geophysical Investigation Cannon Air Force Base, New Mexico*

Dear Mr. Pierard

This responds to the Hazardous Waste Bureau's letter of January 16, 2020. As Colonel Masaitis stated in his October 24, 2019 letter regarding the United States Geological Survey (USGS) geophysical study at Cannon, the Air Force did not initiate or perform the geophysical study at Cannon. The USGS initiated and performed the survey. The USGS will not prepare an investigation report about the survey, but has forwarded the survey data to an Air Force contractor. The contractor will use the data during development of a Conceptual Site Model (CSM) for Cannon Air Force Base (CAFB). The CSM is estimated to be completed in the next few months. Once finalized and approved by the Air Force, a courtesy copy will be forward to the Hazardous Waste Bureau. A courtesy copy of the survey data the Air Force received from the USGS is attached.

As a further courtesy, the Air Force hereby notifies you that the USGS is planning on further investigation at CAFB. We anticipate the additional work to be a non-invasive geophysical survey. We do not have exact details of the investigation and timing currently.

The Air Force appreciates the valued working relationship CAFB and the Air Force Civil Engineer Center has with you and your department. If you have any further comments or questions pertaining to the USGS survey, please contact me at (575) 904-6744 or at christipher.gierke@us.af.mil.

Sincerely

C.N. GIERKE, GS-12, AFCEC
Remedial Project Manager

Attachement:
USGS Survey Data

cc:
CAFB, Colonel Robert Masaitis
NMED, Gabriel Acevedo
NMED, Benjamin Wear
NMED, David Cobrain

USGS
science for a changing world

SERVICE COMPANY	USGS
file type	ORIGINAL
field office	USGS
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longitude	-103.314 E
eng units or cps	

company CANNON AIR FORCE BASE
well BH-1
field CANNON
county CURRY state NM

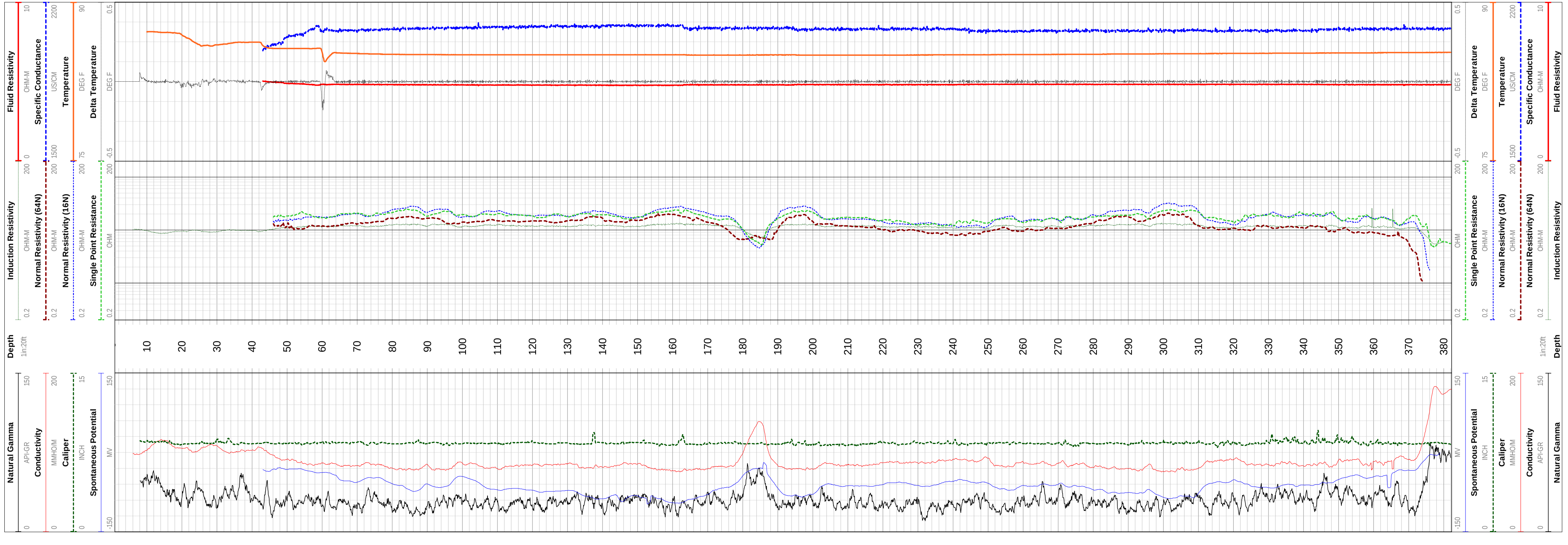
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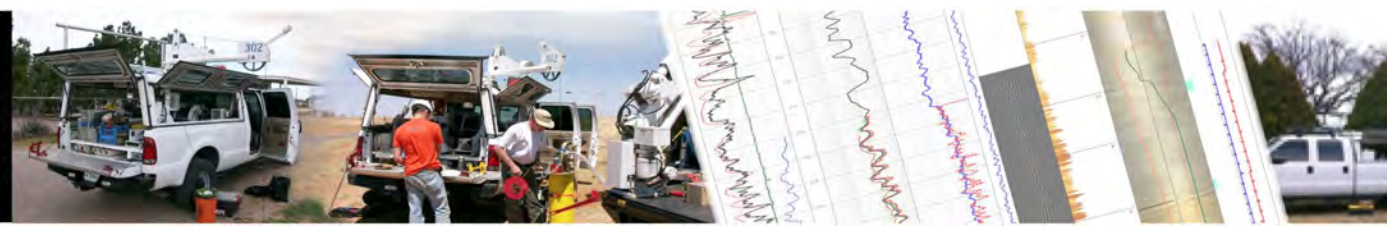
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elev df NA
elev perm datum 4274

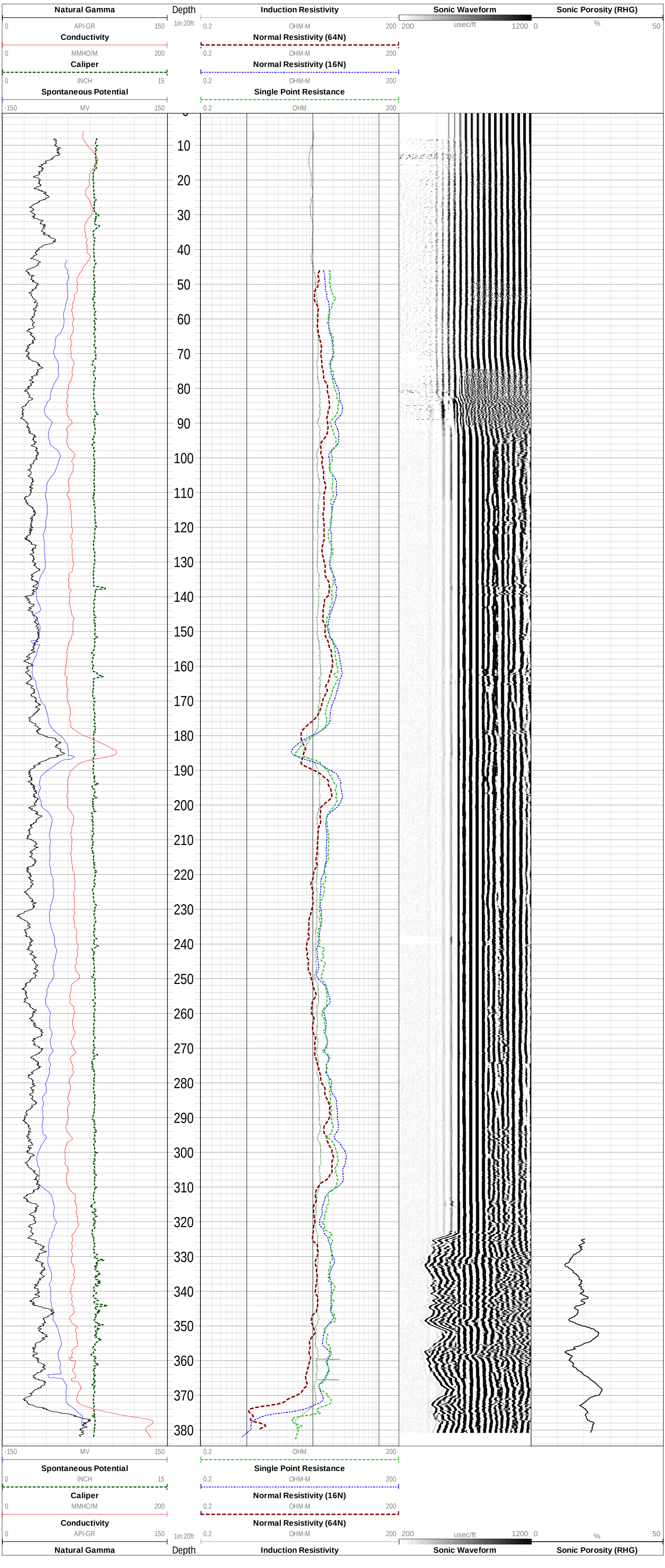
DATE	05/06/19	time circ stopped	
log direction		log sample int	.10
file type id		feet or meter	F
depth driller		sys serial	1
fluid type	MUD	sys version	3.6XH
log bottom	385.00	casing diameter	NA
log top	0.00	casing bottom	
time		casing type	OPEN HOLE
recorded by	PAYNE	casing thick	
tool serial num		bit size	7.875
fluid density		fluid viscosity	
Name Prn AP		truck cal num	
mean surface temp		mud sample source	
temp gradient		mud res	
mag declination		mud temp	
density matrix	2.65	res mud filtrate	
neutron matrix	SANDSTONE	res mud cake	
delta t matrix	54	temp mud filtrate	
deltat fluid		temp mud cake	
fluid ph		elect cutoff	9999
remarks2		remarks1	



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Well Name BH-1 Date of Logging 5/6/2019 County Curry State New Mexico



U.S. DEPARTMENT OF THE INTERIOR — U.S. GEOLOGICAL SURVEY

USGS
science for a changing world

SERVICE COMPANY	USGS
file type	ORIGINAL
field office	USGS
latitude	34.3795
longitude	-103.308
eng units or cps	E

company CANNON AIR FORCE BASE
well BH-2
field CANNON
county CURRY state NM

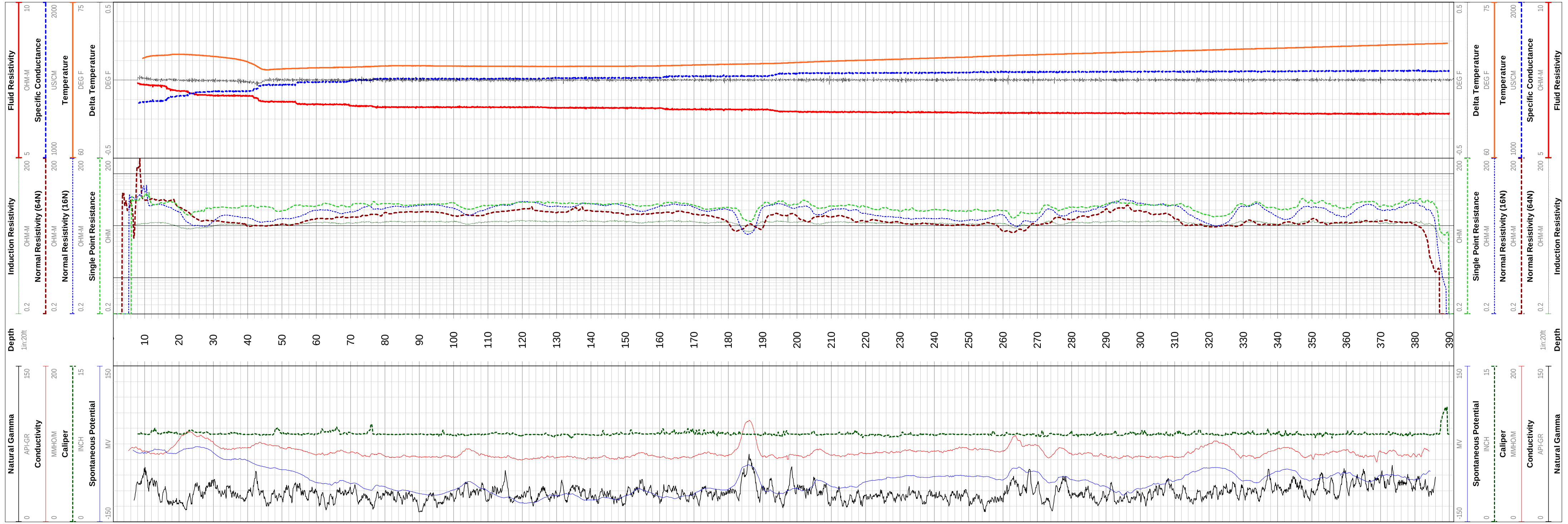
UNIQUE WELL ID
LOCATION CLOVIS
PROVINCE
section NA township NA range NA

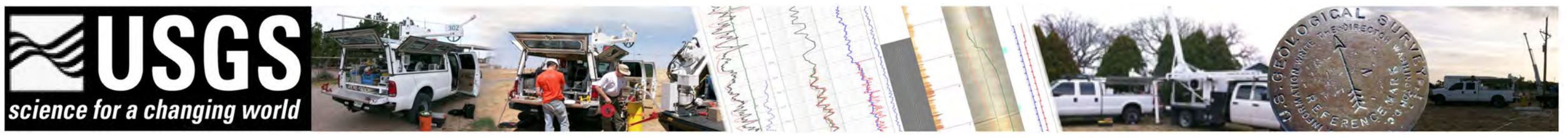
other1serv
ZW
other2serv
ZI
other3serv
ZE

permanent datum LSD
log meas from LSD
logging unit 302
drl meas from NA

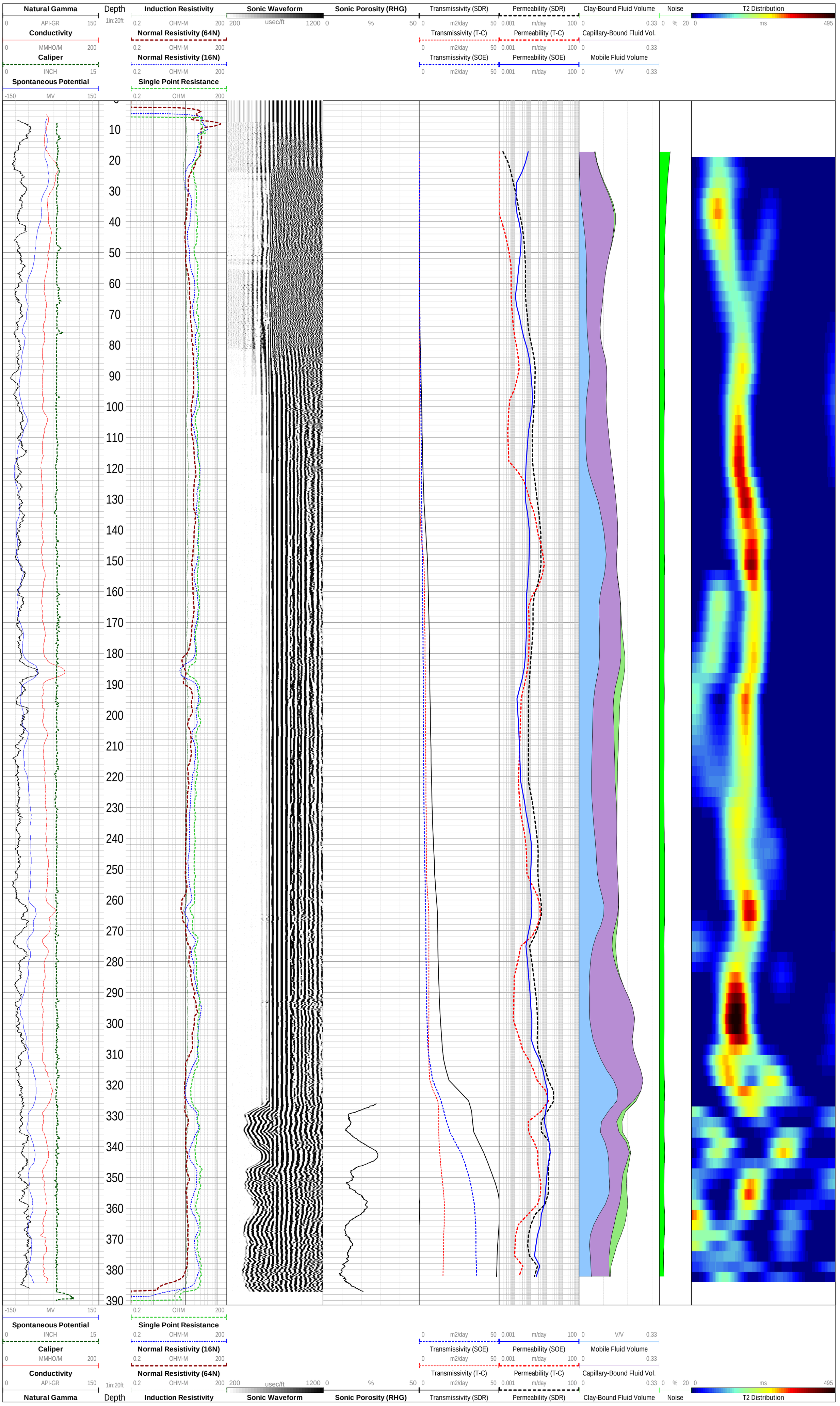
elev gl NA
elev kb NA
elev df NA
elev perm datum 4274

DATE	05/09/19	time circ stopped	
log direction		log sample int	.10
file type id		feet or meter	F
depth driller		sys serial	1
fluid type	MUD	sys version	3.6XH
log bottom	391.30	casing diameter	NA
log top	0.10	casing bottom	
time		casing type	OPEN HOLE
recorded by	PAYNE	casing thick	
tool serial num		bit size	7.875
fluid density		fluid viscosity	
Name Prn AP		truck cal num	
mean surface temp		mud sample source	
temp gradient		mud res	
mag declination		mud temp	
density matrix	2.65	res mud filtrate	
neutron matrix	SANDSTONE	res mud cake	
delta t matrix	54	temp mud filtrate	
deltat fluid		temp mud cake	
fluid ph		elect cutoff	9999
remarks2		remarks1	





Well Name BH-2 Date of Logging 5/9/2019 County Curry State New Mexico

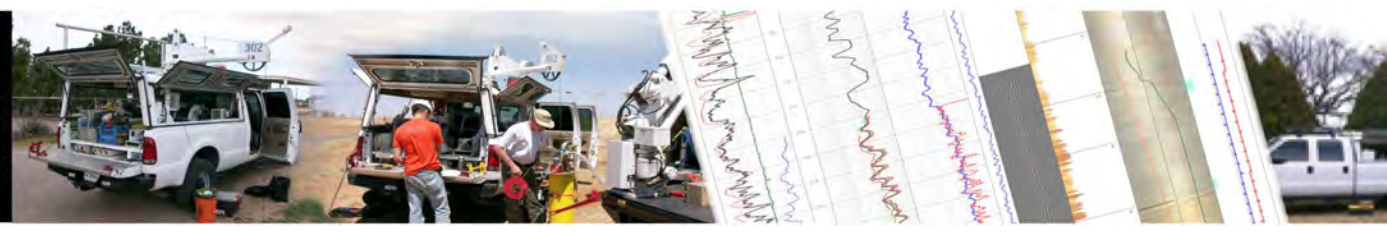


company	CANNON AIR FORCE BASE		
well	BH-3		
field	CANNON		
county	CURRY	state	NM
UNIQUE WELL ID			other1serv
LOCATION	CLOVIS		ZW
PROVINCE			other2serv
			ZI
			other3serv
section NA	township NA	range NA	ZE

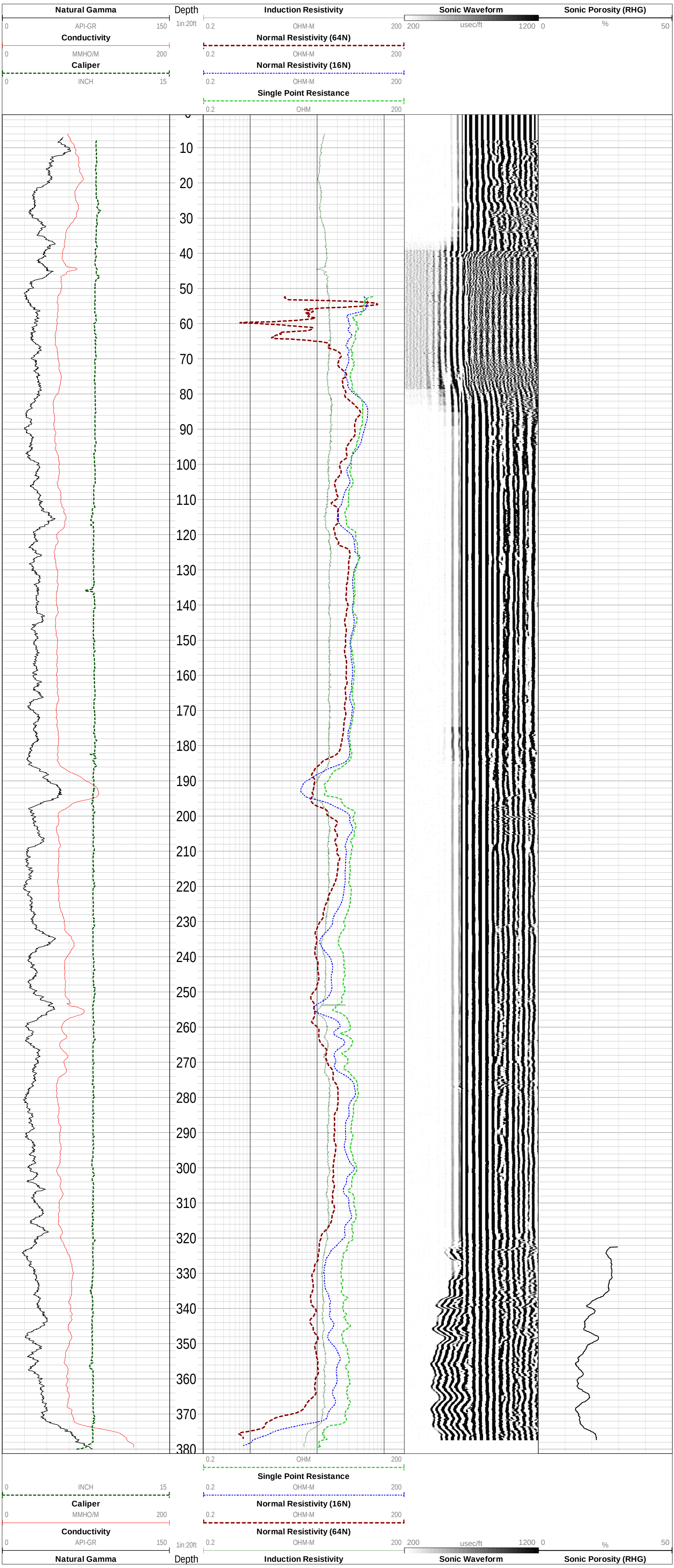
SERVICE COMPANY USGS
file type ORIGINAL
field office USGS
latitude 34.3814
longitude -103.303
eng units or cps E

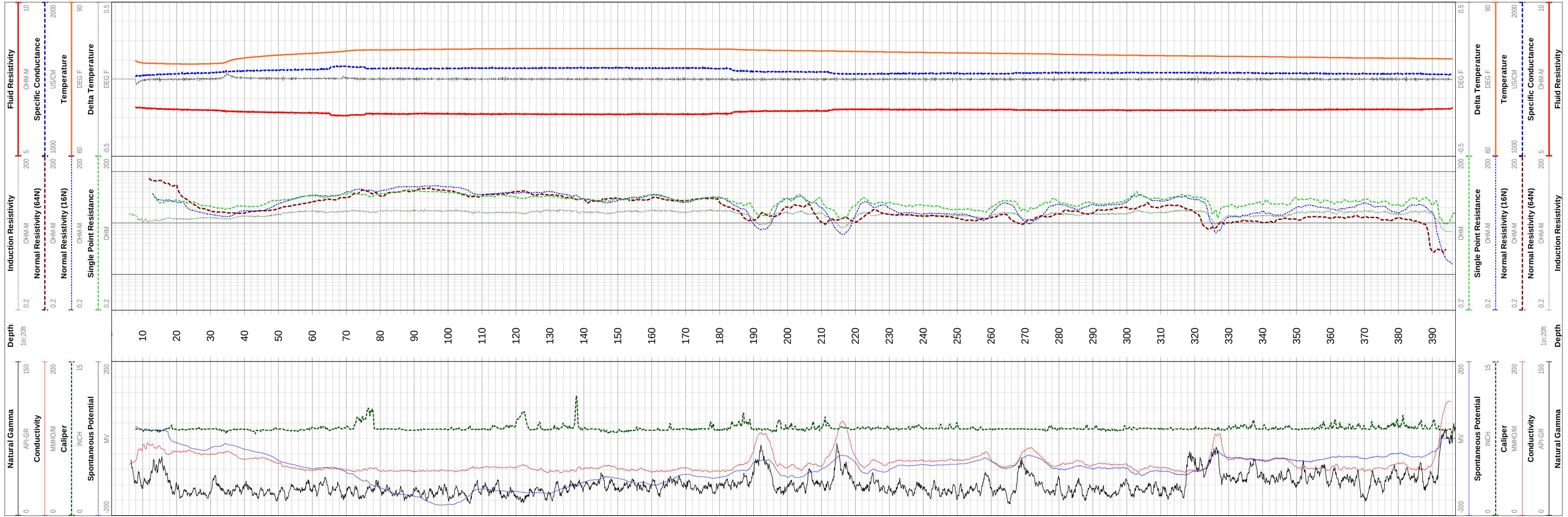
permanent datum	LSD		
log meas from	LSD		
logging unit	302		
drl meas from	NA		
DATE	05/04/19	time circ stopped	
log direction		log sample int	.10
file type id		feet or meter	F
depth driller		sys serial	1
fluid type	MUD	sys version	3.6XH
log bottom	381.70	casing diameter	NA
log top	0.10	casing bottom	
time		casing type	OPEN HOLE
recorded by	PAYNE	casing thick	
tool serial num		bit size	7.875
fluid density		fluid viscosity	
Name Prn AP		truck cal num	
mean surface temp		mud sample source	
temp gradient		mud res	
mag declination		mud temp	
density matrix	2.65	res mud filtrate	
neutron matrix	SANDSTONE	res mud cake	
delta t matrix	54	temp mud filtrate	
deltat fluid		temp mud cake	
fluid ph		elect cutoff	9999
remarks2		remarks1	

USGS
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Well Name BH-3 Date of Logging 5/4/2019 County Curry State New Mexico



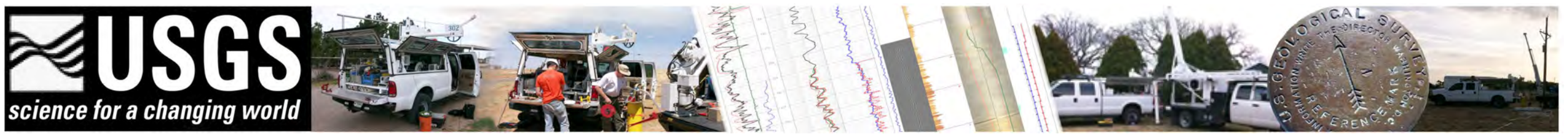


SERVICE COMPANY	USGS	company	CANNON AIR FORCE BASE
ORIGINAL		well	BH-4
file type	USGS	field	CANNON
field office		county	CURRY
latitude	34.3744	state	NM
longitude	-103.303	UNIQUE WELL ID	
eng units or cps	E	LOCATION	CLOVIS
		PROVINCE	
		section NA	township NA
		range NA	

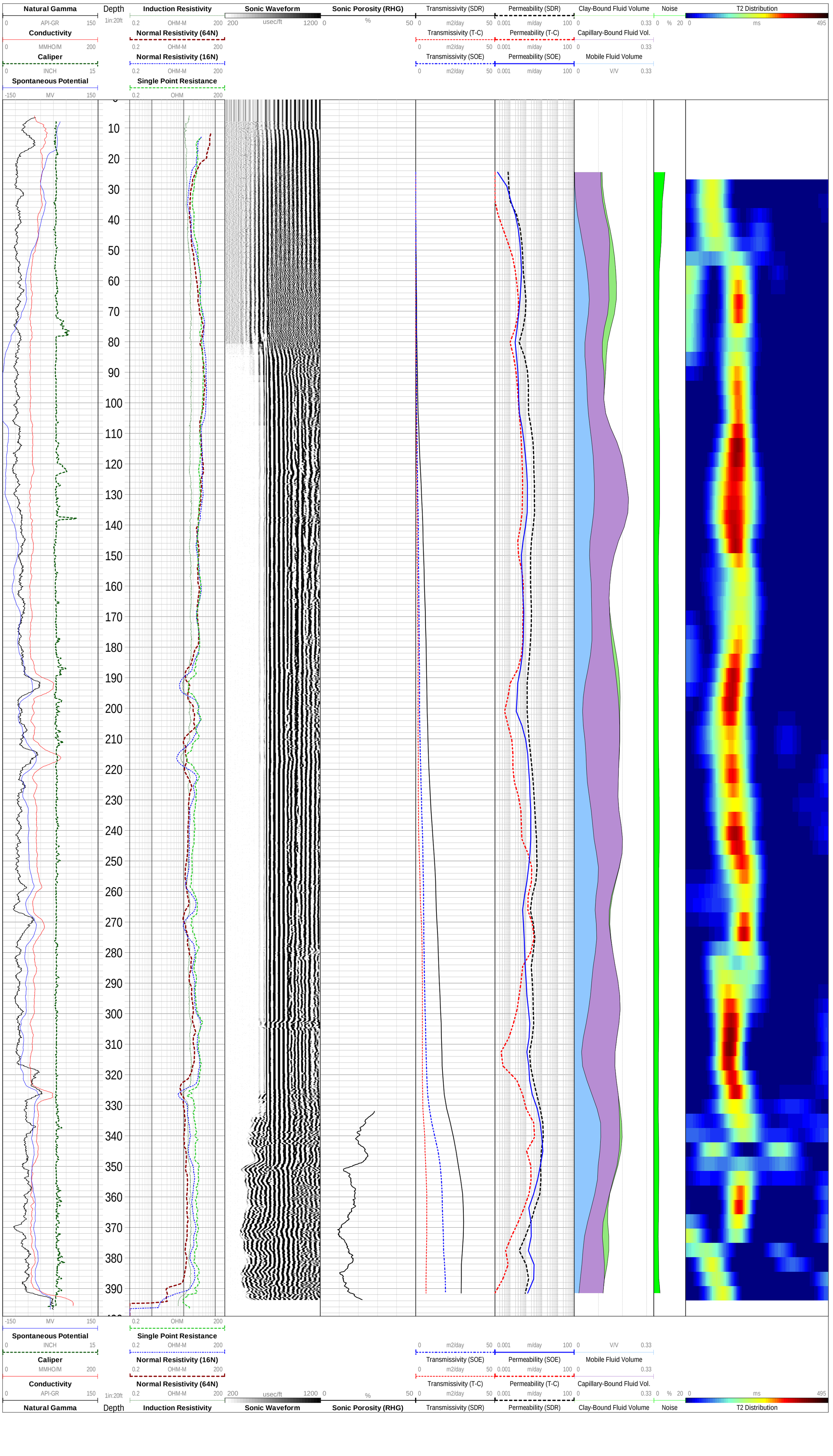
other1serv
ZW
other2serv
ZI
other3serv
ZE

permanent datum	LSD	elev gl	NA
log meas from	LSD	elev kb	NA
logging unit	302	elev df	NA
drl meas from	NA	elev perm datum	4274

DATE	05/11/19	time circ stopped	
log direction		log sample int	.10
file type id		feet or meter	F
depth driller		sys serial	1
fluid type	MUD	sys version	3.6XH
log bottom	397.90	casing diameter	NA
log top	0.00	casing bottom	
time		casing type	OPEN HOLE
recorded by	PAYNE	casing thick	
tool serial num		bit size	7.875
fluid density		fluid viscosity	
Name Prn AP		truck cal num	
mean surface temp		mud sample source	
temp gradient		mud res	
mag declination		mud temp	
density matrix	2.65	res mud filtrate	
neutron matrix	SANDSTONE	res mud cake	
delta t matrix	54	temp mud filtrate	
deltat fluid		temp mud cake	
fluid ph		elect cutoff	9999
remarks2		remarks1	



Well Name BH-4 Date of Logging 5/11/2019 County Curry State New Mexico



U.S. DEPARTMENT OF THE INTERIOR — U.S. GEOLOGICAL SURVEY

USGS science for a changing world

SERVICE COMPANY	USGS
file type	ORIGINAL
field office	USGS
latitude	34.3719
longitude	-103.309
eng units or cps	E

company CANNON AIR FORCE BASE
well MW-A
field CANNON
county CURRY state NM

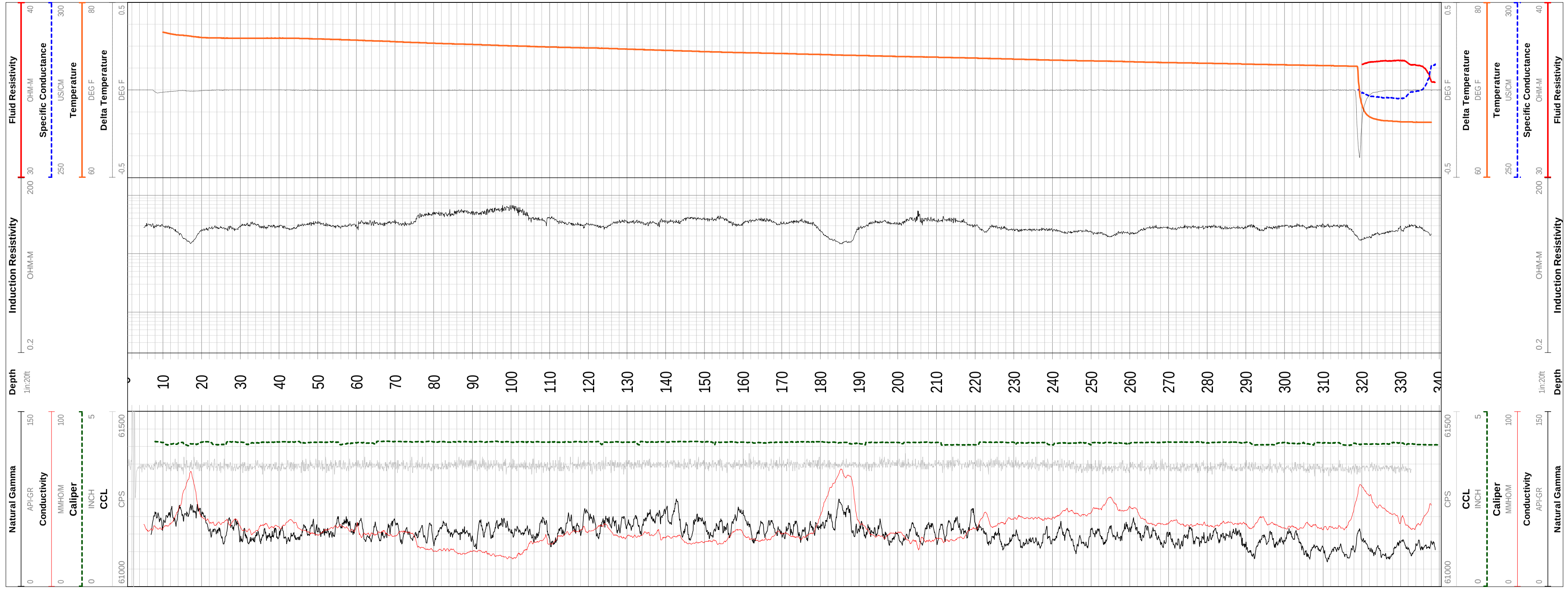
UNIQUE WELL ID
LOCATION CLOVIS
PROVINCE
section NA township NA range NA

other1serv
ZW
other2serv
ZI
other3serv
ZE

permanent datum LSD
log meas from LSD
logging unit 302
drl meas from NA

elev gl NA
elev kb NA
elev df NA
elev perm datum 4267

DATE	05/03/19	time circ stopped	
log direction		log sample int	.10
file type id		feet or meter	F
depth driller		sys serial	1
fluid type	H2O	sys version	3.6XH
log bottom	340.40	casing diameter	4
log top	0.00	casing bottom	
time		casing type	PVC
recorded by	PAYNE	casing thick	
tool serial num		bit size	
fluid density		fluid viscosity	
Name Prn AP		truck cal num	
mean surface temp		mud sample source	
temp gradient		mud res	
mag declination		mud temp	
density matrix	2.65	res mud filtrate	
neutron matrix	SANDSTONE	res mud cake	
delta t matrix	54	temp mud filtrate	
deltat fluid		temp mud cake	
fluid ph		elect cutoff	9999
remarks2		remarks1	



U.S. DEPARTMENT OF THE INTERIOR — U.S. GEOLOGICAL SURVEY

USGS
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SERVICE COMPANY	USGS
file type	ORIGINAL
field office	USGS
latitude	34.3795
longitude	-103.308
eng units or cps	E

company CANNON AIR FORCE BASE
well BH-2
field CANNON
county CURRY state NM

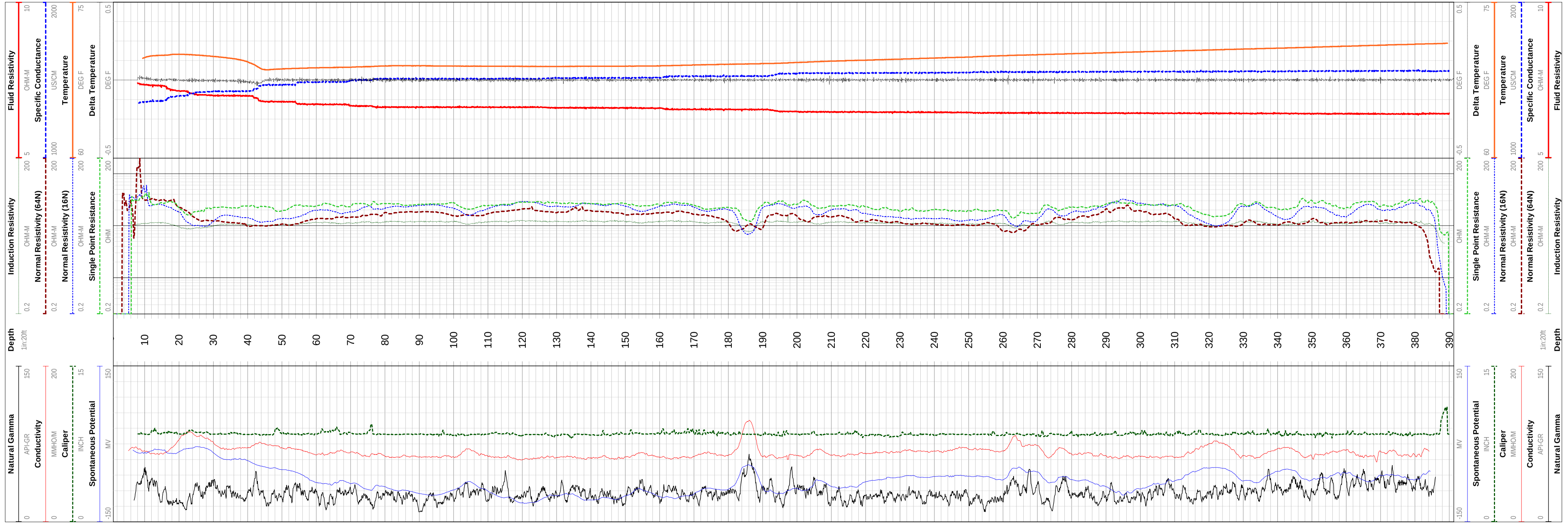
UNIQUE WELL ID
LOCATION CLOVIS
PROVINCE
section NA township NA range NA

other1serv
ZW
other2serv
ZI
other3serv
ZE

permanent datum LSD
log meas from LSD
logging unit 302
drl meas from NA

elev gl NA
elev kb NA
elev df NA
elev perm datum 4274

DATE	05/09/19	time circ stopped	
log direction		log sample int	.10
file type id		feet or meter	F
depth driller		sys serial	1
fluid type	MUD	sys version	3.6XH
log bottom	391.30	casing diameter	NA
log top	0.10	casing bottom	
time		casing type	OPEN HOLE
recorded by	PAYNE	casing thick	
tool serial num		bit size	7.875
fluid density		fluid viscosity	
Name Prn AP		truck cal num	
mean surface temp		mud sample source	
temp gradient		mud res	
mag declination		mud temp	
density matrix	2.65	res mud filtrate	
neutron matrix	SANDSTONE	res mud cake	
delta t matrix	54	temp mud filtrate	
deltat fluid		temp mud cake	
fluid ph		elect cutoff	9999
remarks2		remarks1	

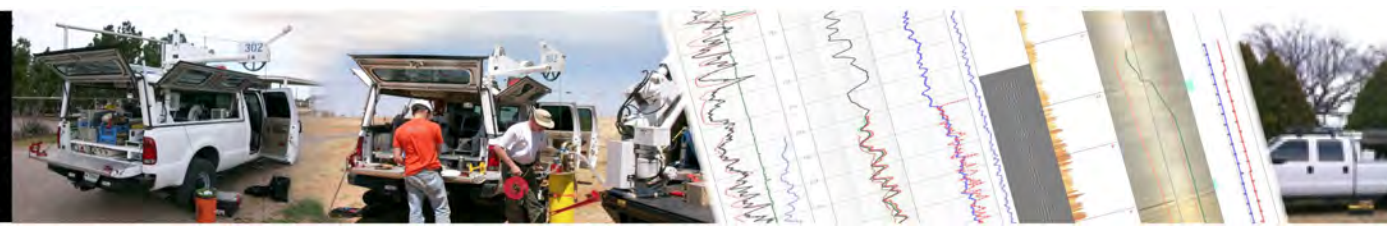


company	CANNON AIR FORCE BASE		
well	BH-3		
field	CANNON		
county	CURRY	state	NM
UNIQUE WELL ID			other1serv
LOCATION	CLOVIS		ZW
PROVINCE			other2serv
			ZI
			other3serv
section NA	township NA	range NA	ZE

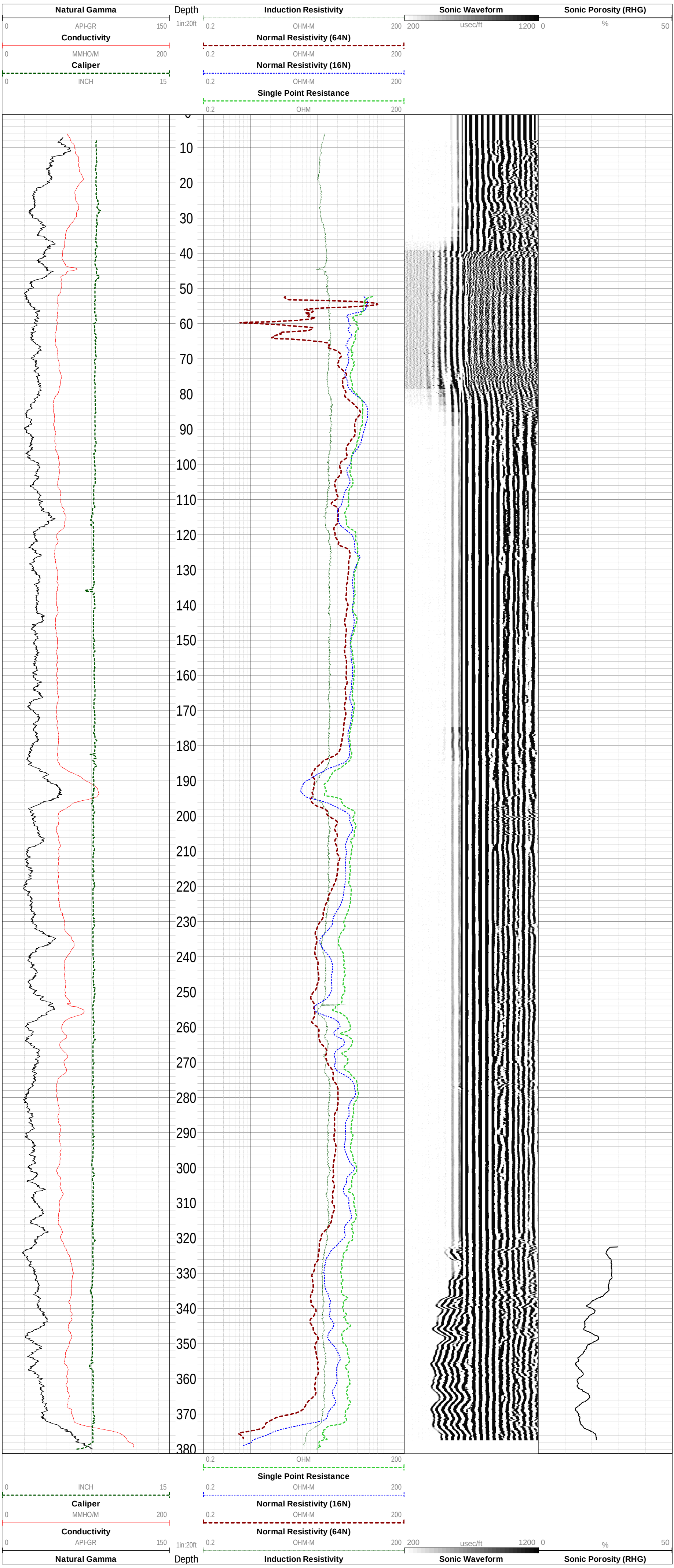
SERVICE COMPANY USGS
file type ORIGINAL
field office USGS
latitude 34.3814
longitude -103.303
eng units or cps E

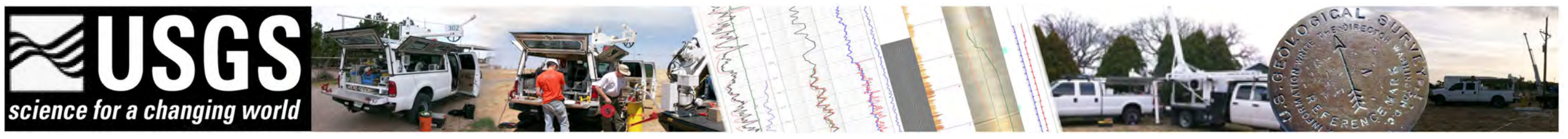
permanent datum	LSD		
log meas from	LSD		
logging unit	302		
drl meas from	NA		
DATE	05/04/19	time circ stopped	
log direction		log sample int	.10
file type id		feet or meter	F
depth driller		sys serial	1
fluid type	MUD	sys version	3.6XH
log bottom	381.70	casing diameter	NA
log top	0.10	casing bottom	
time		casing type	OPEN HOLE
recorded by	PAYNE	casing thick	
tool serial num		bit size	7.875
fluid density		fluid viscosity	
Name Prn AP		truck cal num	
mean surface temp		mud sample source	
temp gradient		mud res	
mag declination		mud temp	
density matrix	2.65	res mud filtrate	
neutron matrix	SANDSTONE	res mud cake	
delta t matrix	54	temp mud filtrate	
deltat fluid		temp mud cake	
fluid ph		elect cutoff	9999
remarks2		remarks1	

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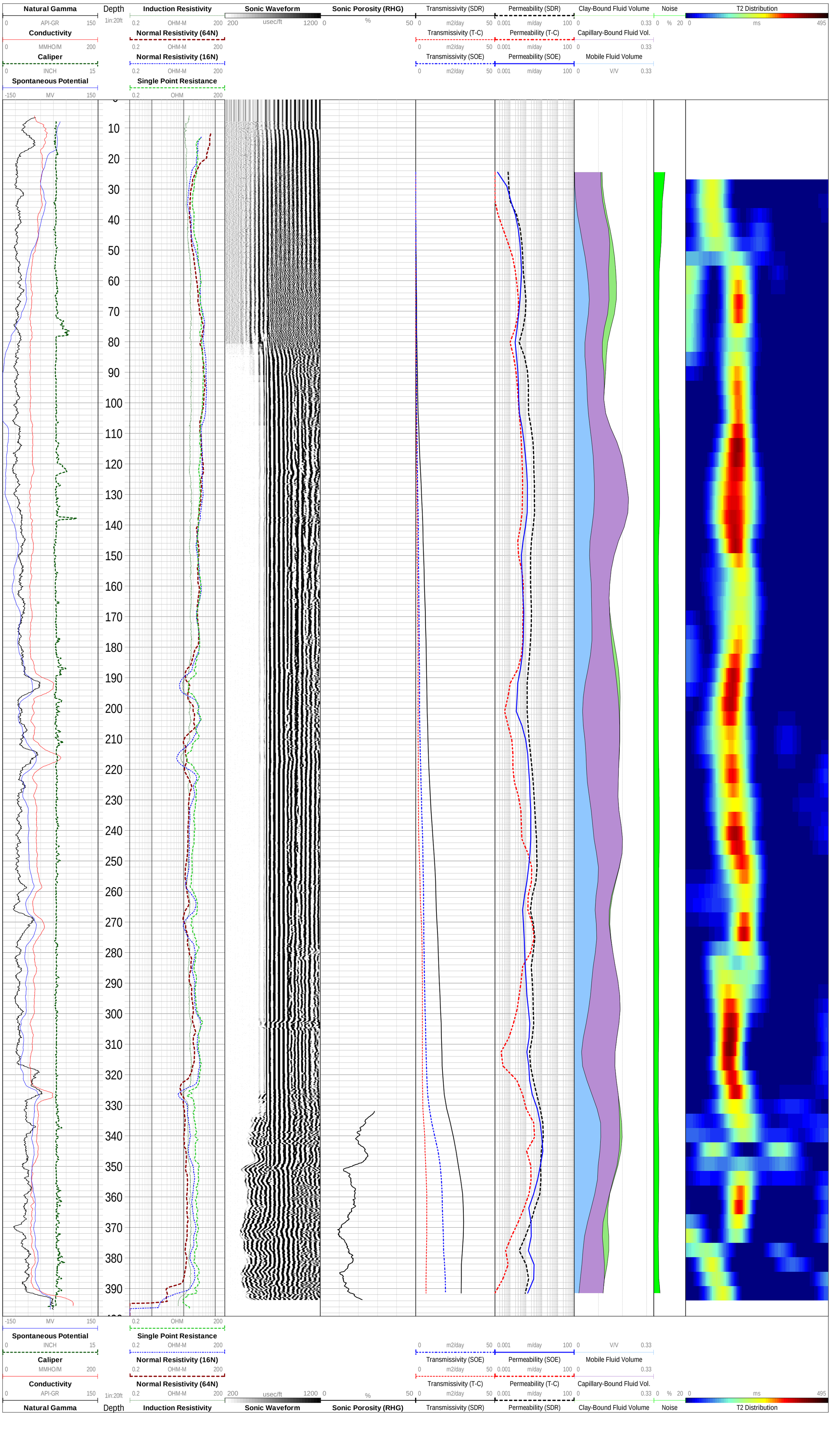


Well Name BH-3 Date of Logging 5/4/2019 County Curry State New Mexico





Well Name BH-4 Date of Logging 5/11/2019 County Curry State New Mexico



U.S. DEPARTMENT OF THE INTERIOR — U.S. GEOLOGICAL SURVEY

USGS science for a changing world

SERVICE COMPANY	USGS
file type	ORIGINAL
field office	USGS
latitude	34.3719
longitude	-103.309
eng units or cps	E

company CANNON AIR FORCE BASE
well MW-A
field CANNON
county CURRY state NM

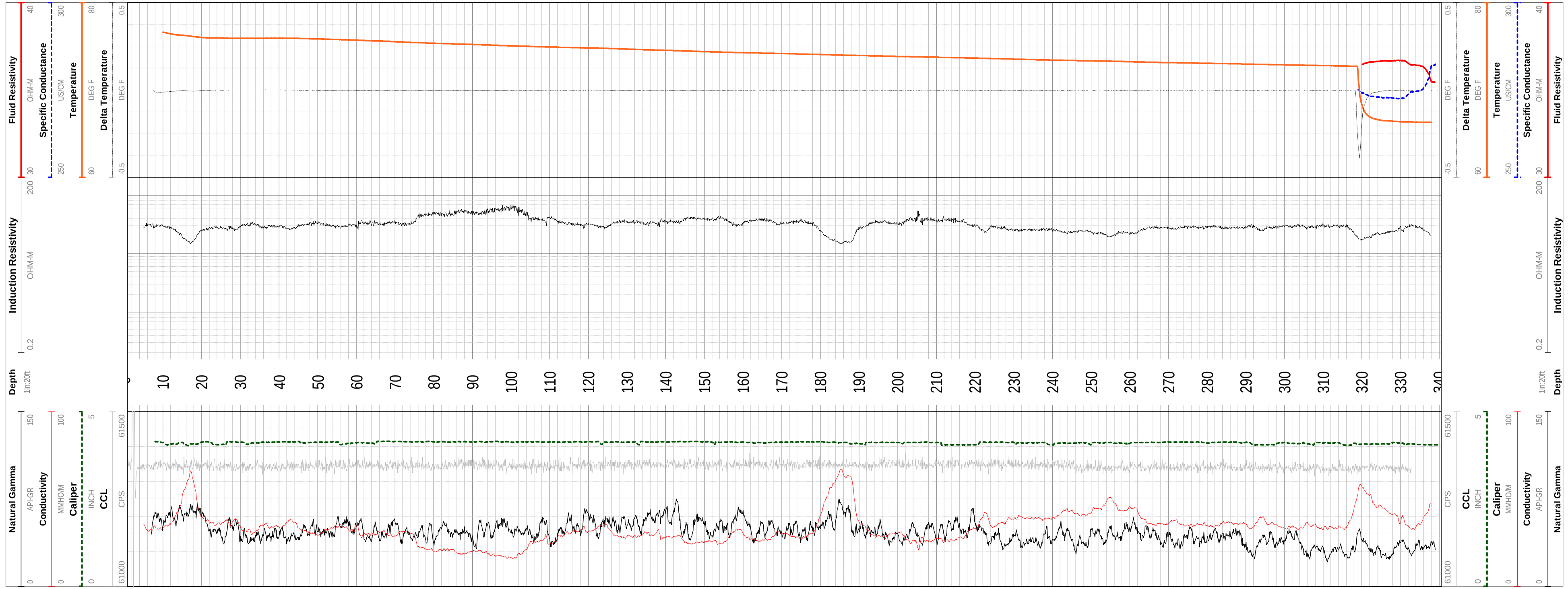
UNIQUE WELL ID
LOCATION CLOVIS
PROVINCE
section NA township NA range NA

other1serv
ZW
other2serv
ZI
other3serv
ZE

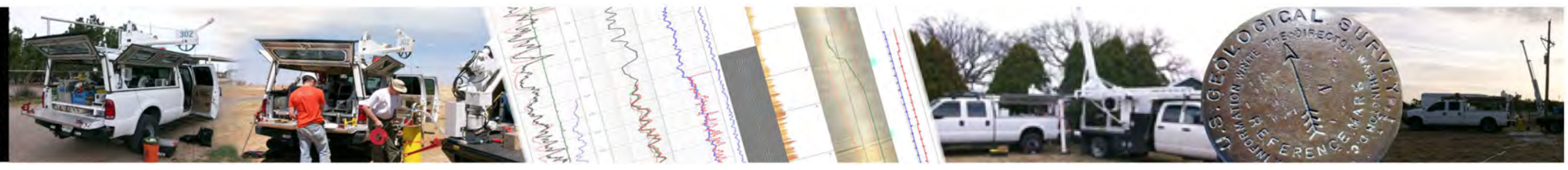
permanent datum LSD
log meas from LSD
logging unit 302
drl meas from NA

elev gl NA
elev kb NA
elev df NA
elev perm datum 4267

DATE	05/03/19	time circ stopped	
log direction		log sample int	.10
file type id		feet or meter	F
depth driller		sys serial	1
fluid type	H2O	sys version	3.6XH
log bottom	340.40	casing diameter	4
log top	0.00	casing bottom	
time		casing type	PVC
recorded by	PAYNE	casing thick	
tool serial num		bit size	
fluid density		fluid viscosity	
Name Prn AP		truck cal num	
mean surface temp		mud sample source	
temp gradient		mud res	
mag declination		mud temp	
density matrix	2.65	res mud filtrate	
neutron matrix	SANDSTONE	res mud cake	
delta t matrix	54	temp mud filtrate	
deltat fluid		temp mud cake	
fluid ph		elect cutoff	9999
remarks2		remarks1	

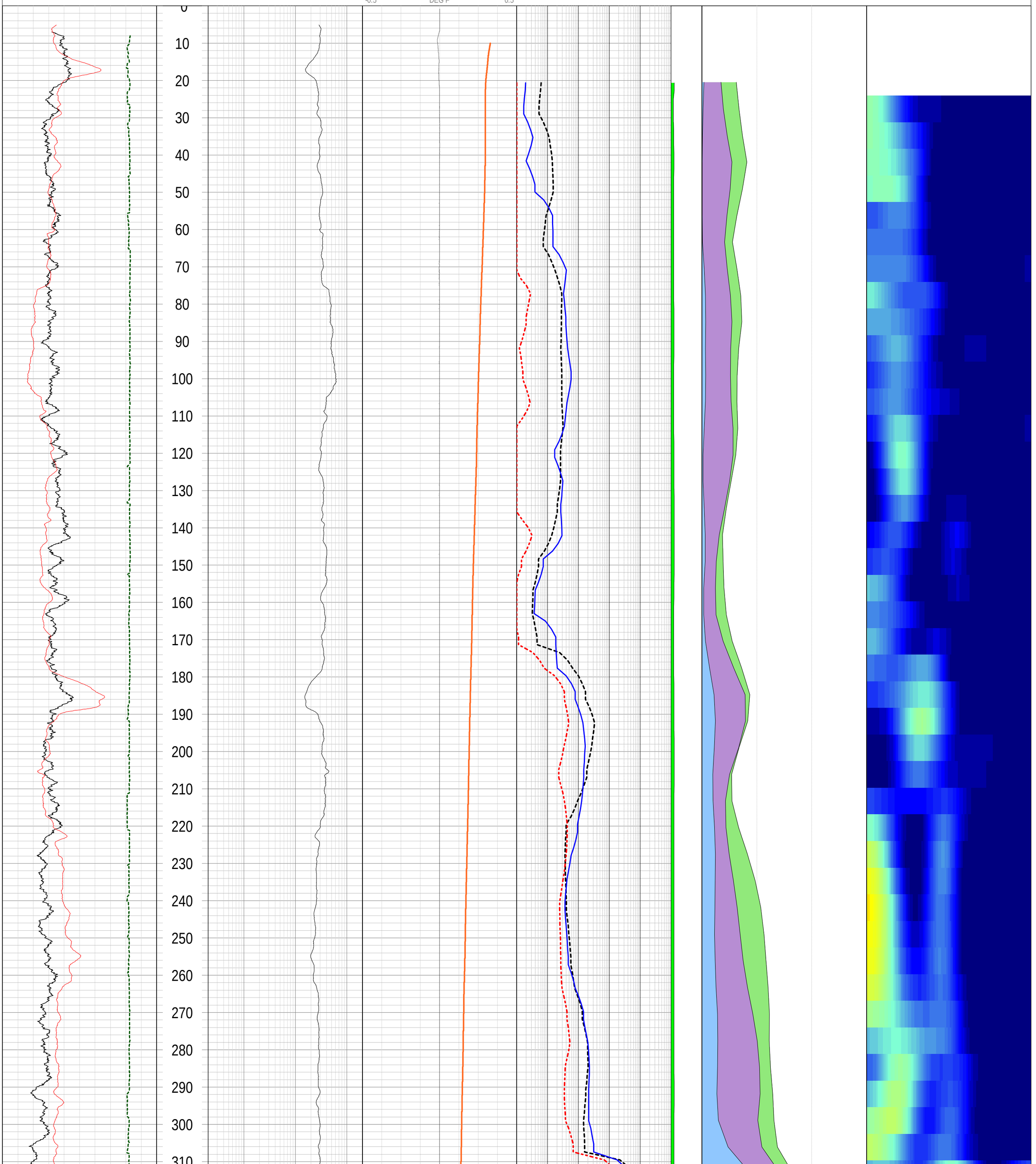


USGS science for a changing world



Well Name MW-A Date of Logging 5/3/2019 County Curry State NM Cooperator Cannon AFB

Natural Gamma 0 API-GR 150
Conductivity 0 MMHO/M 100
Caliper 0 INCH 5
Depth 1in:20ft
Induction Resistivity 0.2 OHM-M 200
Fluid Resistivity 30 OHM-M 40
Specific Conductance 200 US/CM 300
Temperature 60 DEG F 80
Delta Temperature -0.5 DEG F 0.5
Permeability (SDR) 0.0001 m/day 10
Permeability (T-C) 0.0001 m/day 10
Permeability (SOE) 0.0001 m/day 10
Noise 0 % 20
Clay-Bound Fluid Volume 0 0.3
Capillary-Bound Fluid Volume 0 0.3
Mobile Fluid Volume 0 0.3
T2 Distribution 3.283 ms 6.566



-0.5 DEG F 0.5 Delta Temperature
0 INCH 5 Caliper
60 DEG F 80 Temperature
0.0001 m/day 10 Permeability (SOE)
0 0.3 Mobile Fluid Volume
0 MMHO/M 100 Conductivity
200 US/CM 300 Specific Conductance
0.0001 m/day 10 Permeability (T-C)
0 0.3 Capillary-Bound Fluid Volume
0 API-GR 150 Natural Gamma
1in:20ft Depth
0.2 OHM-M 200 Induction Resistivity
30 OHM-M 40 Fluid Resistivity
0.0001 m/day 10 Permeability (SDR)
0 % 20 Noise
0 0.3 3.283 ms 6.566 Clay-Bound Fluid Volume / T2 Distribution

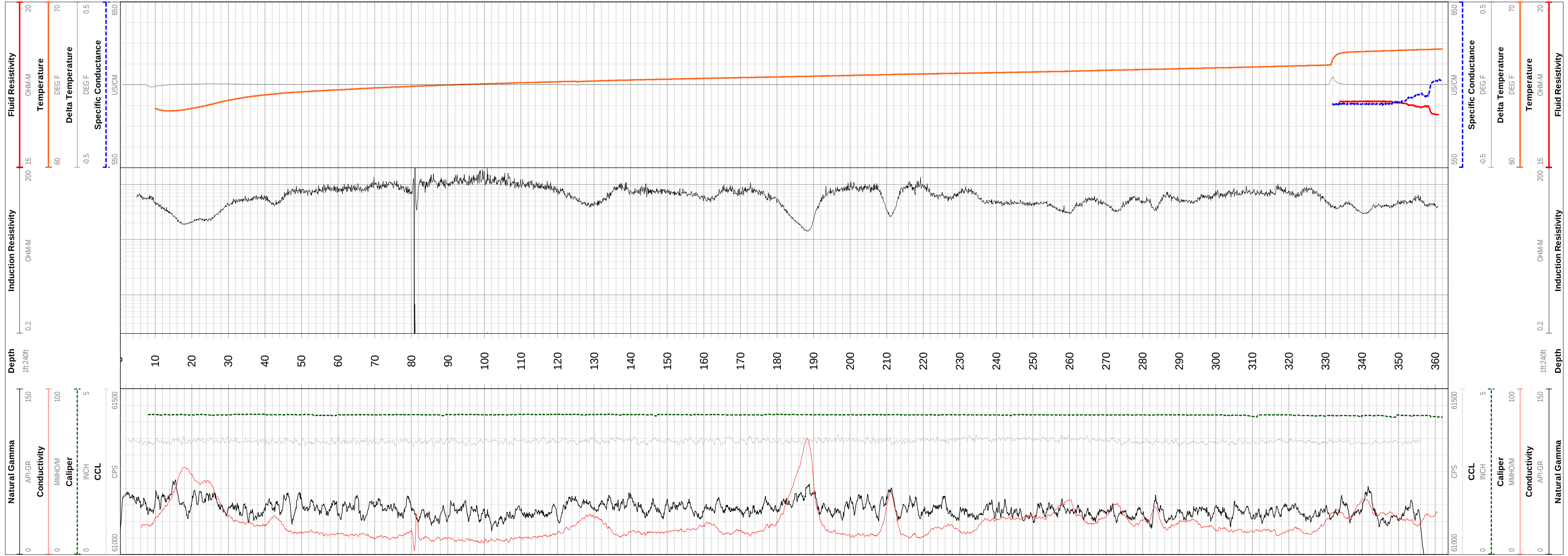
USGS

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SERVICE COMPANY	USGS	company	CANNON AIR FORCE BASE
file type	ORIGINAL	well	MW-B
field office	USGS	field	CANNON
latitude	34.3674	county	CURRY
longitude	-103.302	state	NM
eng units or cps	E		

UNIQUE WELL ID		other1serv
LOCATION	CLOVIS	ZW
PROVINCE		other2serv
		ZI
section NA	township NA	other3serv
range NA		ZE

permanent datum	LSD		elev gl NA
log meas from	LSD		elev kb NA
logging unit	302		elev df NA
drl meas from	NA		elev perm datum 4265
DATE	05/02/19	time circ stopped	
log direction		log sample int	.10
file type id		feet or meter	F
depth driller		sys serial	1
fluid type	H2O	sys version	3.6XH
log bottom	363.60	casing diameter	4
log top	0.90	casing bottom	
time		casing type	PVC
recorded by	PAYNE	casing thick	
tool serial num		bit size	
fluid density		fluid viscosity	
Name Prn AP		truck cal num	
mean surface temp		mud sample source	
temp gradient		mud res	
mag declination		mud temp	
density matrix	2.65	res mud filtrate	
neutron matrix	SANDSTONE	res mud cake	
delta t matrix	54	temp mud filtrate	
deltat fluid		temp mud cake	
fluid ph		elect cutoff	9999
remarks2		remarks1	



USGS

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SERVICE COMPANY USGS
file type ORIGINAL
field office USGS
latitude 34.3657
longitude -103.304 E
eng units or cps

company CANNON AIR FORCE BASE
well MW-C-B
field CANNON
county CURRY state NM

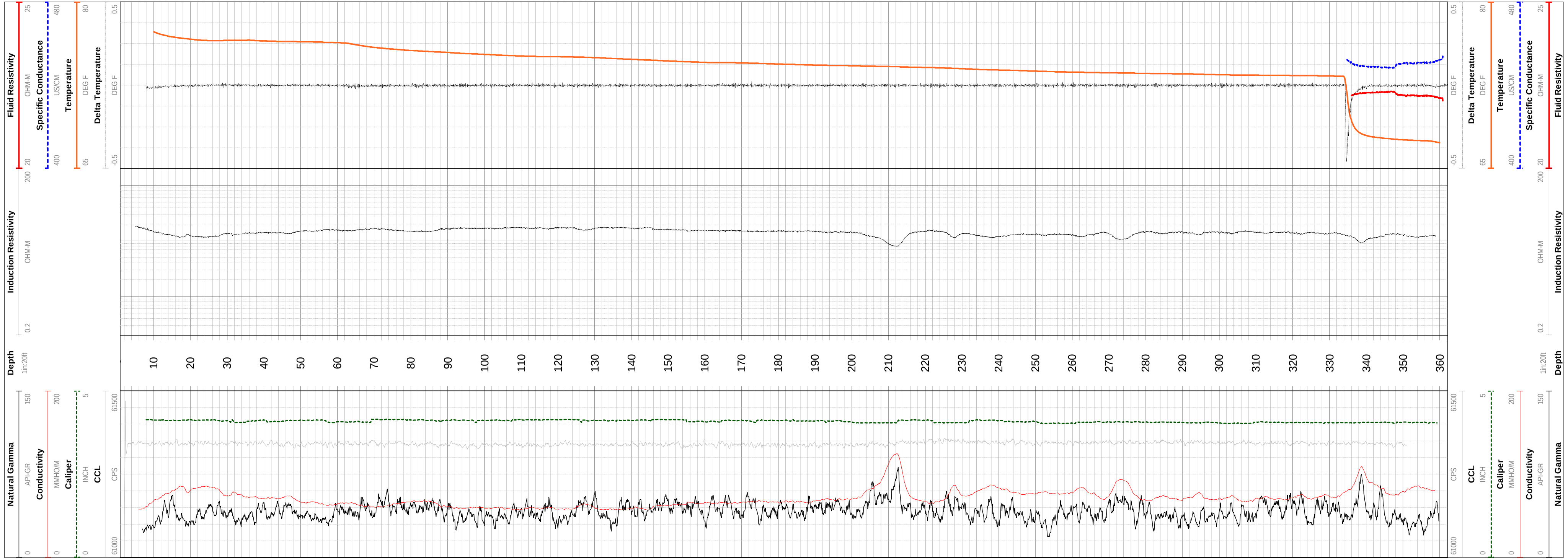
UNIQUE WELL ID
LOCATION CLOVIS
PROVINCE
section NA township NA range NA

other1serv ZW
other2serv ZI
other3serv ZE

permanent datum LSD
log meas from LSD
logging unit 302
drl meas from NA

elev gl NA
elev kb NA
elev df NA
elev perm datum 4267

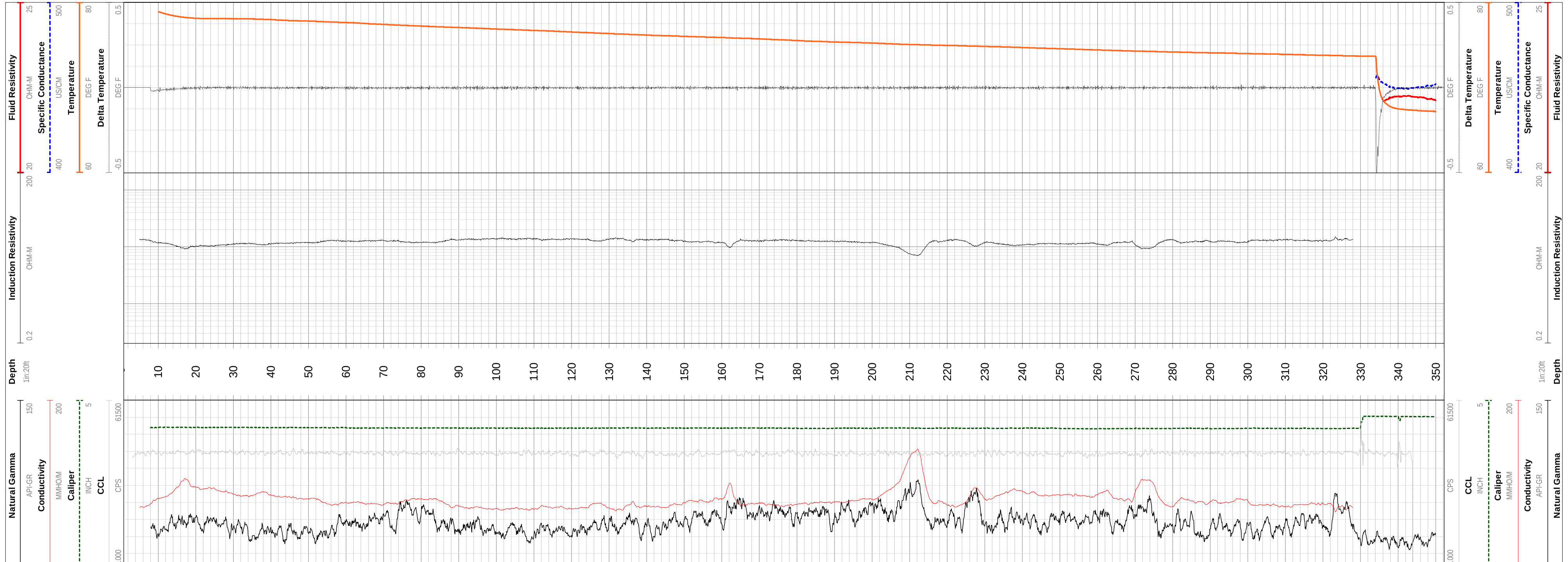
DATE	05/01/19	time circ stopped	
log direction		log sample int	.10
file type id		feet or meter	F
depth driller		sys serial	1
fluid type	H2O	sys version	3.6XH
log bottom	359.30	casing diameter	4
log top	0.10	casing bottom	
time		casing type	PVC
recorded by	PAYNE	casing thick	
tool serial num		bit size	
fluid density		fluid viscosity	
Name Prn AP		truck cal num	
mean surface temp		mud sample source	
temp gradient		mud res	
mag declination		mud temp	
density matrix	2.65	res mud filtrate	
neutron matrix	SANDSTONE	res mud cake	
delta t matrix	54	temp mud filtrate	
deltat fluid		temp mud cake	
fluid ph		elect cutoff	9999
remarks2		remarks1	



USGS
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SERVICE COMPANY	USGS	company	CANNON AIR FORCE BASE
file type	ORIGINAL	well	MW-C
field office	USGS	field	CANNON
latitude	34.3657	county	CURRY state NM
longitude	-103.304	UNIQUE WELL ID	other1serv
eng units or cps	E	LOCATION CLOVIS	ZW
		PROVINCE	other2serv
			ZI
		section NA township NA range NA	other3serv
			ZE
permanent datum LSD			elev gl NA
log meas from LSD			elev kb NA
logging unit 302			elev df NA
drl meas from NA			elev perm datum 4266

DATE	05/01/19	time circ stopped	NA
log direction		log sample int	.10
file type id		feet or meter	F
depth driller		sys serial	1
fluid type	H2O	sys version	3.6XH
log bottom	350.60	casing diameter	4
log top	-0.10	casing bottom	
time		casing type	PVC
recorded by	PAYNE	casing thick	
tool serial num		bit size	
fluid density		fluid viscosity	
Name Prn AP		truck cal num	
mean surface temp		mud sample source	
temp gradient		mud res	
mag declination		mud temp	
density matrix	2.65	res mud filtrate	
neutron matrix	SANDSTONE	res mud cake	
delta t matrix	54	temp mud filtrate	
deltat fluid		temp mud cake	
fluid ph		elect cutoff	9999
remarks2		remarks1	



U.S. DEPARTMENT OF THE INTERIOR · GEOLOGICAL SURVEY

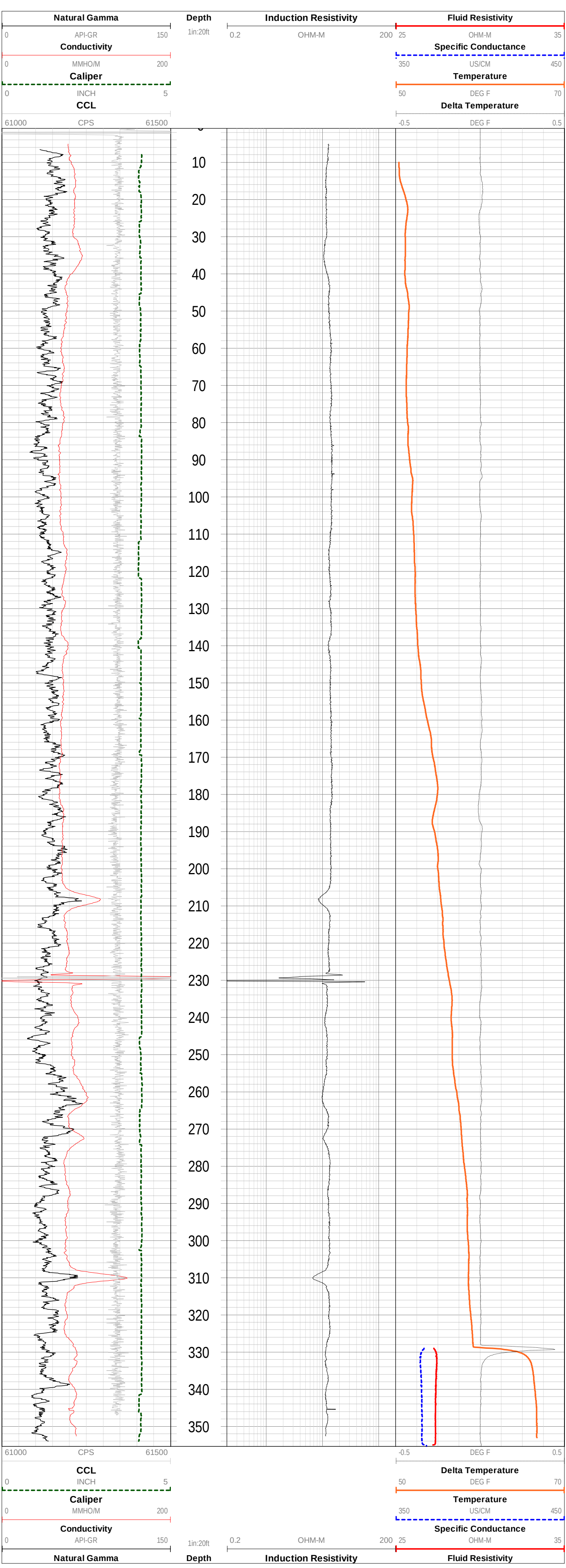
USGS

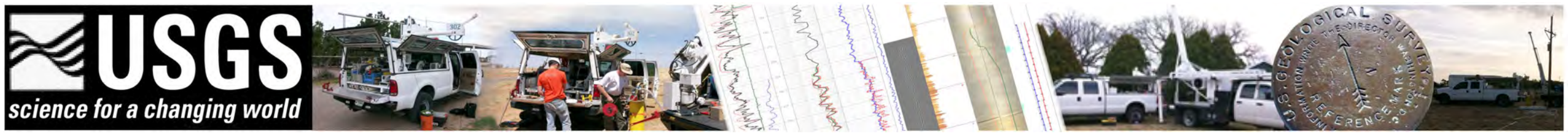
science for a changing world

SERVICE COMPANY USGS
file type ORIGINAL
field office USGS
latitude 34.3659
longitude -103.306
eng units or cps E

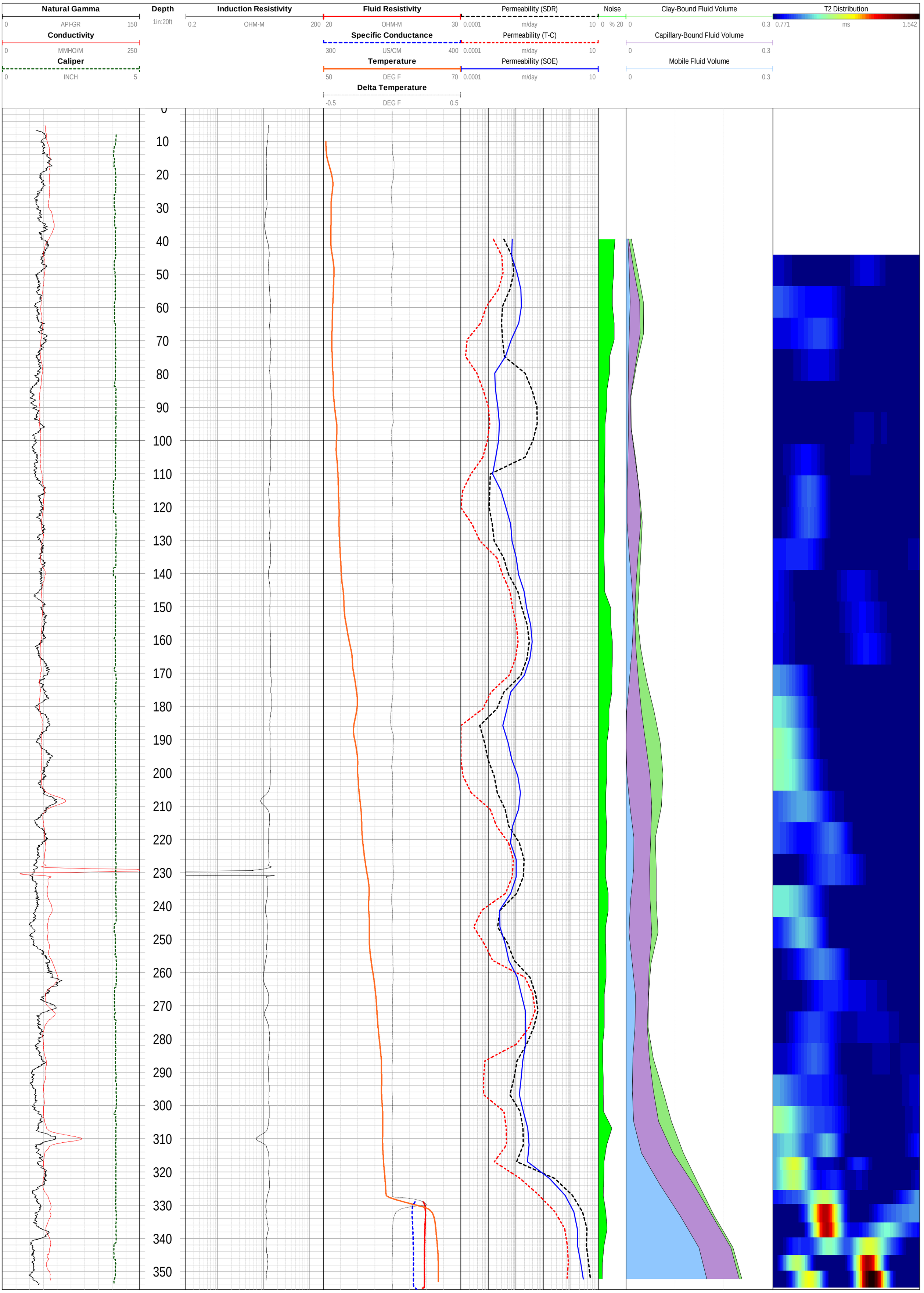
company	CANNON AIR FORCE BASE				
well	MW-D				
field	CANNON				
county	CURRY		state	NM	
UNIQUE WELL ID				other1serv	
LOCATION	CLOVIS			ZW	
PROVINCE				other2serv	
				ZI	
				other3serv	
section	NA	township NA	range NA	ZE	
permanent datum	LSD			elev gl NA	
log meas from	LSD			elev kb NA	
logging unit	302			elev df NA	
drl meas from	NA			elev perm datum	4265

DATE	05/02/19	time circ stopped	
log direction		log sample int	.10
file type id		feet or meter	F
depth driller		sys serial	1
fluid type	H2O	sys version	3.6XH
log bottom	355.30	casing diameter	4
log top	0.00	casing bottom	
time		casing type	PVC
recorded by	PAYNE	casing thick	
tool serial num		bit size	
fluid density		fluid viscosity	
Name Prn AP		truck cal num	
mean surface temp		mud sample source	
temp gradient		mud res	
mag declination		mud temp	
density matrix	2.65	res mud filtrate	
neutron matrix	SANDSTONE	res mud cake	
delta t matrix	54	temp mud filtrate	
deltat fluid		temp mud cake	
fluid ph		elect cutoff	9999
remarks2		remarks1	





Well Name MW-D Date of Logging 5/2/2019 County Curry State New Mexico Cooperator Cannon AFB



USGS
science for a changing world

SERVICE COMPANY USGS
file type ORIGINAL
field office USGS
latitude 34.3907
longitude -103.307
eng units or cps E

company CANNON AIR FORCE BASE
well MW-E
field CANNON
county CURRY state NM

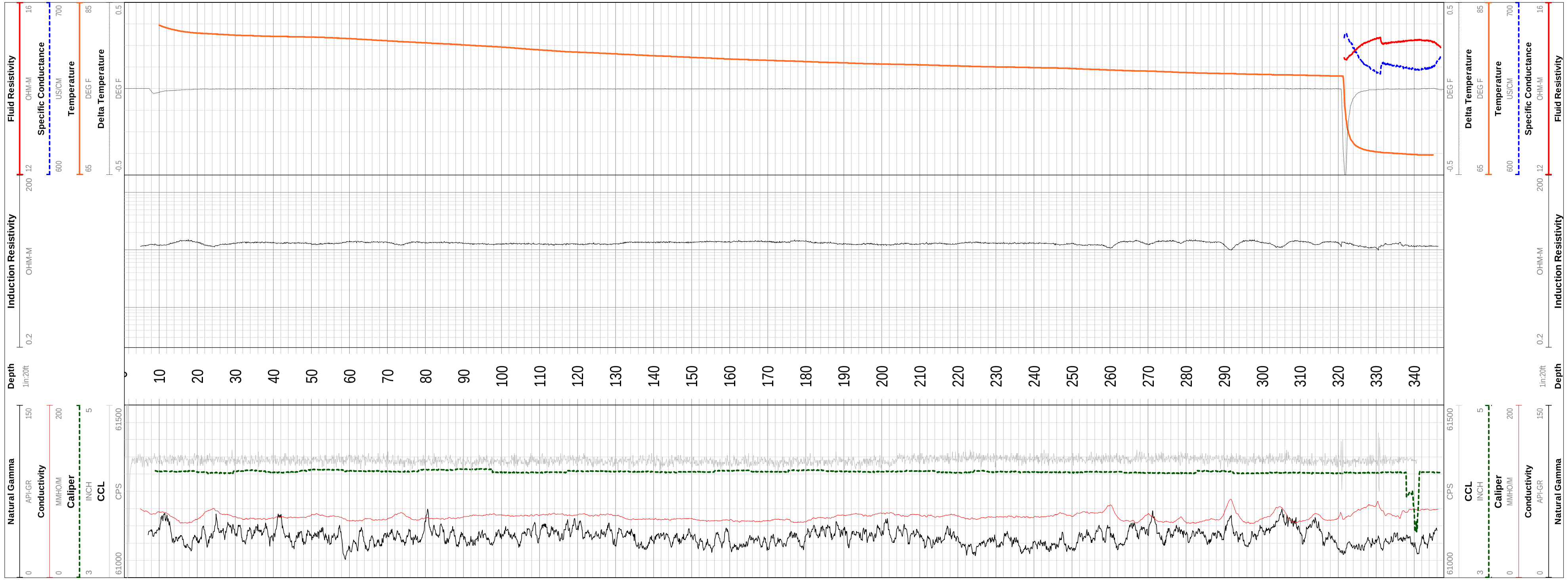
UNIQUE WELL ID
LOCATION CLOVIS
PROVINCE
section NA township NA range NA

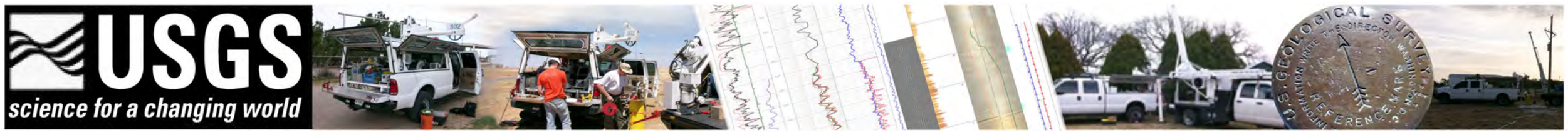
other1serv
ZW
other2serv
ZI
other3serv
ZE

permanent datum LSD
log meas from LSD
logging unit 302
drl meas from NA

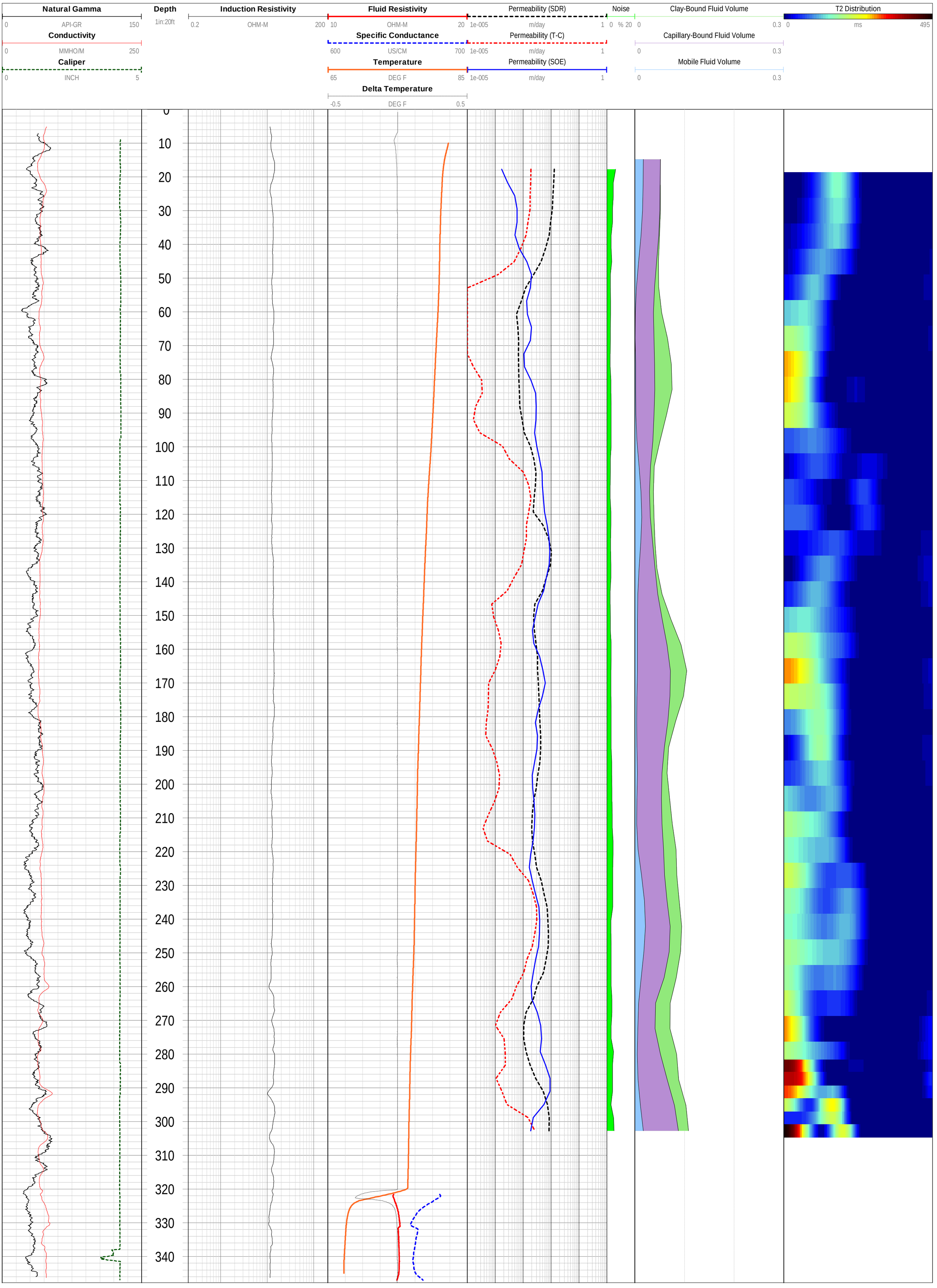
elev gl NA
elev kb NA
elev df NA
elev perm datum 4282

DATE	05/06/19	time circ stopped	
log direction		log sample int	.10
file type id		feet or meter	F
depth driller		sys serial	1
fluid type	H2O	sys version	3.6XH
log bottom	347.60	casing diameter	4
log top	0.00	casing bottom	
time		casing type	PVC
recorded by	MCDOWELL	casing thick	
tool serial num		bit size	
fluid density		fluid viscosity	
Name Prn AP		truck cal num	
mean surface temp		mud sample source	
temp gradient		mud res	
mag declination		mud temp	
density matrix	2.65	res mud filtrate	
neutron matrix	SANDSTONE	res mud cake	
delta t matrix	54	temp mud filtrate	
deltat fluid		temp mud cake	
fluid ph		elect cutoff	9999
remarks2		remarks1	





Well Name MW-E Date of Logging 5/6/2019 County Curry State New Mexico Cooperator Cannon AFB



USGS science for a changing world

SERVICE COMPANY USGS
file type ORIGINAL
field office USGS
latitude 34.3892
longitude -103.303
eng units or cps E

company CANNON AIR FORCE BASE
well MW-F
field CANNON
county CURRY state NM

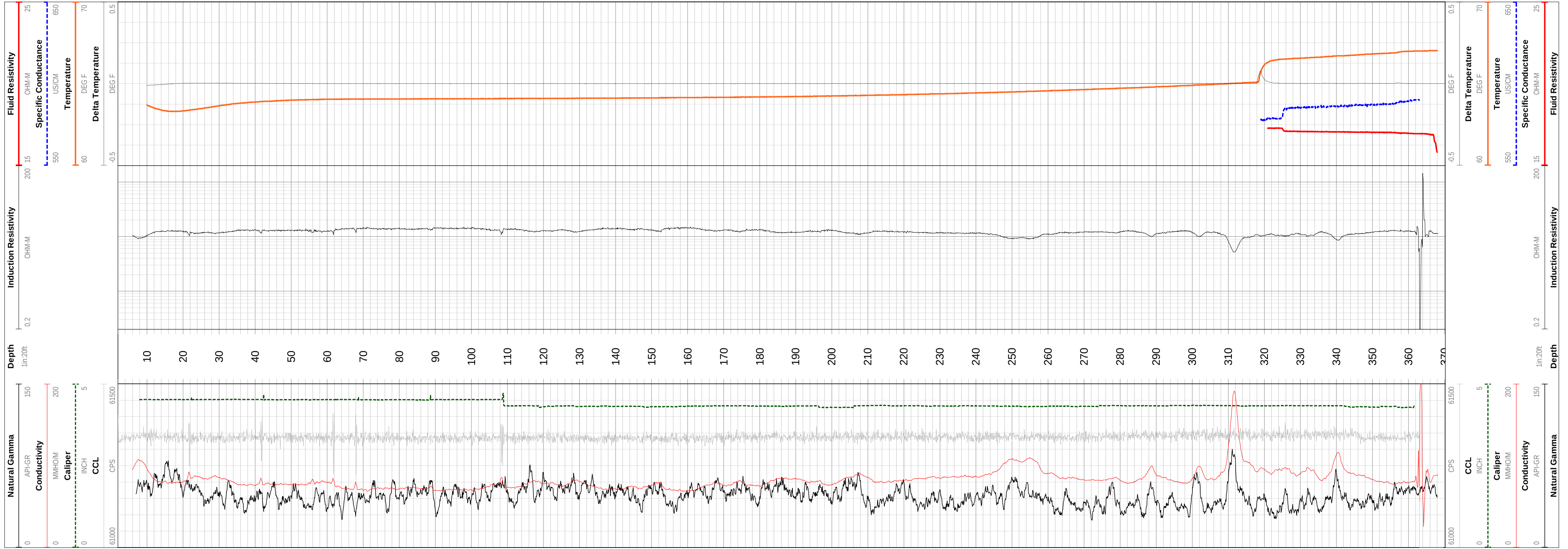
UNIQUE WELL ID
LOCATION CLOVIS
PROVINCE
section NA township NA range NA

other1serv
ZW
other2serv
ZI
other3serv
ZE

permanent datum LSD
log meas from LSD
logging unit 302
drl meas from NA

elev gl NA
elev kb NA
elev df NA
elev perm datum 4278

DATE	05/06/19	time circ stopped	
log direction		log sample int	.10
file type id		feet or meter	F
depth driller		sys serial	1
fluid type	H2O	sys version	3.6XH
log bottom	369.60	casing diameter	4
log top	0.00	casing bottom	
time		casing type	PVC
recorded by	PAYNE	casing thick	
tool serial num		bit size	
fluid density		fluid viscosity	
Name Prn AP		truck cal num	
mean surface temp		mud sample source	
temp gradient		mud res	
mag declination		mud temp	
density matrix	2.65	res mud filtrate	
neutron matrix	SANDSTONE	res mud cake	
delta t matrix	54	temp mud filtrate	
deltat fluid		temp mud cake	
fluid ph		elect cutoff	9999
remarks2		remarks1	



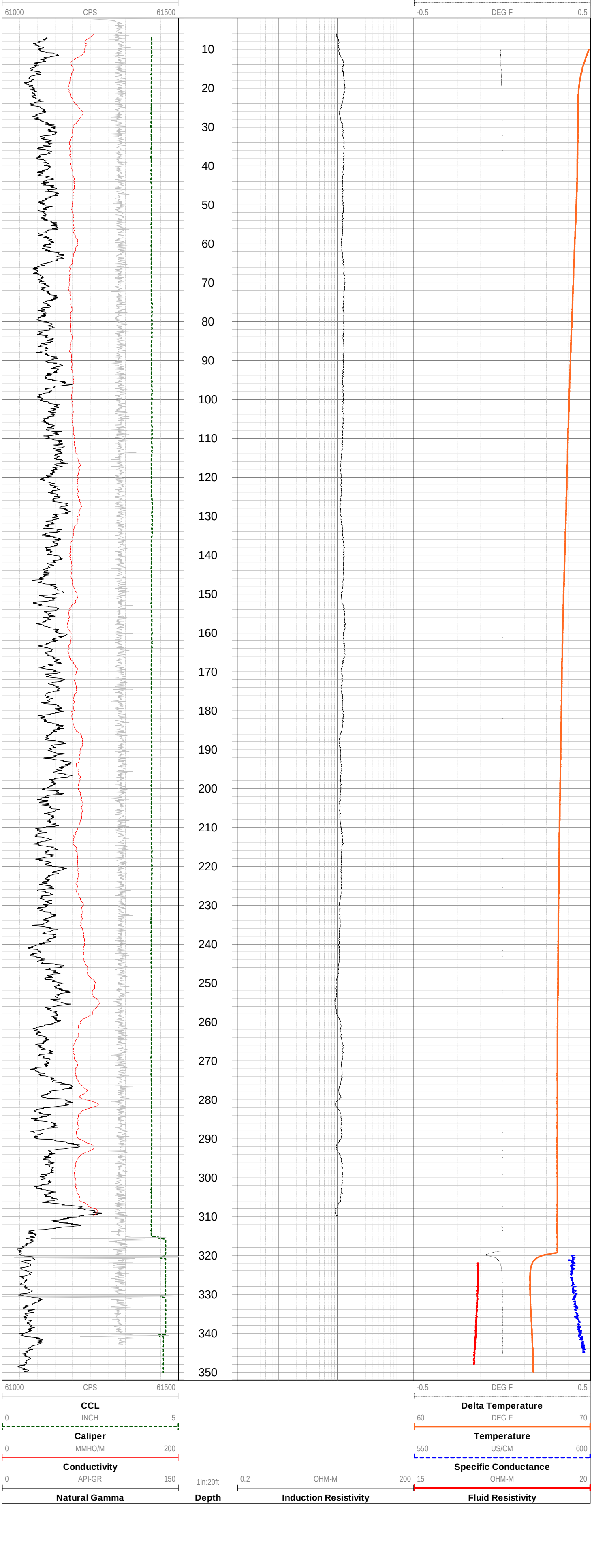
USGS
science for a changing world

SERVICE COMPANY USGS
file type ORIGINAL
field office USGS
latitude 34.3892
longitude -103.304
eng units or cps E

company	CANNON AIR FORCE BASE		
well	MW-FA		
field	CANNON		
county	CURRY	state	NM
UNIQUE WELL ID		other1serv	
LOCATION	CLOVIS	ZW	
PROVINCE		other2serv	
		ZI	
		other3serv	
section NA	township NA	range NA	ZE

permanent datum	LSD	elev gl	NA
log meas from	LSD	elev kb	NA
logging unit	302	elev df	NA
drl meas from	NA	elev perm datum	4278

DATE	05/06/19	time circ stopped	
log direction		log sample int	.10
file type id		feet or meter	F
depth driller		sys serial	1
fluid type	H2O	sys version	3.6XH
log bottom	350.30	casing diameter	4
log top	-0.30	casing bottom	
time		casing type	PVC
recorded by	PAYNE	casing thick	
tool serial num		bit size	
fluid density		fluid viscosity	
Name Prn AP		truck cal num	
mean surface temp		mud sample source	
temp gradient		mud res	
mag declination		mud temp	
density matrix	2.65	res mud filtrate	
neutron matrix	SANDSTONE	res mud cake	
delta t matrix	54	temp mud filtrate	
deltat fluid		temp mud cake	
fluid ph		elect cutoff	9999
remarks2		remarks1	



U.S. DEPARTMENT OF THE INTERIOR — U.S. GEOLOGICAL SURVEY

USGS *science for a changing world*

SERVICE COMPANY	USGS
file type	ORIGINAL
field office	USGS
latitude	34.3868
longitude	-103.303 E
eng units or cps	

company CANNON AIR FORCE BASE
well MW-G
field CANNON
county CURRY state NM

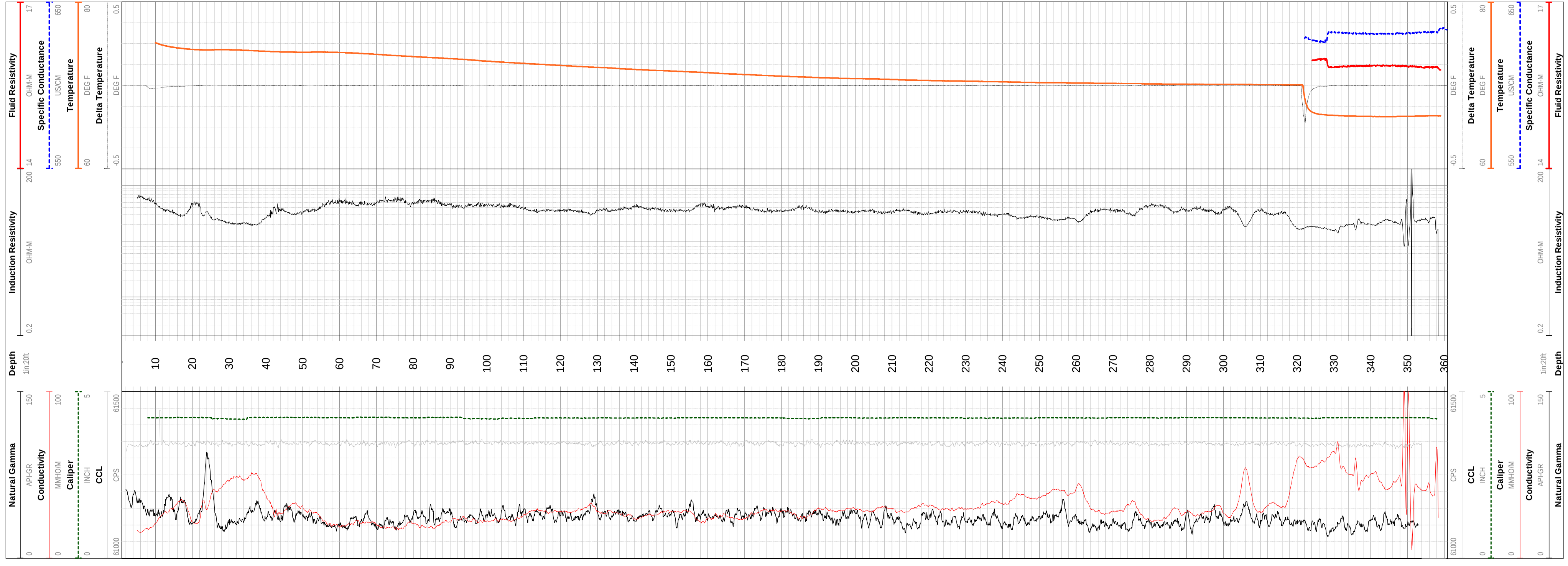
UNIQUE WELL ID
LOCATION CLOVIS
PROVINCE
section NA township NA range NA

other1serv
ZI
other2serv
ZW
other3serv
ZE

permanent datum LSD
log meas from LSD
logging unit 302
drl meas from NA

elev gl NA
elev kb NA
elev df NA
elev perm datum 4279

DATE	05/05/19	time circ stopped	
log direction		log sample int	.10
file type id		feet or meter	F
depth driller		sys serial	1
fluid type	H2O	sys version	3.6XH
log bottom	360.60	casing diameter	4
log top	0.10	casing bottom	
time		casing type	PVC
recorded by	MCDOWELL	casing thick	
tool serial num		bit size	
fluid density		fluid viscosity	
Name Prn AP		truck cal num	
mean surface temp		mud sample source	
temp gradient		mud res	
mag declination		mud temp	
density matrix	2.65	res mud filtrate	
neutron matrix	SANDSTONE	res mud cake	
delta t matrix	54	temp mud filtrate	
deltat fluid		temp mud cake	
fluid ph		elect cutoff	9999
remarks2		remarks1	



USGS
science for a changing world

SERVICE COMPANY	USGS
file type	ORIGINAL
field office	USGS
latitude	34.3868
longitude	-103.303
eng units or cps	E

company CANNON AIR FORCE BASE
well MW-GA
field CANNON
county CURRY state NM

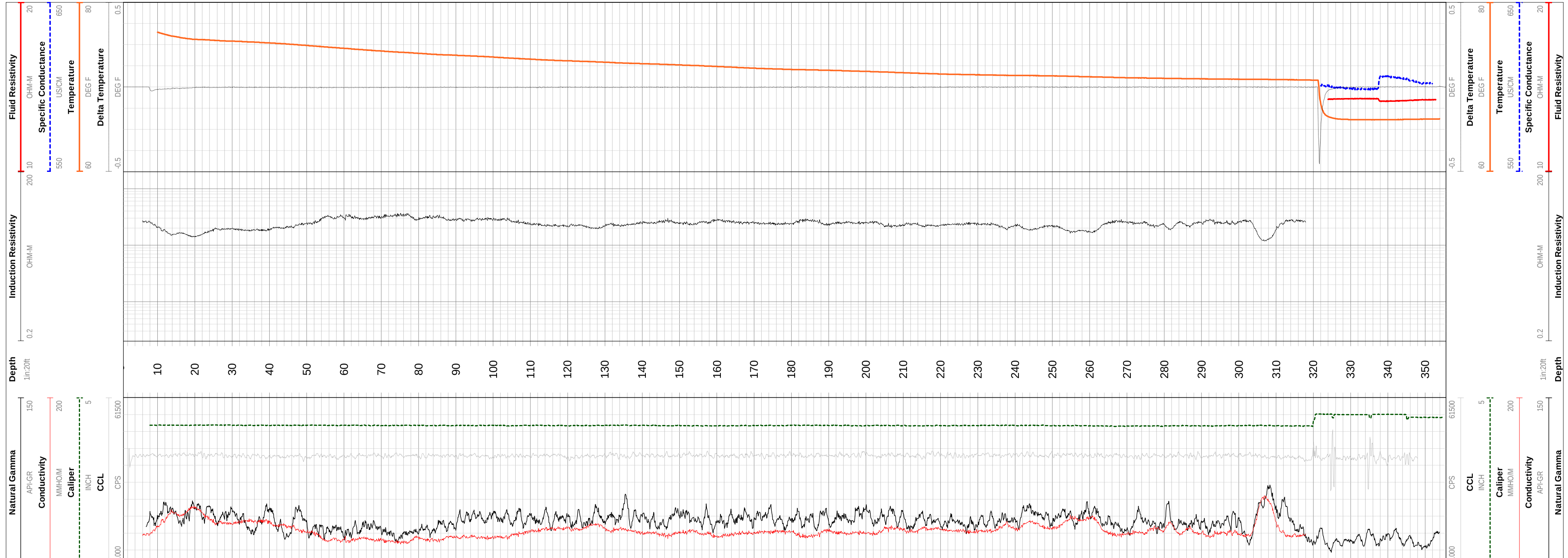
UNIQUE WELL ID
LOCATION CLOVIS
PROVINCE
section NA township NA range NA

other1serv
ZW
other2serv
ZI
other3serv
ZE

permanent datum LSD
log meas from LSD
logging unit 302
drl meas from NA

elev gl NA
elev kb NA
elev df NA
elev perm datum 4279

DATE	05/05/19	time circ stopped	
log direction		log sample int	.10
file type id		feet or meter	F
depth driller		sys serial	1
fluid type	H2O	sys version	3.6XH
log bottom	355.70	casing diameter	4
log top	0.10	casing bottom	
time		casing type	PVC
recorded by	PAYNE	casing thick	
tool serial num		bit size	
fluid density		fluid viscosity	
Name Prn AP		truck cal num	0.5956
mean surface temp		mud sample source	
temp gradient		mud res	
mag declination		mud temp	
density matrix	2.65	res mud filtrate	
neutron matrix	SANDSTONE	res mud cake	
delta t matrix	54	temp mud filtrate	
deltat fluid		temp mud cake	
fluid ph		elect cutoff	9999
remarks2		remarks1	



USGS
science for a changing world

SERVICE	USGS
COMPANY	
file type	ORIGINAL
field office	USGS
latitude	34.3854
longitude	-103.304
eng units or cps	E

company CANNON AIR FORCE BASE
well MW-H
field CANNON
county CURRY state NM

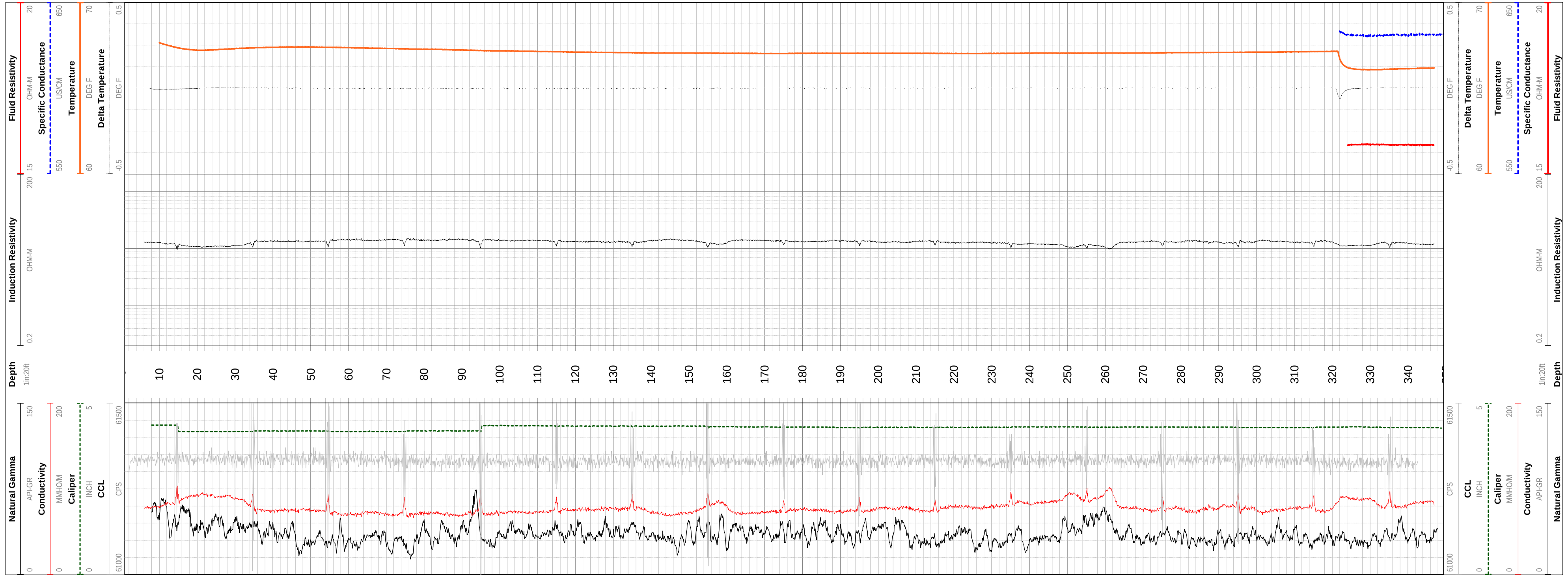
UNIQUE WELL ID
LOCATION CLOVIS
PROVINCE
section NA township NA range NA

other1serv
ZW
other2serv
ZI
other3serv
ZE

permanent datum LSD
log meas from LSD
logging unit 302
drl meas from NA

elev gl NA
elev kb NA
elev df NA
elev perm datum 4279

DATE	05/05/19	time circ stopped	
log direction		log sample int	.10
file type id		feet or meter	F
depth driller		sys serial	1
fluid type	H2O	sys version	3.6XH
log bottom	349.90	casing diameter	4
log top	0.00	casing bottom	
time		casing type	PVC
recorded by	PAYNE	casing thick	
tool serial num		bit size	
fluid density		fluid viscosity	
Name Prn AP		truck cal num	
mean surface temp		mud sample source	
temp gradient		mud res	
mag declination		mud temp	
density matrix	2.65	res mud filtrate	
neutron matrix	SANDSTONE	res mud cake	
delta t matrix	54	temp mud filtrate	
deltat fluid		temp mud cake	
fluid ph		elect cutoff	9999
remarks2		remarks1	

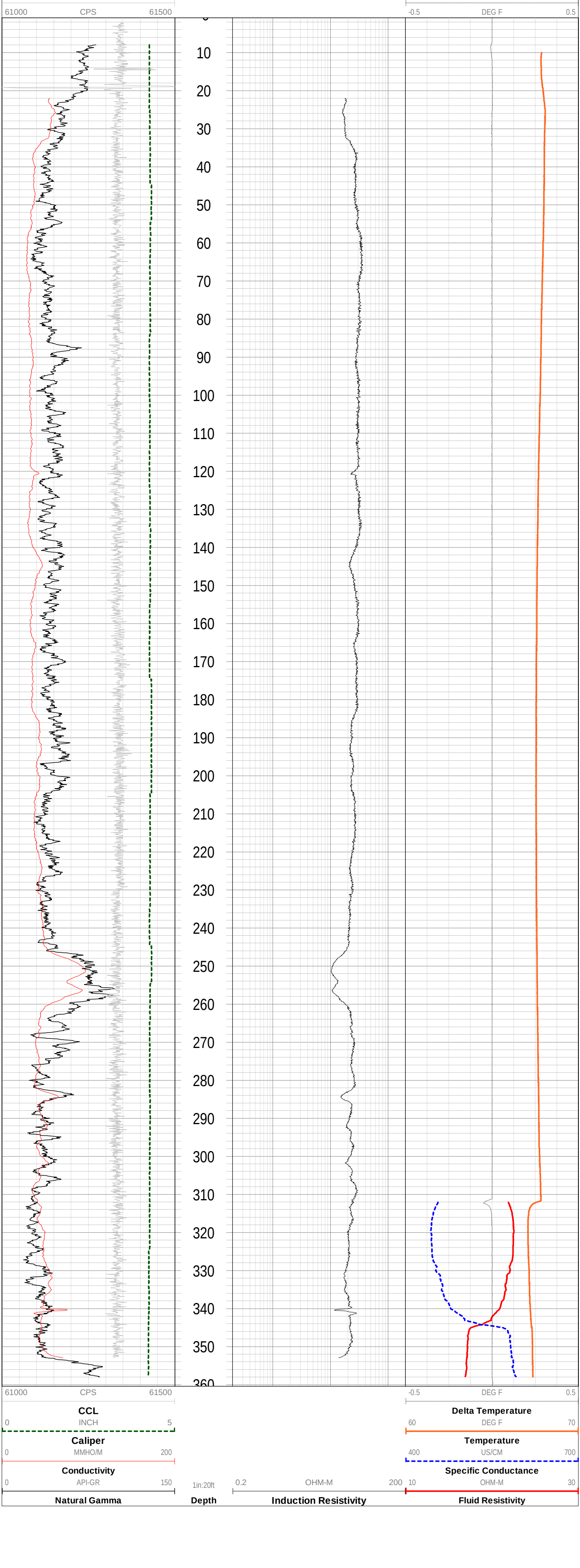


SERVICE COMPANY USGS
file type ORIGINAL
field office USGS
latitude 34.3883678
longitude -103.2963119
eng units or cps E

company	CANNON AIR FORCE BASE		
well	MW-NA		
field	CANNON		
county	CURRY	state	NM
UNIQUE WELL ID		other1serv	
LOCATION	CLOVIS	ZW	
PROVINCE		other2serv	
		ZI	
section	township range	other3serv	
		ZE	

permanent datum	LSD	elev gl	NA
log meas from	LSD	elev kb	NA
logging unit	302	elev df	NA
drl meas from	NA	elev perm datum	4269

DATE	05/08/19	time circ stopped	
log direction		log sample int	.10
file type id		feet or meter	F
depth driller		sys serial	1
fluid type	H20	sys version	3.6XH
log bottom	360.0	casing diameter	4
log top	0.1	casing bottom	
time		casing type	PVC
recorded by	PAYNE	casing thick	
tool serial num		bit size	
fluid density		fluid viscosity	
Name Prn AP		truck cal num	
mean surface temp		mud sample source	
temp gradient		mud res	
mag declination		mud temp	
density matrix	2.65	res mud filtrate	
neutron matrix	SANDSTONE	res mud cake	
delta t matrix	54	temp mud filtrate	
deltat fluid		temp mud cake	
fluid ph		elect cutoff	9999
remarks2		remarks1	



USGS
science for a changing world

company	CANNON AIR FORCE BASE		
well	MW-OA		
field	CANNON		
county	CURRY	state	NM
UNIQUE WELL ID			other1serv
LOCATION	CLOVIS		ZW
PROVINCE			other2serv
			ZI
			other3serv
section NA	township NA	range NA	ZE

SERVICE COMPANY USGS
file type ORIGINAL
field office USGS
latitude 34.3834
longitude -103.297
eng units or cps E

permanent datum	LSD			elev gl	NA
log meas from	LSD			elev kb	NA
logging unit	302			elev df	NA
drl meas from	NA			elev perm datum	4273

DATE	05/05/19	time circ stopped	
log direction		log sample int	.10
file type id		feet or meter	F
depth driller		sys serial	1
fluid type	H2O	sys version	3.6XH
log bottom	366.80	casing diameter	4
log top	-0.10	casing bottom	
time		casing type	PVC
recorded by	PAYNE	casing thick	
tool serial num		bit size	
fluid density		fluid viscosity	
Name Prn AP		tnuck cal num	
mean surface temp		mud sample source	
temp gradient		mud res	
mag declination		mud temp	
density matrix	2.65	res mud filtrate	
neutron matrix	SANDSTONE	res mud cake	
delta t matrix	54	temp mud filtrate	
deltat fluid		temp mud cake	
fluid ph		elect cutoff	9999
remarks2		remarks1	

USGS
science for a changing world

company	CANNON AIR FORCE BASE		
well	MW-PA		
field	CANNON		
county	CURRY	state	NM
UNIQUE WELL ID			other1serv
LOCATION	CLOVIS		ZW
PROVINCE			other2serv
			ZI
			other3serv
section NA	township NA	range NA	ZE

SERVICE COMPANY USGS
file type ORIGINAL
field office USGS
latitude 34.3862
longitude -103.302
eng units or cps E

permanent datum LSD			elev gl NA
log meas from LSD			elev kb NA
logging unit 302			elev df NA
drl meas from NA			elev perm datum 4274
DATE	05/04/19	time circ stopped	
log direction		log sample int	.10
file type id		feet or meter	F
depth driller		sys serial	1
fluid type	H2O	sys version	3.6XH
log bottom	361.50	casing diameter	4
log top	0.00	casing bottom	
time		casing type	PVC
recorded by	PAYNE	casing thick	
tool serial num		bit size	
fluid density		fluid viscosity	
Name Prn AP		tnuck cal num	
mean surface temp		mud sample source	
temp gradient		mud res	
mag declination		mud temp	
density matrix	2.65	res mud filtrate	
neutron matrix	SANDSTONE	res mud cake	
delta t matrix	54	temp mud filtrate	
deltat fluid		temp mud cake	
fluid ph		elect cutoff	9999
remarks2		remarks1	

USGS
science for a changing world

SERVICE COMPANY USGS
file type ORIGINAL
field office USGS
latitude 34.3897
longitude -103.302
eng units or cps E

company	CANNON AIR FORCE BASE		
well	MW-RB		
field	CANNON		
county	CURRY	state	NM
UNIQUE WELL ID		other1serv	
LOCATION	CLOVIS	ZW	
PROVINCE		other2serv	
		ZI	
		other3serv	
section NA	township NA	range NA	ZE

permanent datum	LSD	elev gl	NA
log meas from	LSD	elev kb	NA
logging unit	302	elev df	NA
drl meas from	NA	elev perm datum	4282

DATE	05/07/19	time circ stopped	
log direction		log sample int	.10
file type id		feet or meter	F
depth driller		sys serial	1
fluid type	H2O	sys version	3.6XH
log bottom	331.50	casing diameter	4
log top	0.00	casing bottom	
time		casing type	PVC
recorded by	MCDOWELL	casing thick	
tool serial num		bit size	
fluid density		fluid viscosity	
Name Prn AP		truck cal num	
mean surface temp		mud sample source	
temp gradient		mud res	
mag declination		mud temp	
density matrix	2.65	res mud filtrate	
neutron matrix	SANDSTONE	res mud cake	
delta t matrix	54	temp mud filtrate	
deltat fluid		temp mud cake	
fluid ph		elect cutoff	9999
remarks2		remarks1	

U.S. DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

USGS
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SERVICE COMPANY USGS
file type ORIGINAL
field office USGS
latitude 34.3661
longitude -103.302 E
eng units or cps

company CANNON AIR FORCE BASE
well MW-SA
field CANNON
county CURRY state NM

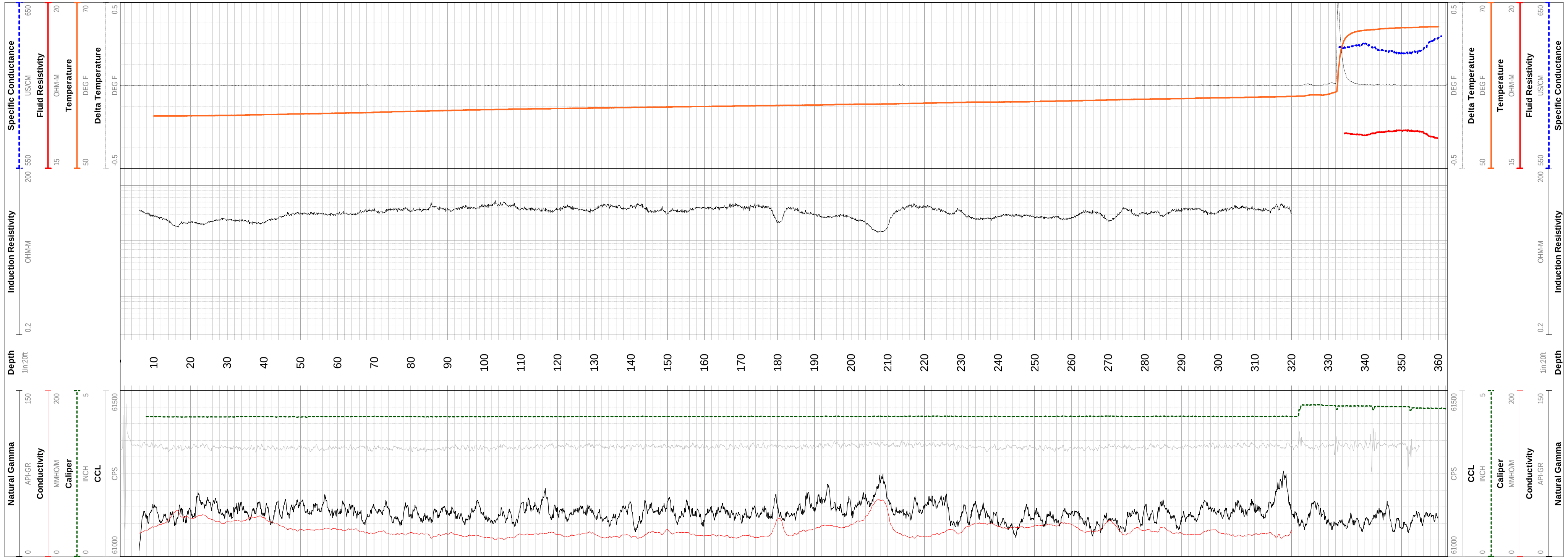
UNIQUE WELL ID
LOCATION CLOVIS
PROVINCE
section NA township NA range NA

other1serv
ZW
other2serv
ZI
other3serv
ZE

permanent datum LSD
log meas from LSD
logging unit 302
drl meas from NA

elev gl NA
elev kb NA
elev df NA
elev perm datum 4264

DATE	05/02/19	time circ stopped	
log direction		log sample int	.10
file type id		feet or meter	F
depth driller		sys serial	1
fluid type	H2O	sys version	3.6XH
log bottom	362.70	casing diameter	4
log top	0.10	casing bottom	
time		casing type	PVC
recorded by	PAYNE	casing thick	
tool serial num		bit size	
fluid density		fluid viscosity	
Name Prn AP		truck cal num	
mean surface temp		mud sample source	
temp gradient		mud res	
mag declination		mud temp	
density matrix	2.65	res mud filtrate	
neutron matrix	SANDSTONE	res mud cake	
delta t matrix	54	temp mud filtrate	
deltat fluid		temp mud cake	
fluid ph		elect cutoff	9999
remarks2		remarks1	

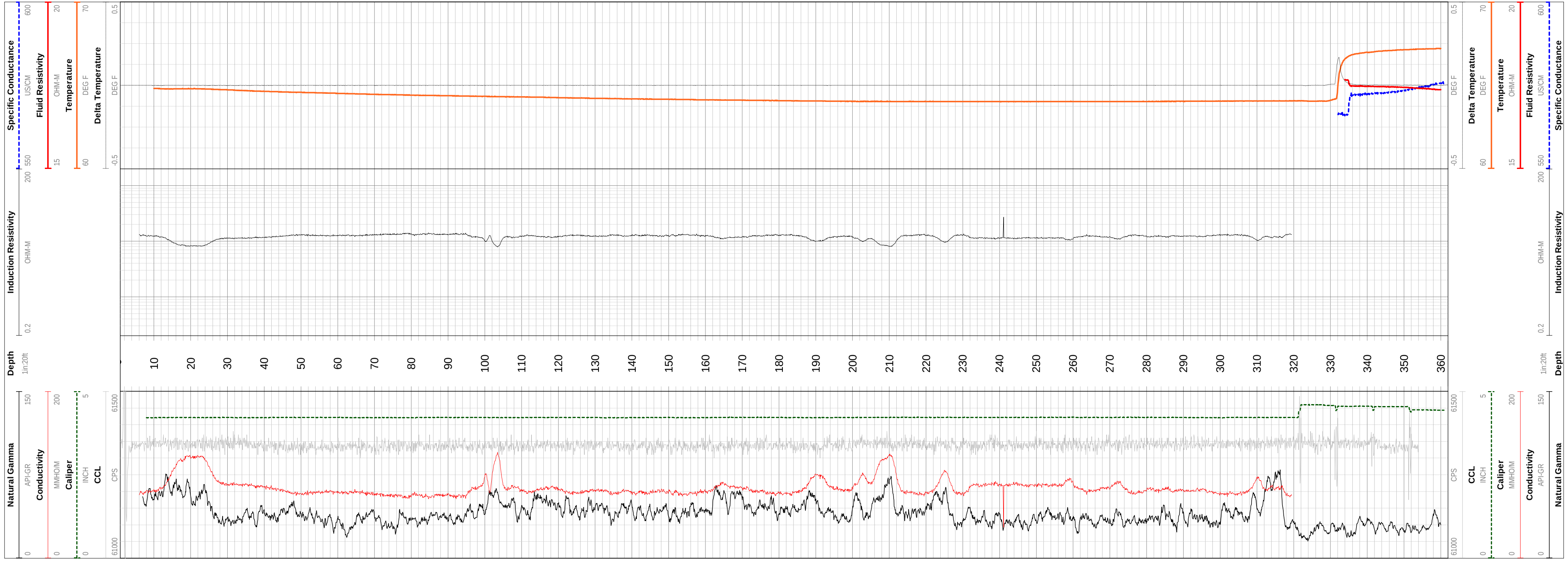


USGS
science for a changing world

company CANNON AIR FORCE BASE
well MW-TA
field CANNON
county CURRY state NM

SERVICE COMPANY	USGS	UNIQUE WELL ID	other1serv
file type	ORIGINAL	LOCATION CLOVIS	ZW
field office	USGS	PROVINCE	other2serv
latitude	34.3666		ZI
longitude	-103.302 E		other3serv
eng units or cps		section NA township NA range NA	ZE
permanent datum	LSD		elev gl NA
log meas from	LSD		elev kb NA
logging unit	302		elev df NA
drl meas from	NA		elev perm datum 4264

DATE	05/02/19	time circ stopped	
log direction		log sample int	.10
file type id		feet or meter	F
depth driller		sys serial	1
fluid type	H2O	sys version	3.6XH
log bottom	361.90	casing diameter	4
log top	0.00	casing bottom	
time		casing type	PVC
recorded by	PAYNE	casing thick	
tool serial num		bit size	
fluid density		fluid viscosity	
Name Prn AP		truck cal num	
mean surface temp		mud sample source	
temp gradient		mud res	
mag declination		mud temp	
density matrix	2.65	res mud filtrate	
neutron matrix	SANDSTONE	res mud cake	
delta t matrix	54	temp mud filtrate	
deltat fluid		temp mud cake	
fluid ph		elect cutoff	9999
remarks2		remarks1	



company	CANNON AIR FORCE BASE		
well	MW-UA		
field	CANNON		
county	CURRY	state	NM
UNIQUE WELL ID			other1serv
LOCATION	CLOVIS		ZW
PROVINCE			other2serv
			ZI
			other3serv
section NA	township NA	range NA	ZE

SERVICE COMPANY USGS
file type ORIGINAL
field office USGS
latitude 34.6797
longitude -103.302
eng units or cps E

permanent datum	LSD		elev gl NA
log meas from	LSD		elev kb NA
logging unit	302		elev df NA
drl meas from	NA		elev perm datum 4264

DATE	05/02/19	time circ stopped	
log direction		log sample int	.10
file type id		feet or meter	F
depth driller		sys serial	1
fluid type	H2O	sys version	3.6XH
log bottom	362.90	casing diameter	4
log top	0.10	casing bottom	
time		casing type	PVC
recorded by	PAYNE	casing thick	
tool serial num		bit size	
fluid density		fluid viscosity	
Name Prn AP		truck cal num	
mean surface temp		mud sample source	
temp gradient		mud res	
mag declination		mud temp	
density matrix	2.65	res mud filtrate	
neutron matrix	SANDSTONE	res mud cake	
delta t matrix	54	temp mud filtrate	
deltat fluid		temp mud cake	
fluid ph		elect cutoff	9999
remarks2		remarks1	

USGS
science for a changing world

company	CANNON AIR FORCE BASE		
well	MW-V		
field	CANNON		
county	CURRY	state	NM
UNIQUE WELL ID			other1serv
LOCATION	CLOVIS		ZW
PROVINCE			other2serv
			ZI
			other3serv
section NA	township NA	range NA	ZE

SERVICE COMPANY USGS
file type ORIGINAL
field office USGS
latitude 34.4050
longitude -103.336
eng units or cps E

permanent datum	LSD		elev gl NA
log meas from	LSD		elev kb NA
logging unit	302		elev df NA
drl meas from	NA		elev perm datum 4328

DATE	05/01/19	time circ stopped	
log direction		log sample int	.10
file type id		feet or meter	F
depth driller		sys serial	1
fluid type	H2O	sys version	3.6XH
log bottom	370.50	casing diameter	4
log top	-0.60	casing bottom	
time		casing type	PVC
recorded by	PAYNE	casing thick	
tool serial num		bit size	
fluid density		fluid viscosity	
Name Prn AP		tnuck cal num	
mean surface temp		mud sample source	
temp gradient		mud res	
mag declination		mud temp	
density matrix	2.65	res mud filtrate	
neutron matrix	SANDSTONE	res mud cake	
delta t matrix	54	temp mud filtrate	
deltat fluid		temp mud cake	
fluid ph		elect cutoff	9999
remarks2		remarks1	

USGS science for a changing world

SERVICE COMPANY USGS
file type ORIGINAL
field office USGS
latitude 34.3728
longitude -103.328
eng units or cps E

company CANNON AIR FORCE BASE
well MW-X
field CANNON
county CURRY state NM

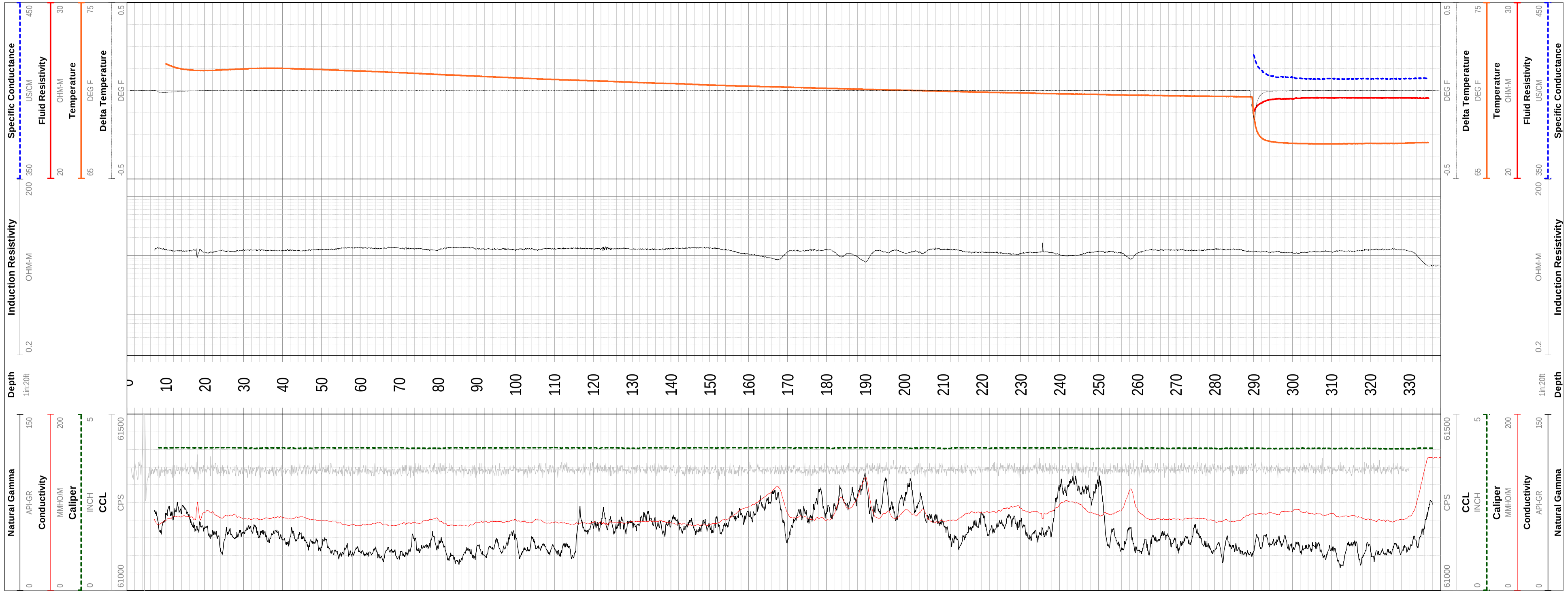
UNIQUE WELL ID
LOCATION CLOVIS
PROVINCE
section NA township NA range NA

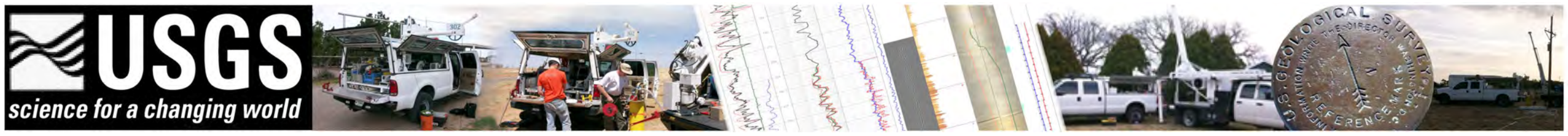
other1serv
ZW
other2serv
ZI
other3serv
ZE

permanent datum LSD
log meas from LSD
logging unit 302
drl meas from NA

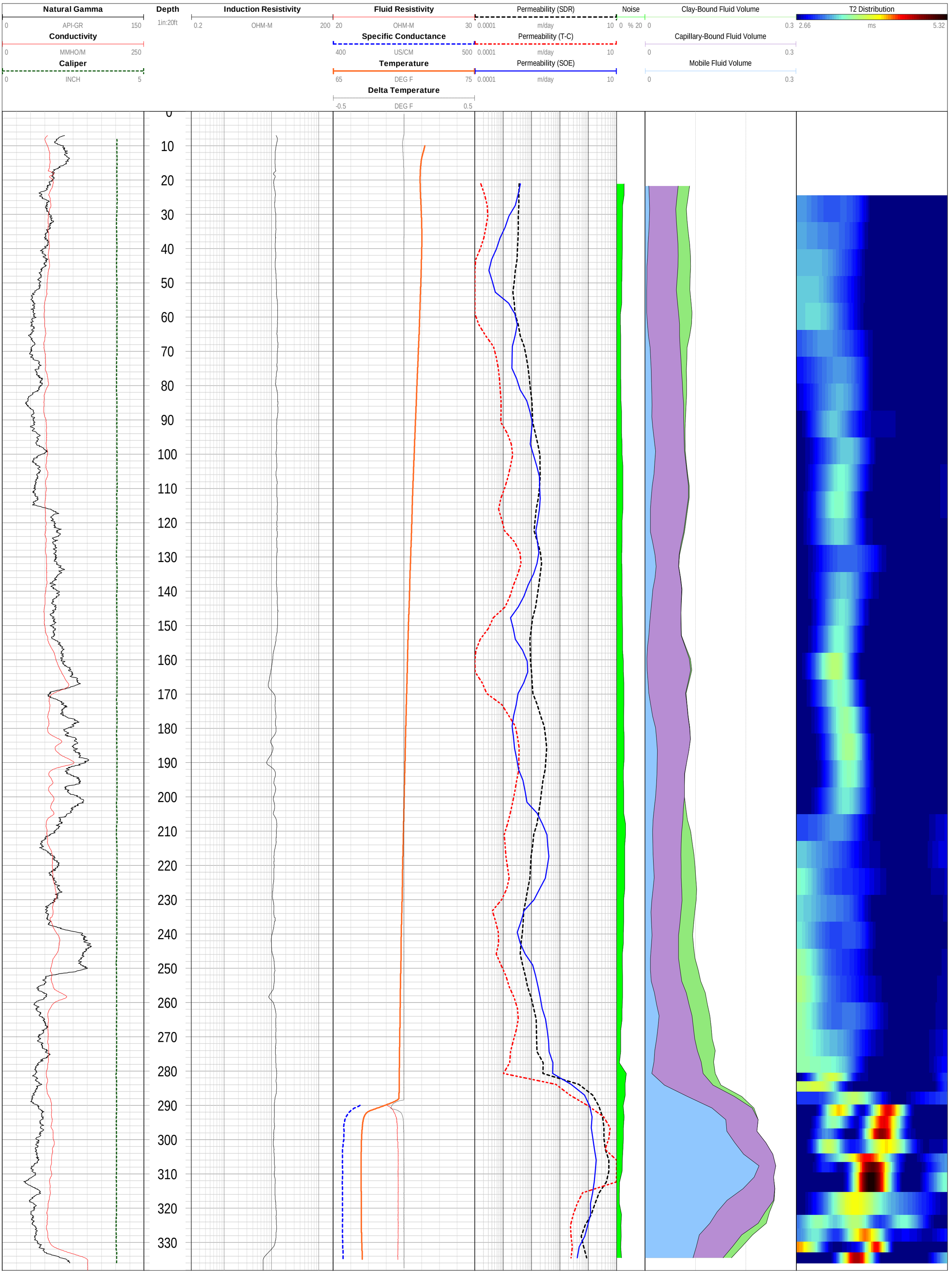
elev gl NA
elev kb NA
elev df NA
elev perm datum 4274

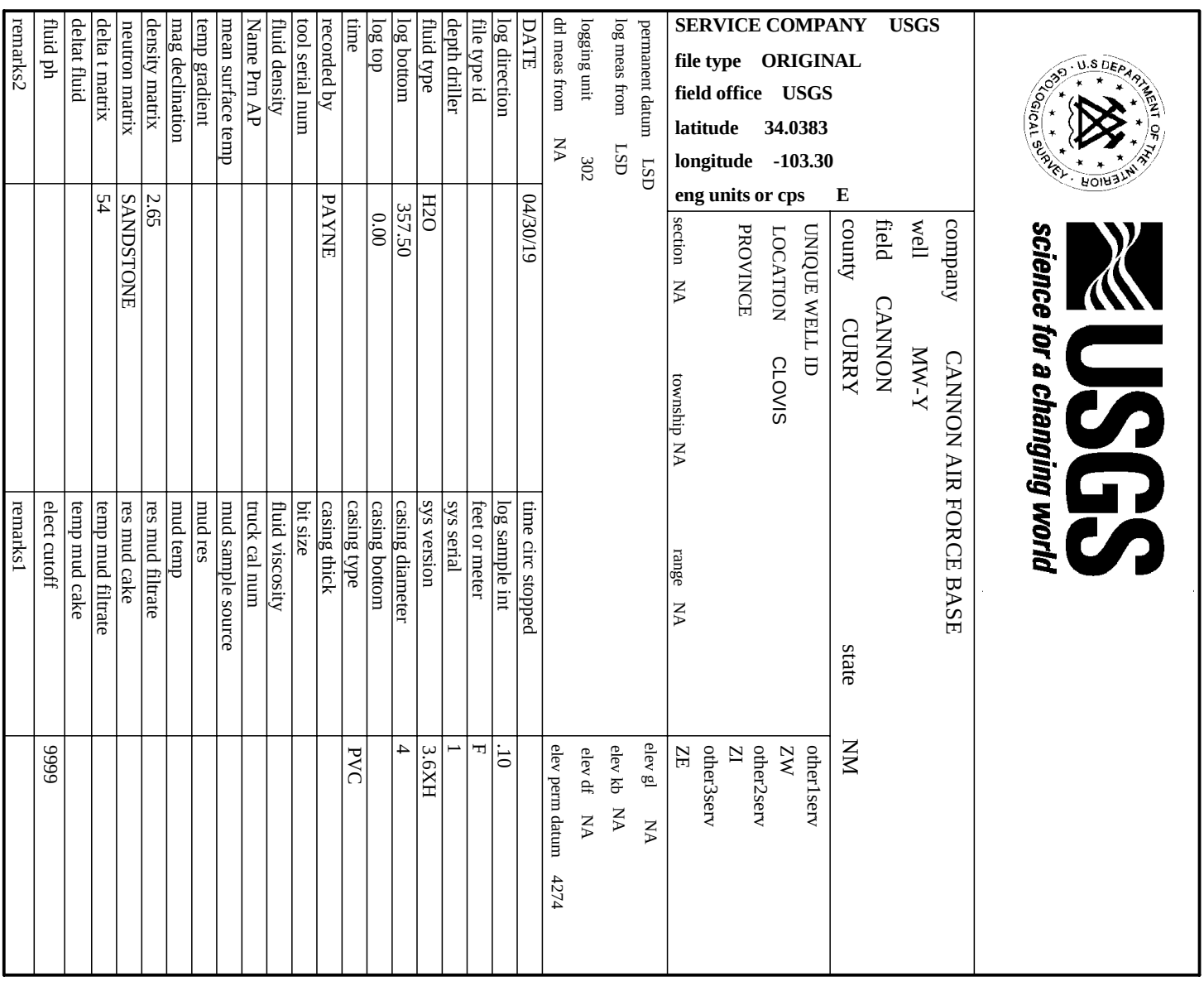
DATE	05/01/19	time circ stopped	
log direction		log sample int	.10
file type id		feet or meter	F
depth driller		sys serial	1
fluid type	H2O	sys version	3.6XH
log bottom	337.40	casing diameter	4
log top	0.00	casing bottom	
time		casing type	PVC
recorded by	PAYNE	casing thick	
tool serial num		bit size	
fluid density		fluid viscosity	
Name Prn AP		truck cal num	
mean surface temp		mud sample source	
temp gradient		mud res	
mag declination		mud temp	
density matrix	2.65	res mud filtrate	
neutron matrix	SANDSTONE	res mud cake	
delta t matrix	54	temp mud filtrate	
deltat fluid		temp mud cake	
fluid ph		elect cutoff	9999
remarks2		remarks1	





Well Name MW-X Date of Logging 5/8/2019 County Curry State New Mexico Cooperator Cannon AFB





SERVICE COMPANY USGS
file type ORIGINAL
field office USGS
latitude 34.0383
longitude -103.30
eng units or cps E

company	CANNON AIR FORCE BASE				
well	MW-Y				
field	CANNON				
county	CURRY		state	NM	
UNIQUE WELL ID				other1serv	
LOCATION	CLOVIS			ZW	
PROVINCE				other2serv	
				ZI	
				other3serv	
section	NA	township	NA	range	NA	ZE	
permanent datum	LSD			elev gl	NA
log meas from	LSD			elev kb	NA
logging unit	302			elev df	NA
dtl meas from	NA			elev perm datum	4274

DATE	04/30/19	time circ stopped	
log direction		log sample int	.10
file type id		feet or meter	F
depth driller		sys serial	1
fluid type	H2O	sys version	3.6XH
log bottom	357.50	casing diameter	4
log top	0.00	casing bottom	
time		casing type	PVC
recorded by	PAYNE	casing thick	
tool serial num		bit size	
fluid density		fluid viscosity	
Name Prn AP		truck cal num	
mean surface temp		mud sample source	
temp gradient		mud res	
mag declination		mud temp	
density matrix	2.65	res mud filtrate	
neutron matrix	SANDSTONE	res mud cake	
delta t matrix	54	temp mud filtrate	
deltat fluid		temp mud cake	
fluid ph		elect cutoff	9999
remarks2		remarks1	

ENTERED

CAFB PFAs USGS Boring Locations

Cobrain, Dave, NMENV

From: KOTTKAMP, SHEEN T GS-12 USAF AFCEC AFCEC/CZOW <sheen.kottkamp.1@us.af.mil>
Sent: Tuesday, May 28, 2019 9:56 AM
To: Cobrain, Dave, NMENV; Wear, Benjamin, NMENV; Acevedo, Gabriel, NMENV
Cc: SEGURA, CHRISTOPHER G GS-14 USAF AFCEC/CZO; GIERKE, CHRISTIPHER N GS-12 USAF AFCEC 27 SOCES/AFCEC/CZO
Subject: [EXT] FW: Drilling Activity at CAFB
Attachments: Boreholes_Apr_2019.pdf

Good morning Dave. I wanted to clarify the recent activity conducted by the USGS at Cannon AFB. There appears to be some confusion regarding the purpose of the activity. The USGS has conducted geophysical studies at other Air Force Installations and we (Cannon) were informed that they had resources/funding to execute a study at the base. Obviously, I was in favor of such a project. USGS took the lead in execution in coordination with AFCEC. The USGS captured geophysical logging of all existing monitoring wells. In addition, we (AF) wanted an additional four temporary borings installed specifically targeting the potential paleo channel locations on the installation for geophysical logging purposes. The goal of the study was really threefold; a more thorough understanding of the subsurface geology/strata of the Ogallala formation from the ground surface to the confining red beds (Triassic) across the installation, understanding saturated thickness/water availability within the saturated zone, as well as understanding the diversity of the surface of the confining layer in relationship to the potential presence of paleo channels within the installation boundary. The location of the additional temporary exploratory borings was predicated on the potential of encountering a paleo channel and gaining a clearer understanding of the respective subsurface geology and depth to the red beds in these areas. In addition, since we had to execute expeditiously, locations were selected that would allow us to forgo implementing an "airfield waiver" which can be a long involved process. The locations chosen for the temporary borings and the study were not promulgated on any of our RCRA permitted sites or in the execution/administration of the Restoration Program in regard to permit directives/requirements. I'm looking forward to the upcoming data regarding the study as it will definitely help us increase our understanding of the subsurface geology/hydrogeology of the installation. Currently we have no dry wells; however as you are aware, groundwater levels continue to decline throughout the area. If you recall, I replaced a total of six wells back in 2017. Three of the wells were replaced specifically due to water decline. When we receive the data from the study, I or Chris G. can certainly provide a courtesy copy. Attached is an overview map depicting the location of the temporary borings as well as the associated location geo-reference data. Let me know if you have any additional questions. I hope all is well. Sheen

---

From: Cobrain, Dave, NMENV <dave.cobrain@state.nm.us>
Sent: Wednesday, May 8, 2019 5:21 PM
To: GIERKE, CHRISTIPHER N GS-12 USAF AFCEC 27 SOCES/AFCEC/CZO <christipher.gierke@us.af.mil>; Acevedo, Gabriel, NMENV <Gabriel.Acevedo@state.nm.us>
Cc: Wear, Benjamin, NMENV <Benjamin.Wear@state.nm.us>; Kieling, John, NMENV <john.kieling@state.nm.us>
Subject: [Non-DoD Source] RE: Drilling Activity at CAFB

Mr. Gierke,

The Hazardous Waste Bureau (HWB) is concerned that four borings are being drilled through the Ogallala Aquifer to the underlying Triassic siltstone at Cannon Air Force Base without installing wells in the

borings. This appears to not only be a lost opportunity but also a waste of resources considering the cost of mobilization and drilling. Although HWB does not know the locations of the borings, this represents a lost opportunity to collect data regarding current and future groundwater levels, the lithology of the Ogallala formation at those locations and also water quality data in the event of a future release at the base. If these locations are near Solid Waste Management Units or Areas of Concern listed on the CAFB RCRA permit, the Air Force may have to expend additional resources to install wells at these same or nearby locations. The Air Force should have discussed the locations with the HWB prior to drilling to consider well installation or in the event that the locations might have been adjusted to take advantage of the drilling to acquire data or possibly replace wells that are now dry due to declining water levels. Although the Air Force can conduct work at risk, prior discussion with HWB and submittal of a work plan would likely result in a more appropriate and efficient use of Air Force resources and avoid the need to repeat work in the future. HWB would appreciate your providing the locations of the borings and, if the work has not yet been completed, the installation of monitoring wells at the boring locations. Please call if you would like to discuss this further.

Thanks.

Dave

Dave Cobrain
New Mexico Environment Department
Hazardous Waste Bureau
2905 Rodeo Park Drive East Bldg 1
Santa Fe, NM 87505-6313
Main Office Phone 505-476-6000
Direct Line 505-476-6055
Fax 505-476-6030

From: GIERKE, CHRISTIPHER N GS-12 USAF AFCEC 27 SOCES/AFCEC/CZO <christipher.gierke@us.af.mil>
Sent: Wednesday, May 8, 2019 9:30 AM
To: Acevedo, Gabriel, NMENV <Gabriel.Acevedo@state.nm.us>
Cc: Cobrain, Dave, NMENV <dave.cobrain@state.nm.us>; Wear, Benjamin, NMENV <Benjamin.Wear@state.nm.us>; KOTTKAMP, SHEEN T GS-12 USAF AFCEC AFCEC/CZOW <sheen.kottkamp.1@us.af.mil>; SEGURA, CHRISTOPHER G GS-14 USAF AFCEC/CZO <christopher.segura.2@us.af.mil>
Subject: [EXT] RE: Drilling Activity at CAFB

Mr. Acevedo,
Thank you for the email. The Air Force Civil Engineering Center (AFCEC) is not installing any new ground water monitoring well(s) on the east side of the base near the fence line. The US Geological Survey (USGS), in partnership with AFCEC, is completing a preliminary (initial) hydrogeological investigation. They are making four new borings via mud-rotary drilling and will complete geophysical logging of the new borings. This initial effort is primarily focused on collecting data that is needed to better understand the surface of the clay (red bed) layers that act as a lower aquitard to the surficial alluvial aquifer sediments onsite. These borings are temporary and will be plugged and filled. No groundwater sampling will occur. Please feel free to contact me with any further questions or concerns.

If possible, could you provide your response soonest in regards to the "2018 Ground Water Monitoring Report MAFR" question emailed 03May2019. We are working to finalize the report, and require your input to move forward. Thank you.

V/R
Christipher Gierke
Remedial Project Manager

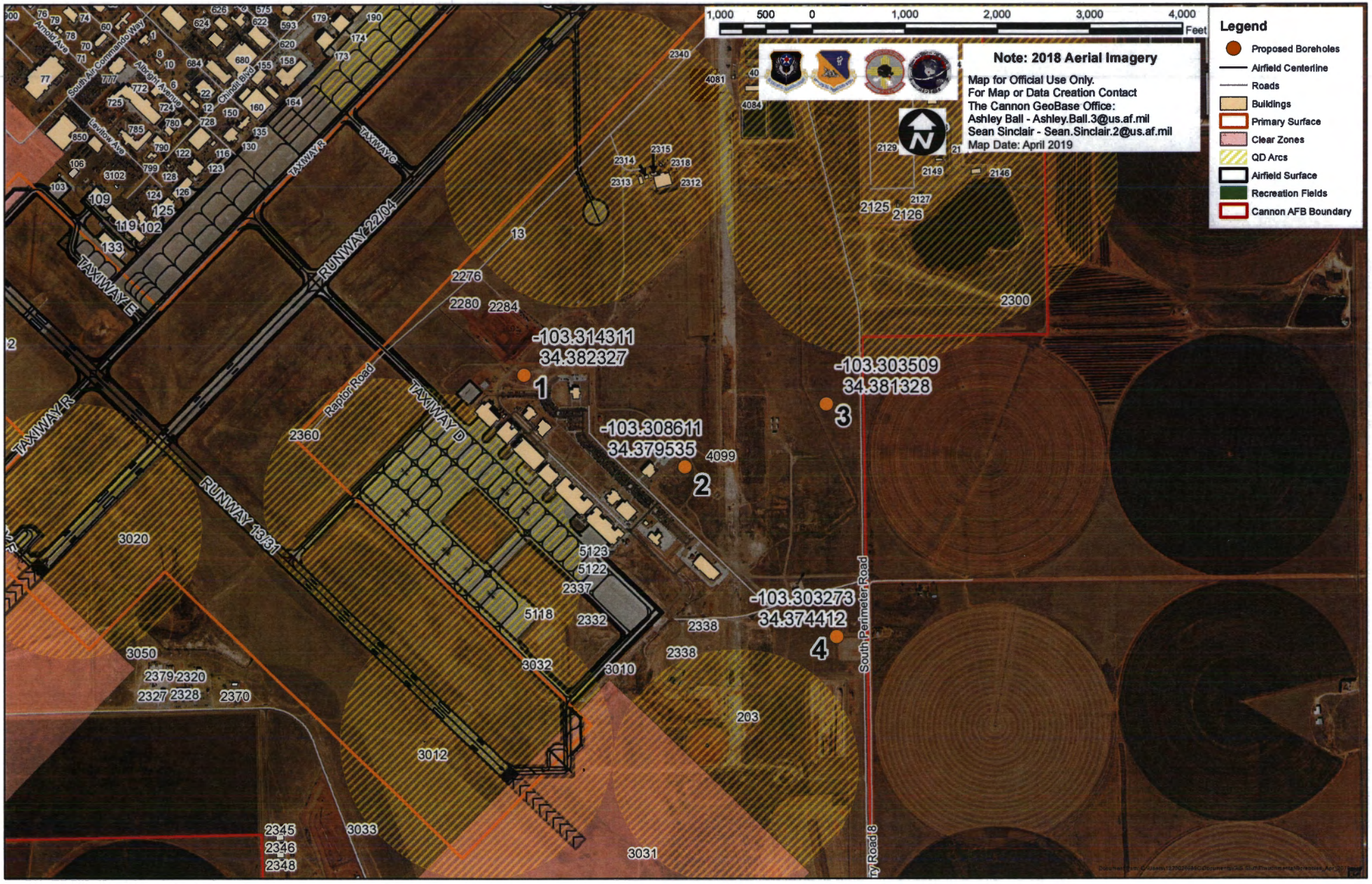
AFCEC/CZO
Comm: 575-904-6744 DSN: 640-6744

From: Acevedo, Gabriel, NMENV <Gabriel.Acevedo@state.nm.us>
Sent: Monday, May 6, 2019 1:54 PM
To: GIERKE, CHRISTIPHER N GS-12 USAF AFCEC 27 SOCES/AFCEC/CZO <christipher.gierke@us.af.mil>
Cc: Cobrain, Dave, NMENV <dave.cobrain@state.nm.us>; Wear, Benjamin, NMENV <Benjamin.Wear@state.nm.us>
Subject: [Non-DoD Source] Drilling Activity at CAFB

Christipher,

We received information last week that a drill rig was setting up at the eastern boundary of CAFB. If this is in fact the case, can you provide us with the details regarding the purpose of the drilling activities and the proposed groundwater sample analyses? The NMED has a concern that a monitoring well is being installed for groundwater monitoring purposes at a RCRA-permitted facility without prior notification to the NMED and without an approved work plan. Please provide information regarding the well installation by email at your earliest convenience but no later than the 8th of this month.

Gabriel Acevedo
Environmental Scientist & Specialist
New Mexico Environment Department
Hazardous Waste Bureau
2905 Rodeo Park Drive East, Building 1
Office: (505) 476-6000
Direct Line: (505) 476-6043
Email: gabriel.acevedo@state.nm.us


1,000 500 0 1,000 2,000 3,000 4,000
Feet
Note: 2018 Aerial Imagery
Map for Official Use Only.
For Map or Data Creation Contact
The Cannon GeoBase Office:
Ashley Ball - Ashley.Ball.3@us.af.mil
Sean Sinclair - Sean.Sinclair.2@us.af.mil
Map Date: April 2019
Legend
Proposed Boreholes
Airfield Centerline
Roads
Buildings
Primary Surface
Clear Zones
QD Arcs
Airfield Surface
Recreation Fields
Cannon AFB Boundary
-103.314311
34.382327
1
-103.308611
34.379535
2
-103.303509
34.381328
3
-103.303273
34.374412
4
RUNWAY 22/04
RUNWAY 13/31
TAXIWAY R
TAXIWAY C
TAXIWAY E
TAXIWAY D
Raptor Road
South Perimeter Road
Arnold Ave
South Air Commando Way
Chindit Blvd
Lexington Ave

Appendix E

Groundwater Flow Maps

DBS&A
Daniel B. Stephens & Associates, Inc.

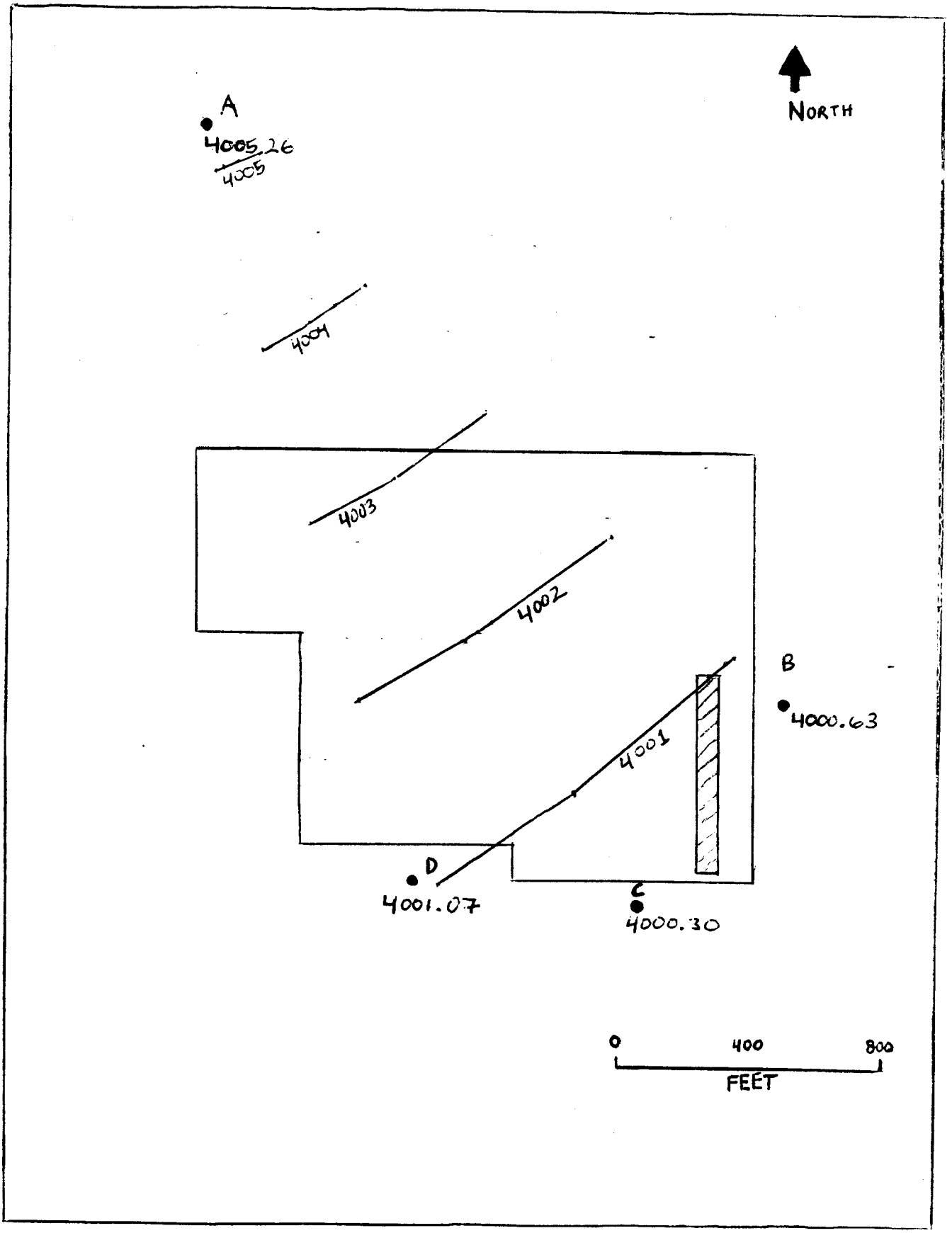


Figure 5: Potentiometric Surface of the High Plains Aquifer in the Landfill No. 5 Area, Constructed from First Quarter 1985 Data (Modified after Radian, 1985)

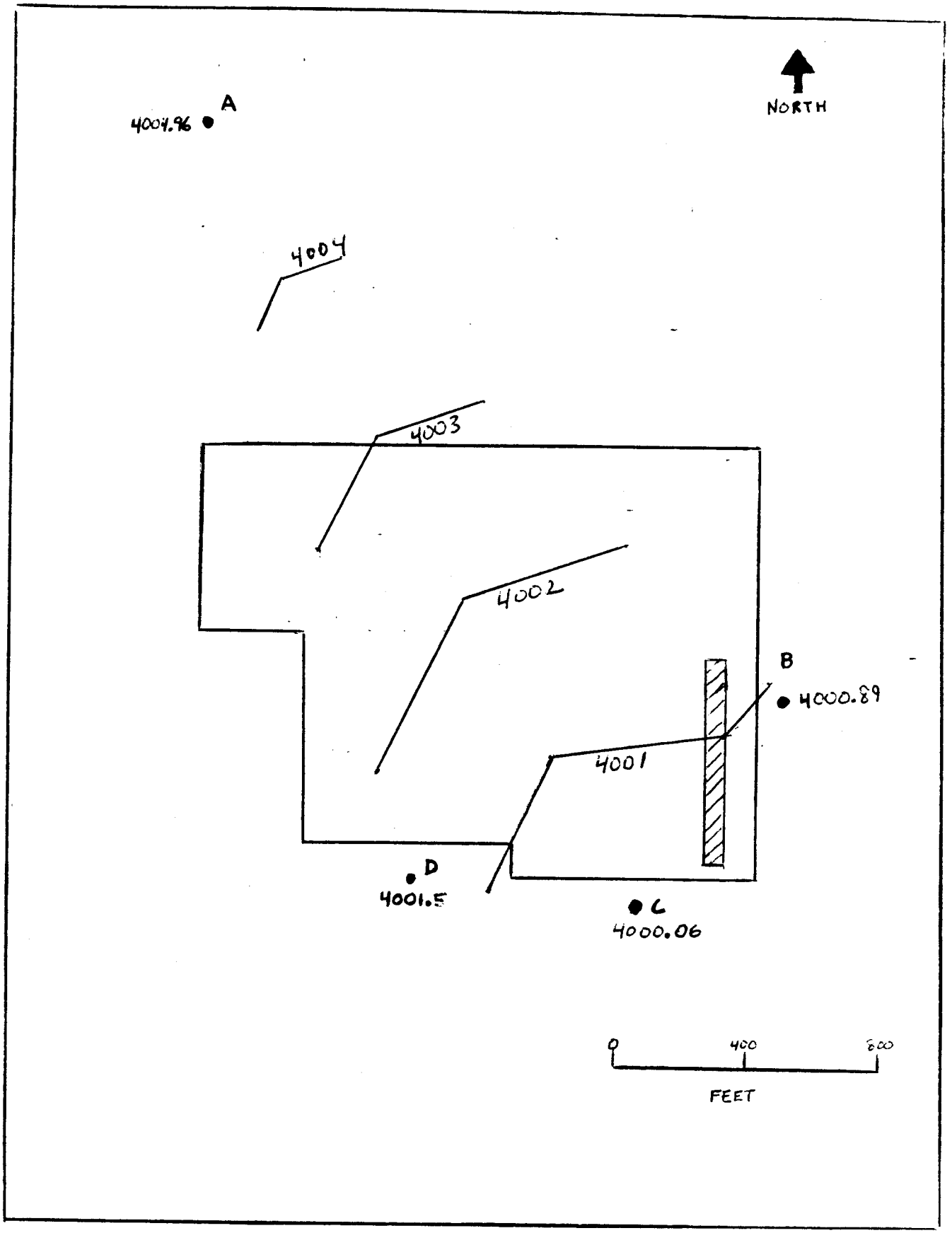


Figure 6: Potentiometric Surface of the High Plains Aquifer in the Landfill No. 5 Area, Constructed from Second Quarter 1985 Data (Modified after Radian, 1985)

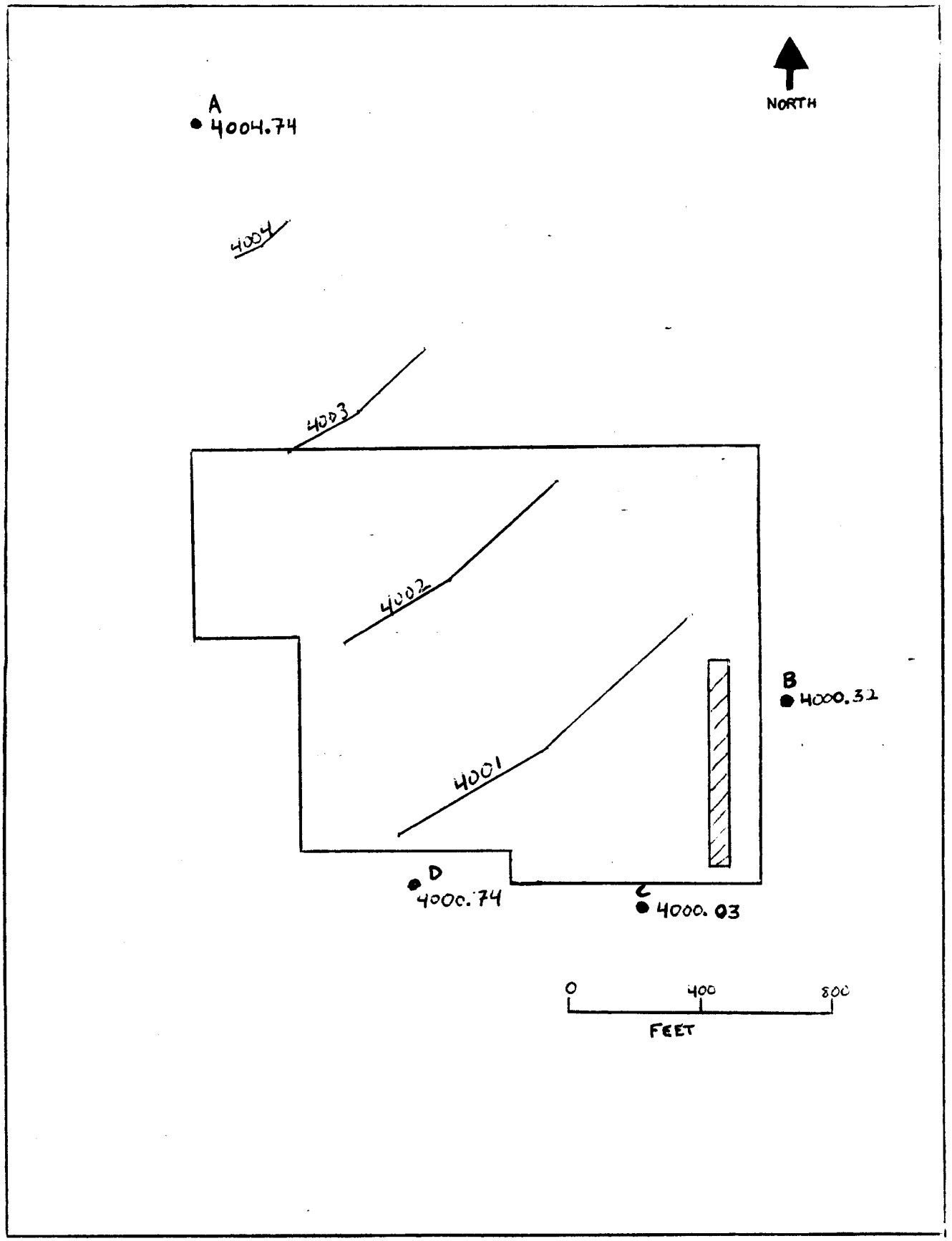


Figure 7: Potentiometric Surface of the High Plains Aquifer in the Landfill No. 5 Area, Constructed from Third Quarter 1985 Data (Modified after Radian, 1985)

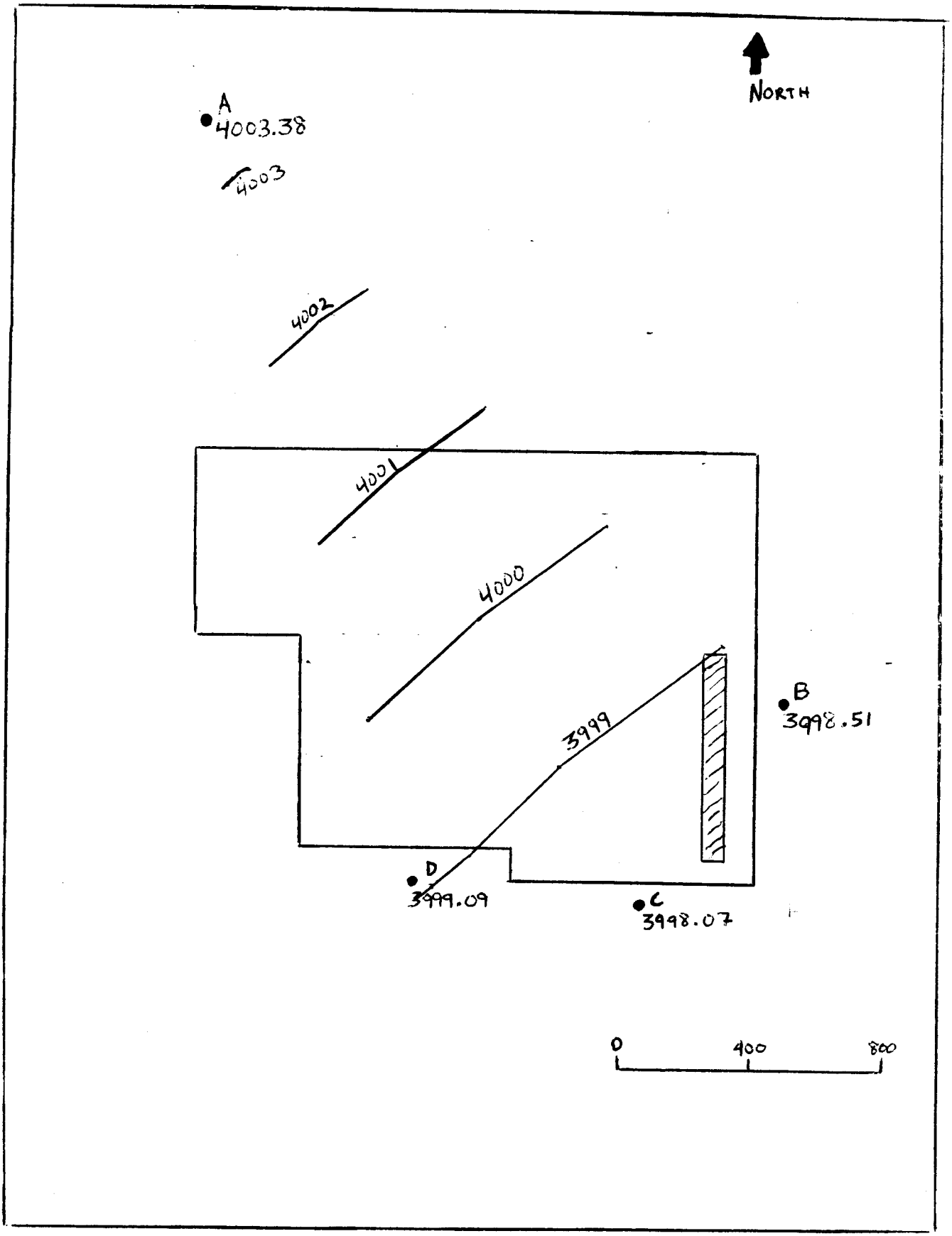
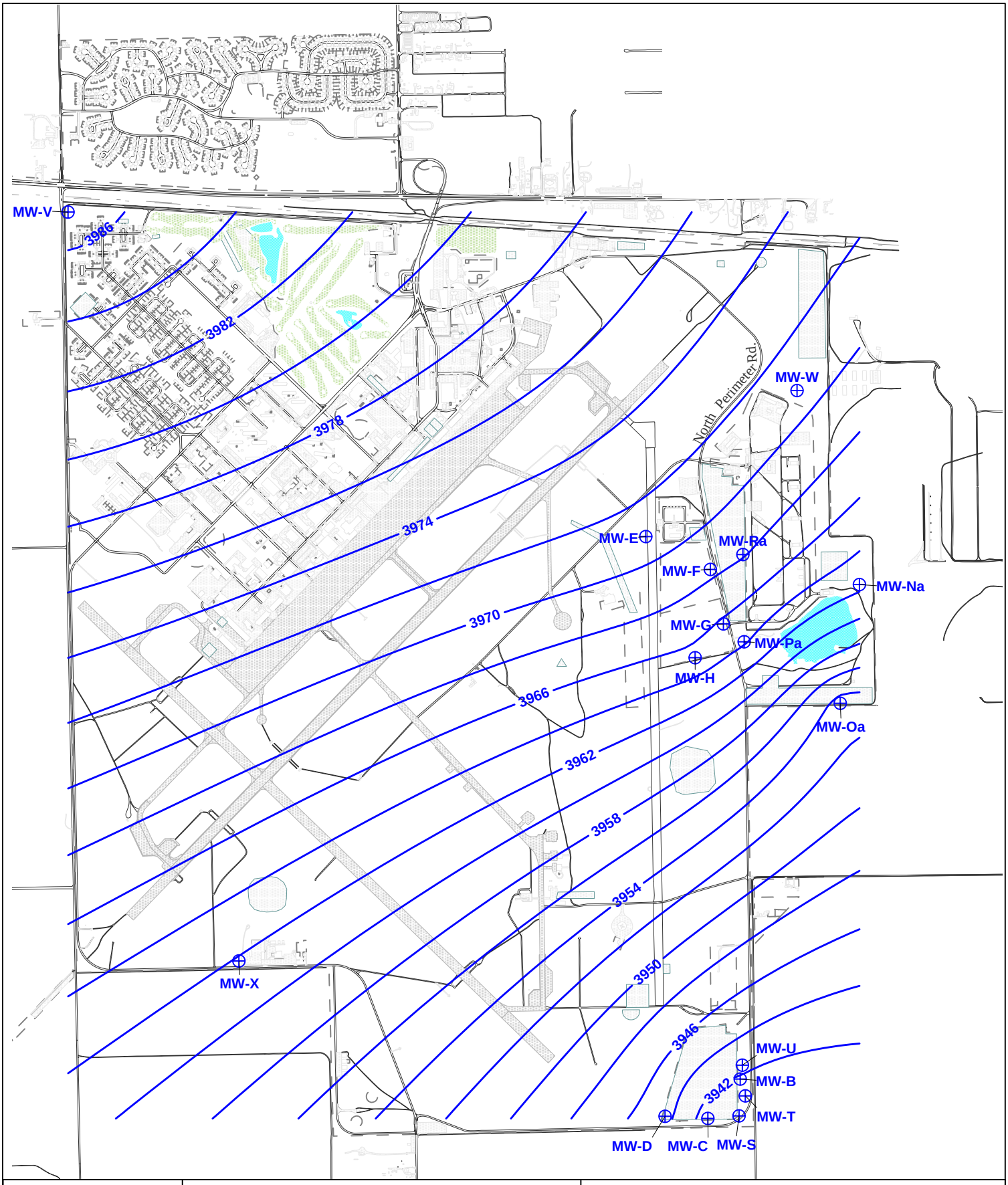


Figure 8: Potentiometric Surface of the High Plains Aquifer in the Landfill No. 5 Area, Constructed from Fourth Quarter 1985 Data (Modified after Radian, 1985)



N
W E
S
0 2000
feet

NOTES

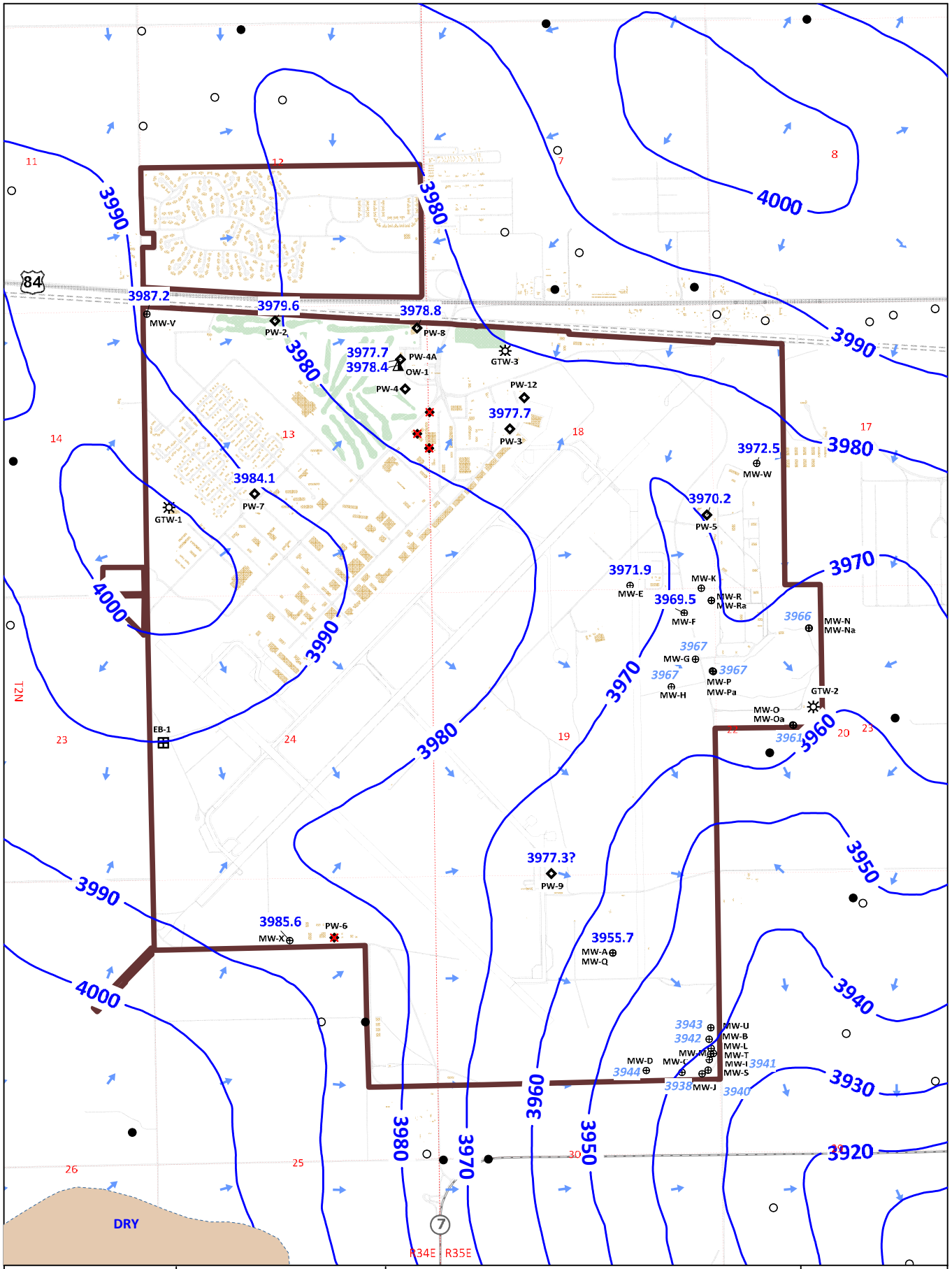
~ 3976 ~ Water table elevation contours (feet NAVD 88)

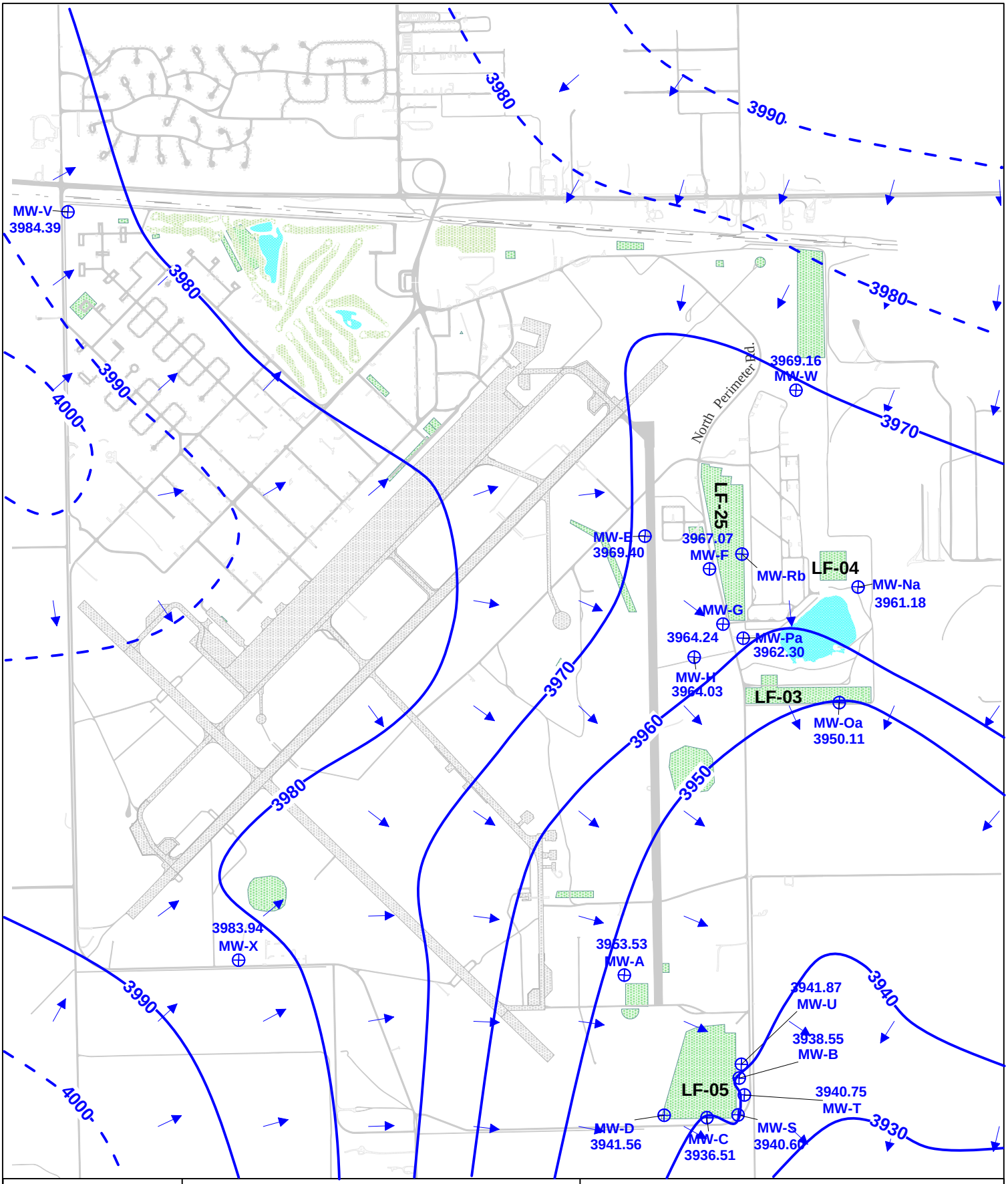
Top of casing elevations derived from USGS Report 2006-5280
MW-X omitted from calculation; suspect top of casing survey
Digital data files provided by GeoBase/CAFB
Projection: UTM Zone 13N, NAD 83

FIGURE 4.
Ground Water Flow Map
10-30-2010

Cannon Air Force Base

Curry County, New Mexico


3990
3980
4000
3970
3960
3950
3940
3930
3920
3987.2
MW-V
3979.6
PW-2
3978.8
PW-8
3977.7
3978.4
PW-4A
OW-1
PW-4
GTW-3
PW-12
3977.7
PW-3
3984.1
PW-7
GTW-1
3972.5
MW-W
3970.2
PW-5
3971.9
MW-E
MW-K
3969.5
MW-F
MW-R
MW-Ra
3966
MW-N
MW-Na
3967
MW-G
3967
MW-H
3967
MW-P
MW-Pa
GTW-2
MW-O
MW-Oa
3961
EB-1
3977.3?
PW-9
3985.6
MW-X
PW-6
3955.7
MW-A
MW-Q
3943
3942
MW-U
MW-B
MW-L
MW-T
MW-I
MW-S
MW-D
MW-C
3944
3941
3938
MW-J
3940
DRY
R34E
R35E
T2N
84
7
N
W
E
S
0
2,500
FEET
Notes:
Contour Interval: 10 ft NAVD 88
4050 - Ground water elevation, (measured water level)
4050 - Level extrapolated from recent data
Arrows indicate direction of ground water movement
FIGURE 3.41
APPROXIMATE ALTITUDE of GROUND WATER in the SOUTHERN HIGH PLAINS AQUIFER, OCTOBER 2011, CANNON AFB
Water Sustainability and Management Report
Cannon Air Force Base, New Mexico



NOTES

3976 Water table elevation contours (feet NAVD 88)

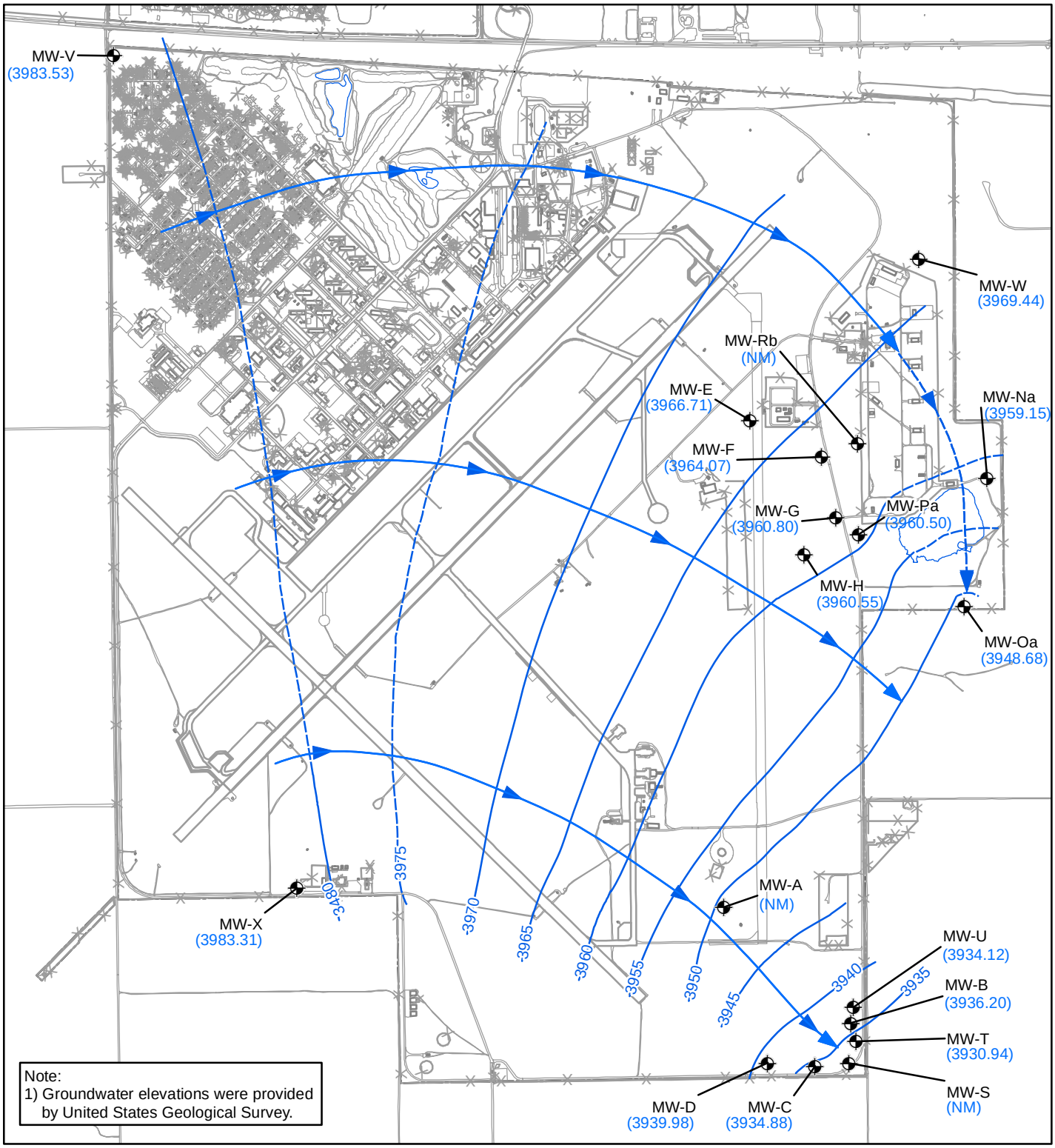
Groundwater flow vector

Contours supplemented with interpreted local flow patterns
Top of casing elevations from TRINITY, 2012
Digital data files provided by GeoBase/CAFB
Projection: UTM Zone 13N, NAD 83

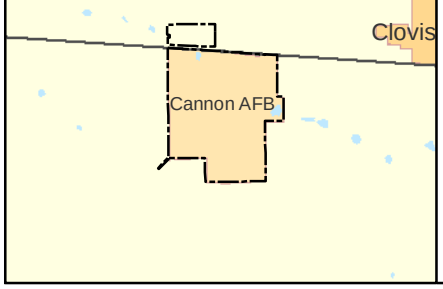
FIGURE 5.
Groundwater Flow Map
10-15-2012

Cannon Air Force Base

Curry County, New Mexico



Locator Map



Legend

- Monitoring Well Location
- Interpreted Groundwater Elevation (ft amsl)
- Groundwater Elevation (ft amsl)
- Groundwater Flow Direction
- Interpreted Groundwater Flow Direction
- Base Boundary

amsl = above mean sea level
ft = feet
NM = not measured

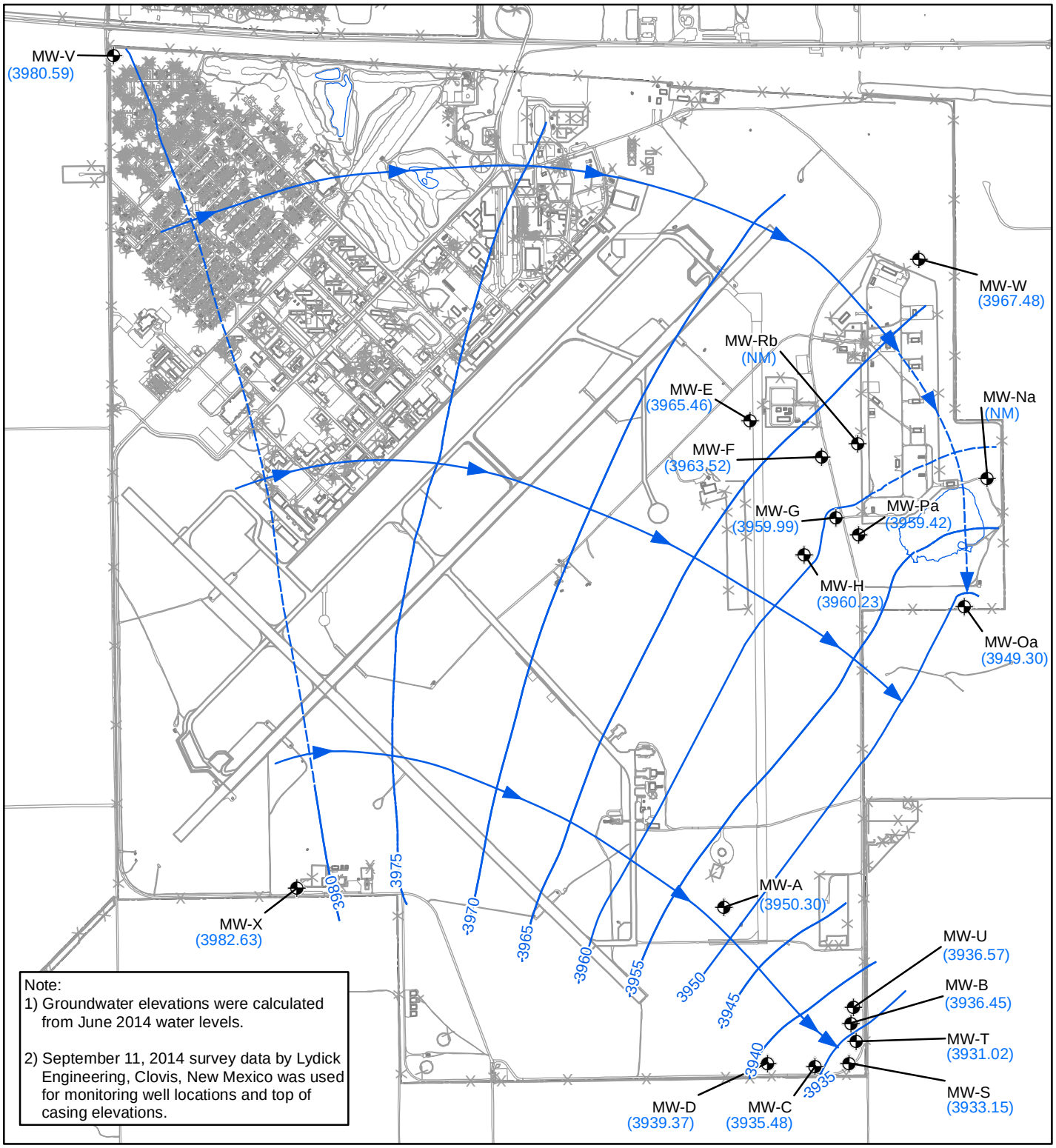
N

0 1,000 2,000 4,000 Feet

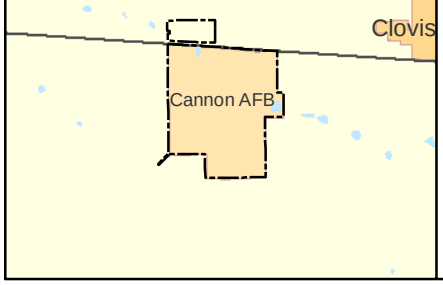
Potentiometric Surface Map - July 2013
Cannon Air Force Base, New Mexico

Drawn By:	Date:	
JM	10/20/2015	**Figure 4-1**
Checked By:	Project No.	
KK	23446539	

Z:\cannon\MW_Landfill_Inps_Rprt\4-1.mxd



Locator Map



Legend

- Monitoring Well Location
- Interpreted Groundwater Elevation (ft amsl)
- Groundwater Elevation (ft amsl)
- Base Boundary

amsl = above mean sea level
ft = feet
NM = not measured

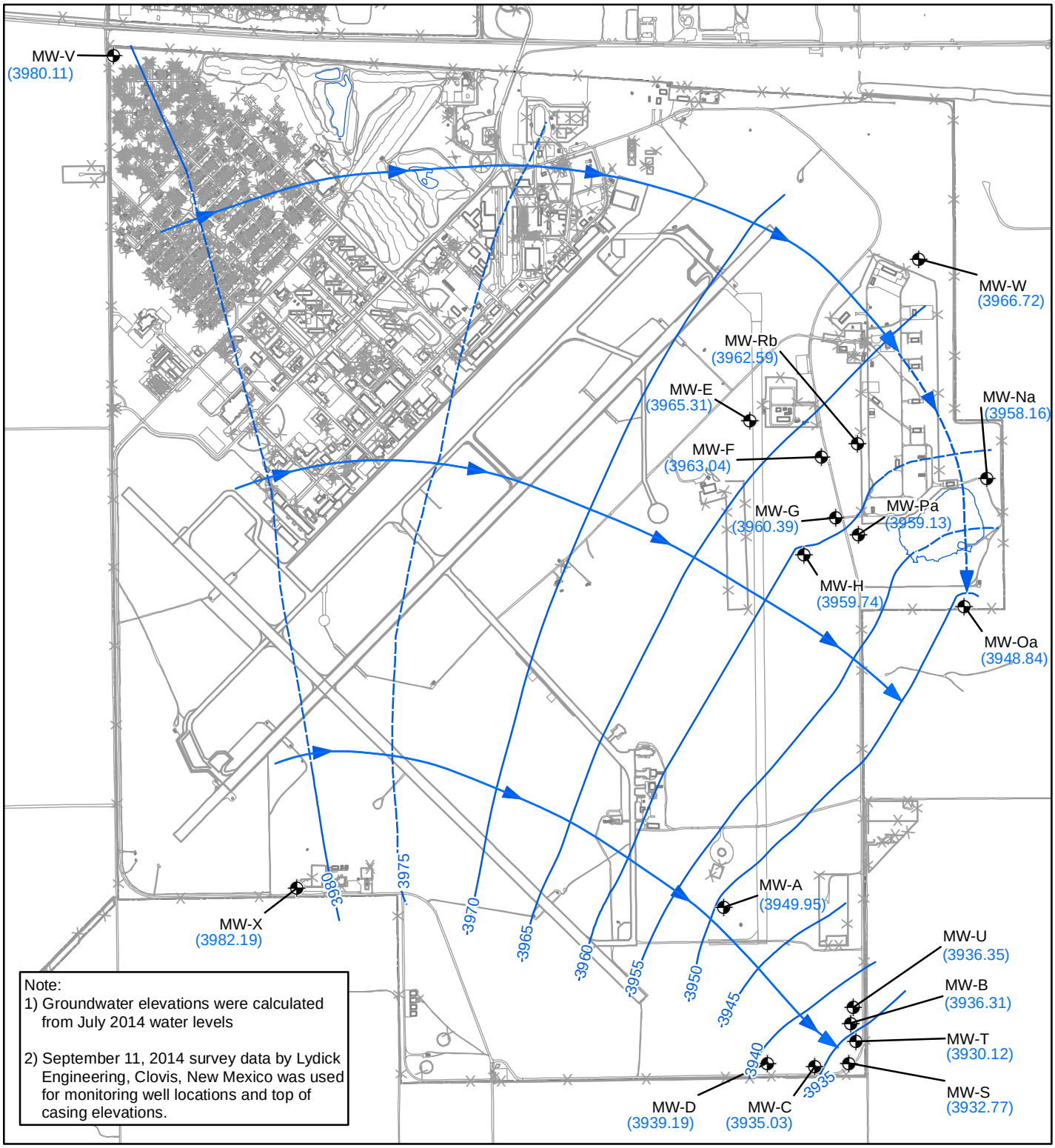
N

0 1,000 2,000 4,000 Feet

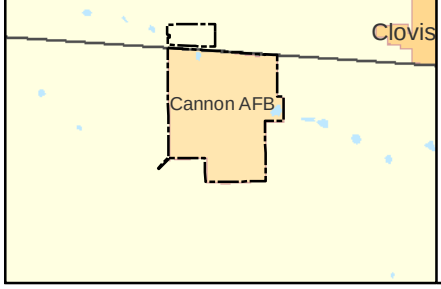
Potentiometric Surface Map - June 2014
Cannon Air Force Base, New Mexico

Drawn By:	Date:	
LLS	10/20/2015	**Figure 4-2**
Checked By:	Project No.	
KK	23446539	

Z:\cannon\MW_Landfill_Inps_Rprt\4-2.mxd



Locator Map



Legend

- Monitoring Well Location
- Interpreted Groundwater Elevation (ft amsl)
- Groundwater Elevation (ft amsl)
- Groundwater Flow Direction
- Interpreted Groundwater Flow Direction
- Base Boundary

amsl = above mean sea level
ft = feet

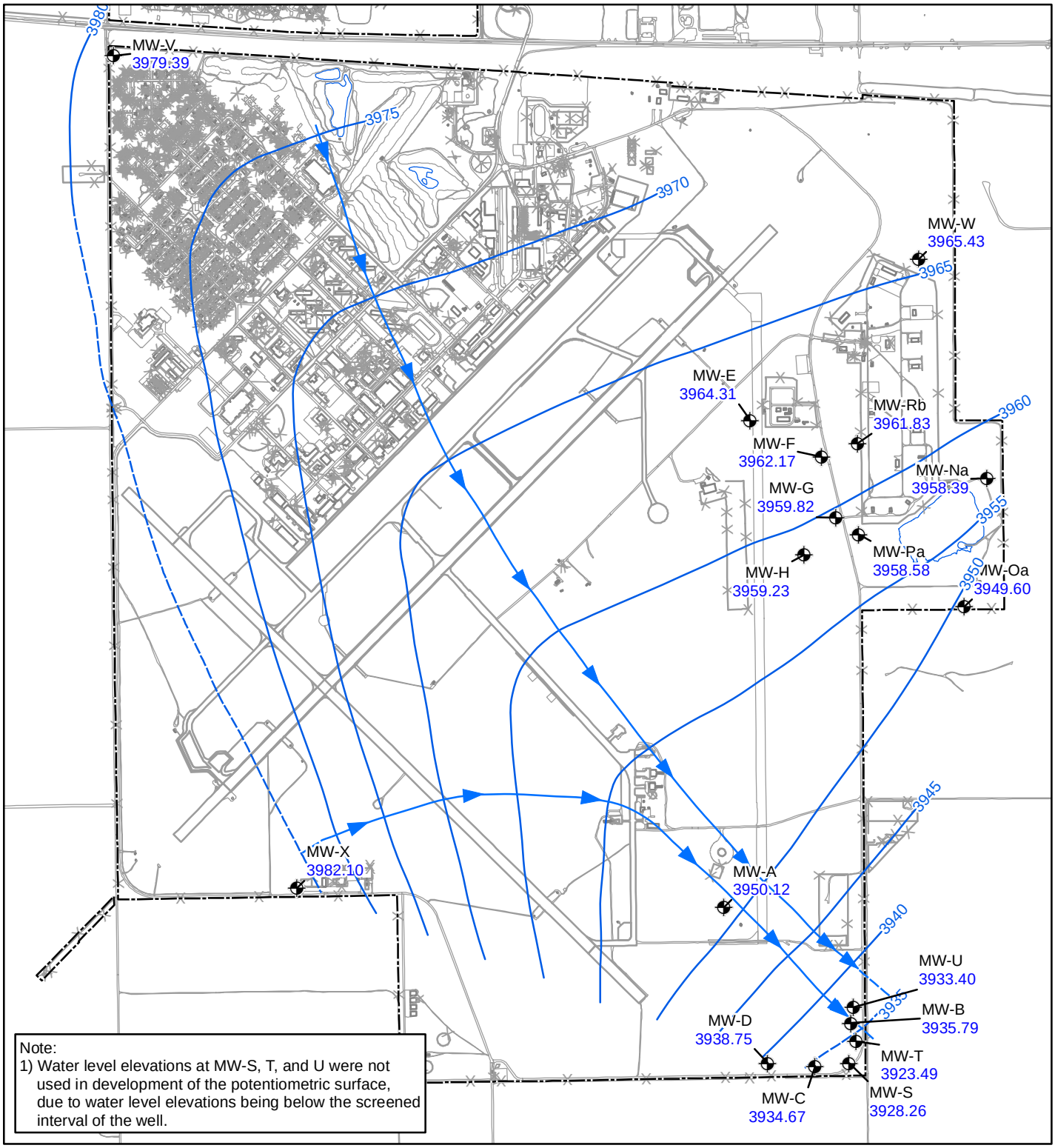
N

0 1,000 2,000 4,000 Feet

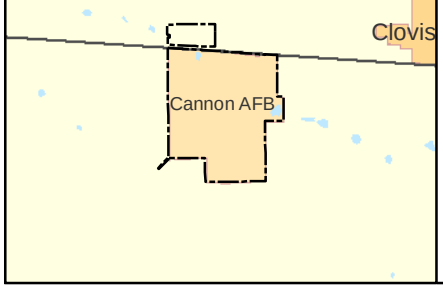
Potentiometric Surface Map - July 2014
Cannon Air Force Base, New Mexico

Drawn By:	Date:	
LLS	10/21/2015	**Figure 4-3**
Checked By:	Project No.	
KK	23446539	

Z:\cannon\MW_Landfill_Inps_Rprt\4-3.mxd



Locator Map



Legend

- Monitoring Well Location
- Interpreted Groundwater Elevation (ft amsl)
- Groundwater Elevation (ft amsl)
- Groundwater Flow Direction
- Interpreted Groundwater Flow Direction
- Base Boundary

amsl = above mean sea level
ft = feet

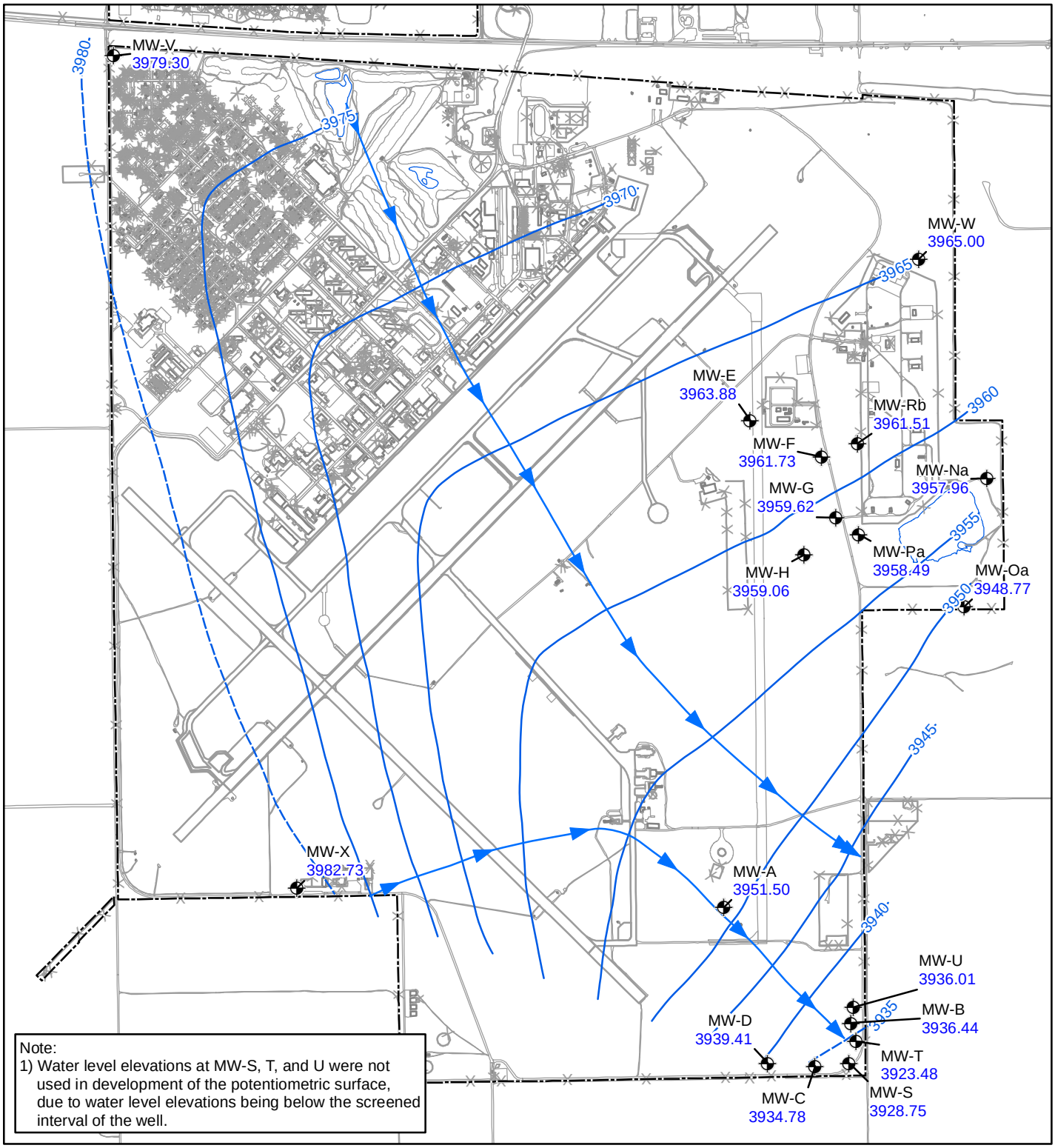
N

0 1,000 2,000 4,000 Feet

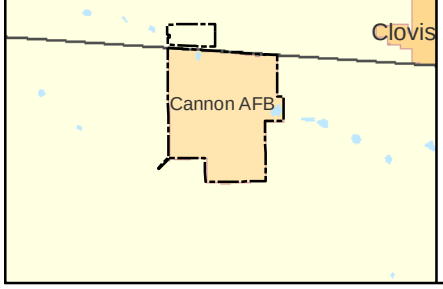
Potentiometric Surface Map - May 2015
Cannon Air Force Base, New Mexico

Drawn By:	Date:	
LLS	8/23/2016	**Figure 3-1**
Checked By:	Project No.	
KK	23446539	

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Locator Map



Legend

- Monitoring Well Location
- Groundwater Elevation (ft amsl)
- Interpreted Groundwater Elevation (ft amsl)
- Groundwater Flow Direction
- Interpreted Groundwater Flow Direction
- Base Boundary

amsl = above mean sea level
ft = feet

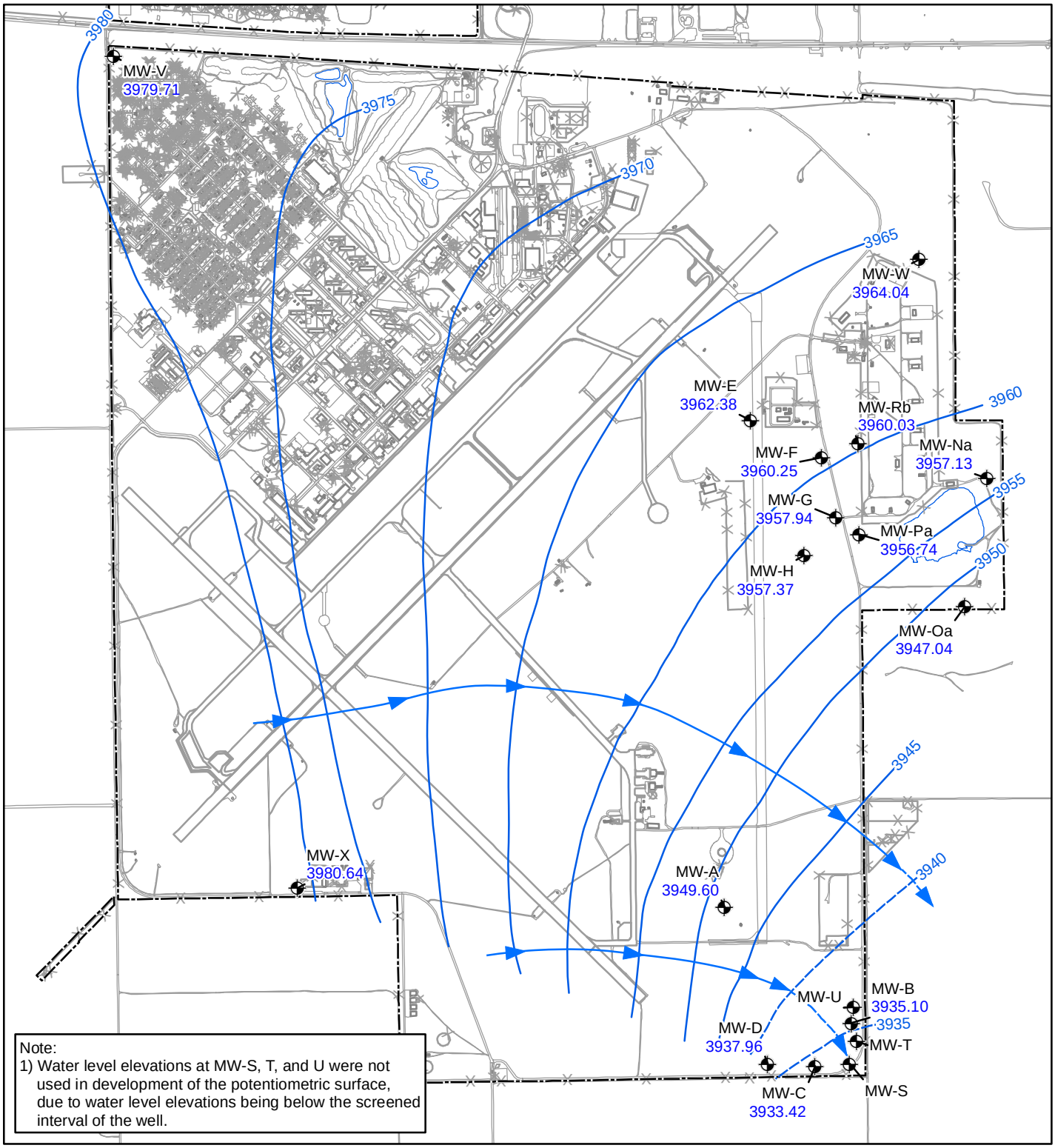
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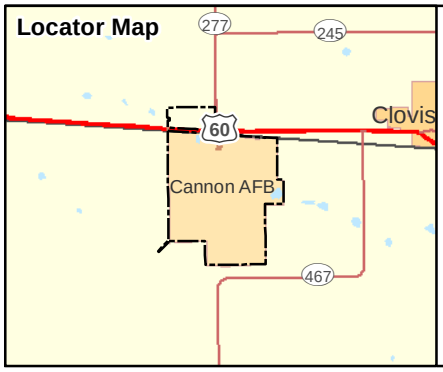
0 1,000 2,000 4,000 Feet

Potentiometric Surface Map - April 2016
Cannon Air Force Base, New Mexico

Drawn By:	Date:	
LLS	8/23/2016	**Figure 3-2**
Checked By:	Project No.	
KK	23446539	

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Legend

- Monitoring Well Location
- Interpreted Groundwater Elevation (ft amsl)
- Groundwater Elevation (ft amsl)
- Groundwater Flow Direction
- Interpreted Groundwater Flow Direction
- Base Boundary

amsl = above mean sea level
ft = feet

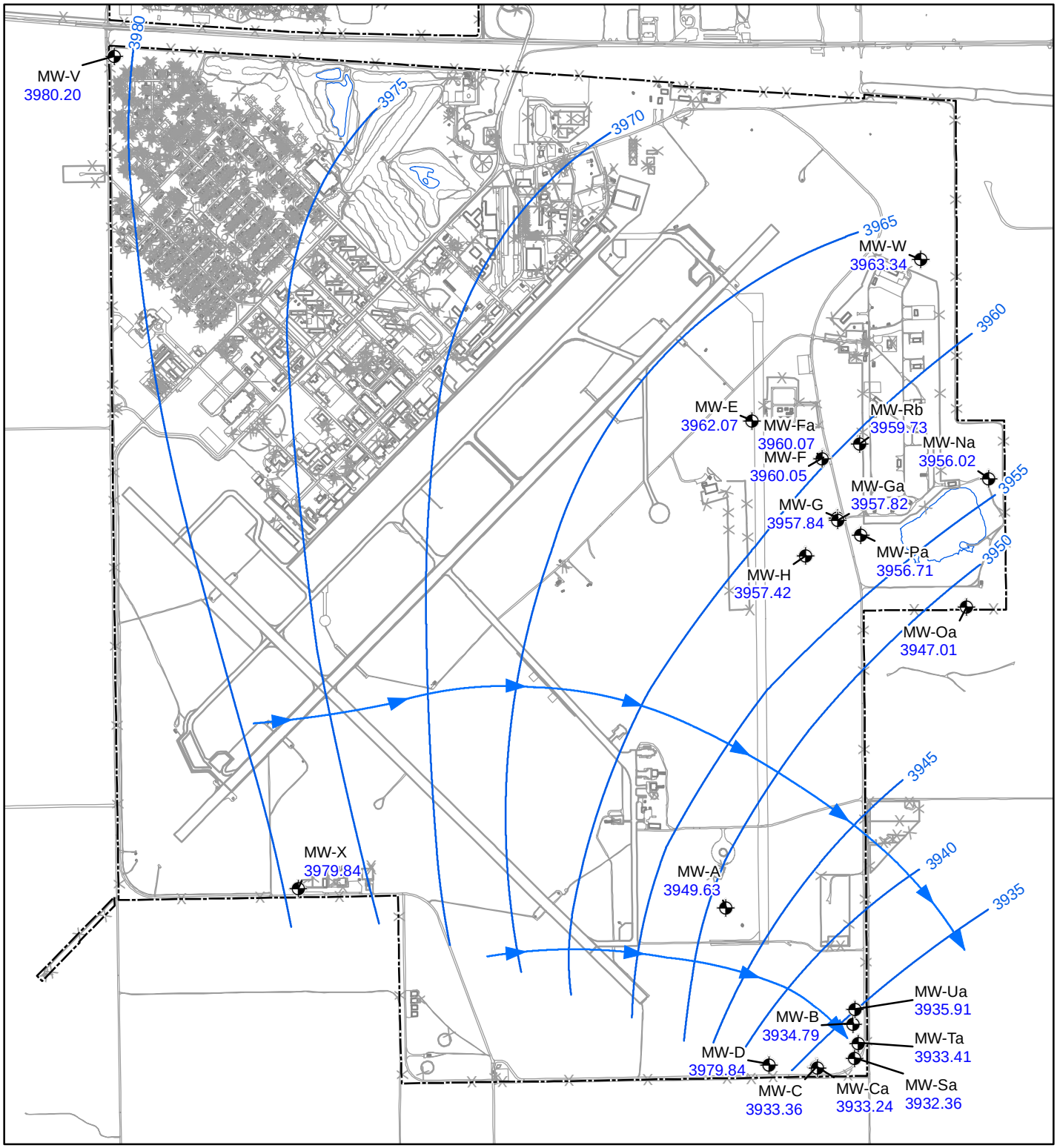
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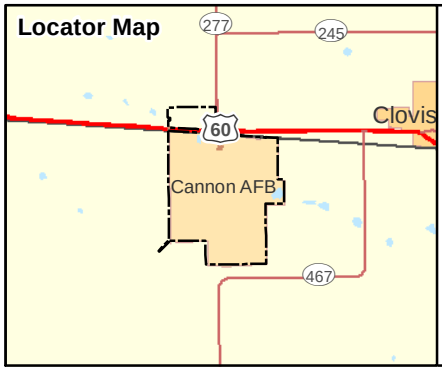
0 1,000 2,000 4,000 Feet

Potentiometric Surface Map - April 2017
Cannon Air Force Base, New Mexico

Drawn By:	Date:	
LLS	8/21/2018	**Figure 3-1**
Checked By:	Project No.	
KK	23446539	

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Legend

- Monitoring Well Location
- Groundwater Elevation (ft amsl)
- Groundwater Flow Direction
- Base Boundary

amsl = above mean sea level
ft = feet

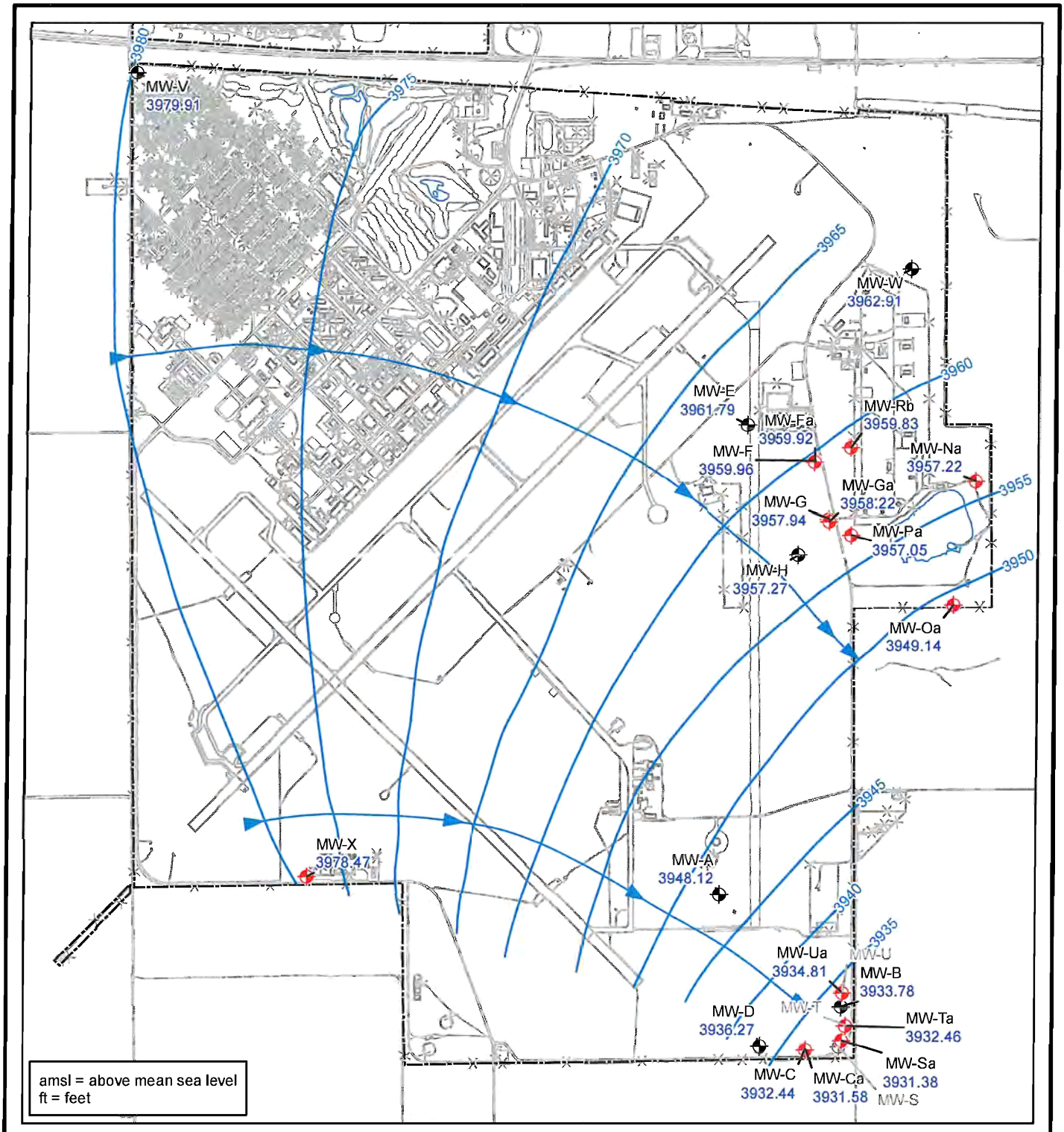
N

0 1,000 2,000 4,000 Feet

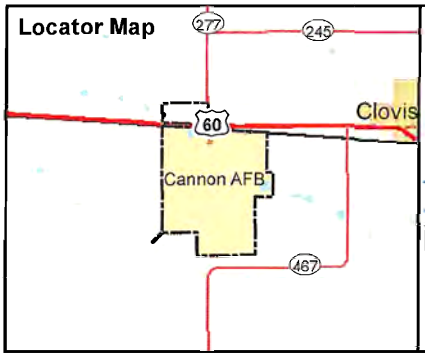
Potentiometric Surface Map - May 2018
Cannon Air Force Base, New Mexico

Drawn By:	Date:	
LLS	8/8/2018	**Figure 3-2**
Checked By:	Project No.	
KK	23446539	

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Locator Map



Legend

- Monitoring Well Sampled Under Optimized Sampling Plan
- Monitoring Well Used For Water Level Only
- Abandoned Monitoring Well
- Groundwater Elevation (ft amsl)
- Groundwater Flow Direction
- Base Boundary

N

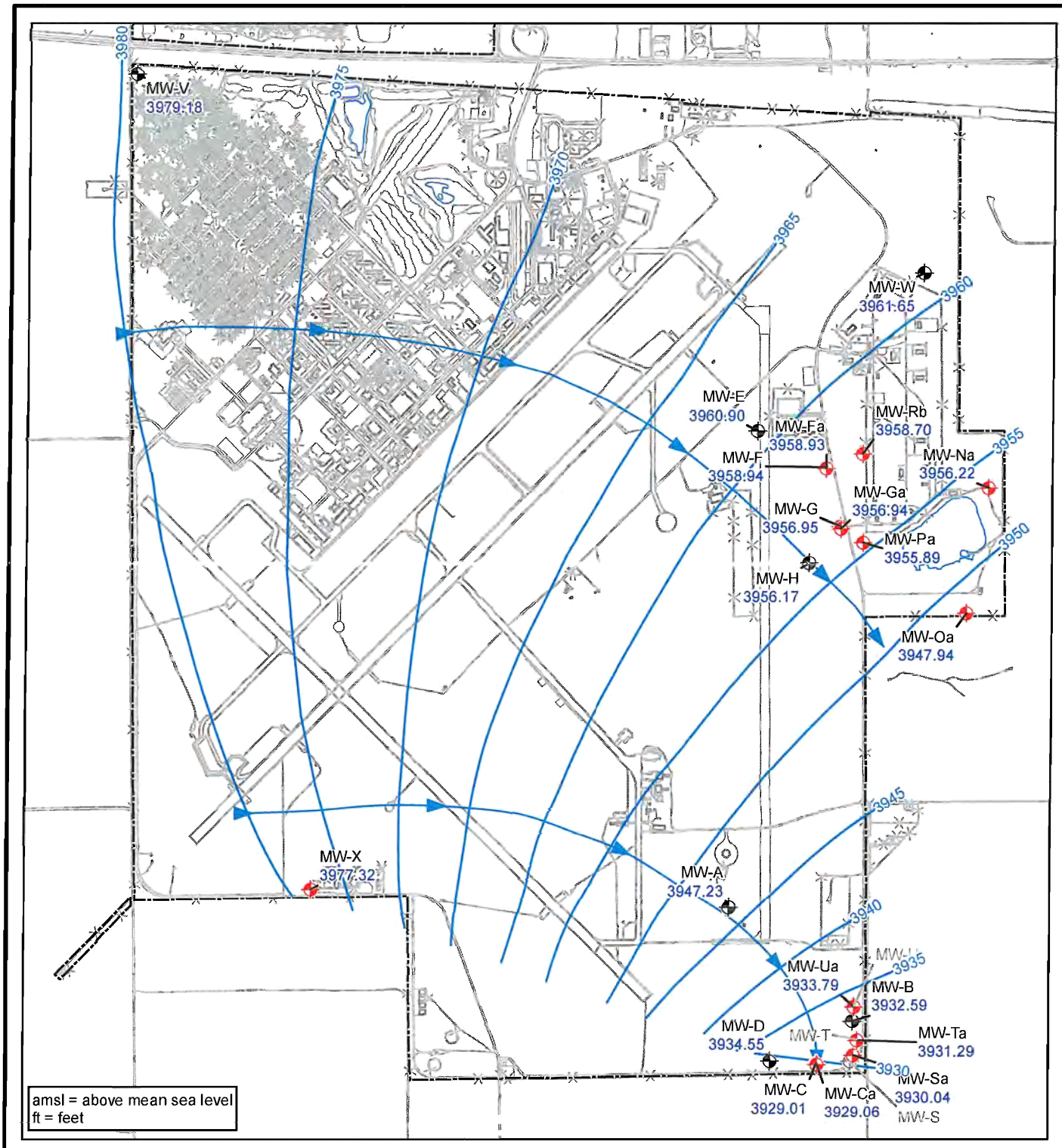
0 1,000 2,000 4,000 Feet

Potentiometric Surface Map - June 2019

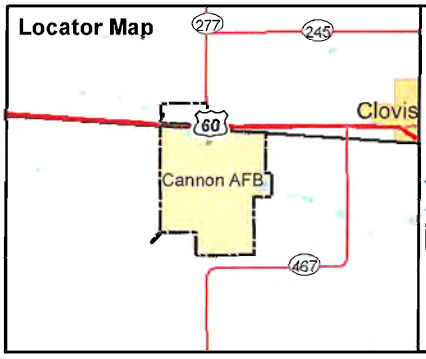
Cannon Air Force Base, New Mexico

Drawn By:	Date:	
DPG	7/27/2020	**Figure 3-1**
Checked By:	Project No.	
KK	23446539	

O:\DCS\Projects\ENV\GIS\cannon\Figures\ACM_WP\202003-1.mxd



Locator Map



Legend

- Monitoring Well Sampled Under Optimized Sampling Plan
- Monitoring Well Used For Water Level Only
- Abandoned Monitoring Well
- Groundwater Elevation (ft amsl)
- Groundwater Flow Direction
- Base Boundary

N

0 1,000 2,000 4,000 Feet

Potentiometric Surface Map - June 2020

Cannon Air Force Base, New Mexico

Drawn By:	Date:	
DPG	7/27/2020	**Figure 3-2**
Checked By:	Project No.	
KK	23446539	

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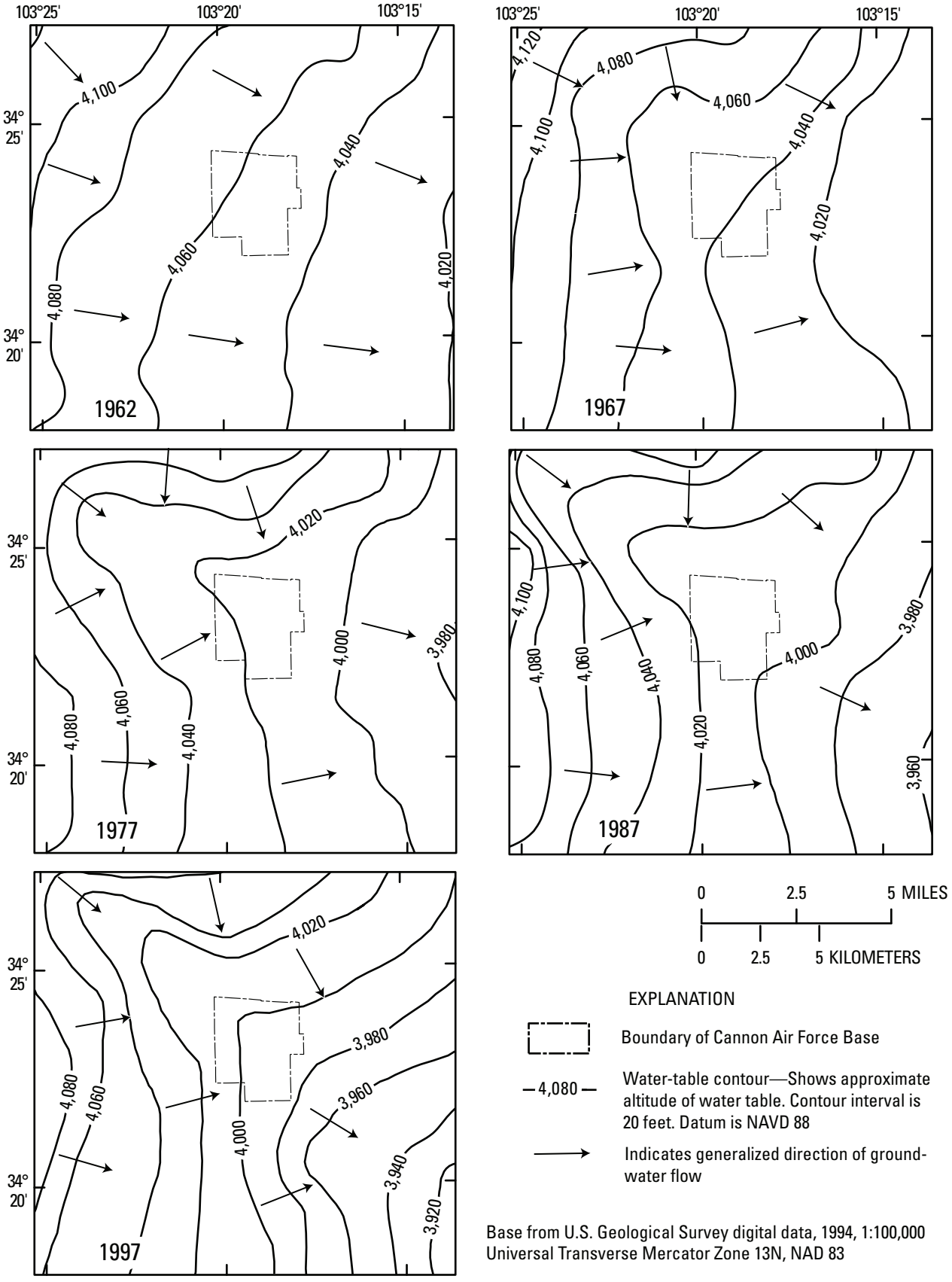
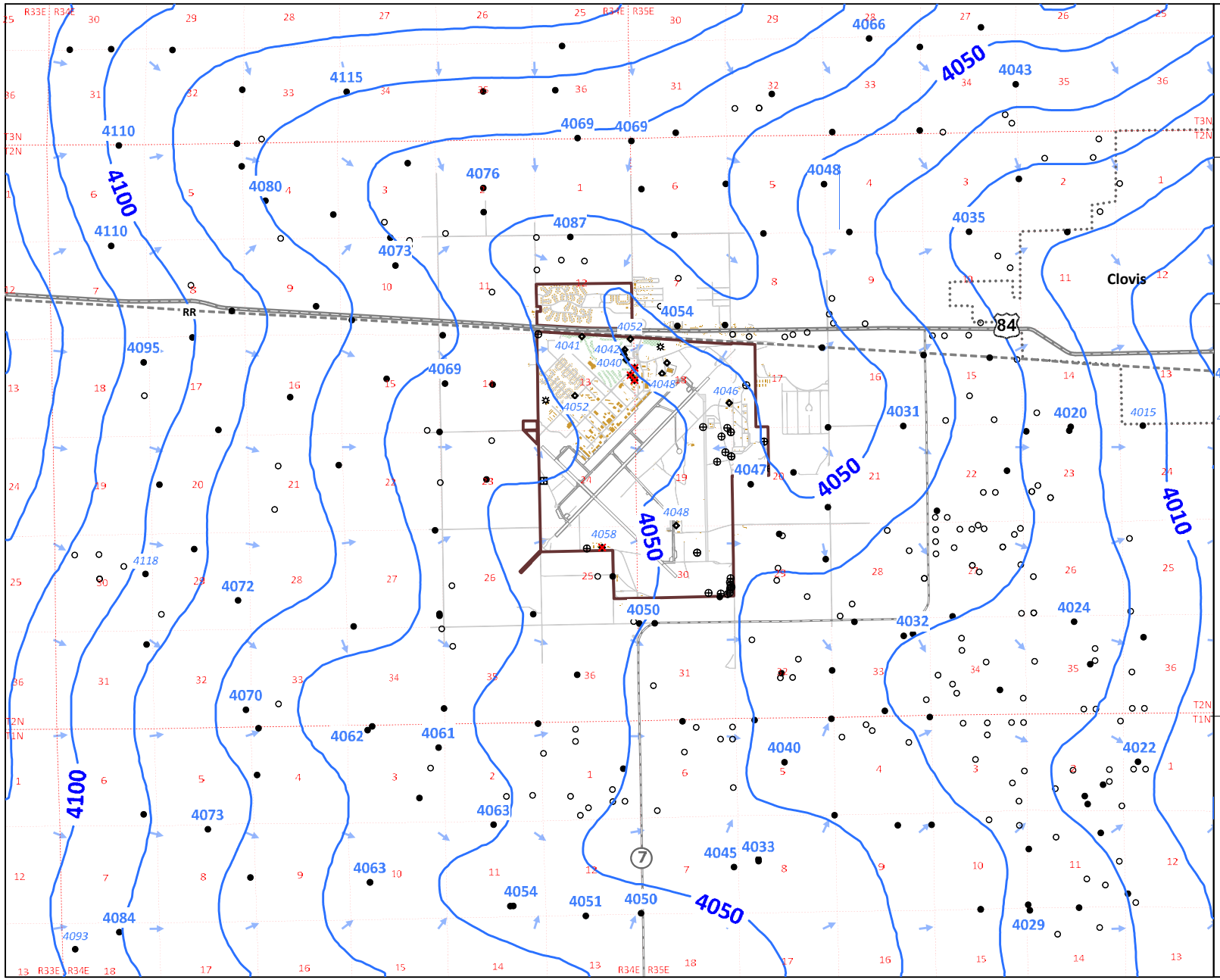


Figure 3. Approximate ground-water altitude and general direction of ground-water flow in the Southern High Plains aquifer in the Cannon Air Force Base area, 1962, 1967, 1977, 1987, and 1997.



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Notes:

Contour interval: 10 feet NAVD'88

4050 - Ground water elevation, (measured water level)

4050 - Supplemental control; consists of measured levels within 1-2 yrs of time of interest; within installation, data is extrapolated from trends

- Arrows show indicated direction of ground water movement

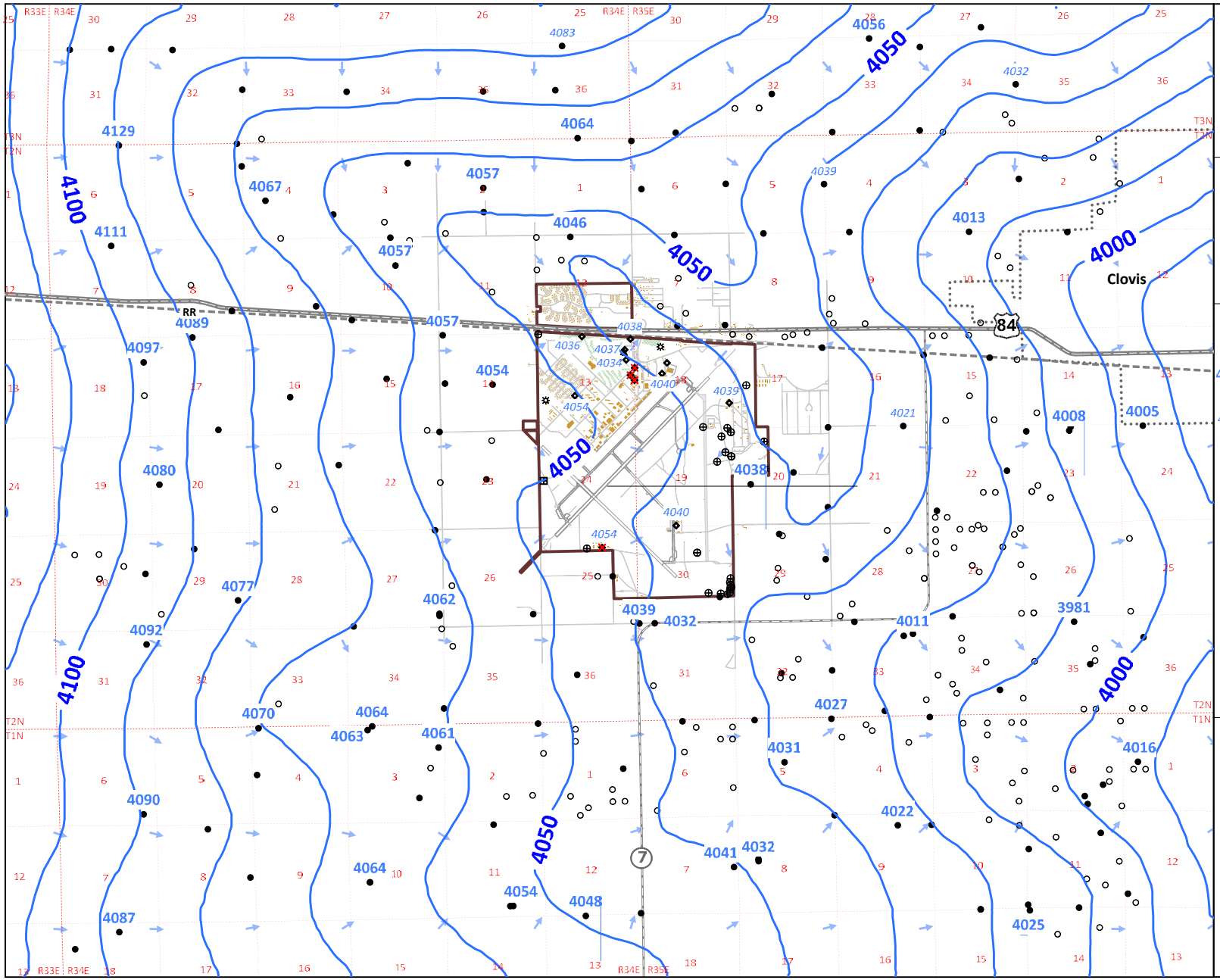
Contours reflect the general flow regime interpreted from the data set, which appears to have accuracy on the order of ±5 ft at the installation and perhaps twice (±10 ft) that in the outlying area. Contours subjectively omit data that appeared anomalous or didn't "fit" the emerging pattern, particularly so with supplemental data.

FIGURE 3.34
APPROXIMATE ALTITUDE of GROUND WATER in the SOUTHERN HIGH PLAINS AQUIFER, FALL / WINTER 1962, CANNON AFB & VICINITY

Water Sustainability and Management Report

Cannon Air Force Base, New Mexico

Trinity Analysis & Development Corp.



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Notes:

Contour interval: 10 feet NAVD'88

4050 - Ground water elevation, (measured water level)

4050 - Supplemental control; consists of measured levels within 1-2 yrs of time of interest; within installation, data is extrapolated from trends

- Arrows show indicated direction of ground water movement

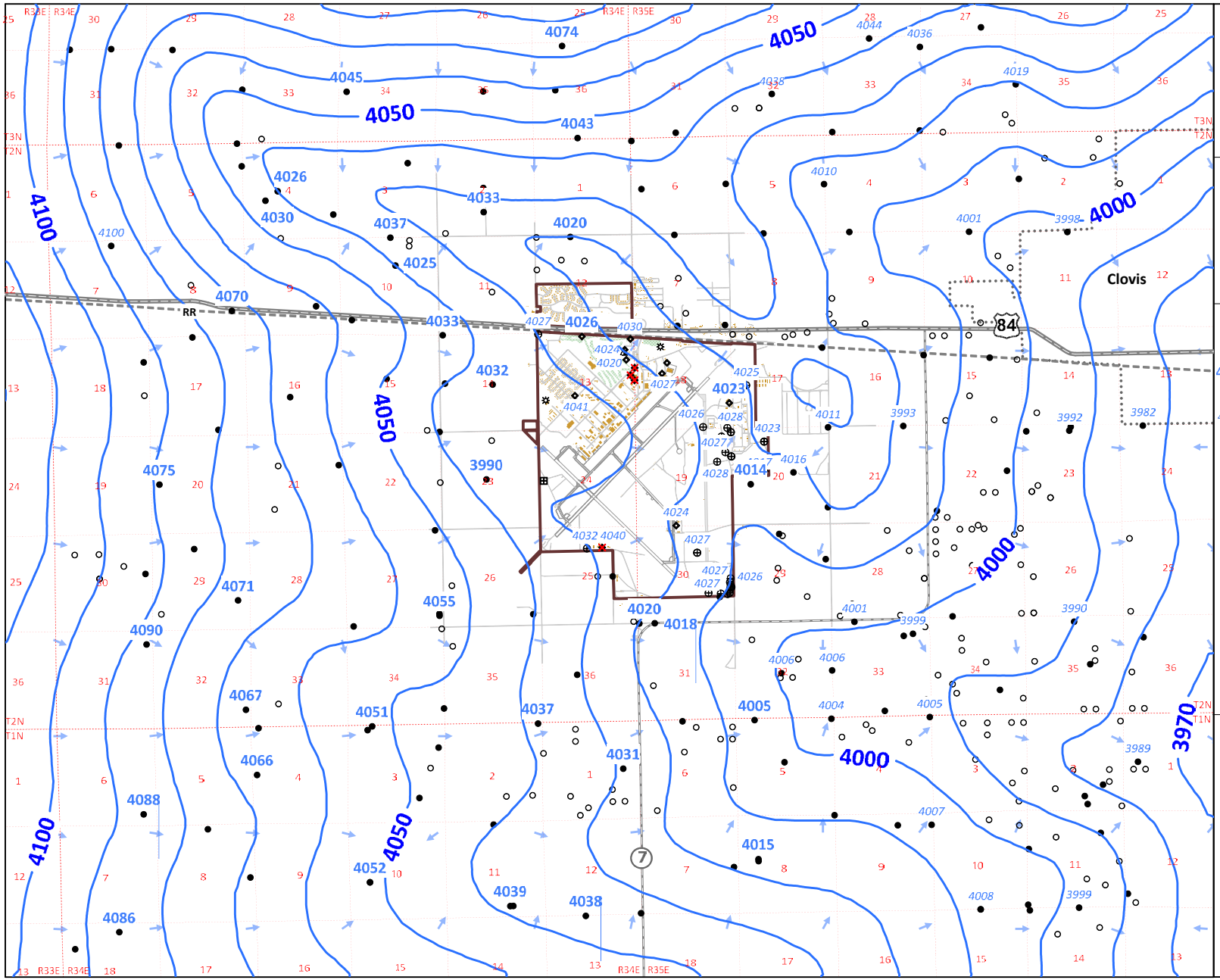
Contours reflect the general flow regime interpreted from the data set, which appears to have accuracy on the order of ±5 ft at the installation and perhaps twice (±10 ft) that in the outlying area. Contours subjectively omit data that appeared anomalous or didn't "fit" the emerging pattern, particularly so with supplemental data.

FIGURE 3.35
APPROXIMATE ALTITUDE of GROUND WATER in the SOUTHERN HIGH PLAINS AQUIFER, FALL / WINTER 1967, CANNON AFB & VICINITY

Water Sustainability and Management Report

Cannon Air Force Base, New Mexico

Trinity Analysis & Development Corp.



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Notes:

Contour interval: 10 feet NAVD'88

4050 - Ground water elevation, (measured water level)

4050 - Supplemental control; consists of measured levels within 1-2 yrs of time of interest; within installation, data is extrapolated from trends

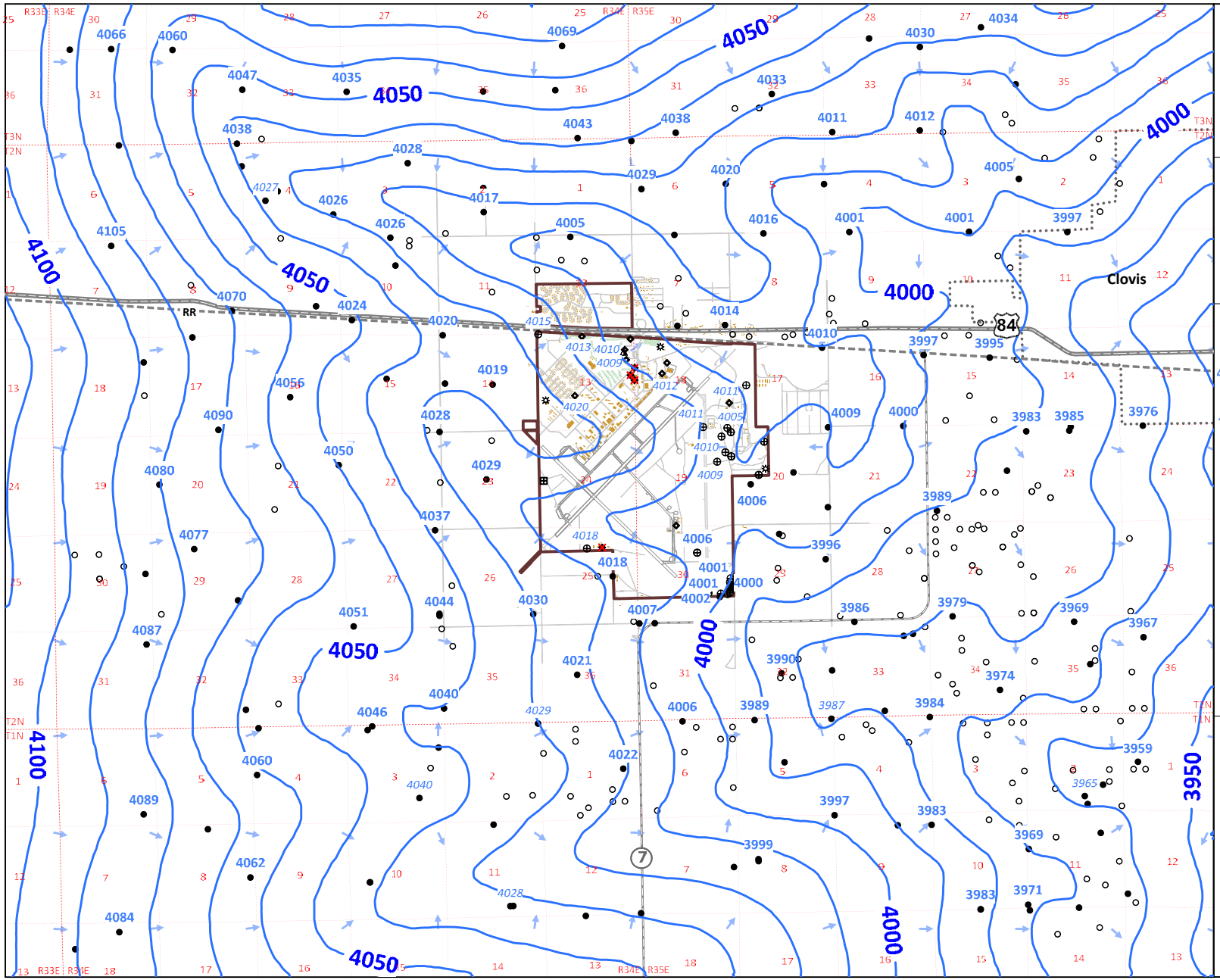
- Arrows show indicated direction of ground water movement

Contours reflect the general flow regime interpreted from the data set, which appears to have accuracy on the order of ±5 ft at the installation and perhaps twice (±10 ft) that in the outlying area. Contours subjectively omit data that appeared anomalous or didn't "fit" the emerging pattern, particularly so with supplemental data.

FIGURE 3.36
APPROXIMATE ALTITUDE of GROUND WATER in the SOUTHERN HIGH PLAINS AQUIFER, FALL / WINTER 1977, CANNON AFB & VICINITY

Water Sustainability and Management Report
Cannon Air Force Base, New Mexico

Trinity Analysis & Development Corp.



Notes:

Contour interval: 10 feet NAVD'88

4050 - Ground water elevation, (measured water level)

4050 - Supplemental control; consists of measured levels within 1-2 yrs of time of interest; within installation, data is extrapolated from trends

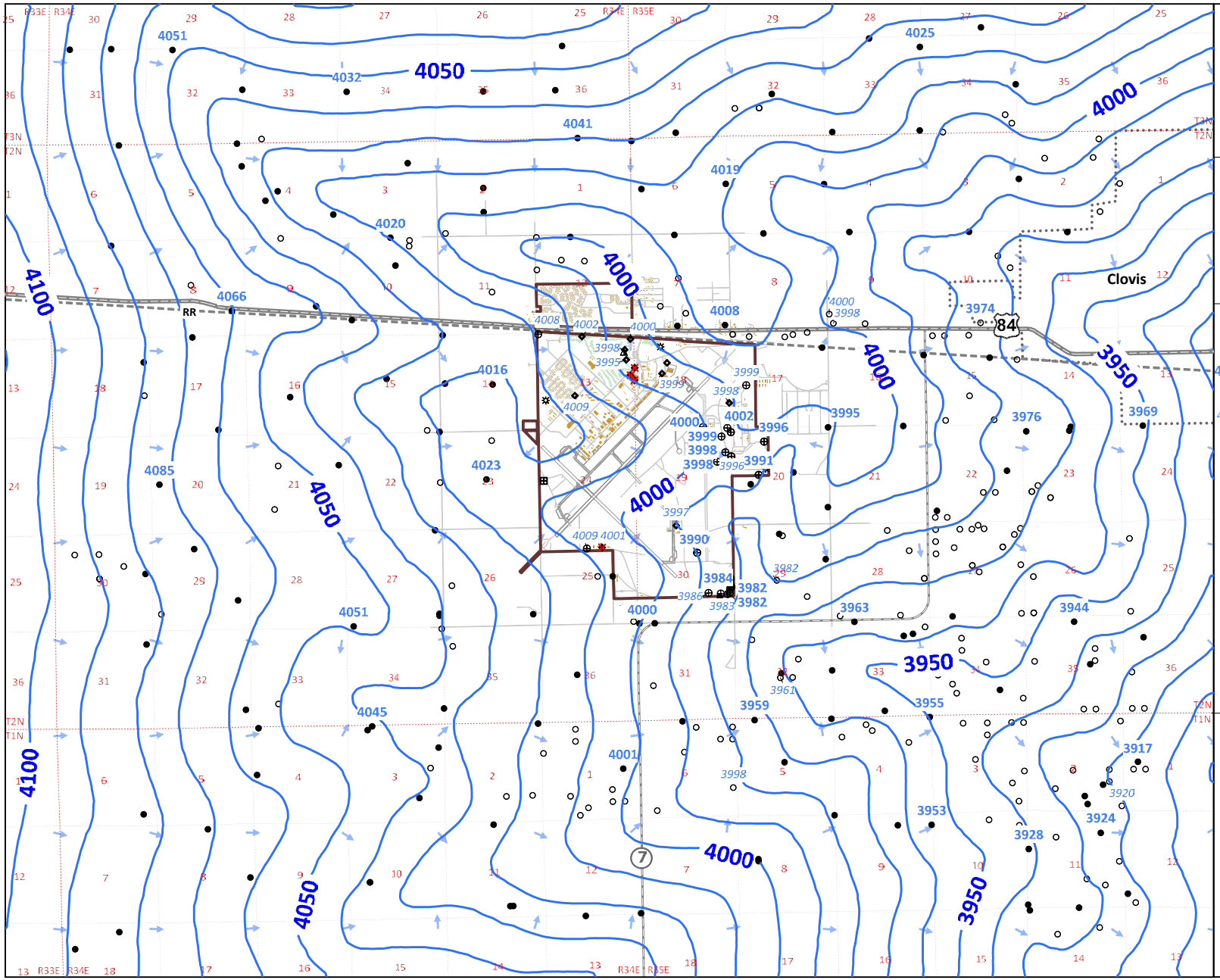
- Arrows show indicated direction of ground water movement

Contours reflect the general flow regime interpreted from the data set, which appears to have accuracy on the order of ±5 ft at the installation and perhaps twice (±10 ft) that in the outlying area. Contours subjectively omit data that appeared anomalous or didn't "fit" the emerging pattern, particularly so with supplemental data.

FIGURE 3.37
APPROXIMATE ALTITUDE of GROUND WATER in the SOUTHERN HIGH PLAINS AQUIFER, FALL / WINTER 1987, CANNON AFB & VICINITY

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Cannon Air Force Base, New Mexico

Trinity Analysis & Development Corp.



Notes:

Contour interval: 10 feet NAVD'88

4050 - Ground water elevation, (measured water level)

4050 - Supplemental control; consists of measured levels within 1-2 yrs of time of interest; within installation, data is extrapolated from trends

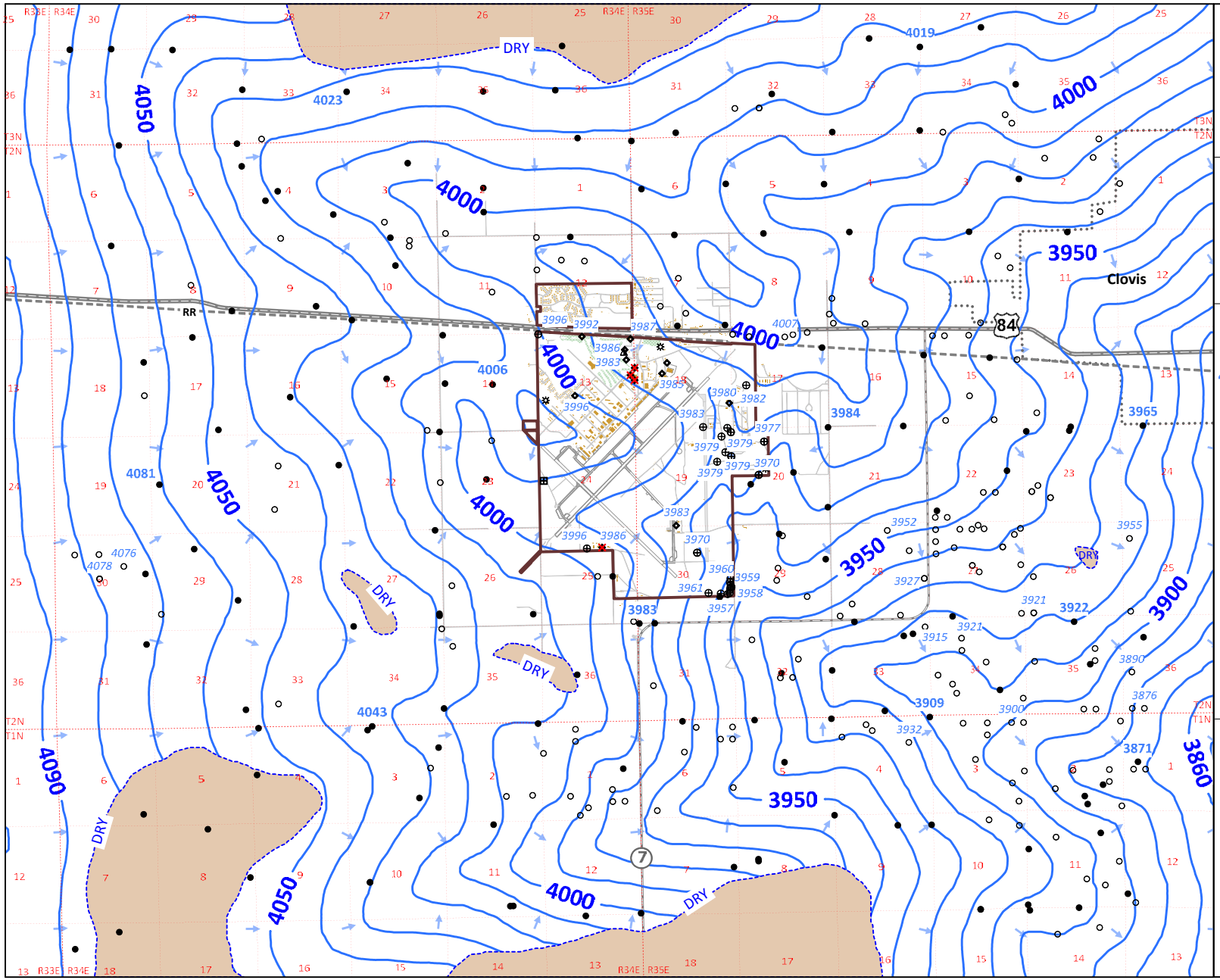
- Arrows show indicated direction of ground water movement

Contours reflect the general flow regime interpreted from the data set, which appears to have accuracy on the order of ±5 ft at the installation and perhaps twice (±10 ft) that in the outlying area. Contours subjectively omit data that appeared anomalous or didn't "fit" the emerging pattern, particularly so with supplemental data.

FIGURE 3.38
APPROXIMATE ALTITUDE of GROUND WATER in the SOUTHERN HIGH PLAINS AQUIFER, FALL / WINTER 1997, CANNON AFB & VICINITY

Water Sustainability and Management Report
Cannon Air Force Base, New Mexico

Trinity Analysis & Development Corp.



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Notes:

Contour interval: 10 feet NAVD'88

4050 ● - Ground water elevation, (measured water level)

4050 ● - Supplemental control; consists of measured levels within 1-2 yrs of time of interest; within installation, data is extrapolated from trends

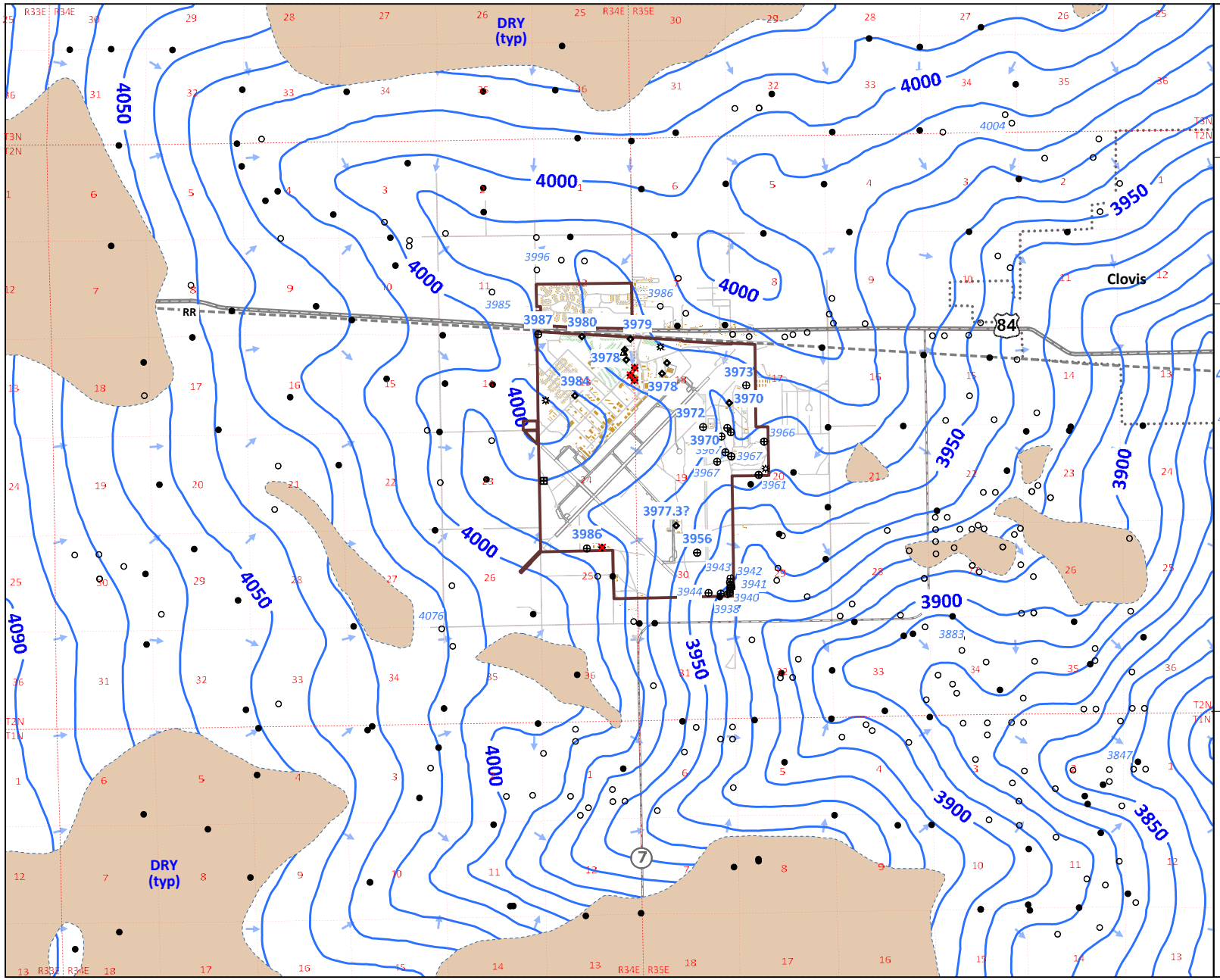
- Arrows show indicated direction of ground water movement

Contours reflect the general flow regime interpreted from the data set, which appears to have accuracy on the order of ±5 ft at the installation and perhaps twice (±10 ft) that in the outlying area. Contours subjectively omit data that appeared anomalous or didn't "fit" the emerging pattern, particularly so with supplemental data.

FIGURE 3.39
APPROXIMATE ALTITUDE of GROUND WATER in the SOUTHERN HIGH PLAINS AQUIFER, FALL / WINTER 2006 CANNON AFB & VICINITY

Water Sustainability and Management Report
Cannon Air Force Base, New Mexico

Trinity Analysis & Development Corp.



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Notes:

Contour interval: 10 feet NAVD'88

4050 ● - Ground water elevation, (measured water level)

4050 ● - Supplemental control; consists of measured levels within 1-2 yrs of time of interest; within installation, data is extrapolated from trends

↗ - Arrows show indicated direction of ground water movement

Contours reflect the general flow regime interpreted from the data set, which appears to have accuracy on the order of ±5 ft at the installation and perhaps twice (±10 ft) that in the outlying area. Contours subjectively omit data that appeared anomalous or didn't "fit" the emerging pattern, particularly so with supplemental data.

FIGURE 3.40

APPROXIMATE ALTITUDE of GROUND WATER in the SOUTHERN HIGH PLAINS AQUIFER, OCTOBER 2011, CANNON AFB & VICINITY

Water Sustainability and Management Report

Cannon Air Force Base, New Mexico

Trinity Analysis & Development Corp.

yielding formation of the Southern High Plains aquifer and consists of eolian

Langhian and others (2006) by using groundwater levels measured during the

scale. The USGS in cooperation with the Air Force Civil Engineering Center,

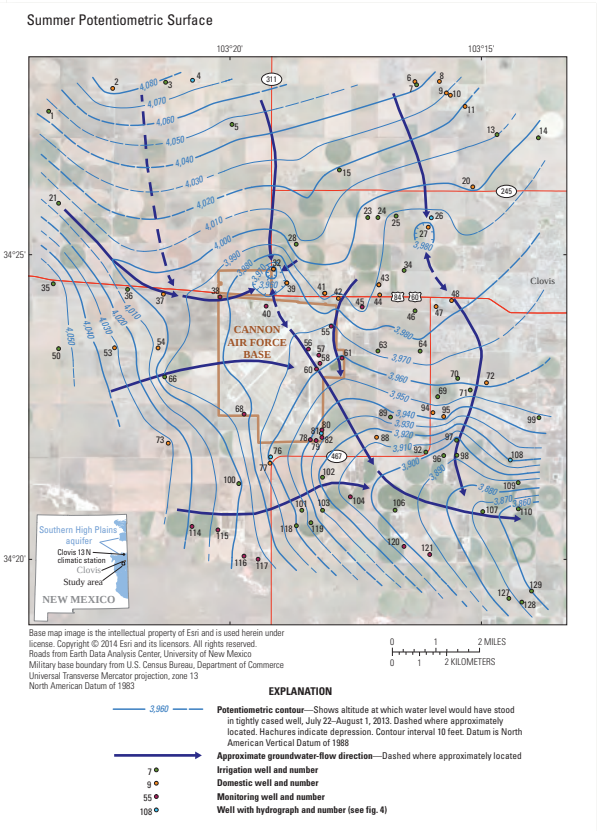


Figure 1. Potentiometric surface of summer groundwater conditions on and around Cannon Air Force Base, July 22–August 1, 2013, Curry County, New Mexico. Data shown in table 1.

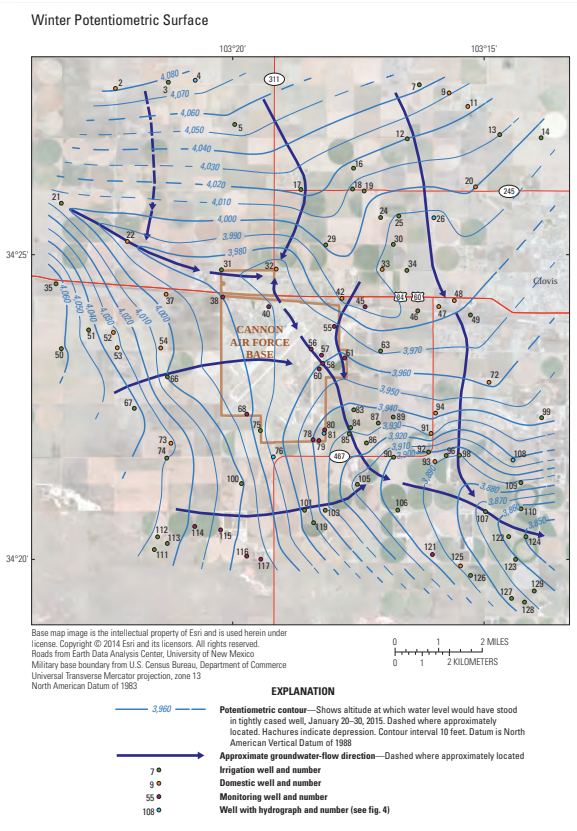


Figure 2. Potentiometric surface of winter groundwater conditions on and around Cannon Air Force Base, January 20–30, 2015, Curry County, New Mexico. Data shown in table 1.

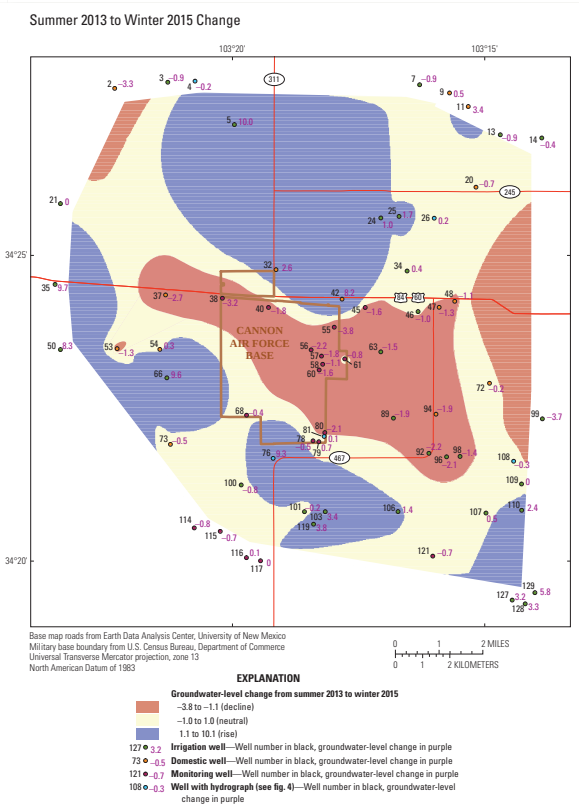
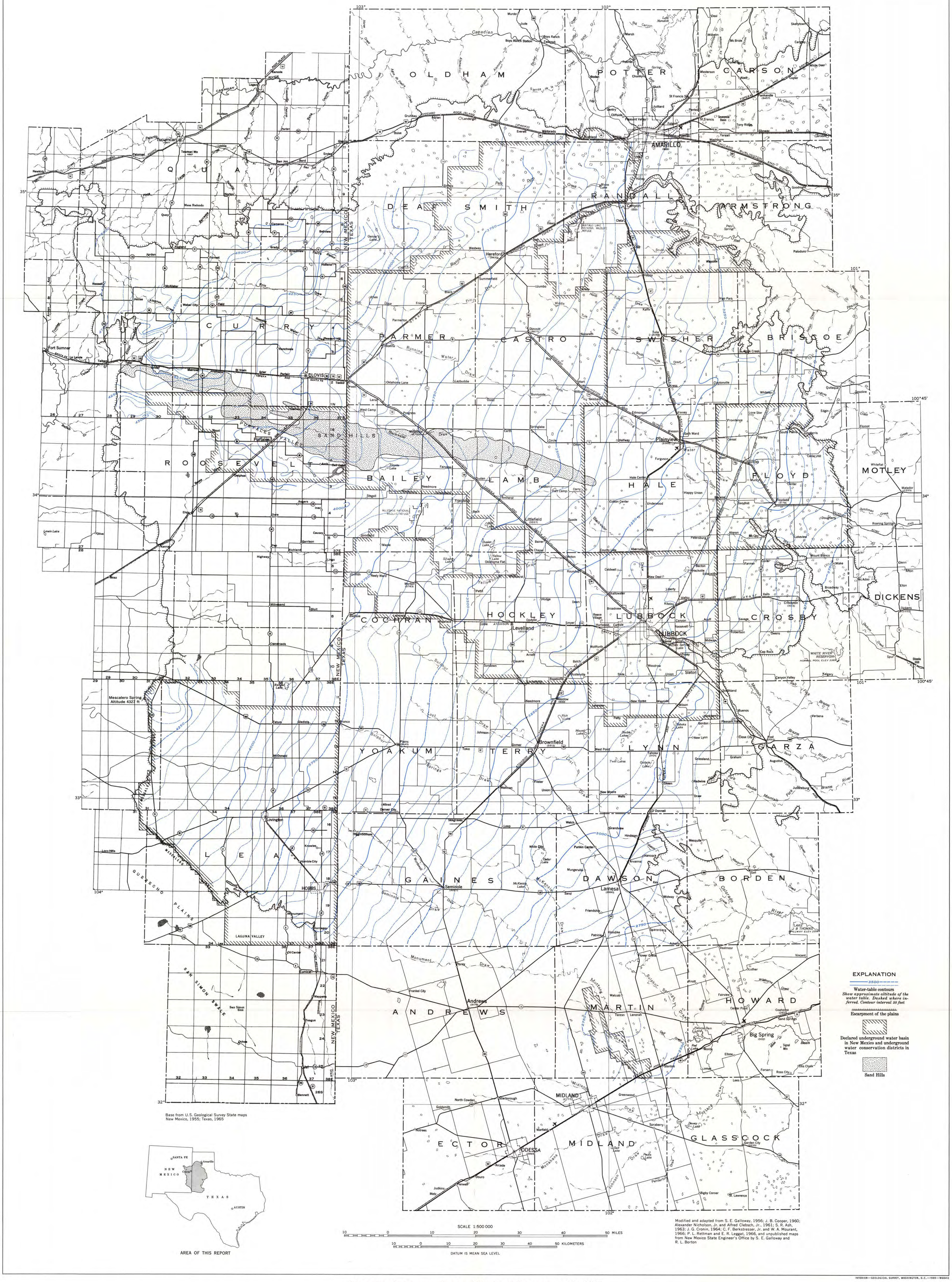


Figure 3. Map of groundwater-level change between summer 2013 (July 22–August 1) and winter 2015 (January 20–30) on and around Cannon Air Force Base, Curry County, New Mexico.



INTERIOR—GEOLOGICAL SURVEY, WASHINGTON, D.C.—1969—W68412

Map showing approximate altitude of the water table, 1967

GROUND WATER IN THE OGALLALA FORMATION IN THE SOUTHERN HIGH PLAINS OF TEXAS AND NEW MEXICO

By
James G. Cronin

1969

INTRODUCTION

The High Plains aquifer in southeastern New Mexico is part of a regional aquifer system extending from South Dakota on the north through Wyoming, Colorado, Nebraska, Kansas, and Oklahoma, to Texas and New Mexico on the south. The principal aquifer, the Ogallala Formation of Tertiary age, is hydraulically connected with other unconsolidated deposits, principally of Quaternary age. Alluvium and terrace deposits hydraulically connected with the Ogallala are included in the High Plains aquifer in New Mexico.

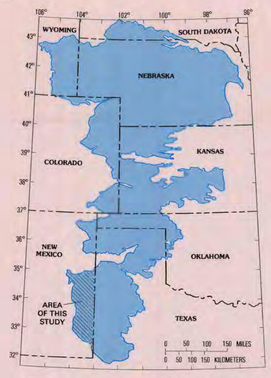
During 1978, the U.S. Geological Survey began a 5-year study of the High Plains regional aquifer system to provide hydrologic information for evaluation of the regional effects of its long-term development and to develop and evaluate computer models for simulation of an aquifer response to alternative changes in ground-water management proposals (Weeks, 1978). This report presents some of the hydrologic information compiled for the New Mexico part of that study.

The High Plains aquifer is the principal source of water in southeastern New Mexico because of its areal extent and the relatively large yields of water to wells completed in the aquifer. The aquifer commonly yields 250 to 800 gallons per minute and locally yields as much as 1,000 gallons per minute to wells. The agricultural economy that exists in the semiarid climate of southeastern New Mexico has expanded significantly because of this major source of water.

The increased use of water from the aquifer has created concern about its dependability for future supplies. If the water is to be used beneficially for an extended period of time, water users and managers need to understand the physical regime, the imposed stresses, and the effect of those stresses on the system and manage the system accordingly.

LOCATION AND GENERAL FEATURES

The High Plains aquifer extends over much of the extreme southeastern part of New Mexico, (index map) and is the principal aquifer in Lea, Roosevelt, and Curry Counties. The aquifer has an areal extent of about 7,600 square miles. Physiographically the area is mostly upland plains and intermediate slopes. Although locally the surface is irregular, the regional slope is eastward at 8 to 20 feet per mile. Large areas on the upland plains are comparatively flat, featureless, and undissected. Much of the surface has very broad gentle swales or low hills, shallow depressions, and some dune-covered areas. Streams draining the plains are all ephemeral flowing only for short periods during and after intense rainfall.



INDEX MAP SHOWING LOCATION OF THE HIGH PLAINS AQUIFER (SHADED) AND STUDY AREA IN NEW MEXICO

METRIC CONVERSION FACTORS

MULTIPLY	BY	TO OBTAIN
inch	25.40	millimeter
foot	0.3048	meter
foot per mile	0.1894	meter per kilometer
foot per day	0.3048	meter per day
mile	1.609	kilometer
acre	0.4047	hectare
square mile	2.590	square kilometer
gallon per minute	0.06308	liter per second

Temperature in degrees Fahrenheit (°F) can be converted to degrees Celsius (°C) as follows: °C=5/9 (°F–32)

National Geodetic Vertical Datum of 1929 (NGVD of 1929): A geodetic datum derived from a general adjustment of the first-order level nets of both the United States and Canada, formerly called "Mean Sea Level." NGVD of 1929 is referred to as sea level in this report.

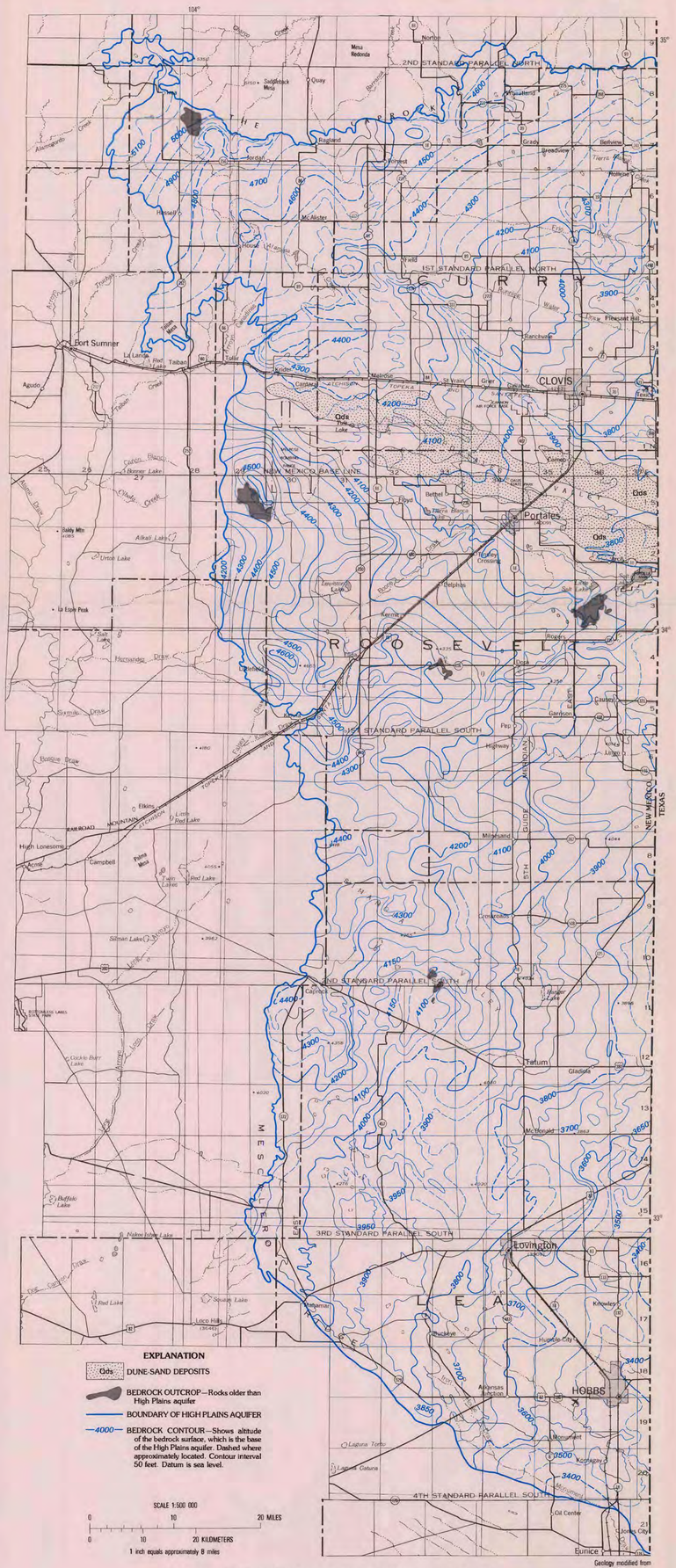
CLIMATE

The semiarid climate of the area is characterized by an average annual precipitation ranging from about 14 to 17 inches, a rapid rate of evaporation, little relative humidity, persistent and significant winds, warm to hot summer days and cool nights, and moderate winters with some severe cold periods. Winter snowfalls and snow cover usually are light and of short duration.

Precipitation records indicate the precipitation usually decreases from east to west and from north to south across the study area. Altitude, precipitation, and temperature data at specific sites are shown in the following table:

Climatological data, 1978, for southern High Plains of New Mexico

Station	Altitude in feet above sea level	Average annual precipitation, in inches	Average annual temperature, in degrees Fahrenheit
Clovis	4,280	17.07	57.4
Portales	4,010	16.40	58.0
Elida	4,350	17.32	57.6
Hobbs	3,615	14.36	61.7



MAP SHOWING ALTITUDE OF THE BEDROCK SURFACE, WHICH IS THE BASE OF THE HIGH PLAINS AQUIFER

GEOLOGY

The High Plains aquifer in New Mexico is underlain by rocks of Triassic, Jurassic, and Cretaceous age. The surface depicted by contours on the adjacent map represents the configuration of the buried bedrock surface. The configuration also represents the base of the High Plains aquifer and is useful in determining the thickness of the overlying deposits and in studying the ancestral drainage pattern and mode of deposition of the materials that comprise the High Plains aquifer. Data from several thousand well and test-hole logs were used in constructing the contours showing the base of the High Plains aquifer. In some areas, data are adequate to define in detail the complex surface of the rocks beneath the High Plains aquifer, but in other areas the surface is only approximately defined because detailed data are not available. The most significant features shown on the bedrock-surface map are the generally southeastward slope of the bedrock surface and the southeastward direction of the pre-Tertiary drainage.

The configuration of the bedrock surface underlying the High Plains aquifer affected the depositional pattern and the thickness of the overlying aquifer and subsequently affected ground-water flow through the aquifer. The slope of the bedrock surface ranges from 10 to 20 feet per mile and averages about 15 feet per mile.

The Triassic, Jurassic, and Cretaceous rocks that directly underlie the High Plains aquifer are composed primarily of shale, mudstone, siltstone, and fine-grained sandstone. In addition, there are some lithologic units composed of medium- to very coarse grained sandstone, conglomerate, limestone, and dolomite.

The High Plains aquifer, as defined in this report consists of one or more hydraulically connected geologic units of the late Tertiary or Quaternary age. These rocks overlie the bedrock surface depicted on the adjacent map. The rocks of late Tertiary age consist of the Ogallala Formation, and the Quaternary deposits consist of alluvial, dune sand, and valley-fill deposits. The thickness of the High Plains aquifer ranges from 0 to about 500 feet. The Ogallala is the principal geologic unit in the High Plains aquifer; however, the alluvial deposits are significant in the northern part of Roosevelt County.

The Ogallala Formation is mostly unconsolidated clay, silt, fine- to coarse-grained sand, and gravel. Some caliche is present near the top and locally within the formation. When the Ogallala was deposited, aggrading streams filled valleys eroded deep into pre-Ogallala rocks. Braided steams flowed eastward from the mountains in central and southern New Mexico transporting rock debris, which was deposited as a heterogenous sequence of unconsolidated material. There is evidence that the upper part of the Ogallala in southern New Mexico may contain a considerable thickness of windblown sediments as well (C. V. Theis, U.S. Geological Survey, oral commun., 1980). In the upper part of the Ogallala Formation the sediments have been cemented, chiefly by calcium carbonate, to form single or multiple beds of caliche. The degree of cementation varies greatly, and the thickness of the beds ranges from a few inches to 60 feet. Because the caliche is resistant to erosion, it forms the caprock escarpment along the northern and western boundaries of the High Plains in this area.

The unconsolidated Quaternary alluvial and valley-fill deposits, like the Ogallala Formation, consist of clay, silt, sand, and gravel. These rocks primarily are derived from reworked Ogallala material. The alluvial deposits are believed to have a maximum thickness of about 120 feet in the southeastward trending Portales Valley area in Roosevelt County. The valley is about 50 miles long and reaches a maximum width of about 30 miles. Although this broad flat valley is as much as 250 feet lower than the surrounding terrain, there is no surface-water flow except during the most intense storms that occur at intervals of several years. Minor areas of valley-fill deposits may be located at numerous sites on the High Plains, but these deposits generally are not thick enough to extend down to the water table nor are they areally extensive.

Dune-sand deposits of Quaternary age, consisting predominantly of very fine to medium-grained windblown sand, are part of the High Plains aquifer. The most extensive area of dune sand is in northeastern Roosevelt and southern Curry Counties where the dune-sand deposits are parallel to and overlie the northern edge of the Portales Valley. The dune area is about 50 miles long and ranges from about 3 to 12 miles wide. A few of the dunes reach heights of 40 feet, but most are considerably lower. Many of the older dunes are stabilized and have some vegetation on them, whereas the active dunes have a typical dune topography with an absence of vegetation. The active dunes generally are less than 10 feet high.

GROUND WATER IN THE HIGH PLAINS AQUIFER

CONFIGURATION OF THE WATER TABLE

The configuration of the water table in the High Plains is shown on the adjacent map. The aquifer boundary, on the map is the physical limit of the various geologic units comprising the High Plains aquifer. Water-level data for this map were obtained during the winter of 1978, when the effects of seasonal pumping for irrigation were at a minimum.

Hydraulic interconnection between geologic units that comprise the High Plains aquifer is sufficient to permit contouring a continuous water table throughout most of the area. The degree of hydraulic interconnection may vary from place to place; and, locally, some water-yielding beds may have a water level representative of an artesian-pressure surface because of clay lenses within the aquifer. However, from a regional aspect, water-table conditions prevail in the aquifer.

The aquifer is not saturated in some areas, or, the saturation is laterally discontinuous with the principal water body. Isolated wells located in the shaded area on the water-table map may penetrate saturated High Plains sediments in buried channels or sinks in the bedrock. As depicted on the map, the water table is discontinuous throughout an area of about 2,150 square miles.

The water-table map shows a general east-southeastward slope of the water table across the High Plains. The general direction of ground-water movement is at right angles to the water-table contours, in the down-gradient direction. Typically, the slope of the water table is between 10 and 15 feet per mile. The configuration of the water table is controlled by several factors, including (1) Slope of the base of the aquifer; (2) changes in the thickness and hydraulic conductivity of the saturated materials; (3) natural discharge of ground water to springs and seeps; (4) withdrawal of ground water by wells; and (5) recharge by infiltration of water through permeable overlying beds. Typically, closely spaced contours indicate steeply sloping water table, which may be the result of less permeable aquifer material, decreased thickness of the water-bearing materials, steeply sloping bedrock surface, or a combination of these factors. Flattening of the gradient indicated by the widely spaced contours may be due to increased permeability of the aquifer materials, increased thickness of the water-bearing materials, or both.

Up-gradient flexures of water-table contours generally are indicative of the effects of ground-water withdrawals on the aquifer because water tends to flow toward these cones of depression that disturb the general flow pattern. Up-gradient flexures may also be the result of zones of increased permeability that allow water to migrate through the zone and away from the area more rapidly than from adjacent less permeable zones. An example of this condition is in the Portales Valley in Roosevelt County. This effect is magnified in the Portales Valley because a large concentration of irrigation wells creates a regional cone of depression.

Down-gradient flexures or increased spacing of water-table contours indicate recharged by infiltration of water through overlying beds. An example of this type of contour deflection is shown on the water-table map and coincides with the sand-dune area in northeastern Roosevelt and southwestern Curry Counties shown on the bedrock-surface map. Down-gradient flexures also may be caused by a topographic high (hill) in the underlying bedrock surface. An example of this feature is shown in the area near Caprock in western Lea County on the bedrock-surface map.

SATURATED THICKNESS

The saturated thickness in the High Plains aquifer ranges from 0 to slightly more than 200 feet. Areas having the greatest saturated thickness are southeast of Clovis in Curry and Roosevelt Counties and in the vicinity of Lovington and Hobbs in Lea County. The saturated thickness at any point may be estimated by subtracting the altitude of the aquifer base from the altitude of the water table at that point.

An area of about 2,150 square miles, mostly in northern Lea County and southern and western Roosevelt Counties, does not have significant saturated thickness except in narrow Ogallala-filled bedrock channels and depressions. In those areas with only thin basal saturation of the High Plains aquifer sediments, wells cannot be drilled with assurance of obtaining water from the aquifer.

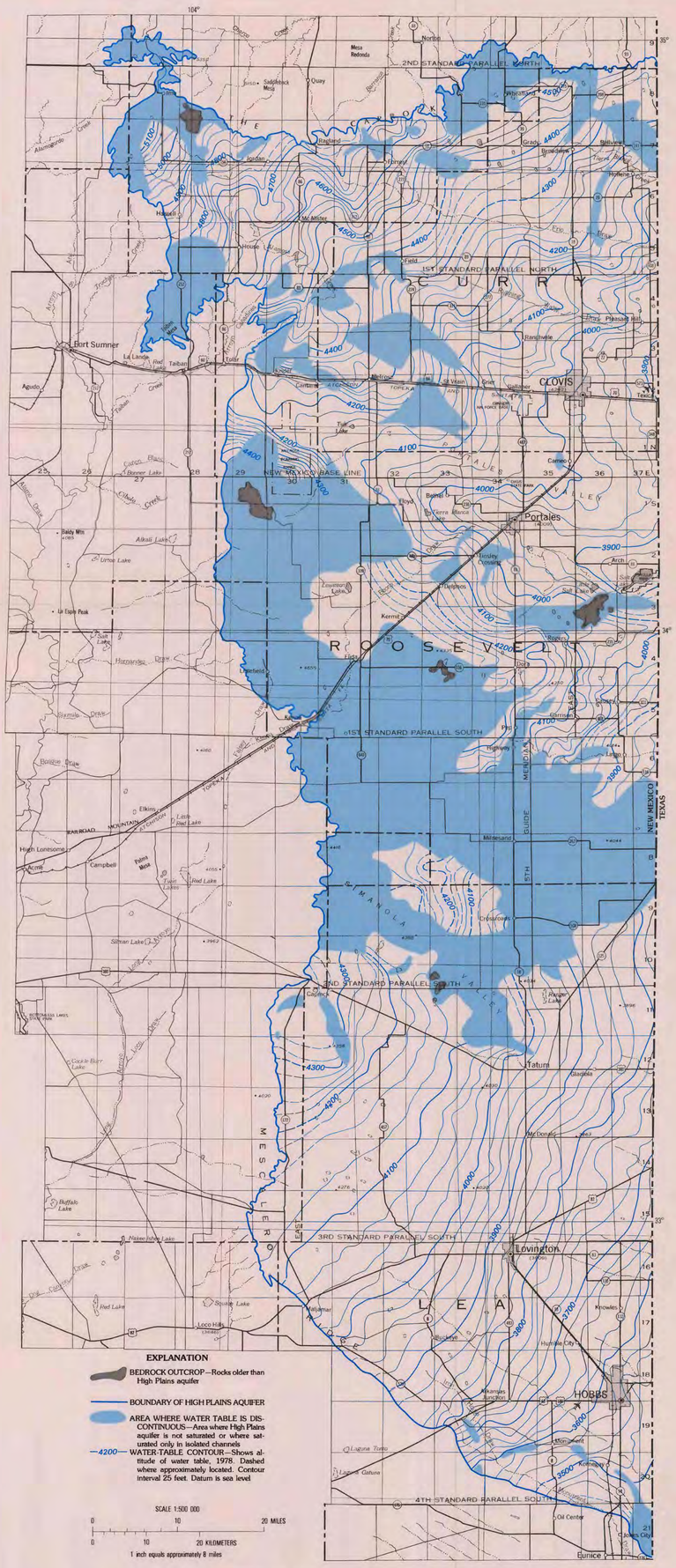
HYDRAULIC PROPERTIES

Hydraulic conductivity and specific yield are two hydrologic properties that were estimated during the course of this study. The hydraulic conductivity may be defined as the volume of water at the existing kinematic viscosity that will move in unit time under a unit hydraulic gradient through a unit area measured at right angles to the direction of flow. The specific yield is the ratio defined by the volume of water that a saturated rock will yield by gravity divided by the volume of the rock.

Hydraulic properties of the aquifer were estimated by using existing aquifer-test data published in previous studies and by using lithologic logs from wells. Based on aquifer tests conducted in the High Plains aquifer and laboratory grain-size analyses, empirical relationships were developed to estimate values of hydraulic conductivity and specific yield for various grain-size materials in the aquifer. Lithologic logs were examined and values were assigned to the various intervals of clay, silt, sand, and gravel in that part of the log representing the saturated zone. Evaluation of 127 fully penetrating logs and 133 partly penetrating logs was made in this manner. The results indicated the High Plains aquifer in Lea County and the southern part of Roosevelt County has a hydraulic conductivity ranging from 25 to 135 feet per day with an average hydraulic conductivity of about 50 feet per day. The results also indicate that the aquifer in northern Roosevelt, Curry, and Quay Counties has a hydraulic conductivity ranging from 11 to 200 feet per day with an average hydraulic conductivity of about 60 feet per day. The evaluation of the lithologic logs indicated that the aquifer has a specific yield ranging from about 0.05 to .20 with an average of about 0.15.

RECHARGE

The quantity of natural recharge to the aquifer from precipitation was not determined; however, previous work by Theis (1932, 1934, 1937), which utilized several methods, determined recharge to be less than 0.5 inch per year. Only 3 to 4 percent of the precipitation falling on the High Plains reaches the water table; the remainder is returned to the atmosphere by evapotranspiration.



MAP SHOWING ALTITUDE AND CONFIGURATION OF THE WATER TABLE FOR THE HIGH PLAINS AQUIFER, 1978

IRRIGATION DEVELOPMENT AND WATER-LEVEL CHANGE

Irrigation began in the High Plains before 1910 by farmers irrigating small plots of land using windmills. Irrigation increased slowly and was relatively insignificant until about 1945. Rapid development of irrigated cropland began about 1945 and continued at a relatively constant rate until 1978 as indicated in the graph below. Irrigated cropland increased from about 15,000 acres during 1940 to about 490,000 acres during 1978. The actual cropland irrigated during any year may be 10 to 40 percent less than the potentially available acreage due to crop rotation, precipitation during growing seasons, or economics.

The irrigated area, by counties, within the boundaries of the High Plains is shown in the adjacent graph. Curry County has developed about 222,000 acres for irrigation, Roosevelt County about 138,000, Lea County about 119,000, and Quay County about 11,000 acres. Recently, the most rapid increase in irrigated land has been occurring in Curry and Roosevelt Counties.

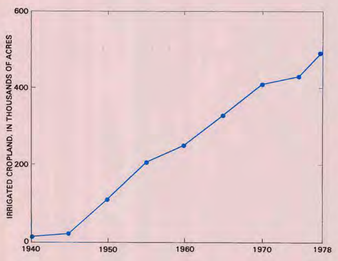
Prior to large-scale development of irrigation, the High Plains ground-water system was in a state of dynamic equilibrium, with long-term recharge equal to long-term discharge. Irrigated farming on the High Plains has significantly increased the quantity of water discharged from the system. Increased discharge has resulted in a lowering of the water level as water is removed from storage in the aquifer. The removal of water from storage, or ground-water mining, is most evident in three general areas where irrigation wells are numerous and relatively concentrated: (1) Eastern Lea County; (2) Portales Valley; and (3) southeastern Curry County.

The distribution of irrigated acreage and the decline in water level from predevelopment conditions to 1978 are shown on the water-level-decline map, which illustrates the areal extent of water-level declines and the relationship of irrigated areas to this decline. The greatest decline in water level is in eastern Curry County where levels have declined more than 100 feet near the New Mexico-Texas border. Water levels in the Portales Valley and in eastern Lea County locally have declined more than 60 feet. Water-level declines of 20 to 60 feet are common in all of these areas where irrigation wells are concentrated.

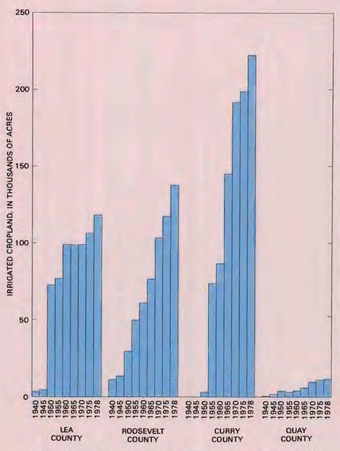
The water level in eastern Lea County has been declining as much as 2 feet per year and is declining at an average rate of 1 foot per year. The water level in Portales Valley has declined as much as 3.5 feet in 1 year and is declining at an average rate of 2 feet per year. The water level in southeastern Curry County has declined as much as 6 feet in 1 year and is declining at an average rate of 3 feet per year.

Hydrographs, which are graphical representations of water-level changes with time in a well, are shown adjacent to the water water-level-decline map for wells in areas that are extensively developed for irrigation. Many of the wells outside extensively developed areas have had little or no continuous water-level decline. The wells for which hydrographs are shown are located on the water-level-decline map.

Continuous large-scale withdrawals of water from the High Plains aquifer will result in a continuing decline in the water table. The areas likely to be most affected are those bordering the non-saturated High Plains deposits and areas where wells penetrate relatively thin saturated zones. Because of decreased well yield and increased power costs, irrigation may become uneconomical in some parts of the area.



GRAPH OF ESTIMATED TOTAL IRRIGATED CROPLAND, INCLUDING IDLE AND FALLOW LAND IN CROP ROTATION, 1940-78



GRAPH OF ESTIMATED IRRIGATED CROPLAND, INCLUDING IDLE AND FALLOW LAND IN CROP ROTATION, BY COUNTIES 1940-78

WATER QUALITY IN THE HIGH PLAINS AQUIFER

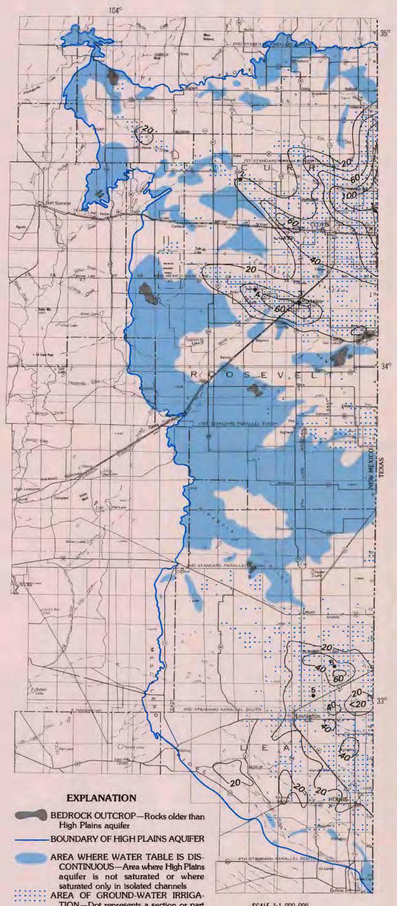
All natural water contains mineral matter dissolved from rock and soil with which it has come in contact. The quantity and kind of dissolved-mineral matter in ground water depends on the type of rocks or soil through which the water has passed and the pressure and temperature. In addition to natural factors, water infiltration from stock ponds, improperly sealed wells, and recycled irrigation water may affect the chemical quality of the ground water.

The chemical composition of water is an important factor in determining its utility because the quality of the water ideally should not adversely affect the user, product, or the land irrigated. The suitability of water for domestic, municipal, stock, industrial, or irrigation use is in part determined by the dissolved-solids concentration. Standards governing the chemical quality of water for public supplies have been established by the U.S. Environmental Protection Agency (1976, 1977). These standards place an upper limit of 500 milligrams per liter on the dissolved-solids concentration of drinking water where better quality is not available; limits have also been placed on concentrations of numerous other selected chemical constituents. Chemical-quality diagrams and concentration of dissolved solids from selected wells are shown on the water-quality map.

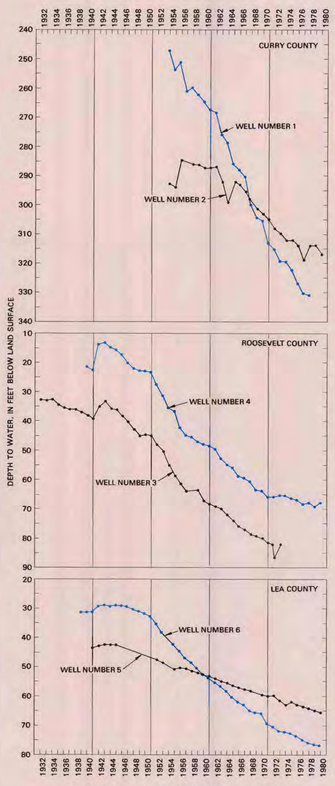
Water for stock also is subject to quality limitations. However, most animals apparently can tolerate water that would be considered unsatisfactory for people (Hem, 1970, p. 324).

The usefulness of water for irrigation is also governed by its chemical quality (Hem, 1970, p. 324-333). The dissolved-solids concentration, or the specific conductance, along with the relative proportion of sodium to calcium plus magnesium (called sodium-adsorption ration or SAR) are used to evaluate the suitability of water for irrigation. Important factors other than salinity-sodium hazards are the types and drainage characteristics of the soils, quantity of water applied, and salt or mineral tolerance of crops. Water that may not be chemically suitable for use on normal or relatively impermeable soils may be used on permeable, well-drained soils where rapid leaching is possible.

Water in the High Plains aquifer generally is suitable for domestic, municipal, and irrigation use, but the water typically has large concentrations of calcium, magnesium, and bicarbonate and in some areas may contain objectionably large concentrations of fluoride or chloride. Waters with large concentrations of dissolved-mineral constituents most commonly are present in areas or zones where the underlying bedrock may be contributing small quantities of more mineralized water to the aquifer. This is most likely to occur in northeastern Lea and southern Roosevelt Counties where the High Plains aquifer overlies rocks of Cretaceous age.



MAP OF DISTRIBUTION OF 1978 IRRIGATED ACREAGE AND WATER-LEVEL DECLINE FROM PREDEVELOPMENT TO 1978



HYDROGRAPHS SHOWING WATER-LEVEL FLUCTUATIONS IN WELLS, 1931-80

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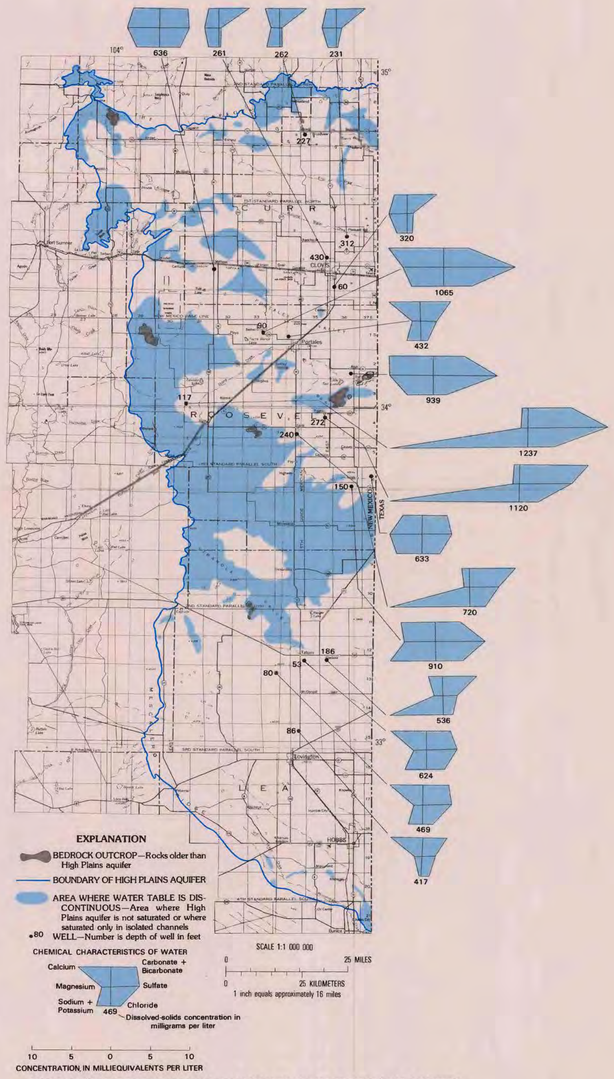
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MAP SHOWING GENERALIZED WATER QUALITY IN THE HIGH PLAINS AQUIFER

Base from U.S. Geological Survey
State base map, 1967
Revised as of 1984

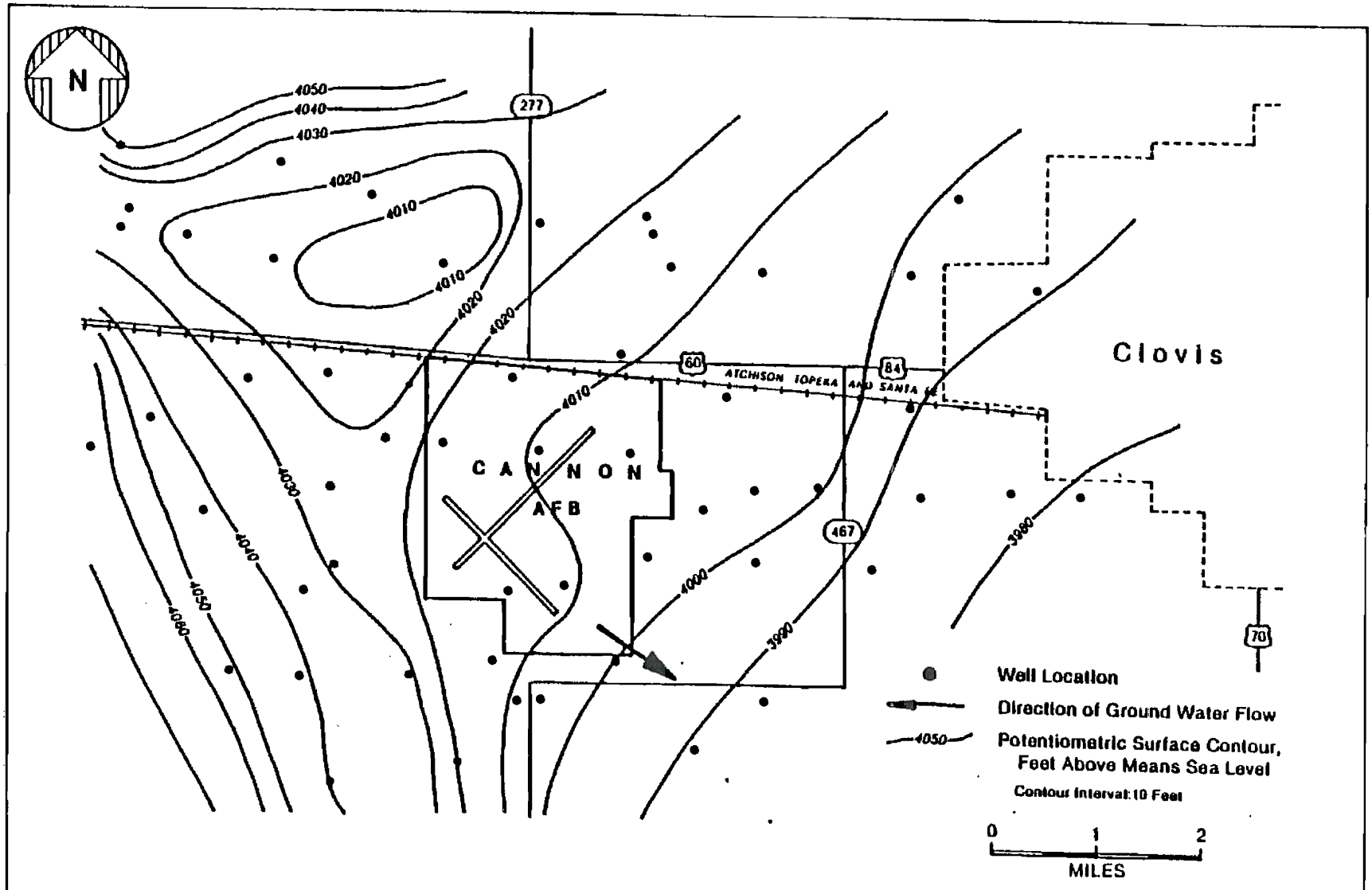
GEOHYDROLOGY OF THE HIGH PLAINS AQUIFER IN SOUTHEASTERN NEW MEXICO

By
Donald L. Hart, Jr. and Douglas P. McAda

1985

INTERIOR—GEOLOGICAL SURVEY, RESTON, VA—1985—W84174

For sale by Branch of Distribution, U.S. Geological Survey, Box 25286, Federal Center, Denver, CO 80225



SOURCE: Installation Restoration Program Phase II–Stage I Draft, Radian Corp., March 1986

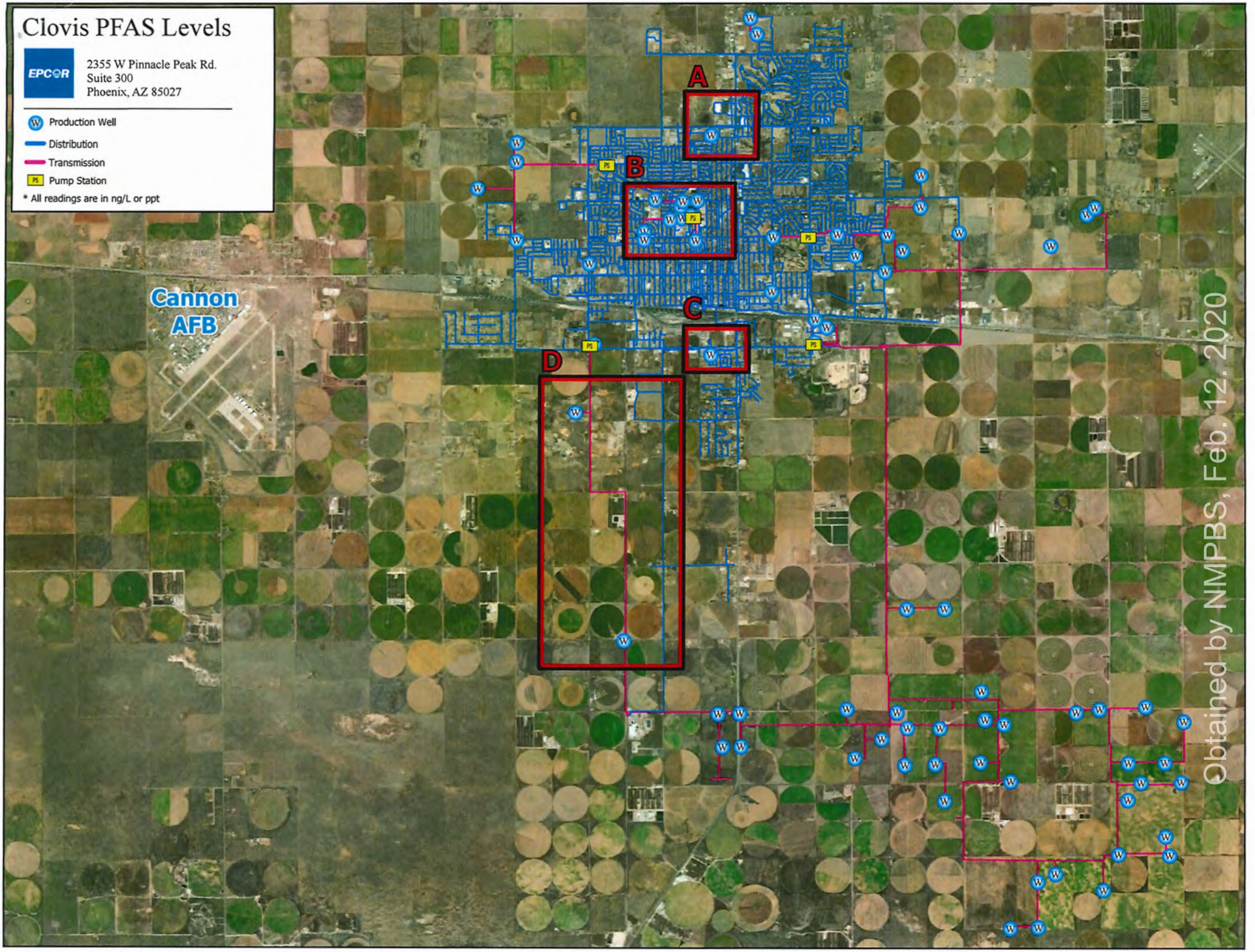
FIGURE 4-7
GROUNDWATER ELEVATION IN THE VICINITY OF CANNON AFB, NEW MEXICO.
JAN. – FEB. 1982

WH&A 1012 (REV.3/83)
WALK, HAYDEL & ASSOCIATES, INC.
ENGINEERS
NEW ORLEANS–MOBILE–BATON ROUGE

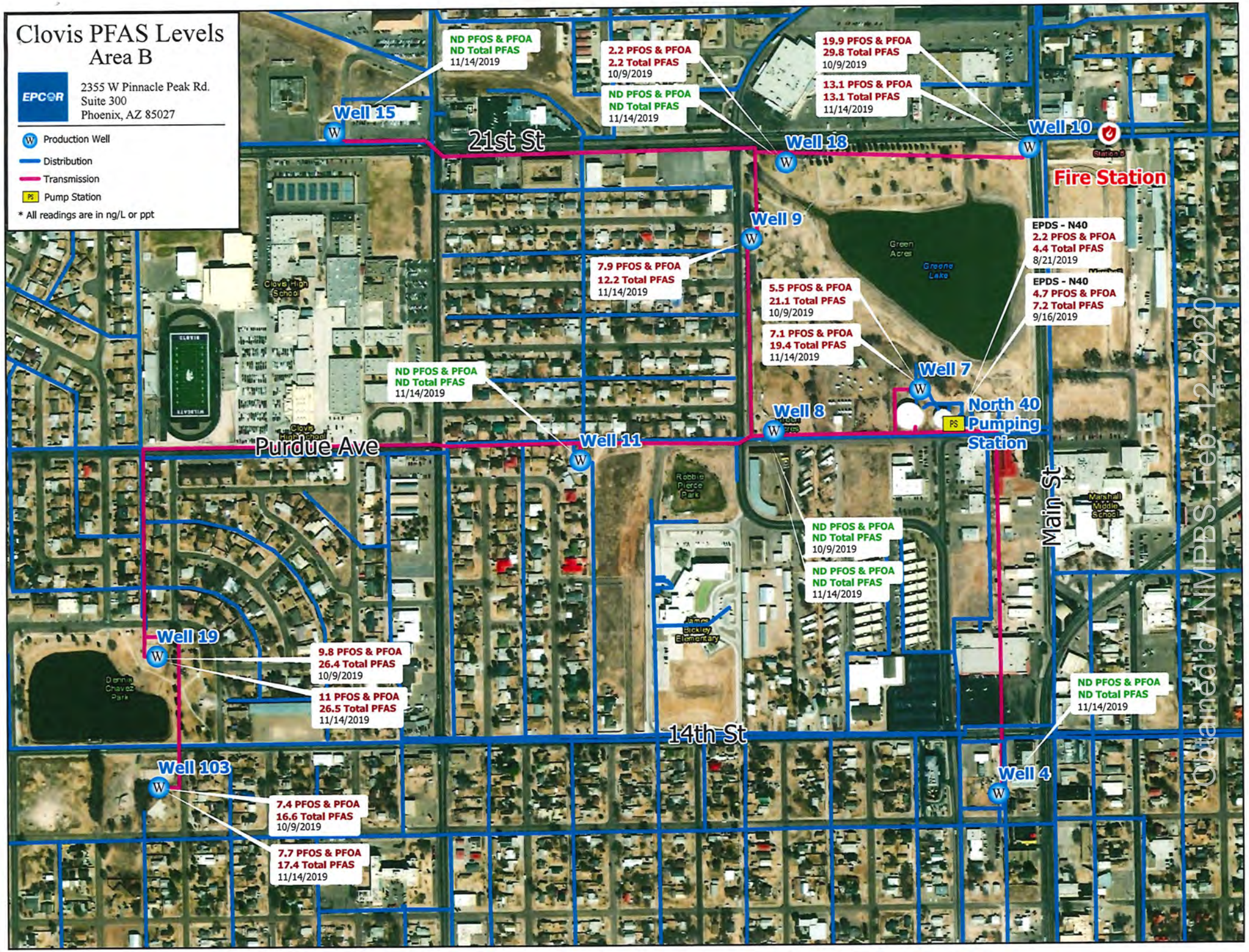
Appendix F

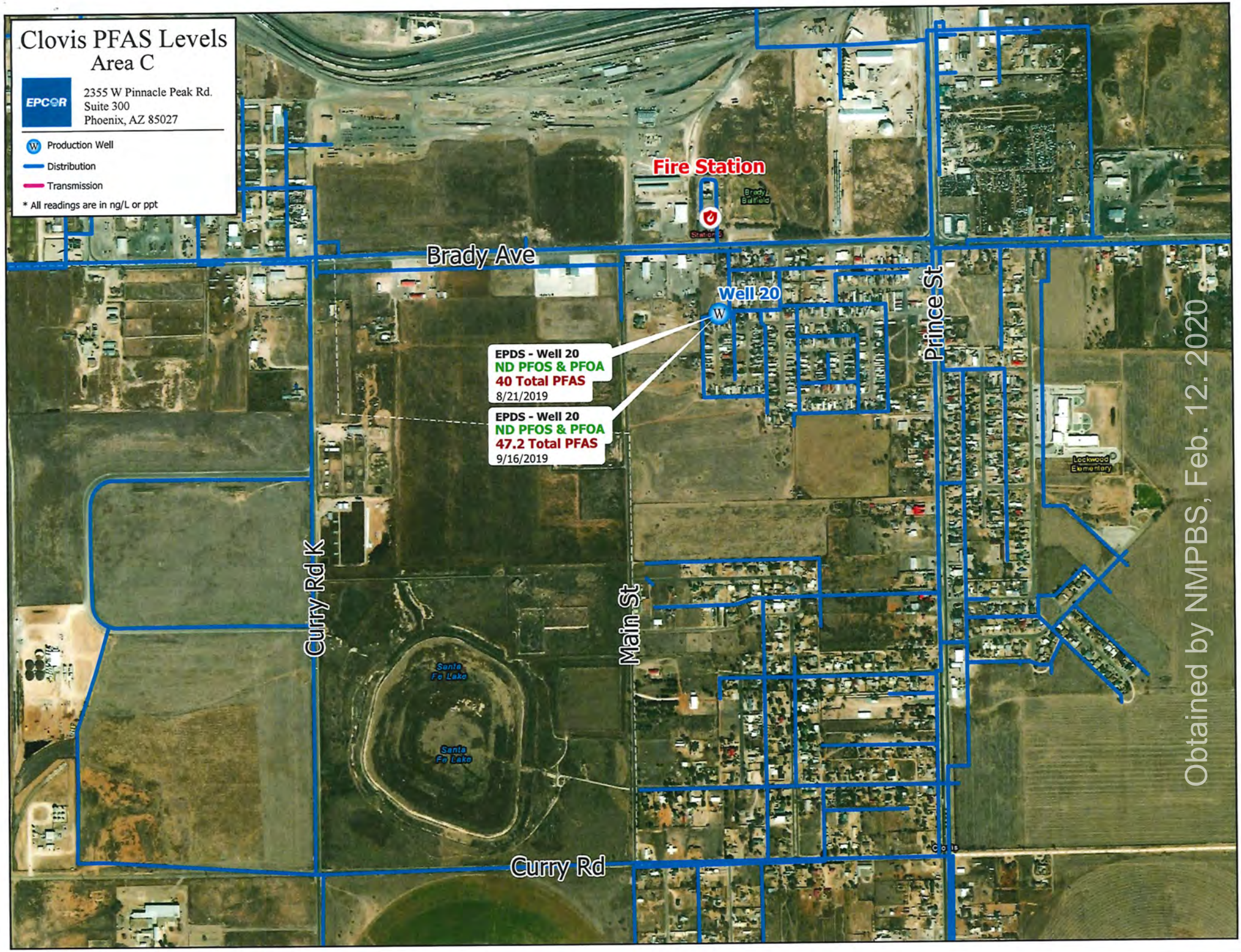
2019 EPCOR Sample Location Maps

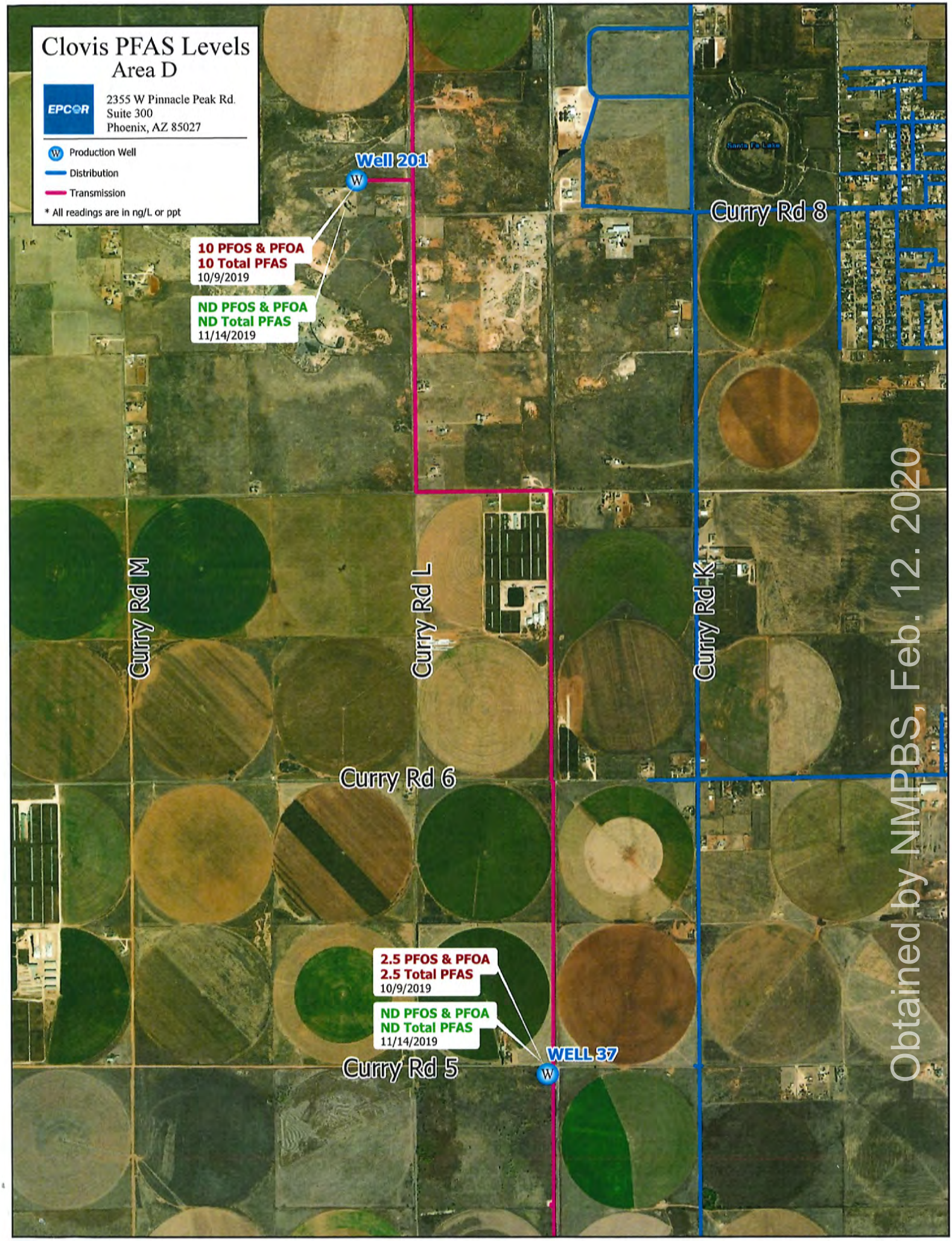
DBS&A
Daniel B. Stephens & Associates, Inc.


Clovis PFAS Levels
EPCOR
2355 W Pinnacle Peak Rd.
Suite 300
Phoenix, AZ 85027
Production Well
Distribution
Transmission
Pump Station
* All readings are in ng/L or ppt
A
B
C
D
Cannon AFB
Obtained by NMPBS, Feb. 12, 2020


Clovis PFAS Levels
Area A
EPCOR
2355 W Pinnacle Peak Rd.
Suite 300
Phoenix, AZ 85027
Production Well
Distribution
Transmission
* All readings are in ng/L or ppt
Sorgen Lake
Llano Estacado Blvd
EPDS - Well 205
ND PFOS & PFOA
6.3 Total PFAS
8/21/2019
EPDS - Well 205
ND PFOS & PFOA
3.5 Total PFAS
9/16/2019
Well 205
Wallace St
Fire Station
Gidding St
Axtell St
Obtained by NMED BS, Feb. 12, 2020


Clovis PFAS Levels
Area B
EPCOR
2355 W Pinnacle Peak Rd.
Suite 300
Phoenix, AZ 85027
Production Well
Distribution
Transmission
Pump Station
* All readings are in ng/L or ppt
Well 15
ND PFOS & PFOA
ND Total PFAS
11/14/2019
21st St
2.2 PFOS & PFOA
2.2 Total PFAS
10/9/2019
ND PFOS & PFOA
ND Total PFAS
11/14/2019
Well 18
19.9 PFOS & PFOA
29.8 Total PFAS
10/9/2019
13.1 PFOS & PFOA
13.1 Total PFAS
11/14/2019
Well 10
Station 3
Fire Station
Well 9
7.9 PFOS & PFOA
12.2 Total PFAS
11/14/2019
Green Acres
Greene Lake
EPDS - N40
2.2 PFOS & PFOA
4.4 Total PFAS
8/21/2019
EPDS - N40
4.7 PFOS & PFOA
7.2 Total PFAS
9/16/2019
5.5 PFOS & PFOA
21.1 Total PFAS
10/9/2019
7.1 PFOS & PFOA
19.4 Total PFAS
11/14/2019
Clovis High School
ND PFOS & PFOA
ND Total PFAS
11/14/2019
Well 7
Well 8
North 40
Pumping
Station
PS
Purdue Ave
Well 11
Robbie Pierce Park
Main St
Marshall Middle School
ND PFOS & PFOA
ND Total PFAS
10/9/2019
ND PFOS & PFOA
ND Total PFAS
11/14/2019
James Bickley Elementary
Well 19
9.8 PFOS & PFOA
26.4 Total PFAS
10/9/2019
11 PFOS & PFOA
26.5 Total PFAS
11/14/2019
Dennis Chavez Park
14th St
ND PFOS & PFOA
ND Total PFAS
11/14/2019
Well 4
Well 103
7.4 PFOS & PFOA
16.6 Total PFAS
10/9/2019
7.7 PFOS & PFOA
17.4 Total PFAS
11/14/2019
Obtained by NMPRS; Feb. 12, 2020


Clovis PFAS Levels
Area C
EPCOR
2355 W Pinnacle Peak Rd.
Suite 300
Phoenix, AZ 85027
Production Well
Distribution
Transmission
* All readings are in ng/L or ppt
Fire Station
Brady Ave
Well 20
Prince St
EPDS - Well 20
ND PFOS & PFOA
40 Total PFAS
8/21/2019
EPDS - Well 20
ND PFOS & PFOA
47.2 Total PFAS
9/16/2019
Curry Rd K
Main St
Curry Rd
Santa Fe Lake
Santa Fe Lake
Lockwood Elementary
Obtained by NMPBS, Feb. 12, 2020


Clovis PFAS Levels
Area D
EPCOR
2355 W Pinnacle Peak Rd.
Suite 300
Phoenix, AZ 85027
Production Well
Distribution
Transmission
* All readings are in ng/L or ppt
Well 201
10 PFOS & PFOA
10 Total PFAS
10/9/2019
ND PFOS & PFOA
ND Total PFAS
11/14/2019
Curry Rd 8
Curry Rd M
Curry Rd L
Curry Rd K
Curry Rd 6
2.5 PFOS & PFOA
2.5 Total PFAS
10/9/2019
ND PFOS & PFOA
ND Total PFAS
11/14/2019
WELL 37
Curry Rd 5
Obtained by NMPBS, Feb. 12. 2020

Appendix G

Laboratory Reports for Highland Dairy Sampling

DBS&A
Daniel B. Stephens & Associates, Inc.

GEL Laboratories LLC
a member of The GEL Group INC

PO Box 30712 Charleston, SC 29417
2040 Savage Road Charleston, SC 29407
P 843.556.8171
F 843.766.1178

gel.com

October 09, 2018

Art Schaap
Highland Dairy
650 Cr-O
Clovis, New Mexico 88101

Re: Dairy Farm testing
Work Order: 459957

Dear Art Schaap:

GEL Laboratories, LLC (GEL) appreciates the opportunity to provide the enclosed analytical results for the sample(s) we received on September 22, 2018. This original data report has been prepared and reviewed in accordance with GEL's standard operating procedures.

Our policy is to provide high quality, personalized analytical services to enable you to meet your analytical needs on time every time. We trust that you will find everything in order and to your satisfaction. If you have any questions, please do not hesitate to call me at (843) 556-8171, ext. 4487.

Sincerely,

B Luthman

Brielle Luthman
Project Manager

Enclosures

GEL LABORATORIES LLC
2040 Savage Road Charleston SC 29407 − (843) 556−8171 − www.gel.com

Certificate of Analysis Report
for

HILD001 Highland Dairy

Client SDG: 459957 GEL Work Order: 459957

The Qualifiers in this report are defined as follows:

* A quality control analyte recovery is outside of specified acceptance criteria

** Analyte is a Tracer compound

** Analyte is a surrogate compound

H Analytical holding time was exceeded

J Value is estimated

U Analyte was analyzed for, but not detected above the MDL, MDA, MDC or LOD.

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless qualified on the Certificate of Analysis.

The designation ND, if present, appears in the result column when the analyte concentration is not detected above the limit as defined in the 'U' qualifier above.

This data report has been prepared and reviewed in accordance with GEL Laboratories LLC standard operating procedures. Please direct any questions to your Project Manager, Brielle Luthman.

Reviewed by B Luthman

GEL LABORATORIES LLC
2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Report Date: October 9, 2018

Company : Highland Dairy
Address : 650 Cr-O

Clovis, New Mexico 88101
Contact: Art Schaap
Project: Dairy Farm testing

Client Sample ID: D1 (Dairy Supply Well) Project: HILD00118
Sample ID: 459957001 Client ID: HILD001
Matrix: Ground Water
Collect Date: 21-SEP-18 14:00
Receive Date: 22-SEP-18
Collector: Client

Parameter	Qualifier	Result	DL	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
Carbon Analysis												
SM 5310 B Total Organic Carbon "As Received"												
Total Organic Carbon Average	J	0.745	0.330	1.00	mg/L		1	TSM	09/25/18	2147	1805070	1
Ion Chromatography												
EPA 300.0 Chloride, Liquid "As Received"												
Nitrate-N		3.30	0.165	0.500	mg/L		5	JXH5	09/23/18	1035	1804797	2
Sulfate		84.5	0.665	2.00	mg/L		5					
Chloride		880	13.4	40.0	mg/L		200	JXH5	09/24/18	1328	1804797	3
LCMSMS PFCs												
EPA 537 PFCs by LC-MS/MS "As Received"												
Perfluorobutyric acid (PFBA)		181	0.740	2.24	ng/L	0.0224	1	GXC1	09/27/18	0831	1805951	4
Perfluorodecanesulfonate (PFDS)	U	ND	0.740	2.18	ng/L	0.0224	1					
Perfluorodecanoic acid (PFDA)	U	ND	0.740	2.24	ng/L	0.0224	1					
Perfluorododecanoic acid (PFDoA)	U	ND	0.740	2.24	ng/L	0.0224	1					
Perfluoroheptanoic acid (PFHpA)		190	0.740	2.24	ng/L	0.0224	1					
Perfluorononanoic acid (PFNA)		3.01	0.740	2.24	ng/L	0.0224	1					
Perfluorooctanesulfonamide (PFOSA)	U	ND	0.740	2.09	ng/L	0.0224	1					
Perfluorotetradecanoic acid (PFTeDA)	U	ND	0.740	2.24	ng/L	0.0224	1					
Perfluorotridecanoic acid (PFTrDA)	U	ND	0.740	2.24	ng/L	0.0224	1					
Perfluoroundecanoic acid (PFUdA)	U	ND	0.740	2.24	ng/L	0.0224	1					
Perfluorobutanesulfonate (PFBS)		208	37.0	99.8	ng/L	0.0224	50	GXC1	09/27/18	0639	1805951	5
Perfluorohexanesulfonate (PFHxS)		1810	37.0	102	ng/L	0.0224	50					
Perfluorohexanoic acid (PFHxA)		837	37.0	112	ng/L	0.0224	50					
Perfluorooctanesulfonate (PFOS)		1120	37.0	112	ng/L	0.0224	50					
Perfluorooctanoic acid (PFOA)		504	37.0	112	ng/L	0.0224	50					
Perfluoropentanoic acid (PFPeA)		563	37.0	112	ng/L	0.0224	50					
Metals Analysis-ICP-MS												
200.2/200.8 Arsenic "As Received"												
Arsenic	J	4.78	2.00	5.00	ug/L	1.00	1	BAJ	09/27/18	1719	1805110	6
Titration and Ion Analysis												
EPA310.1/SM2320B Bicarbonates "As Received"												
Bicarbonate alkalinity (CaCO3)		252	1.45	4.00	mg/L			RXB5	09/25/18	1658	1805228	7

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch

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Certificate of Analysis

Report Date: October 9, 2018

Company : Highland Dairy
Address : 650 Cr-O

Clovis, New Mexico 88101
Contact: Art Schaap
Project: Dairy Farm testing

Client Sample ID: D1 (Dairy Supply Well) Project: HILD00118
Sample ID: 459957001 Client ID: HILD001

Parameter	Qualifier	Result	DL	RL	Units	PF	DF	Analyst Date	Time	Batch	Method
EPA 200.2	ICP-MS 200.2 PREP			JXM8	09/24/18		2136	1805109			
EPA 537	PFCs Extraction in Drinking Water			NOR1	09/26/18		1015	1805949			

The following Analytical Methods were performed:

Method	Description	Analyst Comments
1	SM 5310 B	
2	EPA 300.0	
3	EPA 300.0	
4	EPA 537	
5	EPA 537	
6	EPA 200.8	
7	SM 2320B	

Surrogate/Tracer Recovery	Test	Result	Nominal	Recovery%	Acceptable Limits
Perfluoro-n-[1,2-13C2] decanoic aci	EPA 537 PFCs by LC-MS/MS "As Received"	5.42 ng/L	5.61	97	(70%-130%)
Perfluoro-n-[1,2-13C2] octanoic acid	EPA 537 PFCs by LC-MS/MS "As Received"	5.42 ng/L	5.61	97	(70%-130%)
Perfluoro-n-[2,3,4-13C3] butanoic aci	EPA 537 PFCs by LC-MS/MS "As Received"	6.18 ng/L	5.61	110	(70%-130%)
Sodium perfluoro-1-[1,2,3,4-13C4]oc	EPA 537 PFCs by LC-MS/MS "As Received"	4.69 ng/L	5.61	84	(70%-130%)

Notes:

Column headers are defined as follows:

DF: Dilution Factor
DL: Detection Limit
MDA: Minimum Detectable Activity
MDC: Minimum Detectable Concentration
Lc/LC: Critical Level
PF: Prep Factor
RL: Reporting Limit
SQL: Sample Quantitation Limit

GEL LABORATORIES LLC
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Certificate of Analysis

Report Date: October 9, 2018

Company : Highland Dairy
Address : 650 Cr-O

Clovis, New Mexico 88101
Contact: Art Schaap
Project: Dairy Farm testing

Client Sample ID: Milk Tank 1
Sample ID: 459957002
Matrix: Milk
Collect Date: 21-SEP-18 14:15
Receive Date: 22-SEP-18
Collector: Client

Project: HILD00118
Client ID: HILD001

Parameter	Qualifier	Result	DL	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
LCMSMS PFCs												
EPA 537Mod PFCs by LC-MS/MS "As Received"												
Perfluorooctanoic acid (PFOA)		21.0	7.07	20.2	ng/L	0.202	1	GXC1	09/25/18	1727	1805458	1
Perfluorooctanesulfonate (PFOS)		675	33.3	101	ng/L	0.202	5	GXC1	09/26/18	1242	1805458	2

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
EPA 537 Mod, PFAS by LCMS	PFCs Extraction in Liquid	GXC1	09/25/18	1005	1805456

The following Analytical Methods were performed:

Method	Description	Analyst Comments
1	EPA 537 Mod, PFAS by LCMSMS Compliant with QSM 5.1	
2	EPA 537 Mod, PFAS by LCMSMS Compliant with QSM 5.1	

Notes:

Column headers are defined as follows:

DF: Dilution Factor
DL: Detection Limit
MDA: Minimum Detectable Activity
MDC: Minimum Detectable Concentration
Lc/LC: Critical Level
PF: Prep Factor
RL: Reporting Limit
SQL: Sample Quantitation Limit

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Certificate of Analysis

Report Date: October 9, 2018

Company : Highland Dairy
Address : 650 Cr-O

Clovis, New Mexico 88101
Contact: Art Schaap
Project: Dairy Farm testing

Client Sample ID: Milk Tank 2
Sample ID: 459957003
Matrix: Milk
Collect Date: 21-SEP-18 14:20
Receive Date: 22-SEP-18
Collector: Client

Project: HILD00118
Client ID: HILD001

Parameter	Qualifier	Result	DL	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
LCMSMS PFCs												
EPA 537Mod PFCs by LC-MS/MS "As Received"												
Perfluorooctanoic acid (PFOA)	J	13.4	6.74	19.2	ng/L	0.192	1	GXC1	09/25/18	1753	1805458	1
Perfluorooctanesulfonate (PFOS)		416	31.8	96.2	ng/L	0.192	5	GXC1	09/26/18	1308	1805458	2

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
EPA 537 Mod, PFAS by LCMS	PFCs Extraction in Liquid	GXC1	09/25/18	1005	1805456

The following Analytical Methods were performed:

Method	Description	Analyst Comments
1	EPA 537 Mod, PFAS by LCMSMS Compliant with QSM 5.1	
2	EPA 537 Mod, PFAS by LCMSMS Compliant with QSM 5.1	

Notes:

Column headers are defined as follows:

DF: Dilution Factor
DL: Detection Limit
MDA: Minimum Detectable Activity
MDC: Minimum Detectable Concentration
Lc/LC: Critical Level
PF: Prep Factor
RL: Reporting Limit
SQL: Sample Quantitation Limit

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Certificate of Analysis

Report Date: October 9, 2018

Company : Highland Dairy
Address : 650 Cr-O

Clovis, New Mexico 88101
Contact: Art Schaap
Project: Dairy Farm testing

Client Sample ID: Trip Blank
Sample ID: 459957004
Matrix: Ground Water
Collect Date: 21-SEP-18 14:30
Receive Date: 22-SEP-18
Collector: Client

Project: HILD00118
Client ID: HILD001

Parameter	Qualifier	Result	DL	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
LCMSMS PFCs												
EPA 537 PFCs by LC-MS/MS "As Received"												
Perfluorobutanesulfonate (PFBS)	U	ND	0.637	1.72	ng/L	0.0193	1	GXC1	09/27/18	0648	1805951	1
Perfluorobutyric acid (PFBA)	U	ND	0.637	1.93	ng/L	0.0193	1					
Perfluorodecanesulfonate (PFDS)	U	ND	0.637	1.87	ng/L	0.0193	1					
Perfluorodecanoic acid (PFDA)	U	ND	0.637	1.93	ng/L	0.0193	1					
Perfluorododecanoic acid (PFDoA)	U	ND	0.637	1.93	ng/L	0.0193	1					
Perfluoroheptanoic acid (PFHpA)	U	ND	0.637	1.93	ng/L	0.0193	1					
Perfluorohexanesulfonate (PFHxS)	U	ND	0.637	1.76	ng/L	0.0193	1					
Perfluorohexanoic acid (PFHxA)	U	ND	0.637	1.93	ng/L	0.0193	1					
Perfluorononanoic acid (PFNA)	U	ND	0.637	1.93	ng/L	0.0193	1					
Perfluorooctanesulfonamide (PFOSA)	U	ND	0.637	1.80	ng/L	0.0193	1					
Perfluorooctanesulfonate (PFOS)	U	ND	0.637	1.93	ng/L	0.0193	1					
Perfluorooctanoic acid (PFOA)	U	ND	0.637	1.93	ng/L	0.0193	1					
Perfluoropentanoic acid (PFPeA)	U	ND	0.637	1.93	ng/L	0.0193	1					
Perfluorotetradecanoic acid (PFTeDA)	U	ND	0.637	1.93	ng/L	0.0193	1					
Perfluorotridecanoic acid (PFTrDA)	U	ND	0.637	1.93	ng/L	0.0193	1					
Perfluoroundecanoic acid (PFUdA)	U	ND	0.637	1.93	ng/L	0.0193	1					

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
EPA 537	PFCs Extraction in Drinking Water	NOR1	09/26/18	1015	1805949

The following Analytical Methods were performed:

Method	Description	Analyst Comments
1	EPA 537	

Surrogate/Tracer Recovery	Test	Result	Nominal	Recovery%	Acceptable Limits
Perfluoro-n-[1,2-13C2] decanoic aci	EPA 537 PFCs by LC-MS/MS "As Received"	4.88 ng/L	4.83	101	(70%-130%)
Perfluoro-n-[1,2-13C2] octanoic acid	EPA 537 PFCs by LC-MS/MS "As Received"	4.75 ng/L	4.83	99	(70%-130%)
Perfluoro-n-[2,3,4-13C3] butanoic aci	EPA 537 PFCs by LC-MS/MS "As Received"	5.18 ng/L	4.83	107	(70%-130%)
Sodium perfluoro-1-[1,2,3,4-13C4]oc	EPA 537 PFCs by LC-MS/MS "As Received"	4.42 ng/L	4.83	92	(70%-130%)

Notes:

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Certificate of Analysis

Report Date: October 9, 2018

Company :	Highland Dairy
Address :	650 Cr-O
	Clovis, New Mexico 88101
Contact:	Art Schaap
Project:	Dairy Farm testing

Client Sample ID:	Trip Blank	Project:	HILD00118
Sample ID:	459957004	Client ID:	HILD001

Parameter	Qualifier	Result	DL	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method

Column headers are defined as follows:

DF: Dilution Factor
DL: Detection Limit
MDA: Minimum Detectable Activity
MDC: Minimum Detectable Concentration
Lc/LC: Critical Level
PF: Prep Factor
RL: Reporting Limit
SQL: Sample Quantitation Limit

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Certificate of Analysis

Report Date: October 9, 2018

Company : Highland Dairy
Address : 650 Cr-O

Clovis, New Mexico 88101
Contact: Art Schaap
Project: Dairy Farm testing

Client Sample ID: W-5
Sample ID: 459957005
Matrix: Ground Water
Collect Date: 21-SEP-18 14:40
Receive Date: 22-SEP-18
Collector: Client

Project: HILD00118
Client ID: HILD001

Parameter	Qualifier	Result	DL	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
LCMSMS PFCs												
EPA 537 PFCs by LC-MS/MS "As Received"												
Perfluorodecanesulfonate (PFDS)	U	ND	0.607	1.78	ng/L	0.0184	1	GXC1	09/27/18	0656	1805951	1
Perfluorodecanoic acid (PFDA)	U	ND	0.607	1.84	ng/L	0.0184	1					
Perfluorododecanoic acid (PFDoA)	U	ND	0.607	1.84	ng/L	0.0184	1					
Perfluorooctanesulfonamide (PFOSA)		36.9	0.607	1.71	ng/L	0.0184	1					
Perfluorotetradecanoic acid (PFTeDA)	U	ND	0.607	1.84	ng/L	0.0184	1					
Perfluorotridecanoic acid (PFTrDA)	U	ND	0.607	1.84	ng/L	0.0184	1					
Perfluoroundecanoic acid (PFUdA)	U	ND	0.607	1.84	ng/L	0.0184	1					
Perfluorobutanesulfonate (PFBS)		571	60.7	164	ng/L	0.0184	100	GXC1	09/27/18	0941	1805951	2
Perfluorobutyric acid (PFBA)		603	60.7	184	ng/L	0.0184	100					
Perfluoroheptanoic acid (PFHpA)		845	60.7	184	ng/L	0.0184	100					
Perfluorohexanesulfonate (PFHxS)		8530	60.7	167	ng/L	0.0184	100					
Perfluorohexanoic acid (PFHxA)		3090	60.7	184	ng/L	0.0184	100					
Perfluorononanoic acid (PFNA)	U	ND	60.7	184	ng/L	0.0184	100					
Perfluorooctanesulfonate (PFOS)		11400	60.7	184	ng/L	0.0184	100					
Perfluorooctanoic acid (PFOA)		2920	60.7	184	ng/L	0.0184	100					
Perfluoropentanoic acid (PFPeA)		2130	60.7	184	ng/L	0.0184	100					

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
EPA 537	PFCs Extraction in Drinking Water	NOR1	09/26/18	1015	1805949

The following Analytical Methods were performed:

Method	Description	Analyst Comments
1	EPA 537	
2	EPA 537	

Surrogate/Tracer Recovery	Test	Result	Nominal	Recovery%	Acceptable Limits
Perfluoro-n-[1,2-13C2] decanoic aci	EPA 537 PFCs by LC-MS/MS "As Received"	3.85 ng/L	4.60	84	(70%-130%)
Perfluoro-n-[1,2-13C2] octanoic acid	EPA 537 PFCs by LC-MS/MS "As Received"	8.15 ng/L	4.60	177*	(70%-130%)
Perfluoro-n-[2,3,4-13C3] butanoic aci	EPA 537 PFCs by LC-MS/MS "As Received"	4.58 ng/L	4.60	100	(70%-130%)
Sodium perfluoro-1-[1,2,3,4-13C4]oc	EPA 537 PFCs by LC-MS/MS "As Received"	3.02 ng/L	4.60	66*	(70%-130%)

Notes:

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Certificate of Analysis

Report Date: October 9, 2018

Company :	Highland Dairy
Address :	650 Cr-O
	Clovis, New Mexico 88101
Contact:	Art Schaap
Project:	Dairy Farm testing

Client Sample ID:	W-5	Project:	HILD00118
Sample ID:	459957005	Client ID:	HILD001

Parameter	Qualifier	Result	DL	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method

Column headers are defined as follows:

DF: Dilution Factor
DL: Detection Limit
MDA: Minimum Detectable Activity
MDC: Minimum Detectable Concentration
Lc/LC: Critical Level
PF: Prep Factor
RL: Reporting Limit
SQL: Sample Quantitation Limit

GEL LABORATORIES LLC
2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Report Date: October 9, 2018

Company : Highland Dairy
Address : 650 Cr-O

Clovis, New Mexico 88101
Contact: Art Schaap
Project: Dairy Farm testing

Client Sample ID: W-4
Sample ID: 459957006
Matrix: Ground Water
Collect Date: 21-SEP-18 14:50
Receive Date: 22-SEP-18
Collector: Client

Project: HILD00118
Client ID: HILD001

Parameter	Qualifier	Result	DL	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
LCMSMS PFCs												
EPA 537 PFCs by LC-MS/MS "As Received"												
Perfluorodecanesulfonate (PFDS)	U	ND	0.609	1.79	ng/L	0.0185	1	GXC1	09/27/18	0705	1805951	1
Perfluorodecanoic acid (PFDA)	U	ND	0.609	1.85	ng/L	0.0185	1					
Perfluorododecanoic acid (PFDoA)	U	ND	0.609	1.85	ng/L	0.0185	1					
Perfluorononanoic acid (PFNA)		1.93	0.609	1.85	ng/L	0.0185	1					
Perfluorooctanesulfonamide (PFOSA)		2.68	0.609	1.72	ng/L	0.0185	1					
Perfluorotetradecanoic acid (PFTeDA)	U	ND	0.609	1.85	ng/L	0.0185	1					
Perfluorotridecanoic acid (PFTrDA)	U	ND	0.609	1.85	ng/L	0.0185	1					
Perfluoroundecanoic acid (PFUdA)	U	ND	0.609	1.85	ng/L	0.0185	1					
Perfluorobutanesulfonate (PFBS)		115	6.09	16.4	ng/L	0.0185	10	GXC1	10/04/18	1942	1805951	2
Perfluorobutyric acid (PFBA)		87.7	6.09	18.5	ng/L	0.0185	10					
Perfluoroheptanoic acid (PFHpA)		118	6.09	18.5	ng/L	0.0185	10					
Perfluorohexanesulfonate (PFHxS)		883	6.09	16.8	ng/L	0.0185	10					
Perfluorohexanoic acid (PFHxA)		367	6.09	18.5	ng/L	0.0185	10					
Perfluorooctanesulfonate (PFOS)		798	6.09	18.5	ng/L	0.0185	10					
Perfluorooctanoic acid (PFOA)		357	6.09	18.5	ng/L	0.0185	10					
Perfluoropentanoic acid (PFPeA)		292	6.09	18.5	ng/L	0.0185	10					

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
EPA 537	PFCs Extraction in Drinking Water	NOR1	09/26/18	1015	1805949

The following Analytical Methods were performed:

Method	Description	Analyst Comments
1	EPA 537	
2	EPA 537	

Surrogate/Tracer Recovery	Test	Result	Nominal	Recovery%	Acceptable Limits
Perfluoro-n-[1,2-13C2] decanoic aci	EPA 537 PFCs by LC-MS/MS "As Received"	4.64 ng/L	4.61	101	(70%-130%)
Perfluoro-n-[1,2-13C2] octanoic acid	EPA 537 PFCs by LC-MS/MS "As Received"	5.22 ng/L	4.61	113	(70%-130%)
Perfluoro-n-[2,3,4-13C3] butanoic aci	EPA 537 PFCs by LC-MS/MS "As Received"	4.88 ng/L	4.61	106	(70%-130%)
Sodium perfluoro-1-[1,2,3,4-13C4]oc	EPA 537 PFCs by LC-MS/MS "As Received"	4.03 ng/L	4.61	87	(70%-130%)

Notes:

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Certificate of Analysis

Report Date: October 9, 2018

Company :	Highland Dairy
Address :	650 Cr-O
	Clovis, New Mexico 88101
Contact:	Art Schaap
Project:	Dairy Farm testing

Client Sample ID:	W-4	Project:	HILD00118
Sample ID:	459957006	Client ID:	HILD001

Parameter	Qualifier	Result	DL	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method

Column headers are defined as follows:

DF: Dilution Factor
DL: Detection Limit
MDA: Minimum Detectable Activity
MDC: Minimum Detectable Concentration
Lc/LC: Critical Level
PF: Prep Factor
RL: Reporting Limit
SQL: Sample Quantitation Limit

GEL LABORATORIES LLC
2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Report Date: October 9, 2018

Company : Highland Dairy
Address : 650 Cr-O

Clovis, New Mexico 88101
Contact: Art Schaap
Project: Dairy Farm testing

Client Sample ID: W-1
Sample ID: 459957007
Matrix: Ground Water
Collect Date: 21-SEP-18 15:00
Receive Date: 22-SEP-18
Collector: Client

Project: HILD00118
Client ID: HILD001

Parameter	Qualifier	Result	DL	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
LCMSMS PFCs												
EPA 537 PFCs by LC-MS/MS "As Received"												
Perfluorobutanesulfonate (PFBS)		8.12	0.616	1.66	ng/L	0.0187	1	GXC1	09/27/18	0731	1805951	1
Perfluorobutyric acid (PFBA)		7.00	0.616	1.87	ng/L	0.0187	1					
Perfluorodecanesulfonate (PFDS)	U	ND	0.616	1.81	ng/L	0.0187	1					
Perfluorodecanoic acid (PFDA)	U	ND	0.616	1.87	ng/L	0.0187	1					
Perfluorododecanoic acid (PFDoA)	U	ND	0.616	1.87	ng/L	0.0187	1					
Perfluoroheptanoic acid (PFHpA)	U	ND	0.616	1.87	ng/L	0.0187	1					
Perfluorohexanesulfonate (PFHxS)		1.96	0.616	1.70	ng/L	0.0187	1					
Perfluorohexanoic acid (PFHxA)		11.7	0.616	1.87	ng/L	0.0187	1					
Perfluorononanoic acid (PFNA)	U	ND	0.616	1.87	ng/L	0.0187	1					
Perfluorooctanesulfonamide (PFOSA)	U	ND	0.616	1.74	ng/L	0.0187	1					
Perfluorooctanesulfonate (PFOS)	J	0.817	0.616	1.87	ng/L	0.0187	1					
Perfluorooctanoic acid (PFOA)	U	ND	0.616	1.87	ng/L	0.0187	1					
Perfluoropentanoic acid (PFPeA)		14.7	0.616	1.87	ng/L	0.0187	1					
Perfluorotetradecanoic acid (PFTeDA)	U	ND	0.616	1.87	ng/L	0.0187	1					
Perfluorotridecanoic acid (PFTrDA)	U	ND	0.616	1.87	ng/L	0.0187	1					
Perfluoroundecanoic acid (PFUdA)	U	ND	0.616	1.87	ng/L	0.0187	1					

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
EPA 537	PFCs Extraction in Drinking Water	NOR1	09/26/18	1015	1805949

The following Analytical Methods were performed:

Method	Description	Analyst Comments
1	EPA 537	

Surrogate/Tracer Recovery	Test	Result	Nominal	Recovery%	Acceptable Limits
Perfluoro-n-[1,2-13C2] decanoic aci	EPA 537 PFCs by LC-MS/MS "As Received"	3.97 ng/L	4.67	85	(70%-130%)
Perfluoro-n-[1,2-13C2] octanoic acid	EPA 537 PFCs by LC-MS/MS "As Received"	5.08 ng/L	4.67	109	(70%-130%)
Perfluoro-n-[2,3,4-13C3] butanoic aci	EPA 537 PFCs by LC-MS/MS "As Received"	5.04 ng/L	4.67	108	(70%-130%)
Sodium perfluoro-1-[1,2,3,4-13C4]oc	EPA 537 PFCs by LC-MS/MS "As Received"	4.60 ng/L	4.67	99	(70%-130%)

Notes:

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Certificate of Analysis

Report Date: October 9, 2018

Company :	Highland Dairy
Address :	650 Cr-O
	Clovis, New Mexico 88101
Contact:	Art Schaap
Project:	Dairy Farm testing

Client Sample ID:	W-1	Project:	HILD00118
Sample ID:	459957007	Client ID:	HILD001

Parameter	Qualifier	Result	DL	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method

Column headers are defined as follows:

DF: Dilution Factor	Lc/LC: Critical Level
DL: Detection Limit	PF: Prep Factor
MDA: Minimum Detectable Activity	RL: Reporting Limit
MDC: Minimum Detectable Concentration	SQL: Sample Quantitation Limit

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Certificate of Analysis

Report Date: October 9, 2018

Company : Highland Dairy
Address : 650 Cr-O

Clovis, New Mexico 88101
Contact: Art Schaap
Project: Dairy Farm testing

Client Sample ID: W-2
Sample ID: 459957008
Matrix: Ground Water
Collect Date: 21-SEP-18 15:15
Receive Date: 22-SEP-18
Collector: Client

Project: HILD00118
Client ID: HILD001

Parameter	Qualifier	Result	DL	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
LCMSMS PFCs												
EPA 537 PFCs by LC-MS/MS "As Received"												
Perfluorobutyric acid (PFBA)		171	0.601	1.82	ng/L	0.0182	1	GXC1	09/27/18	0739	1805951	1
Perfluorodecanesulfonate (PFDS)	U	ND	0.601	1.77	ng/L	0.0182	1					
Perfluorodecanoic acid (PFDA)	U	ND	0.601	1.82	ng/L	0.0182	1					
Perfluorododecanoic acid (PFDoA)	U	ND	0.601	1.82	ng/L	0.0182	1					
Perfluoroheptanoic acid (PFHpA)		172	0.601	1.82	ng/L	0.0182	1					
Perfluorononanoic acid (PFNA)		2.03	0.601	1.82	ng/L	0.0182	1					
Perfluorooctanesulfonamide (PFOSA)	J	0.966	0.601	1.69	ng/L	0.0182	1					
Perfluorotetradecanoic acid (PFTeDA)	U	ND	0.601	1.82	ng/L	0.0182	1					
Perfluorotridecanoic acid (PFTrDA)	U	ND	0.601	1.82	ng/L	0.0182	1					
Perfluoroundecanoic acid (PFUdA)	U	ND	0.601	1.82	ng/L	0.0182	1					
Perfluorobutanesulfonate (PFBS)		193	6.01	16.2	ng/L	0.0182	10	GXC1	09/27/18	0950	1805951	2
Perfluorohexanesulfonate (PFHxS)		1580	6.01	16.6	ng/L	0.0182	10					
Perfluorohexanoic acid (PFHxA)		737	6.01	18.2	ng/L	0.0182	10					
Perfluorooctanesulfonate (PFOS)		1040	6.01	18.2	ng/L	0.0182	10					
Perfluorooctanoic acid (PFOA)		494	6.01	18.2	ng/L	0.0182	10					
Perfluoropentanoic acid (PFPeA)		572	6.01	18.2	ng/L	0.0182	10					

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
EPA 537	PFCs Extraction in Drinking Water	NOR1	09/26/18	1015	1805949

The following Analytical Methods were performed:

Method	Description	Analyst Comments
1	EPA 537	
2	EPA 537	

Surrogate/Tracer Recovery	Test	Result	Nominal	Recovery%	Acceptable Limits
Perfluoro-n-[1,2-13C2] decanoic aci	EPA 537 PFCs by LC-MS/MS "As Received"	4.75 ng/L	4.55	104	(70%-130%)
Perfluoro-n-[1,2-13C2] octanoic acid	EPA 537 PFCs by LC-MS/MS "As Received"	5.87 ng/L	4.55	129	(70%-130%)
Perfluoro-n-[2,3,4-13C3] butanoic aci	EPA 537 PFCs by LC-MS/MS "As Received"	4.83 ng/L	4.55	106	(70%-130%)
Sodium perfluoro-1-[1,2,3,4-13C4]oc	EPA 537 PFCs by LC-MS/MS "As Received"	4.27 ng/L	4.55	94	(70%-130%)

Notes:

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Certificate of Analysis

Report Date: October 9, 2018

Company :	Highland Dairy
Address :	650 Cr-O
	Clovis, New Mexico 88101
Contact:	Art Schaap
Project:	Dairy Farm testing

Client Sample ID:	W-2	Project:	HILD00118
Sample ID:	459957008	Client ID:	HILD001

Parameter	Qualifier	Result	DL	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method

Column headers are defined as follows:

DF: Dilution Factor
DL: Detection Limit
MDA: Minimum Detectable Activity
MDC: Minimum Detectable Concentration
Lc/LC: Critical Level
PF: Prep Factor
RL: Reporting Limit
SQL: Sample Quantitation Limit

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Certificate of Analysis

Report Date: October 9, 2018

Company : Highland Dairy
Address : 650 Cr-O

Clovis, New Mexico 88101
Contact: Art Schaap
Project: Dairy Farm testing

Client Sample ID: W 1-2
Sample ID: 459957009
Matrix: Ground Water
Collect Date: 21-SEP-18 15:25
Receive Date: 22-SEP-18
Collector: Client

Project: HILD00118
Client ID: HILD001

Parameter	Qualifier	Result	DL	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
LCMSMS PFCs												
EPA 537 PFCs by LC-MS/MS "As Received"												
Perfluorobutanesulfonate (PFBS)		22.3	0.571	1.54	ng/L	0.0173	1	GXC1	09/27/18	0959	1805951	1
Perfluorobutyric acid (PFBA)		16.4	0.571	1.73	ng/L	0.0173	1					
Perfluorodecanesulfonate (PFDS)	U	ND	0.571	1.68	ng/L	0.0173	1					
Perfluorodecanoic acid (PFDA)	U	ND	0.571	1.73	ng/L	0.0173	1					
Perfluorododecanoic acid (PFDoA)	U	ND	0.571	1.73	ng/L	0.0173	1					
Perfluoroheptanoic acid (PFHpA)		10.0	0.571	1.73	ng/L	0.0173	1					
Perfluorohexanesulfonate (PFHxS)		79.4	0.571	1.57	ng/L	0.0173	1					
Perfluorohexanoic acid (PFHxA)		60.8	0.571	1.73	ng/L	0.0173	1					
Perfluorononanoic acid (PFNA)	U	ND	0.571	1.73	ng/L	0.0173	1					
Perfluorooctanesulfonamide (PFOSA)	U	ND	0.571	1.61	ng/L	0.0173	1					
Perfluorooctanesulfonate (PFOS)		19.4	0.571	1.73	ng/L	0.0173	1					
Perfluorooctanoic acid (PFOA)		31.3	0.571	1.73	ng/L	0.0173	1					
Perfluoropentanoic acid (PFPeA)		44.2	0.571	1.73	ng/L	0.0173	1					
Perfluorotetradecanoic acid (PFTeDA)	U	ND	0.571	1.73	ng/L	0.0173	1					
Perfluorotridecanoic acid (PFTrDA)	U	ND	0.571	1.73	ng/L	0.0173	1					
Perfluoroundecanoic acid (PFUdA)	U	ND	0.571	1.73	ng/L	0.0173	1					

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
EPA 537	PFCs Extraction in Drinking Water	NOR1	09/26/18	1015	1805949

The following Analytical Methods were performed:

Method	Description	Analyst Comments
1	EPA 537	

Surrogate/Tracer Recovery	Test	Result	Nominal	Recovery%	Acceptable Limits
Perfluoro-n-[1,2-13C2] decanoic aci	EPA 537 PFCs by LC-MS/MS "As Received"	4.16 ng/L	4.32	96	(70%-130%)
Perfluoro-n-[1,2-13C2] octanoic acid	EPA 537 PFCs by LC-MS/MS "As Received"	4.39 ng/L	4.32	102	(70%-130%)
Perfluoro-n-[2,3,4-13C3] butanoic aci	EPA 537 PFCs by LC-MS/MS "As Received"	4.79 ng/L	4.32	111	(70%-130%)
Sodium perfluoro-1-[1,2,3,4-13C4]oc	EPA 537 PFCs by LC-MS/MS "As Received"	4.48 ng/L	4.32	104	(70%-130%)

Notes:

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Report Date: October 9, 2018

Company :	Highland Dairy
Address :	650 Cr-O
	Clovis, New Mexico 88101
Contact:	Art Schaap
Project:	Dairy Farm testing

Client Sample ID:	W 1-2	Project:	HILD00118
Sample ID:	459957009	Client ID:	HILD001

Parameter	Qualifier	Result	DL	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method

Column headers are defined as follows:

DF: Dilution Factor
DL: Detection Limit
MDA: Minimum Detectable Activity
MDC: Minimum Detectable Concentration
Lc/LC: Critical Level
PF: Prep Factor
RL: Reporting Limit
SQL: Sample Quantitation Limit

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Certificate of Analysis

Report Date: October 9, 2018

Company : Highland Dairy
Address : 650 Cr-O

Clovis, New Mexico 88101
Contact: Art Schaap
Project: Dairy Farm testing

Client Sample ID: H-1
Sample ID: 459957010
Matrix: Ground Water
Collect Date: 21-SEP-18 15:35
Receive Date: 22-SEP-18
Collector: Client

Project: HILD00118
Client ID: HILD001

Parameter	Qualifier	Result	DL	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
LCMSMS PFCs												
EPA 537 PFCs by LC-MS/MS "As Received"												
Perfluorobutyric acid (PFBA)		107	0.594	1.80	ng/L	0.018	1	GXC1	09/27/18	0839	1805951	1
Perfluorodecanesulfonate (PFDS)	U	ND	0.594	1.75	ng/L	0.018	1					
Perfluorodecanoic acid (PFDA)	U	ND	0.594	1.80	ng/L	0.018	1					
Perfluorododecanoic acid (PFDoA)	U	ND	0.594	1.80	ng/L	0.018	1					
Perfluoroheptanoic acid (PFHpA)		103	0.594	1.80	ng/L	0.018	1					
Perfluorononanoic acid (PFNA)	J	1.07	0.594	1.80	ng/L	0.018	1					
Perfluorooctanesulfonamide (PFOSA)	U	ND	0.594	1.67	ng/L	0.018	1					
Perfluorotetradecanoic acid (PFTeDA)	U	ND	0.594	1.80	ng/L	0.018	1					
Perfluorotridecanoic acid (PFTrDA)	U	ND	0.594	1.80	ng/L	0.018	1					
Perfluoroundecanoic acid (PFUdA)	U	ND	0.594	1.80	ng/L	0.018	1					
Perfluorobutanesulfonate (PFBS)		127	5.94	16.0	ng/L	0.018	10	GXC1	10/04/18	1950	1805951	2
Perfluorohexanesulfonate (PFHxS)		872	5.94	16.4	ng/L	0.018	10					
Perfluorohexanoic acid (PFHxA)		369	5.94	18.0	ng/L	0.018	10					
Perfluorooctanesulfonate (PFOS)		424	5.94	18.0	ng/L	0.018	10					
Perfluorooctanoic acid (PFOA)		302	5.94	18.0	ng/L	0.018	10					
Perfluoropentanoic acid (PFPeA)		315	5.94	18.0	ng/L	0.018	10					

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
EPA 537	PFCs Extraction in Drinking Water	NOR1	09/26/18	1015	1805949

The following Analytical Methods were performed:

Method	Description	Analyst Comments
1	EPA 537	
2	EPA 537	

Surrogate/Tracer Recovery	Test	Result	Nominal	Recovery%	Acceptable Limits
Perfluoro-n-[1,2-13C2] decanoic aci	EPA 537 PFCs by LC-MS/MS "As Received"	4.63 ng/L	4.50	103	(70%-130%)
Perfluoro-n-[1,2-13C2] octanoic acid	EPA 537 PFCs by LC-MS/MS "As Received"	4.62 ng/L	4.50	103	(70%-130%)
Perfluoro-n-[2,3,4-13C3] butanoic aci	EPA 537 PFCs by LC-MS/MS "As Received"	5.14 ng/L	4.50	114	(70%-130%)
Sodium perfluoro-1-[1,2,3,4-13C4]oc	EPA 537 PFCs by LC-MS/MS "As Received"	4.12 ng/L	4.50	92	(70%-130%)

Notes:

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Certificate of Analysis

Report Date: October 9, 2018

Company :	Highland Dairy
Address :	650 Cr-O
	Clovis, New Mexico 88101
Contact:	Art Schaap
Project:	Dairy Farm testing

Client Sample ID:	H-1	Project:	HILD00118
Sample ID:	459957010	Client ID:	HILD001

Parameter	Qualifier	Result	DL	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method

Column headers are defined as follows:

DF: Dilution Factor
DL: Detection Limit
MDA: Minimum Detectable Activity
MDC: Minimum Detectable Concentration
Lc/LC: Critical Level
PF: Prep Factor
RL: Reporting Limit
SQL: Sample Quantitation Limit

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Certificate of Analysis

Report Date: October 9, 2018

Company : Highland Dairy
Address : 650 Cr-O

Clovis, New Mexico 88101
Contact: Art Schaap
Project: Dairy Farm testing

Client Sample ID: H-2
Sample ID: 459957011
Matrix: Ground Water
Collect Date: 21-SEP-18 15:45
Receive Date: 22-SEP-18
Collector: Client

Project: HILD00118
Client ID: HILD001

Parameter	Qualifier	Result	DL	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
LCMSMS PFCs												
EPA 537 PFCs by LC-MS/MS "As Received"												
Perfluorobutanesulfonate (PFBS)	J	0.802	0.590	1.59	ng/L	0.0179	1	GXC1	09/27/18	0805	1805951	1
Perfluorobutyric acid (PFBA)	J	0.772	0.590	1.79	ng/L	0.0179	1					
Perfluorodecanesulfonate (PFDS)	U	ND	0.590	1.73	ng/L	0.0179	1					
Perfluorodecanoic acid (PFDA)	U	ND	0.590	1.79	ng/L	0.0179	1					
Perfluorododecanoic acid (PFDoA)	U	ND	0.590	1.79	ng/L	0.0179	1					
Perfluoroheptanoic acid (PFHpA)	U	ND	0.590	1.79	ng/L	0.0179	1					
Perfluorohexanesulfonate (PFHxS)	J	1.39	0.590	1.63	ng/L	0.0179	1					
Perfluorohexanoic acid (PFHxA)		2.76	0.590	1.79	ng/L	0.0179	1					
Perfluorononanoic acid (PFNA)	U	ND	0.590	1.79	ng/L	0.0179	1					
Perfluorooctanesulfonamide (PFOSA)	U	ND	0.590	1.66	ng/L	0.0179	1					
Perfluorooctanesulfonate (PFOS)	U	ND	0.590	1.79	ng/L	0.0179	1					
Perfluorooctanoic acid (PFOA)	U	ND	0.590	1.79	ng/L	0.0179	1					
Perfluoropentanoic acid (PFPeA)		1.92	0.590	1.79	ng/L	0.0179	1					
Perfluorotetradecanoic acid (PFTeDA)	U	ND	0.590	1.79	ng/L	0.0179	1					
Perfluorotridecanoic acid (PFTrDA)	U	ND	0.590	1.79	ng/L	0.0179	1					
Perfluoroundecanoic acid (PFUdA)	U	ND	0.590	1.79	ng/L	0.0179	1					

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
EPA 537	PFCs Extraction in Drinking Water	NOR1	09/26/18	1015	1805949

The following Analytical Methods were performed:

Method	Description	Analyst Comments
1	EPA 537	

Surrogate/Tracer Recovery	Test	Result	Nominal	Recovery%	Acceptable Limits
Perfluoro-n-[1,2-13C2] decanoic aci	EPA 537 PFCs by LC-MS/MS "As Received"	4.61 ng/L	4.47	103	(70%-130%)
Perfluoro-n-[1,2-13C2] octanoic acid	EPA 537 PFCs by LC-MS/MS "As Received"	3.98 ng/L	4.47	89	(70%-130%)
Perfluoro-n-[2,3,4-13C3] butanoic aci	EPA 537 PFCs by LC-MS/MS "As Received"	4.65 ng/L	4.47	104	(70%-130%)
Sodium perfluoro-1-[1,2,3,4-13C4]oc	EPA 537 PFCs by LC-MS/MS "As Received"	4.18 ng/L	4.47	94	(70%-130%)

Notes:

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Certificate of Analysis

Report Date: October 9, 2018

Company :	Highland Dairy
Address :	650 Cr-O
	Clovis, New Mexico 88101
Contact:	Art Schaap
Project:	Dairy Farm testing

Client Sample ID:	H-2	Project:	HILD00118
Sample ID:	459957011	Client ID:	HILD001

Parameter	Qualifier	Result	DL	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method

Column headers are defined as follows:

DF: Dilution Factor	Lc/LC: Critical Level
DL: Detection Limit	PF: Prep Factor
MDA: Minimum Detectable Activity	RL: Reporting Limit
MDC: Minimum Detectable Concentration	SQL: Sample Quantitation Limit

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Certificate of Analysis

Report Date: October 9, 2018

Company : Highland Dairy
Address : 650 Cr-O

Clovis, New Mexico 88101
Contact: Art Schaap
Project: Dairy Farm testing

Client Sample ID: H-3
Sample ID: 459957013
Matrix: Ground Water
Collect Date: 21-SEP-18 16:00
Receive Date: 22-SEP-18
Collector: Client

Project: HILD00118
Client ID: HILD001

Parameter	Qualifier	Result	DL	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
LCMSMS PFCs												
EPA 537 PFCs by LC-MS/MS "As Received"												
Perfluorobutanesulfonate (PFBS)		15.4	0.585	1.58	ng/L	0.0177	1	GXC1	09/27/18	0814	1805951	1
Perfluorobutyric acid (PFBA)		9.41	0.585	1.77	ng/L	0.0177	1					
Perfluorodecanesulfonate (PFDS)	U	ND	0.585	1.72	ng/L	0.0177	1					
Perfluorodecanoic acid (PFDA)	U	ND	0.585	1.77	ng/L	0.0177	1					
Perfluorododecanoic acid (PFDoA)	U	ND	0.585	1.77	ng/L	0.0177	1					
Perfluoroheptanoic acid (PFHpA)	J	1.32	0.585	1.77	ng/L	0.0177	1					
Perfluorohexanesulfonate (PFHxS)		22.3	0.585	1.61	ng/L	0.0177	1					
Perfluorohexanoic acid (PFHxA)		26.7	0.585	1.77	ng/L	0.0177	1					
Perfluorononanoic acid (PFNA)	U	ND	0.585	1.77	ng/L	0.0177	1					
Perfluorooctanesulfonamide (PFOSA)	U	ND	0.585	1.65	ng/L	0.0177	1					
Perfluorooctanesulfonate (PFOS)	J	0.955	0.585	1.77	ng/L	0.0177	1					
Perfluorooctanoic acid (PFOA)	J	1.32	0.585	1.77	ng/L	0.0177	1					
Perfluoropentanoic acid (PFPeA)		20.6	0.585	1.77	ng/L	0.0177	1					
Perfluorotetradecanoic acid (PFTeDA)	U	ND	0.585	1.77	ng/L	0.0177	1					
Perfluorotridecanoic acid (PFTrDA)	U	ND	0.585	1.77	ng/L	0.0177	1					
Perfluoroundecanoic acid (PFUdA)	U	ND	0.585	1.77	ng/L	0.0177	1					

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
EPA 537	PFCs Extraction in Drinking Water	NOR1	09/26/18	1015	1805949

The following Analytical Methods were performed:

Method	Description	Analyst Comments
1	EPA 537	

Surrogate/Tracer Recovery	Test	Result	Nominal	Recovery%	Acceptable Limits
Perfluoro-n-[1,2-13C2] decanoic aci	EPA 537 PFCs by LC-MS/MS "As Received"	4.67 ng/L	4.43	105	(70%-130%)
Perfluoro-n-[1,2-13C2] octanoic acid	EPA 537 PFCs by LC-MS/MS "As Received"	4.63 ng/L	4.43	105	(70%-130%)
Perfluoro-n-[2,3,4-13C3] butanoic aci	EPA 537 PFCs by LC-MS/MS "As Received"	4.76 ng/L	4.43	107	(70%-130%)
Sodium perfluoro-1-[1,2,3,4-13C4]oc	EPA 537 PFCs by LC-MS/MS "As Received"	4.57 ng/L	4.43	103	(70%-130%)

Notes:

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Certificate of Analysis

Report Date: October 9, 2018

Company :	Highland Dairy
Address :	650 Cr-O
	Clovis, New Mexico 88101
Contact:	Art Schaap
Project:	Dairy Farm testing

Client Sample ID:	H-3	Project:	HILD00118
Sample ID:	459957013	Client ID:	HILD001

Parameter	Qualifier	Result	DL	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method

Column headers are defined as follows:

DF: Dilution Factor
DL: Detection Limit
MDA: Minimum Detectable Activity
MDC: Minimum Detectable Concentration
Lc/LC: Critical Level
PF: Prep Factor
RL: Reporting Limit
SQL: Sample Quantitation Limit

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Report Date: October 9, 2018

Company : Highland Dairy
Address : 650 Cr-O

Clovis, New Mexico 88101
Contact: Art Schaap
Project: Dairy Farm testing

Client Sample ID: W-3
Sample ID: 459957015
Matrix: Ground Water
Collect Date: 21-SEP-18 16:30
Receive Date: 22-SEP-18
Collector: Client

Project: HILD00118
Client ID: HILD001

Parameter	Qualifier	Result	DL	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
LCMSMS PFCs												
EPA 537 PFCs by LC-MS/MS "As Received"												
Perfluorobutanesulfonate (PFBS)	U	ND	0.598	1.61	ng/L	0.0181	1	GXC1	09/27/18	0822	1805951	1
Perfluorobutyric acid (PFBA)	U	ND	0.598	1.81	ng/L	0.0181	1					
Perfluorodecanesulfonate (PFDS)	U	ND	0.598	1.76	ng/L	0.0181	1					
Perfluorodecanoic acid (PFDA)	U	ND	0.598	1.81	ng/L	0.0181	1					
Perfluorododecanoic acid (PFDoA)	U	ND	0.598	1.81	ng/L	0.0181	1					
Perfluoroheptanoic acid (PFHpA)	U	ND	0.598	1.81	ng/L	0.0181	1					
Perfluorohexanesulfonate (PFHxS)	U	ND	0.598	1.65	ng/L	0.0181	1					
Perfluorohexanoic acid (PFHxA)	U	ND	0.598	1.81	ng/L	0.0181	1					
Perfluorononanoic acid (PFNA)	U	ND	0.598	1.81	ng/L	0.0181	1					
Perfluorooctanesulfonamide (PFOSA)	U	ND	0.598	1.69	ng/L	0.0181	1					
Perfluorooctanesulfonate (PFOS)	U	ND	0.598	1.81	ng/L	0.0181	1					
Perfluorooctanoic acid (PFOA)	U	ND	0.598	1.81	ng/L	0.0181	1					
Perfluoropentanoic acid (PFPeA)	U	ND	0.598	1.81	ng/L	0.0181	1					
Perfluorotetradecanoic acid (PFTeDA)	U	ND	0.598	1.81	ng/L	0.0181	1					
Perfluorotridecanoic acid (PFTrDA)	U	ND	0.598	1.81	ng/L	0.0181	1					
Perfluoroundecanoic acid (PFUdA)	U	ND	0.598	1.81	ng/L	0.0181	1					

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
EPA 537	PFCs Extraction in Drinking Water	NOR1	09/26/18	1015	1805949

The following Analytical Methods were performed:

Method	Description	Analyst Comments
1	EPA 537	

Surrogate/Tracer Recovery	Test	Result	Nominal	Recovery%	Acceptable Limits
Perfluoro-n-[1,2-13C2] decanoic aci	EPA 537 PFCs by LC-MS/MS "As Received"	4.36 ng/L	4.53	96	(70%-130%)
Perfluoro-n-[1,2-13C2] octanoic acid	EPA 537 PFCs by LC-MS/MS "As Received"	3.93 ng/L	4.53	87	(70%-130%)
Perfluoro-n-[2,3,4-13C3] butanoic aci	EPA 537 PFCs by LC-MS/MS "As Received"	4.76 ng/L	4.53	105	(70%-130%)
Sodium perfluoro-1-[1,2,3,4-13C4]oc	EPA 537 PFCs by LC-MS/MS "As Received"	4.19 ng/L	4.53	92	(70%-130%)

Notes:

GEL LABORATORIES LLC
2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Report Date: October 9, 2018

Company :	Highland Dairy
Address :	650 Cr-O
	Clovis, New Mexico 88101
Contact:	Art Schaap
Project:	Dairy Farm testing

Client Sample ID:	W-3	Project:	HILD00118
Sample ID:	459957015	Client ID:	HILD001

Parameter	Qualifier	Result	DL	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method

Column headers are defined as follows:

DF: Dilution Factor
DL: Detection Limit
MDA: Minimum Detectable Activity
MDC: Minimum Detectable Concentration
Lc/LC: Critical Level
PF: Prep Factor
RL: Reporting Limit
SQL: Sample Quantitation Limit

QC Summary

Report Date: October 9, 2018

Highland Dairy
650 Cr-O
Clovis, New Mexico

Contact: **Art Schaap**

Workorder: **459957**

Parmname	NOM		Sample	Qual	QC	Units	RPD%		REC%	Range	Anlst	Date Time
Carbon Analysis												
Batch 1805070												
QC1204119419 459923001 DUP												
Total Organic Carbon Average		J	0.622	J	0.621	mg/L	0.161	^		(+/-1.00)	TSM	09/25/18 19:09
QC1204119418 LCS												
Total Organic Carbon Average	10.0				9.59	mg/L			95.9	(80%-120%)		09/25/18 18:39
QC1204119417 MB												
Total Organic Carbon Average				U	ND	mg/L						09/25/18 18:29
QC1204119420 459923001 PS												
Total Organic Carbon Average	10.0	J	0.622		10.9	mg/L			102	(65%-120%)		09/25/18 19:29
Ion Chromatography												
Batch 1804797												
QC1204118739 459957001 DUP												
Chloride			880		888	mg/L	0.882			(0%-20%)	JXH5	09/24/18 13:58
Nitrate-N			3.30		3.36	mg/L	1.98			(0%-20%)		09/23/18 11:05
Sulfate			84.5		83.7	mg/L	0.946			(0%-20%)		
QC1204118738 LCS												
Chloride	5.00				4.73	mg/L			94.7	(90%-110%)		09/23/18 06:06
Nitrate-N	2.50				2.41	mg/L			96.3	(90%-110%)		
Sulfate	10.0				9.86	mg/L			98.6	(90%-110%)		
QC1204118737 MB												
Chloride				U	ND	mg/L						09/23/18 05:36

QC Summary

Workorder: **459957**

Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date Time
Ion Chromatography										
Batch 1804797										
Nitrate-N			U	ND	mg/L				JXH5	09/23/18 05:36
Sulfate			U	ND	mg/L					
QC1204118740 459957001 PS										
Chloride	5.00	4.40		9.80	mg/L		108	(90%-110%)		09/24/18 14:28
Nitrate-N	2.50	0.659		3.04	mg/L		95.1	(90%-110%)		09/23/18 11:35
Sulfate	10.0	16.9		27.5	mg/L		106	(90%-110%)		
Metals Analysis - ICPMS										
Batch 1805110										
QC1204119503 459957001 DUP										
Arsenic	J	4.78		5.11	ug/L	6.53 ^		(+/-5.00)	BAJ	09/27/18 17:22
QC1204119502 LCS										
Arsenic	50.0			48.0	ug/L		96	(85%-115%)		09/27/18 17:16
QC1204119501 MB										
Arsenic			U	ND	ug/L					09/27/18 17:13
QC1204119504 459957001 MS										
Arsenic	50.0 J	4.78		55.9	ug/L		102	(75%-125%)		09/27/18 17:25
QC1204119505 459957001 SDILT										
Arsenic	J	4.78	U	ND	ug/L	N/A		(0%-10%)		09/27/18 17:28
Perfluorinated Compounds										
Batch 1805458										
QC1204120197 LCS										
Perfluorooctanesulfonate (PFOS)	19.9			23.9	ng/L		120	(70%-130%)	GXC1	09/25/18 17:18
Perfluorooctanoic acid (PFOA)	19.9			25.5	ng/L		129	(70%-130%)		

QC Summary

Workorder: **459957**

Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date Time
Perfluorinated Compounds										
Batch 1805458										
QC1204120196 MB										
Perfluorooctanesulfonate (PFOS)			U	ND	ng/L				GXC1	09/25/18 17:10
Perfluorooctanoic acid (PFOA)			U	ND	ng/L					
QC1204120198 459957002 MS										
Perfluorooctanesulfonate (PFOS)	199	675		753	ng/L		39*	(70%-130%)		09/26/18 12:51
Perfluorooctanoic acid (PFOA)	199	21.0		237	ng/L		108	(70%-130%)		09/25/18 17:36
QC1204120199 459957002 MSD										
Perfluorooctanesulfonate (PFOS)	199	675		705	ng/L	7	15*	(0%-30%)		09/26/18 12:59
Perfluorooctanoic acid (PFOA)	199	21.0		218	ng/L	8	99	(0%-30%)		09/25/18 17:44
Batch 1805951										
QC1204121183 LCS										
Perfluorobutanesulfonate (PFBS)	17.5			17.8	ng/L		102	(70%-130%)	GXC1	09/27/18 06:22
Perfluorobutyric acid (PFBA)	19.8			19.9	ng/L		101	(70%-130%)		
Perfluorodecanesulfonate (PFDS)	19.1			16.1	ng/L		85	(70%-130%)		
Perfluorodecanoic acid (PFDA)	19.8			19.0	ng/L		96	(70%-130%)		
Perfluorododecanoic acid (PFDoA)	19.8			15.8	ng/L		80	(70%-130%)		
Perfluoroheptanoic acid (PFHpA)	19.8			19.9	ng/L		101	(70%-130%)		
Perfluorohexanesulfonate (PFHxS)	18.0			20.8	ng/L		115	(70%-130%)		
Perfluorohexanoic acid (PFHxA)	19.8			22.3	ng/L		113	(70%-130%)		

QC Summary

Workorder: 459957

Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date Time
Perfluorinated Compounds										
Batch 1805951										
Perfluorononanoic acid (PFNA)	19.8			18.6	ng/L		94	(70%-130%)	GXC1	09/27/18 06:22
Perfluorooctanesulfonamide (PFOSA)	19.8			16.9	ng/L		85	(70%-130%)		
Perfluorooctanesulfonate (PFOS)	19.8			19.4	ng/L		98	(70%-130%)		
Perfluorooctanoic acid (PFOA)	19.8			21.7	ng/L		110	(70%-130%)		
Perfluoropentanoic acid (PFPeA)	19.8			19.5	ng/L		99	(70%-130%)		
Perfluorotetradecanoic acid (PFTeDA)	19.8			17.3	ng/L		88	(70%-130%)		
Perfluorotridecanoic acid (PFTrDA)	19.8			18.4	ng/L		93	(70%-130%)		
Perfluoroundecanoic acid (PFUdA)	19.8			18.5	ng/L		94	(70%-130%)		
**Perfluoro-n-[1,2-13C2] decanoic acid	4.94			5.05	ng/L		102	(70%-130%)		
**Perfluoro-n-[1,2-13C2] octanoic acid	4.94			5.03	ng/L		102	(70%-130%)		
**Perfluoro-n-[2,3,4-13C3] butanoic acid	4.94			5.50	ng/L		111	(70%-130%)		
**Sodium perfluoro-1-[1,2,3,4-13C4]octanesulfonate	4.94			4.60	ng/L		93	(70%-130%)		
QC1204121184 LCSD										
Perfluorobutanesulfonate (PFBS)	17.5			19.4	ng/L	9	111	(0%-30%)		09/27/18 06:31
Perfluorobutyric acid (PFBA)	19.8			21.8	ng/L	9	110	(0%-30%)		
Perfluorodecanesulfonate (PFDS)	19.1			18.9	ng/L	16	99	(0%-30%)		

QC Summary

Workorder: **459957**

Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
Perfluorinated Compounds											
Batch 1805951											
Perfluorodecanoic acid (PFDA)	19.8			18.4	ng/L	3	93	(0%-30%)	GXC1	09/27/18	06:31
Perfluorododecanoic acid (PFDoA)	19.8			18.0	ng/L	13	91	(0%-30%)			
Perfluoroheptanoic acid (PFHpA)	19.8			21.2	ng/L	6	107	(0%-30%)			
Perfluorohexanesulfonate (PFHxS)	18.0			18.3	ng/L	13	102	(0%-30%)			
Perfluorohexanoic acid (PFHxA)	19.8			19.5	ng/L	13	99	(0%-30%)			
Perfluorononanoic acid (PFNA)	19.8			20.2	ng/L	8	102	(0%-30%)			
Perfluorooctanesulfonamide (PFOSA)	19.8			18.9	ng/L	11	95	(0%-30%)			
Perfluorooctanesulfonate (PFOS)	19.8			21.3	ng/L	9	108	(0%-30%)			
Perfluorooctanoic acid (PFOA)	19.8			22.6	ng/L	4	115	(0%-30%)			
Perfluoropentanoic acid (PFPeA)	19.8			21.9	ng/L	12	111	(0%-30%)			
Perfluorotetradecanoic acid (PFTeDA)	19.8			17.8	ng/L	3	90	(0%-30%)			
Perfluorotridecanoic acid (PFTrDA)	19.8			20.8	ng/L	13	105	(0%-30%)			
Perfluoroundecanoic acid (PFUdA)	19.8			18.4	ng/L	1	93	(0%-30%)			
**Perfluoro-n-[1,2-13C2] decanoic acid	4.94			5.00	ng/L		101	(70%-130%)			
**Perfluoro-n-[1,2-13C2] octanoic acid	4.94			4.97	ng/L		101	(70%-130%)			

QC Summary

Workorder: **459957**

Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
Perfluorinated Compounds											
Batch 1805951											
**Perfluoro-n-[2,3,4-13C3] butanoic acid	4.94			5.40	ng/L		109	(70%-130%)	GXC1	09/27/18	06:31
**Sodium perfluoro-1-[1,2,3,4-13C4]octanesulfonate	4.94			4.96	ng/L		100	(70%-130%)			
QC1204121182 MB											
Perfluorobutanesulfonate (PFBS)			U	ND	ng/L					09/27/18	06:14
Perfluorobutyric acid (PFBA)			U	ND	ng/L						
Perfluorodecanesulfonate (PFDS)			U	ND	ng/L						
Perfluorodecanoic acid (PFDA)			U	ND	ng/L						
Perfluorododecanoic acid (PFDoA)			U	ND	ng/L						
Perfluoroheptanoic acid (PFHpA)			U	ND	ng/L						
Perfluorohexanesulfonate (PFHxS)			U	ND	ng/L						
Perfluorohexanoic acid (PFHxA)			U	ND	ng/L						
Perfluorononanoic acid (PFNA)			U	ND	ng/L						
Perfluorooctanesulfonamide (PFOSA)			U	ND	ng/L						
Perfluorooctanesulfonate (PFOS)			U	ND	ng/L						
Perfluorooctanoic acid (PFOA)			U	ND	ng/L						
Perfluoropentanoic acid (PFPeA)			U	ND	ng/L						

QC Summary

Workorder: **459957**

Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date Time
Perfluorinated Compounds										
Batch 1805951										
Perfluorotetradecanoic acid (PFTeDA)			U	ND	ng/L				GXC1	09/27/18 06:14
Perfluorotridecanoic acid (PFTrDA)			U	ND	ng/L					
Perfluoroundecanoic acid (PFUdA)			U	ND	ng/L					
**Perfluoro-n-[1,2-13C2] decanoic acid	4.93			4.91	ng/L		100	(70%-130%)		
**Perfluoro-n-[1,2-13C2] octanoic acid	4.93			4.68	ng/L		95	(70%-130%)		
**Perfluoro-n-[2,3,4-13C3] butanoic acid	4.93			5.41	ng/L		110	(70%-130%)		
**Sodium perfluoro-1-[1,2,3,4-13C4]octanesulfonate	4.93			4.46	ng/L		90	(70%-130%)		
Titration and Ion Analysis										
Batch 1805228										
QC1204119790 459858002 DUP										
Bicarbonate alkalinity (CaCO3)		298		295	mg/L	1.02		(0%-20%)	RXB5	09/25/18 16:26
QC1204119787 LCS										
Alkalinity, Total as CaCO3	100			107	mg/L		107	(90%-110%)		09/25/18 15:53

Notes:

The Qualifiers in this report are defined as follows:

- ** Analyte is a surrogate compound
- < Result is less than value reported
- > Result is greater than value reported
- A The TIC is a suspected aldol-condensation product
- B The target analyte was detected in the associated blank.
- C Analyte has been confirmed by GC/MS analysis
- D Results are reported from a diluted aliquot of the sample
- E %difference of sample and SD is >10%. Sample concentration must meet flagging criteria
- E Concentration of the target analyte exceeds the instrument calibration range

QC Summary

Workorder: **459957**

Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time

E	General Chemistry--Concentration of the target analyte exceeds the instrument calibration range
FB	Mercury was found present at quantifiable concentrations in field blanks received with these samples. Data associated with the blank are deemed invalid for reporting to regulatory agencies
H	Analytical holding time was exceeded
J	Value is estimated
JNX	Non Calibrated Compound
N	Metals--The Matrix spike sample recovery is not within specified control limits
N	Organics--Presumptive evidence based on mass spectral library search to make a tentative identification of the analyte (TIC). Quantitation is based on nearest internal standard response factor
N	Presumptive evidence based on mass spectral library search to make a tentative identification of the analyte (TIC). Quantitation is based on nearest internal standard response factor
N/A	RPD or %Recovery limits do not apply.
N1	See case narrative
ND	Analyte concentration is not detected above the detection limit
NJ	Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier
P	Organics--The concentrations between the primary and confirmation columns/detectors is >40% different. For HPLC, the difference is >70%.
Q	One or more quality control criteria have not been met. Refer to the applicable narrative or DER.
R	Per section 9.3.4.1 of Method 1664 Revision B, due to matrix spike recovery issues, this result may not be reported or used for regulatory compliance purposes.
R	Sample results are rejected
U	Analyte was analyzed for, but not detected above the MDL, MDA, MDC or LOD.
UJ	Compound cannot be extracted
X	Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier
Y	Other specific qualifiers were required to properly define the results. Consult case narrative.
Y	QC Samples were not spiked with this compound
Z	Paint Filter Test--Particulates passed through the filter, however no free liquids were observed.
^	RPD of sample and duplicate evaluated using +/-RL. Concentrations are <5X the RL. Qualifier Not Applicable for Radiochemistry.
d	5-day BOD--The 2:1 depletion requirement was not met for this sample
e	5-day BOD--Test replicates show more than 30% difference between high and low values. The data is qualified per the method and can be used for reporting purposes
h	Preparation or preservation holding time was exceeded

N/A indicates that spike recovery limits do not apply when sample concentration exceeds spike conc. by a factor of 4 or more or %RPD not applicable.
^ The Relative Percent Difference (RPD) obtained from the sample duplicate (DUP) is evaluated against the acceptance criteria when the sample is greater than five times (5X) the contract required detection limit (RL). In cases where either the sample or duplicate value is less than 5X the RL, a control limit of +/- the RL is used to evaluate the DUP result.
* Indicates that a Quality Control parameter was not within specifications.
For PS, PSD, and SDILT results, the values listed are the measured amounts, not final concentrations.

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless qualified on the QC Summary.

Page: 1 of 1
Project # 174212
GEL Quote #: 18-1070
QC Number [1]:
PO Number:

GEL Laboratories LLC
Chemistry | Radiochemistry | Radiobioassay | Specialty Analytics

459957

Chain of Custody and Analytical Request

GEL Work Order Number:

GEL Project Manager:

GEL Laboratories, LLC
2040 Savage Road
Charleston, SC 29407
Phone: (843) 556-8171
Fax: (843) 766-1178

Client Name: Highland dairy
Phone # 575-760 6645
Project/Site Name:
Fax #
Address: 650 Curry RD D Clovis NM 8810
Collected By: B. Zublemen
Send Results To: BZubleman@Gmail.com ART.Schaap@Icloud.com

Sample ID (* For composites - indicate start and stop date/time)	*Date Collected (mm-dd-yy)	*Time Collected (Military) (hhmm)	QC Code [2]	Field Filtered [3]	Sample Matrix [4]	Radioactive (Please supply isotopic info.)	(7) Known or possible hazards	Total number of containers	PFAS	TOC	Sc / Rb / Mn / Tl / Th	Arsenic	Comments
D1 (Dairy Supply Well	9/21/18	1400	N	N	GW			5	X	✓	✓	✓	Estimate 1600 ppt
milk TANK 1	9/21/18	1415	N	N	TANK			2	X				
milk TANK 2	9/21/18	1420	N	N	TANK			2	X				
Trip Blank	9/21/18	1430	N	N	B			1	X				Blank
W-5	9/21/18	1440	N	N	GW			2	X				
W-4	9/21/18	1450	N	N	GW			2	X				
W-3 W-1	9/21/18	1500	N	N	GW			2	X				
W-2	9/21/18	1515	N	N	GW			2	X				
W 1-2	9/21/18	1525	N	N	GW			2	X				
H-1	9/21/18	1535	N	N	GW			2	X				600 PPT

Sample Analysis Requested [5] (Fill in the number of containers for each test)

<-- Preservative Type (6)

Chain of Custody Signatures

	Relinquished By (Signed)	Date	Time	Received by (signed)	Date	Time
1		9-21-18		1	9/22/18	10:00
2				2		
3				3		

TAT Requested: Normal: ✓ Rush: ____ Specify: ____ (Subject to Surcharge)

Fax Results: [ ] Yes [X] No

Select Deliverable: [X] C of A [X] QC Summary [ ] level 1 [ ] Level 2 [ ] Level 3 [ ] Level 4

Additional Remarks:

For Lab Receiving Use Only: *Custody Seal Intact?* [ ] *Yes* [ ] *No* *Cooler Temp:* ____ °C

> *For sample shipping and delivery details, see Sample Receipt & Review form (SRR.)*

Sample Collection Time Zone: [ ] Eastern [ ] Pacific [ ] Central [X] Mountain [ ] Other: ____

1.) Chain of Custody Number = Client Determined

2.) QC Codes: N = Normal Sample, TB = Trip Blank, FD = Field Duplicate, EB = Equipment Blank, MS = Matrix Spike Sample, MSD = Matrix Spike Duplicate Sample, G = Grab, C = Composite

3.) Field Filtered: For liquid matrices, indicate with a - Y - for yes the sample was field filtered or - N - for sample was not field filtered.

4.) Matrix Codes: DW=Drinking Water, GW=Groundwater, SW=Surface Water, WW=Waste Water, W=Water, ML=Misc Liquid, SO=Soil, SD=Sediment, SL=Sludge, SS=Solid Waste, O=Oil, F=Filter, P=Wipe, U=Urine, F=Fecal, N=Nasal

5.) Sample Analysis Requested: Analytical method requested (i.e. **8260B, 6010B/7470A**) and number of containers provided for each (i.e. *8260B* - 3, *6010B/7470A* - 1).

6.) Preservative Type: HA = Hydrochloric Acid, NI = Nitric Acid, SH = Sodium Hydroxide, SA = Sulfuric Acid, AA = Ascorbic Acid, HX = Hexane, ST = Sodium Thiosulfate, If no preservative is added = leave field blank

7.) *Are there any known or possible hazards associated with these samples?*

RCRA Metals
As = Arsenic Hg= Mercury
Ba = Barium Se= Selenium
Cd = Cadmium Ag= Silver
Cr = Chromium MR= Miscellaneous
Pb = Lead RCRA metals

Characteristic Hazards
FL = Flammable/Ignitable
CO = Corrosive
RE = Reactive

TSCA Regulated
PCB = Polychlorinated biphenyls

Listed Waste
LW= Listed Waste
(F,K,P and U-listed wastes.)
Waste code(s):

Other
OT= Other / Unknown
(i.e.: High/low pH, asbestos, beryllium, irritants, other misc. health hazards, etc.)
Description:

Please provide any additional details below regarding handling and/or disposal concerns. (i.e.: Origin of sample(s), type of site collected from, odd matrices, etc.)

Page: 1 of 2
Project # 17 4212
GEL Quote #: 18-10-70
QC Number [1]:
PO Number:

GEL Laboratories LLC
Chemistry | Radiochemistry | Radiobioassay | Specialty Analytics

Chain of Custody and Analytical Request

GEL Work Order Number:
GEL Project Manager:

GEL Laboratories, LLC
2040 Savage Road
Charleston, SC 29407
Phone: (843) 556-8171
Fax: (843) 766-1178

Client Name: Phone #
Project/Site Name: Fax #
Address:
Collected By: Send Results To:

Sample Analysis Requested [5] (Fill in the number of containers for each test)

Sample ID * For composites - indicate start and stop date/time	*Date Collected (mm-dd-yy)	*Time Collected (Military) (hhmm)	QC Code [2]	Field Filtered [3]	Sample Matrix [4]	Should this sample be considered: Radioactive (Please supply isotopic info.)	Should this sample be considered: (7) Known or possible hazards	Total number of containers	P-HS	<-- Preservative Type (6)	Comments
H-2	9-21-18	1545	W	N	GW			2	2		Note: extra sample is required for sample specific QC
H-2	9-21-18	1545	W	N	GW			2	2		
H-3	9-21-18	1600	W	N	GW			2	2		
H-3	9-21-18	1600	W	N	GW			2	2		
~~W-3~~ W-3	9/21-18	1630	W	N	GW			2	2		
~~W-3~~ W-3	9/21/18	1630	W	N	GW			2	2		

Chain of Custody Signatures

	Relinquished By (Signed)	Date	Time	Received by (signed)	Date	Time
1	[signature]	9-21-18		[signature]	9/22/18	1000
2						
3						

TAT Requested: Normal: ✓ Rush: ____ Specify: ____ (Subject to Surcharge)

Fax Results: [ ] Yes [✓] No

Select Deliverable: [✓] C of A [ ] QC Summary [ ] level 1 [ ] Level 2 [ ] Level 3 [ ] Level 4

Additional Remarks:

For Lab Receiving Use Only: *Custody Seal Intact?* [ ] *Yes* [ ] *No* *Cooler Temp:* ____ °C

> *For sample shipping and delivery details, see Sample Receipt & Review form (SRR.)*

Sample Collection Time Zone: [ ] Eastern [ ] Pacific [ ] Central [✓] Mountain [ ] Other: ____

1.) Chain of Custody Number = Client Determined

2.) QC Codes: **N** = Normal Sample, **TB** = Trip Blank, **FD** = Field Duplicate, **EB** = Equipment Blank, **MS** = Matrix Spike Sample, **MSD** = Matrix Spike Duplicate Sample, **G** = Grab, **C** = Composite

3.) Field Filtered: For liquid matrices, indicate with a - **Y** - for yes the sample was field filtered or - **N** - for sample was not field filtered.

4.) Matrix Codes: **DW**=Drinking Water, **GW**=Groundwater, **SW**=Surface Water, **WW**=Waste Water, **W**=Water, **ML**=Misc Liquid, **SO**=Soil, **SD**=Sediment, **SL**=Sludge, **SS**=Solid Waste, **O**=Oil, **F**=Filter, **P**=Wipe, **U**=Urine, **F**=Fecal, **N**=Nasal

5.) Sample Analysis Requested: Analytical method requested (i.e. **8260B, 6010B/7470A**) and number of containers provided for each (i.e. *8260B* - **3**, *6010B/7470A* - **1**).

6.) Preservative Type: **HA** = Hydrochloric Acid, **NI** = Nitric Acid, **SH** = Sodium Hydroxide, **SA** = Sulfuric Acid, **AA** = Ascorbic Acid, **HX** = Hexane, **ST** = Sodium Thiosulfate, If no preservative is added = leave field blank

7.) *Are there any known or possible hazards associated with these samples?*

RCRA Metals
As = Arsenic Hg= Mercury
Ba = Barium Se= Selenium
Cd = Cadmium Ag= Silver
Cr = Chromium MR= Miscellaneous
Pb = Lead RCRA metals

Characteristic Hazards
FL = Flammable/Ignitable
CO = Corrosive
RE = Reactive

TSCA Regulated
PCB = Polychlorinated biphenyls

Listed Waste
LW= Listed Waste
(F,K,P and U-listed wastes.)
Waste code(s):

Other
OT= Other / Unknown
(i.e.: High/low pH, asbestos, beryllium, irritants, other misc. health hazards, etc.)
Description:

Please provide any additional details below regarding handling and/or disposal concerns. (i.e.: Origin of sample(s), type of site collected from, odd matrices, etc.)

GEL Laboratories LLC

SAMPLE RECEIPT & REVIEW FORM

Client: HILD	**SDG/AR/COC/Work Order:** 459957
Received By: STACY BOONE	**Date Received:** 9-22-18 BL
Carrier and Tracking Number	Circle Applicable: FedEx Express FedEx Ground UPS Field Services Courier Other 7828 8808 3429

Suspected Hazard Information	Yes	No	
Shipped as a DOT Hazardous?		✓	Hazard Class Shipped: UN#:
COC/Samples marked or classified as radioactive?		✓	Maximum Net Counts Observed* (Observed Counts - Area Background Counts): 0 CPM / mR/Hr Classified as: Rad 1 Rad 2 Rad 3
Is package, COC, and/or Samples marked HAZ?		✓	If yes, select Hazards below, and contact the GEL Safety Group. PCB's Flammable Foreign Soil RCRA Asbestos Beryllium Other:

*If Net Counts > 100cpm on samples not marked "radioactive", contact the Radiation Safety Group for further investigation.

	Sample Receipt Criteria	Yes	NA	No	Comments/Qualifiers (Required for Non-Conforming Items)
1	Shipping containers received intact and sealed?	✓			Circle Applicable: Seals broken Damaged container Leaking container Other (describe)
2	Chain of custody documents included with shipment?	✓			
3	Samples requiring cold preservation within (0 ≤ 6 deg. C)?*	✓			Preservation Method: Wet Ice Ice Packs Dry ice None Other: *all temperatures are recorded in Celsius TEMP: 4 °C
4	Daily check performed and passed on IR temperature gun?	✓			Temperature Device Serial #: IR3-17 Secondary Temperature Device Serial # (If Applicable):
5	Sample containers intact and sealed?	✓			Circle Applicable: Seals broken Damaged container Leaking container Other (describe)
6	Samples requiring chemical preservation at proper pH?	✓			Sample ID's and Containers Affected: If Preservation added, Lot#:
7	Do any samples require Volatile Analysis?			✓	If Yes, Are Encores or Soil Kits present? Yes___ No___ (If yes, take to VOA Freezer) Do VOA vials contain acid preservation? Yes No___ N/A (If unknown, select No) VOA vials free of headspace? Yes___ No___ N/A___ Sample ID's and containers affected:
8	Samples received within holding time?	✓			ID's and tests affected:
9	Sample ID's on COC match ID's on bottles?	✓			Sample ID's and containers affected:
10	Date & time on COC match date & time on bottles?	✓			Sample ID's affected:
11	Number of containers received match number indicated on COC?	✓			Sample ID's affected:
12	Are sample containers identifiable as GEL provided?	✓			
13	COC form is properly signed in relinquished/received sections?	✓			

Comments (Use Continuation Form if needed):

PM (or PMA) review: Initials BL Date 9/25/18 Page 1 of 1

GL-CHL-SR-001 Rev 5

List of current GEL Certifications as of 09 October 2018

State	Certification
Alaska	17−018
Arkansas	88−0651
CLIA	42D0904046
California	2940
Colorado	SC00012
Connecticut	PH−0169
DoD ELAP/ ISO17025 A2LA	2567.01
Florida NELAP	E87156
Foreign Soils Permit	P330−15−00283, P330−15−00253
Georgia	SC00012
Georgia SDWA	967
Hawaii	SC00012
Idaho Chemistry	SC00012
Idaho Radiochemistry	SC00012
Illinois NELAP	200029
Indiana	C−SC−01
Kansas NELAP	E−10332
Kentucky SDWA	90129
Kentucky Wastewater	90129
Louisiana NELAP	03046 (AI33904)
Louisiana SDWA	LA180011
Maryland	270
Massachusetts	M−SC012
Michigan	9976
Mississippi	SC00012
Nebraska	NE−OS−26−13
Nevada	SC000122018−1
New Hampshire NELAP	205415
New Jersey NELAP	SC002
New Mexico	SC00012
New York NELAP	11501
North Carolina	233
North Carolina SDWA	45709
North Dakota	R−158
Oklahoma	9904
Pennsylvania NELAP	68−00485
Puerto Rico	SC00012
S. Carolina Radiochem	10120002
South Carolina Chemistry	10120001
Tennessee	TN 02934
Texas NELAP	T104704235−18−13
Utah NELAP	SC000122018−27
Vermont	VT87156
Virginia NELAP	460202
Washington	C780

Technical Case Narrative
Highland Dairy (HILD)
SDG #: 459957

LCMSMS-Misc

Product: **The Extraction and Analysis of Per and Polyfluroalkyl Substances Using LCMSMS**
Analytical Method: EPA 537 Mod, PFAS by LCMSMS Compliant with QSM 5.1
Analytical Procedure: GL-OA-E-076 REV# 6
Analytical Batches: 1805458 and 1805456

The following samples were analyzed using the above methods and analytical procedure(s).

GEL Sample ID#	Client Sample Identification
459957002	Milk Tank 1
459957003	Milk Tank 2
1204120196	Method Blank (MB)
1204120197	Laboratory Control Sample (LCS)
1204120198	459957002(Milk Tank 1) Matrix Spike (MS)
1204120199	459957002(Milk Tank 1) Matrix Spike Duplicate (MSD)

The samples in this SDG were analyzed on an "as received" basis.

Data Summary:

All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable, with the following exceptions.

Quality Control (QC) Information

Matrix Spike (MS) Recovery Statement
One or more of the required spiking analytes were not within the acceptance limits in the matrix spike (MS)and/or matrix spike duplicate(MSD). The parent sample, matrix spike (MS) and matrix spike duplicate (MSD) were diluted. The recoveries may not fall within the acceptance range.

Sample	Analyte	Value
1204120198 (Milk Tank 1MS)	Perfluorooctanesulfonate (PFOS)	39* (70%-130%)
1204120199 (Milk Tank 1MSD)	Perfluorooctanesulfonate (PFOS)	15* (70%-130%)

Technical Information

Sample Dilutions
The following samples were diluted to bring the over range concentrations within the calibration range. 1204120198 (Milk Tank 1MS), 1204120199 (Milk Tank 1MSD), 459957002 (Milk Tank 1) and 459957003 (Milk Tank 2).

Analyte	459957	
	002	003
Perfluorooctanesulfonate (PFOS)	5X	5X

Product: **The Extraction and Analysis of Per and Polyfluroalkyl Substances Using LCMSMS**
Analytical Method: EPA 537
Analytical Procedure: GL-OA-E-076 REV# 6
Analytical Batches: 1805951 and 1805949

The following samples were analyzed using the above methods and analytical procedure(s).

GEL Sample ID#	Client Sample Identification
459957001	D1 (Dairy Supply Well)
459957004	Trip Blank
459957005	W-5
459957006	W-4
459957007	W-1
459957008	W-2
459957009	W 1-2
459957010	H-1
459957011	H-2
459957013	H-3
459957015	W-3
1204121182	Method Blank (MB)
1204121183	Laboratory Control Sample (LCS)
1204121184	Laboratory Control Sample Duplicate (LCSD)

The samples in this SDG were analyzed on an "as received" basis.

Data Summary:

All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable, with the following exceptions.

Quality Control (QC) Information

Surrogate Recoveries
Not all surrogate recoveries were within acceptable limits for the following samples and/or QC. The samples were diluted to bring over ranged targets within the calibration range. As a result, the surrogates were diluted below recoverable levels.

Sample	Analyte	Value
459957005 (W-5)	Perfluoro-n-[1, 2-13C2] octanoic acid	177* (70%-130%)
	Sodium perfluoro-1-[1, 2, 3, 4-13C4]octanesulfonate	66* (70%-130%)

For the following sample, the surrogates, 13C4 PFOS and 13C2 PFOA, were outside of the acceptance criteria due to matrix interference. 459957005 (W-5).

Technical Information

Sample Dilutions
The following samples were diluted to bring the over range concentrations within the calibration range. 459957001 (D1 (Dairy Supply Well)), 459957005 (W-5), 459957006 (W-4), 459957008 (W-2) and 459957010

(H-1).

Analyte	459957				
	001	005	006	008	010
Perfluorobutanesulfonate (PFBS)	50X	100X	10X	10X	10X
Perfluorobutyric acid (PFBA)	1X	100X	10X	1X	1X
Perfluoroheptanoic acid (PFHpA)	1X	100X	10X	1X	1X
Perfluorohexanesulfonate (PFHxS)	50X	100X	10X	10X	10X
Perfluorohexanoic acid (PFHxA)	50X	100X	10X	10X	10X
Perfluorononanoic acid (PFNA)	1X	100X	1X	1X	1X
Perfluorooctanesulfonate (PFOS)	50X	100X	10X	10X	10X
Perfluorooctanoic acid (PFOA)	50X	100X	10X	10X	10X
Perfluoropentanoic acid (PFPeA)	50X	100X	10X	10X	10X

Miscellaneous Information

Additional Comments
There was no additional sample volume for matrix QC.

Metals

Product: Determination of Metals by ICP-MS
Analytical Method: EPA 200.8
Analytical Procedure: GL-MA-E-014 REV# 33
Analytical Batch: 1805110

Preparation Method: EPA 200.2
Preparation Procedure: GL-MA-E-016 REV# 18
Preparation Batch: 1805109

The following samples were analyzed using the above methods and analytical procedure(s).

GEL Sample ID#	Client Sample Identification
459957001	D1 (Dairy Supply Well)
1204119501	Method Blank (MB)**ICP-MS**
1204119502	Laboratory Control Sample (LCS)
1204119505	459957001(D1 (Dairy Supply Well)L) Serial Dilution (SD)
1204119503	459957001(D1 (Dairy Supply Well)D) Sample Duplicate (DUP)
1204119504	459957001(D1 (Dairy Supply Well)S) Matrix Spike (MS)

The samples in this SDG were analyzed on an "as received" basis.

Data Summary:

All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable, with the following exceptions.

Calibration Information

ICSA/ICSAB Statement
For the ICP-MS analysis, the ICSA solution contains analyte concentrations which are verified trace impurities indigenous to the purchased standard.

General Chemistry

Product: **Carbon, Total Organic**
Analytical Method: SM 5310 B
Analytical Procedure: GL-GC-E-093 REV# 15
Analytical Batch: 1805070

The following samples were analyzed using the above methods and analytical procedure(s).

GEL Sample ID#	Client Sample Identification
459957001	D1 (Dairy Supply Well)
1204119417	Method Blank (MB)
1204119418	Laboratory Control Sample (LCS)
1204119419	459923001(NonSDG) Sample Duplicate (DUP)
1204119420	459923001(NonSDG) Post Spike (PS)

The samples in this SDG were analyzed on an "as received" basis.

Data Summary:

There are no exceptions, anomalies or deviations from the specified methods. All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable.

Product: **Ion Chromatography**
Analytical Method: EPA 300.0
Analytical Procedure: GL-GC-E-086 REV# 25
Analytical Batch: 1804797

The following samples were analyzed using the above methods and analytical procedure(s).

GEL Sample ID#	Client Sample Identification
459957001	D1 (Dairy Supply Well)
1204118737	Method Blank (MB)
1204118738	Laboratory Control Sample (LCS)
1204118739	459957001(D1 (Dairy Supply Well)) Sample Duplicate (DUP)
1204118740	459957001(D1 (Dairy Supply Well)) Post Spike (PS)

The samples in this SDG were analyzed on an "as received" basis.

Data Summary:

All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable, with the following exceptions.

Technical Information

Sample Dilutions
The following samples 1204118739 (D1 (Dairy Supply Well)DUP), 1204118740 (D1 (Dairy Supply Well)PS) and 459957001 (D1 (Dairy Supply Well)) were diluted because target analyte concentrations exceeded the calibration range. The following samples 1204118739 (D1 (Dairy Supply Well)DUP), 1204118740 (D1 (Dairy Supply Well)PS) and 459957001 (D1 (Dairy Supply Well)) in this sample group were diluted due to matrix interference. Dilutions may be required for many reasons, including to minimize matrix interferences or to bring over range target analyte concentrations into the linear calibration range.

Analyte	459957 001
Chloride	200X
Nitrate	5X
Sulfate	5X

Product: **Alkalinity**
Analytical Method: SM 2320B
Analytical Procedure: GL-GC-E-033 REV# 13
Analytical Batch: 1805228

The following samples were analyzed using the above methods and analytical procedure(s).

GEL Sample ID#	Client Sample Identification
459957001	D1 (Dairy Supply Well)
1204119787	Laboratory Control Sample (LCS)
1204119790	459858002(NonSDG) Sample Duplicate (DUP)

The samples in this SDG were analyzed on an "as received" basis.

Data Summary:

There are no exceptions, anomalies or deviations from the specified methods. All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable.

Certification Statement

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless otherwise noted in the analytical case narrative.

Sample ID: Highland Dairy

PFAS Isotope Dilution Method

Client Data

Name: Hall Environmental Analytical Laboratory
Project:
Location: 2103981-005A
Matrix: Aqueous
Date Collected: 16-Mar-21 14:11

Laboratory Data

Lab Sample: 2103222-05
Date Received: 23-Mar-21 12:02
Column: BEH C18

Analyte	CAS Number	Conc. (ng/L)	RL	Qualifiers	Batch	Extracted	Samp Size	Analyzed	Dilution
PFBA	375-22-4	528	1.99		B1C0203	26-Mar-21	0.251 L	02-Apr-21 03:44	1
PFPeA	2706-90-3	1720	1.99		B1C0203	26-Mar-21	0.251 L	02-Apr-21 03:44	1
PFBS	375-73-5	400	1.99		B1C0203	26-Mar-21	0.251 L	02-Apr-21 03:44	1
4:2 FTS	757124-72-4	79.5	1.99		B1C0203	26-Mar-21	0.251 L	02-Apr-21 03:44	1
PFHxA	307-24-4	2200	9.96	D	B1C0203	26-Mar-21	0.251 L	03-Apr-21 01:58	5
PFPeS	2706-91-4	567	1.99		B1C0203	26-Mar-21	0.251 L	02-Apr-21 03:44	1
PFHpA	375-85-9	837	1.99		B1C0203	26-Mar-21	0.251 L	02-Apr-21 03:44	1
PFHxS	355-46-4	5630	9.96	D	B1C0203	26-Mar-21	0.251 L	03-Apr-21 01:58	5
6:2 FTS	27619-97-2	4400	9.96	D	B1C0203	26-Mar-21	0.251 L	03-Apr-21 01:58	5
PFOA	335-67-1	2710	9.96	D	B1C0203	26-Mar-21	0.251 L	03-Apr-21 01:58	5
PFHpS	375-92-8	673	1.99		B1C0203	26-Mar-21	0.251 L	02-Apr-21 03:44	1
PFNA	375-95-1	22.8	1.99		B1C0203	26-Mar-21	0.251 L	02-Apr-21 03:44	1
PFOSA	754-91-6	90.4	1.99		B1C0203	26-Mar-21	0.251 L	02-Apr-21 03:44	1
PFOS	1763-23-1	8990	9.96	D	B1C0203	26-Mar-21	0.251 L	03-Apr-21 01:58	5
PFDA	335-76-2	ND	1.99		B1C0203	26-Mar-21	0.251 L	02-Apr-21 03:44	1
8:2 FTS	39108-34-4	10.4	1.99		B1C0203	26-Mar-21	0.251 L	02-Apr-21 03:44	1
PFNS	68259-12-1	ND	1.99		B1C0203	26-Mar-21	0.251 L	02-Apr-21 03:44	1
MeFOSAA	2355-31-9	ND	1.99		B1C0203	26-Mar-21	0.251 L	02-Apr-21 03:44	1
EtFOSAA	2991-50-6	ND	1.99		B1C0203	26-Mar-21	0.251 L	02-Apr-21 03:44	1
PFUnA	2058-94-8	ND	1.99		B1C0203	26-Mar-21	0.251 L	02-Apr-21 03:44	1
PFDS	335-77-3	ND	1.99		B1C0203	26-Mar-21	0.251 L	02-Apr-21 03:44	1
PFDoA	307-55-1	ND	1.99		B1C0203	26-Mar-21	0.251 L	02-Apr-21 03:44	1
PFTrDA	72629-94-8	ND	1.99		B1C0203	26-Mar-21	0.251 L	02-Apr-21 03:44	1
PFTeDA	376-06-7	ND	1.99		B1C0203	26-Mar-21	0.251 L	02-Apr-21 03:44	1

Labeled Standards	Type	% Recovery	Limits	Qualifiers	Batch	Extracted	Samp Size	Analyzed	Dilution
13C3-PFBA	IS	97.2	25 - 150		B1C0203	26-Mar-21	0.251 L	02-Apr-21 03:44	1
13C3-PFPeA	IS	77.3	25 - 150		B1C0203	26-Mar-21	0.251 L	02-Apr-21 03:44	1
13C3-PFBS	IS	82.6	25 - 150		B1C0203	26-Mar-21	0.251 L	02-Apr-21 03:44	1
13C2-4:2 FTS	IS	82.8	25 - 150		B1C0203	26-Mar-21	0.251 L	02-Apr-21 03:44	1
13C2-PFHxA	IS	79.5	25 - 150	D	B1C0203	26-Mar-21	0.251 L	03-Apr-21 01:58	5
13C4-PFHpA	IS	80.3	25 - 150		B1C0203	26-Mar-21	0.251 L	02-Apr-21 03:44	1
13C3-PFHxS	IS	66.0	25 - 150	D	B1C0203	26-Mar-21	0.251 L	03-Apr-21 01:58	5
13C2-6:2 FTS	IS	73.0	25 - 150	D	B1C0203	26-Mar-21	0.251 L	03-Apr-21 01:58	5
13C5-PFNA	IS	85.1	25 - 150		B1C0203	26-Mar-21	0.251 L	02-Apr-21 03:44	1
13C8-PFOSA	IS	54.8	10 - 150		B1C0203	26-Mar-21	0.251 L	02-Apr-21 03:44	1
13C2-PFOA	IS	83.0	25 - 150	D	B1C0203	26-Mar-21	0.251 L	03-Apr-21 01:58	5
13C8-PFOS	IS	68.0	25 - 150	D	B1C0203	26-Mar-21	0.251 L	03-Apr-21 01:58	5
13C2-PFDA	IS	84.5	25 - 150		B1C0203	26-Mar-21	0.251 L	02-Apr-21 03:44	1

Sample ID: Highland Dairy — **PFAS Isotope Dilution Method**

Client Data				Laboratory Data			
Name:	Hall Environmental Analytical Laboratory	Matrix:	Aqueous	Lab Sample:	2103222-05	Column:	BEH C18
Project:		Date Collected:	16-Mar-21 14:11	Date Received:	23-Mar-21 12:02		
Location:	2103981-005A						

Labeled Standards	Type	% Recovery	Limits	Qualifiers	Batch	Extracted	Samp Size	Analyzed	Dilution
13C2-8:2 FTS	IS	86.6	25 - 150		B1C0203	26-Mar-21	0.251 L	02-Apr-21 03:44	1
d3-MeFOSAA	IS	84.0	25 - 150		B1C0203	26-Mar-21	0.251 L	02-Apr-21 03:44	1
13C2-PFUnA	IS	85.9	25 - 150		B1C0203	26-Mar-21	0.251 L	02-Apr-21 03:44	1
d5-EtFOSAA	IS	83.3	25 - 150		B1C0203	26-Mar-21	0.251 L	02-Apr-21 03:44	1
13C2-PFDoA	IS	83.3	25 - 150		B1C0203	26-Mar-21	0.251 L	02-Apr-21 03:44	1
13C2-PFTeDA	IS	75.0	20 - 150		B1C0203	26-Mar-21	0.251 L	02-Apr-21 03:44	1

RL - Reporting limit

Results reported to RL.

When reported, PFHxS, PFOA, PFOS, MeFOSAA and EtFOSAA include both linear and branched isomers. Only the linear isomer is reported for all other analytes.

Sample ID: Highland Dairy — **PFAS Isotope Dilution Method**

Client Data

Name: Hall Environmental Analytical Laboratory
Project: 2106267
Location: 2106267-002A
Matrix: Aqueous
Date Collected: 02-Jun-21 09:30

Laboratory Data

Lab Sample: 2106052-02
Date Received: 08-Jun-21 09:28
Column: BEH C18

Analyte	CAS Number	Conc. (ng/L)	RL	Qualifiers	Batch	Extracted	Samp Size	Analyzed	Dilution
PFBA	375-22-4	524	1.97		B1F0065	19-Jun-21	0.254 L	23-Jun-21 04:03	1
PFPeA	2706-90-3	1900	1.97		B1F0065	19-Jun-21	0.254 L	23-Jun-21 04:03	1
PFBS	375-73-5	397	1.97		B1F0065	19-Jun-21	0.254 L	23-Jun-21 04:03	1
4:2 FTS	757124-72-4	59.2	1.97		B1F0065	19-Jun-21	0.254 L	23-Jun-21 04:03	1
PFHxA	307-24-4	2220	19.7	D	B1F0065	19-Jun-21	0.254 L	24-Jun-21 08:07	10
PFPeS	2706-91-4	469	1.97		B1F0065	19-Jun-21	0.254 L	23-Jun-21 04:03	1
PFHpA	375-85-9	792	1.97		B1F0065	19-Jun-21	0.254 L	23-Jun-21 04:03	1
PFHxS	355-46-4	6420	19.7	D	B1F0065	19-Jun-21	0.254 L	24-Jun-21 08:07	10
6:2 FTS	27619-97-2	4580	19.7	D	B1F0065	19-Jun-21	0.254 L	24-Jun-21 08:07	10
PFOA	335-67-1	3300	19.7	D	B1F0065	19-Jun-21	0.254 L	24-Jun-21 08:07	10
PFHpS	375-92-8	676	2.46		B1F0065	19-Jun-21	0.254 L	23-Jun-21 04:03	1
PFNA	375-95-1	22.3	1.97		B1F0065	19-Jun-21	0.254 L	23-Jun-21 04:03	1
PFOSA	754-91-6	81.3	1.97	Q	B1F0065	19-Jun-21	0.254 L	23-Jun-21 04:03	1
PFOS	1763-23-1	15500	19.7	D	B1F0065	19-Jun-21	0.254 L	24-Jun-21 08:07	10
PFDA	335-76-2	ND	1.97		B1F0065	19-Jun-21	0.254 L	23-Jun-21 04:03	1
8:2 FTS	39108-34-4	16.9	2.22		B1F0065	19-Jun-21	0.254 L	23-Jun-21 04:03	1
PFNS	68259-12-1	ND	1.97		B1F0065	19-Jun-21	0.254 L	23-Jun-21 04:03	1
MeFOSAA	2355-31-9	ND	1.97		B1F0065	19-Jun-21	0.254 L	23-Jun-21 04:03	1
EtFOSAA	2991-50-6	ND	2.59		B1F0065	19-Jun-21	0.254 L	23-Jun-21 04:03	1
PFUnA	2058-94-8	ND	1.97		B1F0065	19-Jun-21	0.254 L	23-Jun-21 04:03	1
PFDS	335-77-3	ND	2.71		B1F0065	19-Jun-21	0.254 L	23-Jun-21 04:03	1
PFDoA	307-55-1	ND	1.97		B1F0065	19-Jun-21	0.254 L	23-Jun-21 04:03	1
PFTrDA	72629-94-8	ND	1.97		B1F0065	19-Jun-21	0.254 L	23-Jun-21 04:03	1
PFTeDA	376-06-7	ND	1.97		B1F0065	19-Jun-21	0.254 L	23-Jun-21 04:03	1

Labeled Standards	Type	% Recovery	Limits	Qualifiers	Batch	Extracted	Samp Size	Analyzed	Dilution
13C3-PFBA	IS	136	25 - 150		B1F0065	19-Jun-21	0.254 L	23-Jun-21 04:03	1
13C3-PFPeA	IS	86.4	25 - 150		B1F0065	19-Jun-21	0.254 L	23-Jun-21 04:03	1
13C3-PFBS	IS	91.3	25 - 150		B1F0065	19-Jun-21	0.254 L	23-Jun-21 04:03	1
13C2-4:2 FTS	IS	86.7	25 - 150		B1F0065	19-Jun-21	0.254 L	23-Jun-21 04:03	1
13C2-PFHxA	IS	93.0	25 - 150	D	B1F0065	19-Jun-21	0.254 L	24-Jun-21 08:07	10
13C4-PFHpA	IS	69.1	25 - 150		B1F0065	19-Jun-21	0.254 L	23-Jun-21 04:03	1
13C3-PFHxS	IS	91.0	25 - 150	D	B1F0065	19-Jun-21	0.254 L	24-Jun-21 08:07	10
13C2-6:2 FTS	IS	84.2	25 - 150	D	B1F0065	19-Jun-21	0.254 L	24-Jun-21 08:07	10
13C5-PFNA	IS	73.1	25 - 150		B1F0065	19-Jun-21	0.254 L	23-Jun-21 04:03	1
13C8-PFOSA	IS	57.8	10 - 150		B1F0065	19-Jun-21	0.254 L	23-Jun-21 04:03	1
13C2-PFOA	IS	91.0	25 - 150	D	B1F0065	19-Jun-21	0.254 L	24-Jun-21 08:07	10
13C8-PFOS	IS	52.0	25 - 150	D	B1F0065	19-Jun-21	0.254 L	24-Jun-21 08:07	10

Sample ID: Highland Dairy — **PFAS Isotope Dilution Method**

Client Data				Laboratory Data			
Name:	Hall Environmental Analytical Laboratory	Matrix:	Aqueous	Lab Sample:	2106052-02	Column:	BEH C18
Project:	2106267	Date Collected:	02-Jun-21 09:30	Date Received:	08-Jun-21 09:28		
Location:	2106267-002A						

Labeled Standards	Type	% Recovery	Limits	Qualifiers	Batch	Extracted	Samp Size	Analyzed	Dilution
13C2-PFDA	IS	71.7	25 - 150		B1F0065	19-Jun-21	0.254 L	23-Jun-21 04:03	1
13C2-8:2 FTS	IS	70.6	25 - 150		B1F0065	19-Jun-21	0.254 L	23-Jun-21 04:03	1
d3-MeFOSAA	IS	69.7	25 - 150		B1F0065	19-Jun-21	0.254 L	23-Jun-21 04:03	1
13C2-PFUnA	IS	72.3	25 - 150		B1F0065	19-Jun-21	0.254 L	23-Jun-21 04:03	1
d5-EtFOSAA	IS	73.9	25 - 150		B1F0065	19-Jun-21	0.254 L	23-Jun-21 04:03	1
13C2-PFDoA	IS	62.5	25 - 150		B1F0065	19-Jun-21	0.254 L	23-Jun-21 04:03	1
13C2-PFTeDA	IS	61.1	20 - 150		B1F0065	19-Jun-21	0.254 L	23-Jun-21 04:03	1

RL - Reporting limit

Results reported to RL.

When reported, PFHxS, PFOA, PFOS, MeFOSAA and EtFOSAA include both linear and branched isomers. Only the linear isomer is reported for all other analytes.

Appendix H

Laboratory Report for Cannon AFB Wastewater Sampling

DBS&A
Daniel B. Stephens & Associates, Inc.

TO: AFCEC PFOS/PFOA Team

FROM: EA Engineering, Science, & Technology, Inc., PBC under contract with U.S. Army Corps of Engineers, Omaha District

DATE: 6 November 2019

SUBJECT: Wastewater Treatment Plant Sampling & Analytical Results (Task 03A) Cannon Air Force Base, New Mexico

This technical memorandum (TM) presents the analytical results for per- and polyfluoroalkyl substances (PFAS) sampling completed at the wastewater treatment plant (WWTP) at Cannon Air Force Base, New Mexico on August 29, 2019; analyzed compounds include but are not limited to perfluorooctane sulfonate (PFOS), perfluorooctanoic acid (PFOA), and perfluorobutane sulfonate (PFBS). The sampling and analysis were completed under Task 03A, Quarterly Groundwater Sampling as part of the PFAS Mitigation at 31 Air Force Installations project. The following tables, figures, and attachments are included in this TM:

Table 1	Sample Analytical and Quality Control Requirements
Table 2	Summary of Analytical Results
Figure 1	Site Map
Attachment A	Field Documentation
Attachment B	Analytical Laboratory Report
Attachment C	Data Validation Report

Sampling

Influent and effluent samples were collected at the Cannon Air Force Base WWTP on August 29, 2019 (Figure 1). An influent sample, effluent sample, duplicate effluent sample, and field blank sample were collected. Samples were collected from the influent stream and effluent stream with a high-density polyethylene dipper that was rinsed with and emptied into the stream of influent/effluent three times before drawing a sample. Wastewater was poured from the dipper into the sample containers. A field blank was collected by pouring PFAS-free water provided by SGS North America, Inc. (SGS) into sample containers.

Sample containers were provided by SGS. Container size, type, sample preservative, analytical method, and holding time are specified in Table 1. All samples were labeled, then immediately cooled to ≤10°C with ice and shipped under chain-of-custody to SGS in Orlando, Florida.

Field sampling protocol outlined in the WWTP Sampling Plan (EA 2019) were followed except that samples were collected using a dipper rather than from a sampling port or tap. Field documentation is provided in Attachment A.

Analytical Results

In accordance with the approved sampling plan (EA 2019), analysis was completed for a total of 18 PFAS compounds by LC/MS/MS (Liquid Chromatography with tandem mass spectrometry) compliant with the Department of Defense Quality Systems Manual Table B-15. Nine PFAS compounds were detected in the effluent sample and duplicate (CANON-WWTP-EFL-082919 and CANON-WWTP-EFL-082919-D, respectively). Seven PFAS compounds were detected in the influent sample (CANON-WWTP-INF-082919). No PFAS compounds were detected in the field blank.

Of the 18 compounds analyzed in the samples, PFOS, PFOA, and PFBS have Federal screening levels. The USEPA has established a lifetime health advisory (LHA) limit of 70 nanograms per liter (ng/L) which is applicable to PFOA and PFOS individually, or in combination if both chemicals are present in concentrations above the reporting limit. PFOS was reported at concentrations less than one-half the LHA in the effluent and influent samples, with reported concentrations ranging from an estimated 7.85 ng/L to 14.2 ng/L. PFOA was reported below one-half the LHA in the primary and duplicate effluent samples at estimated concentrations of 4.67 ng/L and 4.4 ng/L, respectively; PFOA was not detected in the influent sample. Combined concentrations of PFOA and PFOS did not exceed the LHA or one-half the LHA in any samples. PFBS was reported in the influent and effluent samples at concentrations below the USEPA Tap Water Regional Screening Level for PFBS of 400,000 ng/L. Concentrations of PFBS ranged from 13.3 ng/L in the influent sample to 43.1 ng/L in the effluent duplicate sample.

Results of the influent and effluent samples are summarized in Table 2. The laboratory analytical report and data validation report are presented as Attachment B and Attachment C, respectively.

References

EA Engineering, Science, and Technology, Inc., PBC (EA). 2019. Wastewater Treatment Plant Sampling Plan. Cannon Air Force Base, New Mexico. August 26.

Table 1: Sample Analytical and Quality Control Requirements

Target Analytes	Matrix	Analytical Method	Sample Container	Preservative	Holding Time
PFAS	Water	LC/MS/MS (Liquid Chromatography with tandem mass spectrometry) compliant with DoD QSM Table B-15	2 x 125 mL HDPE	Cool to ≤10°C	28 days

NOTES:
DoD = Department of Defense
HDPE = High-density polyethylene
PFAS = Per- and polyfluoroalkyl substances
QSM = Quality Systems Manual
USEPA = U.S. Environmental Protection Agency
°C = Degrees Celsius
≤ = Less than or equal to
mL = Milliliter

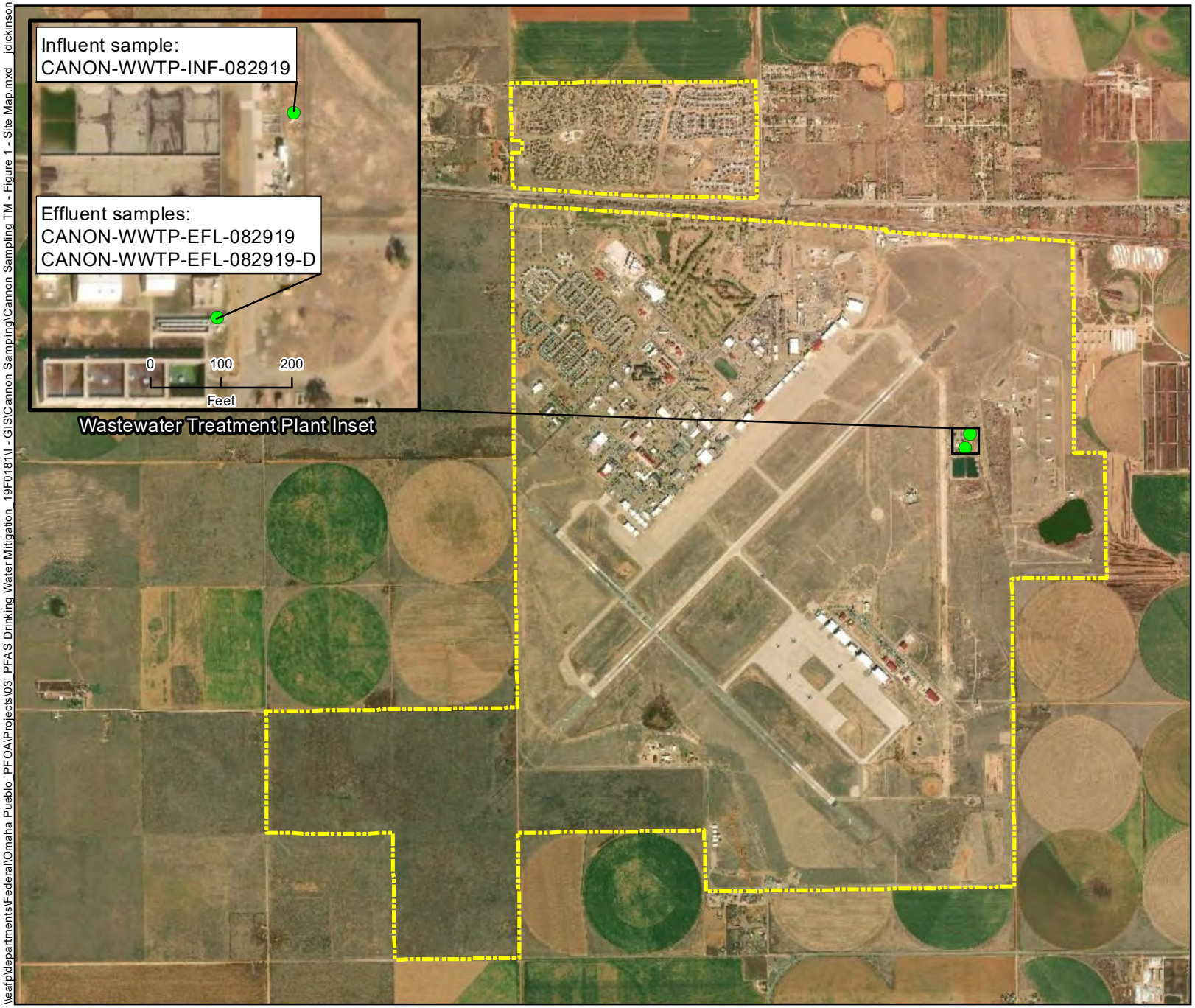
Table 2: Summary of Analytical Results

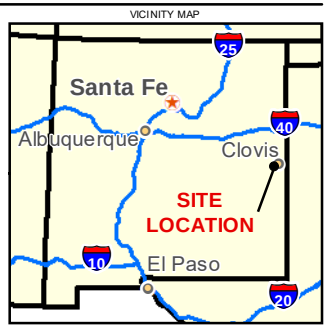
				Location ID	WWTP-EFF CANON-WWTP-EFL-082919	WWTP-EFF CANON-WWTP-EFL-082919-D	WWTP-INF CANON-WWTP-INF-082919
				Sample Name			
				Sample Date	8/29/2019	8/29/2019	8/29/2019
				Parent Sample		CANON-WWTP-EFL	
Analyte	**Unit**	**USEPA Lifetime Health Advisory Level [1]**	**1/2 USEPA Lifetime Health Advisory Level [1]**	**USEPA Regional Screening Level[2]**			
PFAS[3]							
8:2 Fluorotelomersulfonate	ng/L	NS	NS	NS	< 8.3 U	< 8.3 U	< 83 U
Perfluorobutanesulfonic Acid (PFBS)	ng/L	NS	NS	400,000	33.6	43.1	13.3
Perfluorobutanoic Acid	ng/L	NS	NS	NS	22.6	21.6	8.4 J
Perfluorodecanesulfonic Acid	ng/L	NS	NS	NS	< 4.2 U	< 4.2 U	< 4.2 U
Perfluorodecanoic Acid	ng/L	NS	NS	NS	< 4.2 U	< 4.2 U	< 42 U
Perfluorododecanoic Acid	ng/L	NS	NS	NS	< 4.2 U	< 4.2 U	< 42 U
Perfluoroheptanoic Acid	ng/L	NS	NS	NS	19.5	18.6	< 4.2 U
Perfluorohexanesulfonic Acid (PFHXS)	ng/L	NS	NS	NS	7.11 J	7.12 J	67.8
Perfluorohexanoic Acid	ng/L	NS	NS	NS	70.1	67.2	12.3
Perfluorononanoic Acid	ng/L	NS	NS	NS	< 4.2 U	< 4.2 U	< 4.2 U
Perfluorooctanesulfonic Acid (PFOS)	ng/L	70	35	NS	14.2	12.9	7.85 J
Perfluorooctanoic Acid (PFOA)	ng/L	70	35	NS	4.67 J	4.4 J	< 4.2 U
Perfluoropentanoic Acid	ng/L	NS	NS	NS	146	138	15.1
Perfluorotetradecanoic Acid	ng/L	NS	NS	NS	< 4.2 U	< 4.2 U	< 42 U
Perfluorotridecanoic Acid	ng/L	NS	NS	NS	< 4.2 U	< 4.2 U	< 42 U
Perfluoroundecanoic Acid	ng/L	NS	NS	NS	< 4.2 U	< 4.2 U	< 42 U
PFOSA	ng/L	NS	NS	NS	< 4.2 U	< 4.2 U	< 4.2 U
6:2 Fluorotelomer sulfonate	ng/L	NS	NS	NS	102	99.8	12.2 J

Notes:
J = Estimated value
ng/L = Nanogram(s) per liter
NS = No applicable screening criteria available
U = Not detected at the limit of detection.
USEPA = United States Environmental Protection Agency

[1] The 70 ng/l advisory level is applicable to PFOA and PFOS individually, or in combination if both chemicals are present in concentrations above the reporting limit.

[2] Regional Screening Level (May 2019) as presented at EPA website at http://www.epa.gov/region6/6pd/rcra_c/pd-n/screen.htm (target hazard quotient of 1.0).
[3] Analyzed by LC/MS/MS (Liquid Chromatography with tandem mass spectrometry) compliant with Department of Defense Quality Systems Manual Table B-15.





Legend

Cannon AFB Installation Boundary

Sample Location

Map Date: 11/5/2019
Source: ESRI Aerial 2016

N

0 1,500 3,000
Feet

Figure 1
Site Map
Cannon Air Force Base
Curry County, New Mexico

\\eafpydepartments\Federal\Omaha Pueblo_PFOA\Projects\03_PFAS Drinking Water Mitigation_19F0181\I - GIS\Cannon Sampling\Cannon Sampling TM - Figure 1 - Site Map.mxd jdickinson

Attachment A:
Field Documentation

Attachment 1 to SOP AFW-01
Daily PFAS Protocol Checklist

amec foster wheeler

Date: 8/29/19 Installation Name: Cannon AFB

Weather (*temp./precipitation*): 97°, sunny Investigation Area: WWTP

Field Clothing and PPE:

- ☑ Field crew in compliance with Tables 1 and 2, SOP AFW-01
- ☑ Field crew has not used fabric softener on clothing
- ☑ Field crew has not used cosmetics, moisturizers, hand cream, or other related products on exposed body parts this morning
- ☑ Field crew has not applied unacceptable sunscreen or insect repellant

Field Equipment:

- ☑ No Teflon® containing materials on-site
- ☑ All sample materials made from stainless steel, HDPE, acetate, silicon, or polypropylene
- ☑ No waterproof field books on-site other than Rite in the Rain products
- ☑ No plastic clipboards, binders, or spiral hard cover notebooks on-site
- ☑ No adhesives (Post-It Notes) on-site
- ☑ Coolers filled with regular ice only. No chemical (blue) ice packs in possession

Sample Containers:

- ☑ All sample containers made of HDPE or polypropylene. Samples are not stored in containers made of LDPE
- ☑ Caps are lined or unlined and made of HDPE or polypropylene

Wet Weather (as applicable): N/A

- ☐ For personnel in direct contact with samples and/or sampling equipment, wet weather gear made of vinyl, polyurethane, PVC, wax or rubber- coated materials only

Equipment Decontamination:

- ☐ "PFAS-free" water on-site for decontamination of sample equipment
- ☐ Alconox and Liquinox to be used as decontamination materials

Food Considerations:

- ☑ No food or drink on-site with exception of bottled water and/or hydration drinks (i.e., Gatorade and Powerade) that is available for consumption only in the staging area

If any applicable boxes cannot be checked, the Field Manager shall describe the noncompliance issues below and work with field personnel to address noncompliance issues prior to commencement of that day's work. Corrective action shall include removal of noncompliance items from the investigation area or removal of worker offsite until in compliance. Repeated failure to comply with PFAS sample protocols will result in the permanent removal of worker(s) from the investigation area.

Describe the noncompliance issues (include personnel not in compliance) and action/outcome of noncompliance:

Because tap sampling was anticipated, materials for decontamination of dipper were not available.

Field Manager Name: Regina Mullen

Field Manager Signature: [signature] Time: 8/29/19 1243

Location Cannon AFB Date 8/29/19

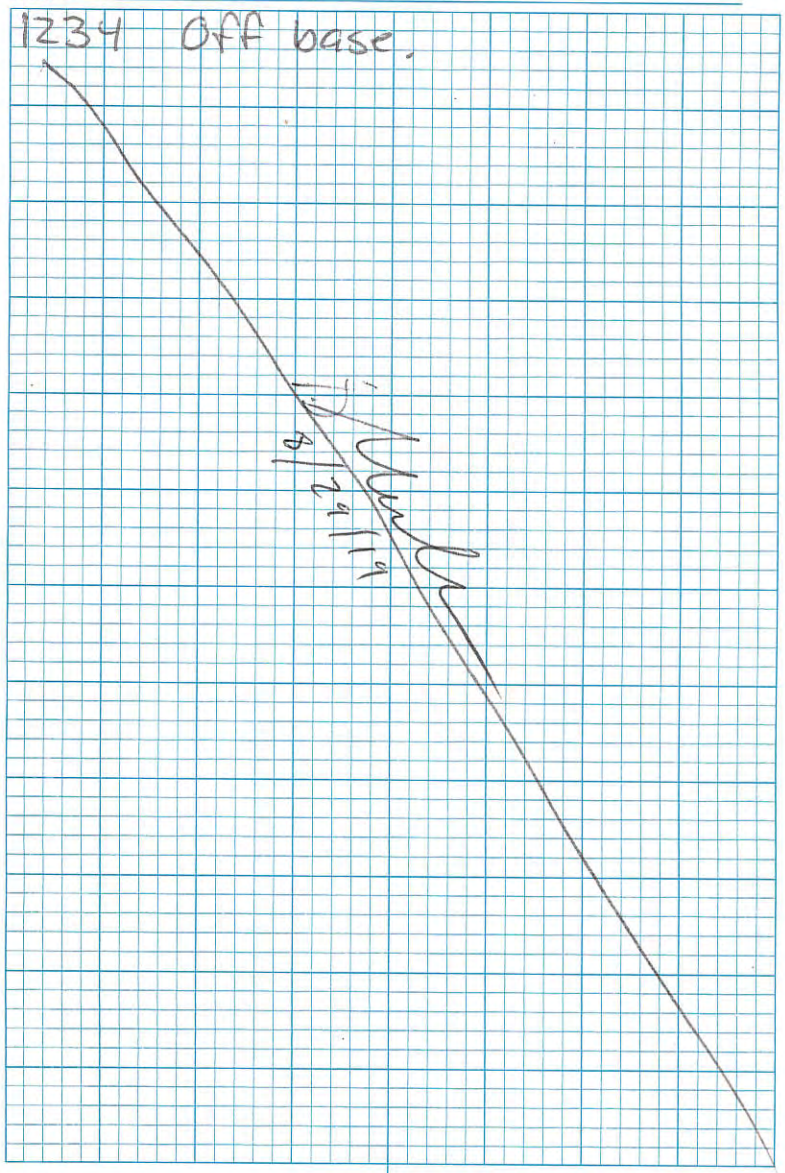
Project / Client USACE Omaha PFAS

1140	Arrive onsite. Meet C. Chavez and C. Gierke at gate.
1154	Arrive at waste water treatment plant. Air Force personnel present include Crystal Chavez, Christipher Gierke, Jeff Aden, and Don Briner. Also present are Sarah Jennings (NMED) and Mark Fuchs (AGEISS).
1203	Effluent sample and duplicate collected (CANON-WWTP-EFL-082919 and CANON-WWTP-EFL-08219-D). Collected with dipper. Cup was rinsed in effluent stream and emptied 3 times before collection.
1212	Field blank collected at location of effluent sampling (CANON-FB01-082919).
1219	Influent sample collected from influent stream with dipper in manner described above (CANON-WWTP-INF-082919) Weather sunny, breezy, and hot.
1230	Depart waste water treatment plant.

Location Cannon AFB Date 8/29/19

Project / Client USACE Omaha PFAS

Scale



Rite in the Rain

SGS North America Inc - Orlando

Chain of Custody

4405 Vineland Road, Suite C-15 Orlando, Fl 32811
TEL. 407-425-6700 FAX: 407-425-0707
www.sgs.com

SGS - ORLANDO JOB # : PAGE 1 OF 1

SGS - ORLANDO Quote # | SKIFF #

Client / Reporting Information

Company Name: EA Engineering
Address: 320 Gold Ave Ste 1300
City: Albuquerque State: NM Zip: 87102
Project Contact: Gina Mullen Email: rmullen@eaest.com
Phone #: 505-610-2427
Sampler(s) Name(s) (Printed)
Sampler 1: R.Mullen Sampler 2:

Project Information

Project Name: Cannon AFB - PFAS
Street
City Clovis State NM
Project # 6332103
Fax # NA
Client Purchase Order # 19642

Analytical Information

537 mod

Matrix Codes

DW - Drinking Water
GW - Ground Water
WW - Water
SW - Surface Water
SO - Soil
SL- Sludge
OI - Oil
LIQ - Other Liquid
AIR - Air
SOL - Other Solid

SGS Orlando Sample #	Field ID / Point of Collection	COLLECTION DATE	TIME	SAMPLED BY:	CONTAINER INFORMATION MATRIX	TOTAL # OF BOTTLES	OTHER	NONE	HCl	NaOH	HNO3	H2SO4	NAOH+ZNAC	DI WATER	MEOH	537 mod	LAB USE ONLY
	CANON-WWTP-EFL-082919	8/29/19	1203	RM	WW	2		X								X	
	CANON-WWTP-EFL-082919-D	8/29/19	1203	RM	WW	2		1								X	
	CANON-WWTP-INF-082919	8/29/19	1219	RM	WW	2		1								X	
	CANON-FB01-082919	8/29/19	1212	RM	LIQ	2		1								X	

Turnaround Time (Business days)

10 Day (Business)
7 Day
5 Day
3 Day *RUSH*
2 Day *RUSH*
1 Day *RUSH*
Other
Rush T/A Data Available VIA Email or Lablink

Approved By: / Date:

Data Deliverable Information

- [ ] COMMERCIAL "A" (RESULTS ONLY)
- [ ] COMMERCIAL "B" (RESULTS PLUS QC)
- [ ] REDT1 (EPA LEVEL 3)
- [ ] FULLT1 (EPA LEVEL 4)
- [ ] EDD'S

Comments / Remarks

Sample Custody must be documented below each time samples change possession, including courier delivery.

Relinquished by Sampler/Affiliation	Date Time:	Received By/Affiliation	Relinquished By/Affiliation	Date Time:	Received By/Affiliation
1 Regina Mullen EA	8/29/19 1730	2	3		4
Relinquished by/Affiliation	Date Time:	Received By/Affiliation	Relinquished By/Affiliation	Date Time:	Received By/Affiliation
5		6	7		8

Lab Use Only : Cooler Temperature (s) Celsius (corrected):

http://www.sgs.com/en/terms-and-conditions

Plan Acceptance Form:
Abbreviated Site Safety and Health Plan

I have read and agree to abide by the contents of the Site Safety and Health Plan and I have attended the Safety Briefing for the aforementioned site.

Name (Printed)	Office	Signature	Date
Gina Mullen	EA-ABQ	G Mullen	8/28/19

Person presenting the safety briefing: Gina Mullen

G Mullen — 8/29/19

Signature — Date

Attachment B:
Laboratory Analytical Report

The results set forth herein are provided by SGS North America Inc.

e-Hardcopy 2.0
Automated Report

Technical Report for

EA Engineering, Science & Technology

Cannon AFB; Clovis, NM

6332103

SGS Job Number: FA67659

Sampling Date: 08/29/19



Report to:

EA Engineering, Science & Technology
225 Schiling Circle
Hunt Valley, MD 21031
tlamond@eaest.com; rmullen@eaest.com;
asmith@eaest.com
ATTN: Tara Lamond

Total number of pages in report: **563**

Test results contained within this data package meet the requirements of the National Environmental Laboratory Accreditation Program and/or state specific certification programs as applicable.

Caitlin Brice, M.S.
General Manager

Client Service contact: Andrea Colby 407-425-6700

Certifications: FL(E83510), LA(03051), KS(E-10327), IL(200063), NC(573), NJ(FL002), NY(12022), SC(96038001) DoD ELAP(ANAB L2229), AZ(AZ0806), CA(2937), TX(T104704404), PA(68-03573), VA(460177), AK, AR, IA, KY, MA, MS, ND, NH, NV, OK, OR, UT, WA, WV

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EHS.US.CustomerCare@sgs.com

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SGS North America Inc.

Sample Summary

EA Engineering, Science & Technology

Job No: FA67659

Cannon AFB; Clovis, NM
Project No: 6332103

Sample Number	Collected Date	Time	By	Received	Matrix Code	Type	Client Sample ID
FA67659-1	08/29/19	12:03	RM	08/30/19	AQ	Water	CANON-WWTP-EFL-082919
FA67659-2	08/29/19	12:03	RM	08/30/19	AQ	Water	CANON-WWTP-EFL-082919-D
FA67659-3	08/29/19	12:19	RM	08/30/19	AQ	Water	CANON-WWTP-INF-082919
FA67659-4	08/29/19	12:12	RM	08/30/19	AQ	Field Blank Water	CANON-FB01-082919

SAMPLE DELIVERY GROUP CASE NARRATIVE

Client: EA Engineering, Science & Technology **Job No:** FA67659

Site: Cannon AFB; Clovis, NM **Report Date** 9/16/2019 7:19:02 PM

3 Samples and 1 Field Blank were collected on 08/29/2019 and were received at SGS North America Inc - Orlando on 08/30/2019 properly preserved, at 2.8 Deg. C and intact. These Samples received an SGS Orlando job number of FA67659. A listing of the Laboratory Sample ID, Client Sample ID and dates of collection are presented in the Results Summary Section. Except as noted below, all method specified calibrations and quality control performance criteria were met for this job. For more information, please refer to QC summary pages.

MS Semi-volatiles By Method EPA 537M QSM5.1 B-15

Matrix: AQ **Batch ID:** OP76797

All samples were extracted within the recommended method holding time.

All samples were analyzed within the recommended method holding time.

Sample(s) FA67788-18MS, FA67788-18MSD were used as the QC samples indicated.

All method blanks for this batch meet method specific criteria.

Sample(s) FA67659-3 have surrogates outside control limits.

FA67659-3: Dilution required due to matrix interference.

SGS Orlando certifies that this report meets the project requirements for analytical data produced for the samples as received at SGS Orlando and as stated on the COC. SGS Orlando certifies that the data meets the Data Quality Objectives for precision, accuracy and completeness as specified in the SGS Orlando Quality Manual except as noted above. This report is to be used in its entirety.
SGS Orlando is not responsible for any assumptions of data quality if partial data packages are used.

Narrative prepared by:

_____

Ariel Hartney, Client Services *(Signature on File)*

Summary of Hits

Job Number: FA67659
Account: EA Engineering, Science & Technology
Project: Cannon AFB; Clovis, NM
Collected: 08/29/19

Lab Sample ID / Analyte	Client Sample ID	Result/ Qual	LOQ	LOD	Units	Method
FA67659-1	**CANON-WWTP-EFL-082919**					
Perfluorobutanoic acid		0.0226	0.017	0.0083	ug/l	EPA 537M QSM5.1 B-15
Perfluoropentanoic acid		0.146	0.0083	0.0042	ug/l	EPA 537M QSM5.1 B-15
Perfluorohexanoic acid		0.0701	0.0083	0.0042	ug/l	EPA 537M QSM5.1 B-15
Perfluoroheptanoic acid		0.0195	0.0083	0.0042	ug/l	EPA 537M QSM5.1 B-15
Perfluorooctanoic acid		0.00467 J	0.0083	0.0042	ug/l	EPA 537M QSM5.1 B-15
Perfluorobutanesulfonic acid		0.0336	0.0083	0.0042	ug/l	EPA 537M QSM5.1 B-15
Perfluorohexanesulfonic acid		0.00711 J	0.0083	0.0042	ug/l	EPA 537M QSM5.1 B-15
Perfluorooctanesulfonic acid		0.0142	0.0083	0.0042	ug/l	EPA 537M QSM5.1 B-15
6:2 Fluorotelomer sulfonate		0.102	0.017	0.0083	ug/l	EPA 537M QSM5.1 B-15
FA67659-2	**CANON-WWTP-EFL-082919-D**					
Perfluorobutanoic acid		0.0216	0.017	0.0083	ug/l	EPA 537M QSM5.1 B-15
Perfluoropentanoic acid		0.138	0.0083	0.0042	ug/l	EPA 537M QSM5.1 B-15
Perfluorohexanoic acid		0.0672	0.0083	0.0042	ug/l	EPA 537M QSM5.1 B-15
Perfluoroheptanoic acid		0.0186	0.0083	0.0042	ug/l	EPA 537M QSM5.1 B-15
Perfluorooctanoic acid		0.00440 J	0.0083	0.0042	ug/l	EPA 537M QSM5.1 B-15
Perfluorobutanesulfonic acid		0.0431	0.0083	0.0042	ug/l	EPA 537M QSM5.1 B-15
Perfluorohexanesulfonic acid		0.00712 J	0.0083	0.0042	ug/l	EPA 537M QSM5.1 B-15
Perfluorooctanesulfonic acid		0.0129	0.0083	0.0042	ug/l	EPA 537M QSM5.1 B-15
6:2 Fluorotelomer sulfonate		0.0998	0.017	0.0083	ug/l	EPA 537M QSM5.1 B-15
FA67659-3	**CANON-WWTP-INF-082919**					
Perfluorobutanoic acid		0.00840 J	0.017	0.0083	ug/l	EPA 537M QSM5.1 B-15
Perfluoropentanoic acid		0.0151	0.0083	0.0042	ug/l	EPA 537M QSM5.1 B-15
Perfluorohexanoic acid		0.0123	0.0083	0.0042	ug/l	EPA 537M QSM5.1 B-15
Perfluorobutanesulfonic acid		0.0133	0.0083	0.0042	ug/l	EPA 537M QSM5.1 B-15
Perfluorohexanesulfonic acid		0.0678	0.0083	0.0042	ug/l	EPA 537M QSM5.1 B-15
Perfluorooctanesulfonic acid		0.00785 J	0.0083	0.0042	ug/l	EPA 537M QSM5.1 B-15
6:2 Fluorotelomer sulfonate		0.0122 J	0.017	0.0083	ug/l	EPA 537M QSM5.1 B-15
FA67659-4	**CANON-FB01-082919**					

No hits reported in this sample.

Sample Results

Report of Analysis

SGS North America Inc.

Report of Analysis

Client Sample ID: CANON-WWTP-EFL-082919
Lab Sample ID: FA67659-1 **Date Sampled:** 08/29/19
Matrix: AQ - Water **Date Received:** 08/30/19
Method: EPA 537M QSM5.1 B-15 EPA 537 MOD **Percent Solids:** n/a
Project: Cannon AFB; Clovis, NM

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	2Q35935.D	1	09/13/19 15:07	NG	09/12/19 13:00	OP76797	S2Q561
Run #2							

	Initial Volume	Final Volume
Run #1	120 ml	1.0 ml
Run #2		

CAS No.	Compound	Result	LOQ	LOD	DL	Units	Q
PERFLUOROALKYLCARBOXYLIC ACIDS							
375-22-4	Perfluorobutanoic acid	0.0226	0.017	0.0083	0.0042	ug/l	
2706-90-3	Perfluoropentanoic acid	0.146	0.0083	0.0042	0.0031	ug/l	
307-24-4	Perfluorohexanoic acid	0.0701	0.0083	0.0042	0.0021	ug/l	
375-85-9	Perfluoroheptanoic acid	0.0195	0.0083	0.0042	0.0021	ug/l	
335-67-1	Perfluorooctanoic acid	0.00467	0.0083	0.0042	0.0021	ug/l	J
375-95-1	Perfluorononanoic acid	0.0042 U	0.0083	0.0042	0.0021	ug/l	
335-76-2	Perfluorodecanoic acid	0.0042 U	0.0083	0.0042	0.0021	ug/l	
2058-94-8	Perfluoroundecanoic acid	0.0042 U	0.0083	0.0042	0.0021	ug/l	
307-55-1	Perfluorododecanoic acid	0.0042 U	0.0083	0.0042	0.0031	ug/l	
72629-94-8	Perfluorotridecanoic acid	0.0042 U	0.0083	0.0042	0.0021	ug/l	
376-06-7	Perfluorotetradecanoic acid	0.0042 U	0.0083	0.0042	0.0021	ug/l	
PERFLUOROALKYLSULFONATES							
375-73-5	Perfluorobutanesulfonic acid	0.0336	0.0083	0.0042	0.0021	ug/l	
355-46-4	Perfluorohexanesulfonic acid	0.00711	0.0083	0.0042	0.0021	ug/l	J
1763-23-1	Perfluorooctanesulfonic acid	0.0142	0.0083	0.0042	0.0031	ug/l	
335-77-3	Perfluorodecanesulfonic acid	0.0042 U	0.0083	0.0042	0.0021	ug/l	
PERFLUOROOCTANESULFONAMIDES							
754-91-6	PFOSA	0.0042 U	0.0083	0.0042	0.0021	ug/l	
FLUOROTELOMER SULFONATES							
27619-97-2	6:2 Fluorotelomer sulfonate	0.102	0.017	0.0083	0.0042	ug/l	
39108-34-4	8:2 Fluorotelomer sulfonate	0.0083 U	0.017	0.0083	0.0042	ug/l	

CAS No.	ID Standard Recoveries	Run# 1	Run# 2	Limits
	13C4-PFBA	93%		50-150%
	13C5-PFPeA	101%		50-150%
	13C5-PFHxA	103%		50-150%
	13C4-PFHpA	103%		50-150%

U = Not detected LOD = Limit of Detection J = Indicates an estimated value
LOQ = Limit of Quantitation DL = Detection Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	CANON-WWTP-EFL-082919		
Lab Sample ID:	FA67659-1	**Date Sampled:**	08/29/19
Matrix:	AQ - Water	**Date Received:**	08/30/19
Method:	EPA 537M QSM5.1 B-15 EPA 537 MOD	**Percent Solids:**	n/a
Project:	Cannon AFB; Clovis, NM		

CAS No.	ID Standard Recoveries	Run# 1	Run# 2	Limits
	13C8-PFOA	107%		50-150%
	13C9-PFNA	102%		50-150%
	13C6-PFDA	97%		50-150%
	13C7-PFUnDA	94%		50-150%
	13C2-PFDoDA	83%		50-150%
	13C2-PFTeDA	72%		50-150%
	13C3-PFBS	94%		50-150%
	13C3-PFHxS	98%		50-150%
	13C8-PFOS	95%		50-150%
	13C8-FOSA	76%		50-150%
	13C2-6:2FTS	87%		50-150%
	13C2-8:2FTS	73%		50-150%

U = Not detected LOD = Limit of Detection J = Indicates an estimated value
LOQ = Limit of Quantitation DL = Detection Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

SGS North America Inc.

Report of Analysis

Client Sample ID: CANON-WWTP-EFL-082919-D
Lab Sample ID: FA67659-2 **Date Sampled:** 08/29/19
Matrix: AQ - Water **Date Received:** 08/30/19
Method: EPA 537M QSM5.1 B-15 EPA 537 MOD **Percent Solids:** n/a
Project: Cannon AFB; Clovis, NM

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	2Q35936.D	1	09/13/19 15:23	NG	09/12/19 13:00	OP76797	S2Q561
Run #2							

	Initial Volume	Final Volume
Run #1	120 ml	1.0 ml
Run #2		

CAS No.	Compound	Result	LOQ	LOD	DL	Units	Q
PERFLUOROALKYLCARBOXYLIC ACIDS							
375-22-4	Perfluorobutanoic acid	0.0216	0.017	0.0083	0.0042	ug/l	
2706-90-3	Perfluoropentanoic acid	0.138	0.0083	0.0042	0.0031	ug/l	
307-24-4	Perfluorohexanoic acid	0.0672	0.0083	0.0042	0.0021	ug/l	
375-85-9	Perfluoroheptanoic acid	0.0186	0.0083	0.0042	0.0021	ug/l	
335-67-1	Perfluorooctanoic acid	0.00440	0.0083	0.0042	0.0021	ug/l	J
375-95-1	Perfluorononanoic acid	0.0042 U	0.0083	0.0042	0.0021	ug/l	
335-76-2	Perfluorodecanoic acid	0.0042 U	0.0083	0.0042	0.0021	ug/l	
2058-94-8	Perfluoroundecanoic acid	0.0042 U	0.0083	0.0042	0.0021	ug/l	
307-55-1	Perfluorododecanoic acid	0.0042 U	0.0083	0.0042	0.0031	ug/l	
72629-94-8	Perfluorotridecanoic acid	0.0042 U	0.0083	0.0042	0.0021	ug/l	
376-06-7	Perfluorotetradecanoic acid	0.0042 U	0.0083	0.0042	0.0021	ug/l	
PERFLUOROALKYLSULFONATES							
375-73-5	Perfluorobutanesulfonic acid	0.0431	0.0083	0.0042	0.0021	ug/l	
355-46-4	Perfluorohexanesulfonic acid	0.00712	0.0083	0.0042	0.0021	ug/l	J
1763-23-1	Perfluorooctanesulfonic acid	0.0129	0.0083	0.0042	0.0031	ug/l	
335-77-3	Perfluorodecanesulfonic acid	0.0042 U	0.0083	0.0042	0.0021	ug/l	
PERFLUOROOCTANESULFONAMIDES							
754-91-6	PFOSA	0.0042 U	0.0083	0.0042	0.0021	ug/l	
FLUOROTELOMER SULFONATES							
27619-97-2	6:2 Fluorotelomer sulfonate	0.0998	0.017	0.0083	0.0042	ug/l	
39108-34-4	8:2 Fluorotelomer sulfonate	0.0083 U	0.017	0.0083	0.0042	ug/l	

CAS No.	ID Standard Recoveries	Run# 1	Run# 2	Limits
	13C4-PFBA	90%		50-150%
	13C5-PFPeA	98%		50-150%
	13C5-PFHxA	100%		50-150%
	13C4-PFHpA	100%		50-150%

U = Not detected LOD = Limit of Detection J = Indicates an estimated value
LOQ = Limit of Quantitation DL = Detection Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	CANON-WWTP-EFL-082919-D		
Lab Sample ID:	FA67659-2	**Date Sampled:**	08/29/19
Matrix:	AQ - Water	**Date Received:**	08/30/19
Method:	EPA 537M QSM5.1 B-15 EPA 537 MOD	**Percent Solids:**	n/a
Project:	Cannon AFB; Clovis, NM		

CAS No.	ID Standard Recoveries	Run# 1	Run# 2	Limits
	13C8-PFOA	104%		50-150%
	13C9-PFNA	99%		50-150%
	13C6-PFDA	94%		50-150%
	13C7-PFUnDA	92%		50-150%
	13C2-PFDoDA	83%		50-150%
	13C2-PFTeDA	80%		50-150%
	13C3-PFBS	90%		50-150%
	13C3-PFHxS	94%		50-150%
	13C8-PFOS	93%		50-150%
	13C8-FOSA	85%		50-150%
	13C2-6:2FTS	84%		50-150%
	13C2-8:2FTS	70%		50-150%

U = Not detected LOD = Limit of Detection J = Indicates an estimated value
LOQ = Limit of Quantitation DL = Detection Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

SGS North America Inc.

Report of Analysis

Client Sample ID: CANON-WWTP-INF-082919
Lab Sample ID: FA67659-3 **Date Sampled:** 08/29/19
Matrix: AQ - Water **Date Received:** 08/30/19
Method: EPA 537M QSM5.1 B-15 EPA 537 MOD **Percent Solids:** n/a
Project: Cannon AFB; Clovis, NM

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	2Q35937.D	1	09/13/19 15:39	NG	09/12/19 13:00	OP76797	S2Q561
Run #2 [a]	2Q35991.D	10	09/15/19 13:12	NAF	09/12/19 13:00	OP76797	S2Q562

	Initial Volume	Final Volume
Run #1	120 ml	1.0 ml
Run #2	120 ml	1.0 ml

CAS No.	Compound	Result	LOQ	LOD	DL	Units	Q
PERFLUOROALKYLCARBOXYLIC ACIDS							
375-22-4	Perfluorobutanoic acid	0.00840	0.017	0.0083	0.0042	ug/l	J
2706-90-3	Perfluoropentanoic acid	0.0151	0.0083	0.0042	0.0031	ug/l	
307-24-4	Perfluorohexanoic acid	0.0123	0.0083	0.0042	0.0021	ug/l	
375-85-9	Perfluoroheptanoic acid	0.0042 U	0.0083	0.0042	0.0021	ug/l	
335-67-1	Perfluorooctanoic acid	0.0042 U	0.0083	0.0042	0.0021	ug/l	
375-95-1	Perfluorononanoic acid	0.0042 U	0.0083	0.0042	0.0021	ug/l	
335-76-2	Perfluorodecanoic acid	0.042 U [b]	0.083	0.042	0.021	ug/l	
2058-94-8	Perfluoroundecanoic acid	0.042 U [b]	0.083	0.042	0.021	ug/l	
307-55-1	Perfluorododecanoic acid	0.042 U [b]	0.083	0.042	0.031	ug/l	
72629-94-8	Perfluorotridecanoic acid	0.042 U [b]	0.083	0.042	0.021	ug/l	
376-06-7	Perfluorotetradecanoic acid	0.042 U [b]	0.083	0.042	0.021	ug/l	
PERFLUOROALKYLSULFONATES							
375-73-5	Perfluorobutanesulfonic acid	0.0133	0.0083	0.0042	0.0021	ug/l	
355-46-4	Perfluorohexanesulfonic acid	0.0678	0.0083	0.0042	0.0021	ug/l	
1763-23-1	Perfluorooctanesulfonic acid	0.00785	0.0083	0.0042	0.0031	ug/l	J
335-77-3	Perfluorodecanesulfonic acid	0.0042 U	0.0083	0.0042	0.0021	ug/l	
PERFLUOROOCTANESULFONAMIDES							
754-91-6	PFOSA	0.0042 U	0.0083	0.0042	0.0021	ug/l	
FLUOROTELOMER SULFONATES							
27619-97-2	6:2 Fluorotelomer sulfonate	0.0122	0.017	0.0083	0.0042	ug/l	J
39108-34-4	8:2 Fluorotelomer sulfonate	0.083 U [b]	0.17	0.083	0.042	ug/l	

CAS No.	ID Standard Recoveries	Run# 1	Run# 2	Limits
	13C4-PFBA	85%	105%	50-150%
	13C5-PFPeA	86%	106%	50-150%
	13C5-PFHxA	93%	107%	50-150%
	13C4-PFHpA	92%	112%	50-150%

U = Not detected LOD = Limit of Detection J = Indicates an estimated value
LOQ = Limit of Quantitation DL = Detection Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	CANON-WWTP-INF-082919		
Lab Sample ID:	FA67659-3	**Date Sampled:**	08/29/19
Matrix:	AQ - Water	**Date Received:**	08/30/19
Method:	EPA 537M QSM5.1 B-15 EPA 537 MOD	**Percent Solids:**	n/a
Project:	Cannon AFB; Clovis, NM		

CAS No.	ID Standard Recoveries	Run# 1	Run# 2	Limits
	13C8-PFOA	99%	116%	50-150%
	13C9-PFNA	93%	120%	50-150%
	13C6-PFDA	0%	116%	50-150%
	13C7-PFUnDA	0%	87%	50-150%
	13C2-PFDoDA	0%	76%	50-150%
	13C2-PFTeDA	0%	68%	50-150%
	13C3-PFBS	85%	107%	50-150%
	13C3-PFHxS	89%	114%	50-150%
	13C8-PFOS	81%	104%	50-150%
	13C8-FOSA	56%	105%	50-150%
	13C2-6:2FTS	93%	123%	50-150%
	13C2-8:2FTS	0%	140%	50-150%

(a) Dilution required due to matrix interference.
(b) Result is from Run# 2

U = Not detected LOD = Limit of Detection J = Indicates an estimated value
LOQ = Limit of Quantitation DL = Detection Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

SGS North America Inc.

Report of Analysis

Client Sample ID:	CANON-FB01-082919		
Lab Sample ID:	FA67659-4	**Date Sampled:**	08/29/19
Matrix:	AQ - Field Blank Water	**Date Received:**	08/30/19
Method:	EPA 537M QSM5.1 B-15 EPA 537 MOD	**Percent Solids:**	n/a
Project:	Cannon AFB; Clovis, NM		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	2Q35938.D	1	09/13/19 15:54	NG	09/12/19 13:00	OP76797	S2Q561
Run #2							

	Initial Volume	Final Volume
Run #1	120 ml	1.0 ml
Run #2		

CAS No.	Compound	Result	LOQ	LOD	DL	Units	Q
PERFLUOROALKYLCARBOXYLIC ACIDS							
375-22-4	Perfluorobutanoic acid	0.0083 U	0.017	0.0083	0.0042	ug/l	
2706-90-3	Perfluoropentanoic acid	0.0042 U	0.0083	0.0042	0.0031	ug/l	
307-24-4	Perfluorohexanoic acid	0.0042 U	0.0083	0.0042	0.0021	ug/l	
375-85-9	Perfluoroheptanoic acid	0.0042 U	0.0083	0.0042	0.0021	ug/l	
335-67-1	Perfluorooctanoic acid	0.0042 U	0.0083	0.0042	0.0021	ug/l	
375-95-1	Perfluorononanoic acid	0.0042 U	0.0083	0.0042	0.0021	ug/l	
335-76-2	Perfluorodecanoic acid	0.0042 U	0.0083	0.0042	0.0021	ug/l	
2058-94-8	Perfluoroundecanoic acid	0.0042 U	0.0083	0.0042	0.0021	ug/l	
307-55-1	Perfluorododecanoic acid	0.0042 U	0.0083	0.0042	0.0031	ug/l	
72629-94-8	Perfluorotridecanoic acid	0.0042 U	0.0083	0.0042	0.0021	ug/l	
376-06-7	Perfluorotetradecanoic acid	0.0042 U	0.0083	0.0042	0.0021	ug/l	
PERFLUOROALKYLSULFONATES							
375-73-5	Perfluorobutanesulfonic acid	0.0042 U	0.0083	0.0042	0.0021	ug/l	
355-46-4	Perfluorohexanesulfonic acid	0.0042 U	0.0083	0.0042	0.0021	ug/l	
1763-23-1	Perfluorooctanesulfonic acid	0.0042 U	0.0083	0.0042	0.0031	ug/l	
335-77-3	Perfluorodecanesulfonic acid	0.0042 U	0.0083	0.0042	0.0021	ug/l	
PERFLUOROOCTANESULFONAMIDES							
754-91-6	PFOSA	0.0042 U	0.0083	0.0042	0.0021	ug/l	
FLUOROTELOMER SULFONATES							
27619-97-2	6:2 Fluorotelomer sulfonate	0.0083 U	0.017	0.0083	0.0042	ug/l	
39108-34-4	8:2 Fluorotelomer sulfonate	0.0083 U	0.017	0.0083	0.0042	ug/l	

CAS No.	ID Standard Recoveries	Run# 1	Run# 2	Limits
	13C4-PFBA	94%		50-150%
	13C5-PFPeA	99%		50-150%
	13C5-PFHxA	100%		50-150%
	13C4-PFHpA	98%		50-150%

U = Not detected LOD = Limit of Detection J = Indicates an estimated value
LOQ = Limit of Quantitation DL = Detection Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID: CANON-FB01-082919
Lab Sample ID: FA67659-4
Matrix: AQ - Field Blank Water
Method: EPA 537M QSM5.1 B-15 EPA 537 MOD
Project: Cannon AFB; Clovis, NM

Date Sampled: 08/29/19
Date Received: 08/30/19
Percent Solids: n/a

CAS No.	ID Standard Recoveries	Run# 1	Run# 2	Limits
	13C8-PFOA	104%		50-150%
	13C9-PFNA	102%		50-150%
	13C6-PFDA	92%		50-150%
	13C7-PFUnDA	95%		50-150%
	13C2-PFDoDA	88%		50-150%
	13C2-PFTeDA	79%		50-150%
	13C3-PFBS	91%		50-150%
	13C3-PFHxS	93%		50-150%
	13C8-PFOS	87%		50-150%
	13C8-FOSA	89%		50-150%
	13C2-6:2FTS	83%		50-150%
	13C2-8:2FTS	75%		50-150%

U = Not detected LOD = Limit of Detection
LOQ = Limit of Quantitation DL = Detection Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Misc. Forms

Custody Documents and Other Forms

Includes the following where applicable:

- Chain of Custody
- QC Evaluation: DOD QSM5.x Limits

FA67659

SGS North America Inc - Orlando
Chain of Custody

SGS - ORLANDO JOB # : PAGE 1 OF 1

4405 Vineland Road, Suite C-15 Orlando, Fl 32811
TEL. 407-425-6700 FAX: 407-425-0707
www.sgs.com

SGS - ORLANDO Quote # | SKIFF #

Client / Reporting Information

Company Name: EA Engineering
Address: 320 Gold Ave Ste 1300
City: Albuquerque State: NM Zip: 87102
Project Contact: Gina Mullen Email: rmullen@eaest.com
Phone #: 505-610-2427
Sampler(s) Name(s) (Printed)
Sampler 1: R.M.Ilen Sampler 2:

Project Information

Project Name: Cannon AFB - PFAS
Street
City Clovis State NM
Project # 6332103
Fax # NA
Client Purchase Order # 19642

Analytical Information

537 mod

Matrix Codes

DW - Drinking Water
GW - Ground Water
WW - Water
SW - Surface Water
SO - Soil
SL - Sludge
OI - Oil
LIQ - Other Liquid
AIR - Air
SOL - Other Solid

SGS Orlando Sample #	Field ID / Point of Collection	COLLECTION DATE	TIME	SAMPLED BY:	MATRIX	CONTAINER INFORMATION TOTAL # OF BOTTLES	OTHER	NONE	HCl	NaOH	HNO3	H2SO4	NAOH+ZNAA	DI WATER	MEOH	537 mod	LAB USE ONLY
1	CANON-WWTP-EFL-032919	8/21/19	1203	RM	WW	2		X								X	
2	CANON-WWTP-EFL-032919-D	8/21/19	1203	RM	WW	2										X	
3	CANON-WWTP-INF-032919	8/21/19	1219	RM	WW	2										X	
4	CANON-FB30i-032919	8/21/19	1212	RM	LIQ	2										X	

Turnaround Time (Business days)

10 Day (Business) Approved By: / Date:
7 Day
5 Day
3 Day *RUSH*
2 Day *RUSH*
1 Day *RUSH*
Other
Rush T/A Data Available VIA Email or Lablink

Data Deliverable Information

- COMMERCIAL "A" (RESULTS ONLY)
- COMMERCIAL "B" (RESULTS PLUS QC)
- REDT1 (EPA LEVEL 3)
- FULLT1 (EPA LEVEL 4)
- EDD'S

Comments / Remarks

Sample Custody must be documented below each time samples change possession, including courier delivery.

	Relinquished by Sampler/Affiliation	Date Time:	Received By/Affiliation	Relinquished By/Affiliation	Date Time:	Received By/Affiliation
1	Regina Mullen EA	8/29/19 1730	2	3	8.30.19	4
5	Relinquished by/Affiliation	Date Time:	6	7	Date Time:	8

http://www.sgs.com/en/terms-and-conditions

Lab Use Only : Cooler Temperature (s) Celsius (corrected): 2.8

ORLD-SMT-0001-03-FORM-COC (1) Rev 031318

FA67659: Chain of Custody
Page 1 of 2

SGS Sample Receipt Summary

Job Number: FA67659 **Client:** EA` **Project:** CANNON AFB

Date / Time Received: 8/30/2019 9:00:00 AM **Delivery Method:** FED EX **Airbill #'s:**

Therm ID: IR 1; **Therm CF:** 1; **# of Coolers:** 1

Cooler Temps (Raw Measured) °C: Cooler 1: (1.8);

Cooler Temps (Corrected) °C: Cooler 1: (2.8);

Cooler Information	Y	N
1. Custody Seals Present	☑	☐
2. Custody Seals Intact	☑	☐
3. Temp criteria achieved	☑	☐
4. Cooler temp verification	IR Gun	
5. Cooler media	Ice (Bag)	

Trip Blank Information	Y	N	N/A
1. Trip Blank present / cooler	☐	☐	☑
2. Trip Blank listed on COC	☐	☐	☑

	W	S	N/A
3. Type Of TB Received	☐	☐	☑

Sample Information	Y	N	N/A
1. Sample labels present on bottles	☑	☐	
2. Samples preserved properly	☑	☐	
3. Sufficient volume/containers recvd for analysis:	☑	☐	
4. Condition of sample	Intact		
5. Sample recvd within HT	☑	☐	
6. Dates/Times/IDs on COC match Sample Label	☑	☐	
7. VOCs have headspace	☐	☐	☑
8. Bottles received for unspecified tests	☐	☑	
9. Compositing instructions clear	☐	☐	☑
10. Voa Soil Kits/Jars received past 48hrs?	☐	☐	☑
11. % Solids Jar received?	☐	☐	☑
12. Residual Chlorine Present?	☐	☐	☑

Misc. Information

Number of Encores: 25-Gram _____ 5-Gram _____ Number of 5035 Field Kits: _____ Number of Lab Filtered Metals: _____

Test Strip Lot #s: pH 0-3 230315 pH 10-12 219813A Other: (Specify) _____ _____

Residual Chlorine Test Strip Lot #: _____

Comments

SM001
Rev. Date 05/24/17

Technician: HEATHERW Date: 8/30/2019 9:00:00 AM Reviewer: _____ Date: _____

FA67659: Chain of Custody
Page 2 of 2

QC Evaluation: DOD QSM5.x Limits

Job Number: FA67659
Account: EA Engineering, Science & Technology
Project: Cannon AFB; Clovis, NM
Collected: 08/29/19

QC Sample ID	CAS#	Analyte	Sample Type	Result Type	Result	Units	Limits

No DOD QSM5.x Limits Found.

* Sample used for QC is not from job FA67659

MS Semi-volatiles

6

QC Data Summaries

Includes the following where applicable:

- Method Blank Summaries
- Blank Spike Summaries
- Matrix Spike and Duplicate Summaries
- Injection Standard Area Summaries
- Isotope Dilution Standard Recovery Summaries
- Initial and Continuing Calibration Summaries
- Run Sequence Reports

Instrument Blank

Job Number: FA67659
Account: EAENGMDS EA Engineering, Science & Technology
Project: Cannon AFB; Clovis, NM

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
S2Q561-IBLK	2Q35930.D	1	09/13/19	NG	n/a	n/a	S2Q561

The QC reported here applies to the following samples: **Method:** EPA 537M QSM5.1 B-15

FA67659-1, FA67659-2, FA67659-3, FA67659-4

CAS No.	Compound	Result	RL	MDL	Units	Q
375-22-4	Perfluorobutanoic acid	ND	0.0080	0.0020	ug/l	
2706-90-3	Perfluoropentanoic acid	ND	0.0040	0.0015	ug/l	
307-24-4	Perfluorohexanoic acid	ND	0.0040	0.0010	ug/l	
375-85-9	Perfluoroheptanoic acid	ND	0.0040	0.0010	ug/l	
335-67-1	Perfluorooctanoic acid	ND	0.0040	0.0010	ug/l	
375-95-1	Perfluorononanoic acid	ND	0.0040	0.0010	ug/l	
335-76-2	Perfluorodecanoic acid	ND	0.0040	0.0010	ug/l	
2058-94-8	Perfluoroundecanoic acid	ND	0.0040	0.0010	ug/l	
307-55-1	Perfluorododecanoic acid	ND	0.0040	0.0015	ug/l	
72629-94-8	Perfluorotridecanoic acid	ND	0.0040	0.0010	ug/l	
376-06-7	Perfluorotetradecanoic acid	ND	0.0040	0.0010	ug/l	
375-73-5	Perfluorobutanesulfonic acid	ND	0.0040	0.0010	ug/l	
355-46-4	Perfluorohexanesulfonic acid	ND	0.0040	0.0010	ug/l	
1763-23-1	Perfluorooctanesulfonic acid	ND	0.0040	0.0015	ug/l	
335-77-3	Perfluorodecanesulfonic acid	ND	0.0040	0.0010	ug/l	
754-91-6	PFOSA	ND	0.0040	0.0010	ug/l	
27619-97-2	6:2 Fluorotelomer sulfonate	ND	0.0080	0.0020	ug/l	
39108-34-4	8:2 Fluorotelomer sulfonate	ND	0.0080	0.0020	ug/l	

CAS No.	ID Standard Recoveries		Limits
	13C4-PFBA	96%	50-150%
	13C5-PFPeA	103%	50-150%
	13C5-PFHxA	103%	50-150%
	13C4-PFHpA	102%	50-150%
	13C8-PFOA	104%	50-150%
	13C9-PFNA	101%	50-150%
	13C6-PFDA	94%	50-150%
	13C7-PFUnDA	100%	50-150%
	13C2-PFDoDA	93%	50-150%
	13C2-PFTeDA	92%	50-150%
	13C3-PFBS	95%	50-150%
	13C3-PFHxS	98%	50-150%
	13C8-PFOS	97%	50-150%
	13C8-FOSA	98%	50-150%

Instrument Blank

Job Number: FA67659
Account: EAENGMDS EA Engineering, Science & Technology
Project: Cannon AFB; Clovis, NM

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
S2Q561-IBLK	2Q35930.D	1	09/13/19	NG	n/a	n/a	S2Q561

The QC reported here applies to the following samples: **Method:** EPA 537M QSM5.1 B-15

FA67659-1, FA67659-2, FA67659-3, FA67659-4

CAS No.	ID Standard Recoveries		Limits
	d3-MeFOSAA	72%	50-150%
	13C2-4:2FTS	82%	50-150%
	13C2-6:2FTS	80%	50-150%
	13C2-8:2FTS	71%	50-150%

Instrument Blank

Job Number: FA67659
Account: EAENGMDS EA Engineering, Science & Technology
Project: Cannon AFB; Clovis, NM

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
S2Q562-IBLK	2Q35987.D	1	09/15/19	NAF	n/a	n/a	S2Q562

The QC reported here applies to the following samples: **Method:** EPA 537M QSM5.1 B-15

FA67659-3

CAS No.	Compound	Result	RL	MDL	Units	Q
335-76-2	Perfluorodecanoic acid	ND	0.0040	0.0010	ug/l	
2058-94-8	Perfluoroundecanoic acid	ND	0.0040	0.0010	ug/l	
307-55-1	Perfluorododecanoic acid	ND	0.0040	0.0015	ug/l	
72629-94-8	Perfluorotridecanoic acid	ND	0.0040	0.0010	ug/l	
376-06-7	Perfluorotetradecanoic acid	ND	0.0040	0.0010	ug/l	
39108-34-4	8:2 Fluorotelomer sulfonate	ND	0.0080	0.0020	ug/l	

CAS No.	ID Standard Recoveries		Limits
	13C4-PFBA	109%	50-150%
	13C5-PFPeA	110%	50-150%
	13C5-PFHxA	111%	50-150%
	13C4-PFHpA	112%	50-150%
	13C8-PFOA	114%	50-150%
	13C9-PFNA	113%	50-150%
	13C6-PFDA	114%	50-150%
	13C7-PFUnDA	117%	50-150%
	13C2-PFDoDA	112%	50-150%
	13C2-PFTeDA	112%	50-150%
	13C3-PFBS	109%	50-150%
	13C3-PFHxS	110%	50-150%
	13C8-PFOS	111%	50-150%
	13C8-FOSA	118%	50-150%
	d3-MeFOSAA	113%	50-150%
	13C2-4:2FTS	103%	50-150%
	13C2-6:2FTS	107%	50-150%
	13C2-8:2FTS	104%	50-150%

Method Blank Summary

Job Number: FA67659
Account: EAENGMDS EA Engineering, Science & Technology
Project: Cannon AFB; Clovis, NM

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
OP76797-MB	2Q35934.D	1	09/13/19	NG	09/12/19	OP76797	S2Q561

The QC reported here applies to the following samples: **Method:** EPA 537M QSM5.1 B-15

FA67659-1, FA67659-2, FA67659-3, FA67659-4

CAS No.	Compound	Result	RL	MDL	Units	Q
375-22-4	Perfluorobutanoic acid	ND	0.016	0.0040	ug/l	
2706-90-3	Perfluoropentanoic acid	ND	0.0080	0.0030	ug/l	
307-24-4	Perfluorohexanoic acid	ND	0.0080	0.0020	ug/l	
375-85-9	Perfluoroheptanoic acid	ND	0.0080	0.0020	ug/l	
335-67-1	Perfluorooctanoic acid	ND	0.0080	0.0020	ug/l	
375-95-1	Perfluorononanoic acid	ND	0.0080	0.0020	ug/l	
335-76-2	Perfluorodecanoic acid	ND	0.0080	0.0020	ug/l	
2058-94-8	Perfluoroundecanoic acid	ND	0.0080	0.0020	ug/l	
307-55-1	Perfluorododecanoic acid	ND	0.0080	0.0030	ug/l	
72629-94-8	Perfluorotridecanoic acid	ND	0.0080	0.0020	ug/l	
376-06-7	Perfluorotetradecanoic acid	ND	0.0080	0.0020	ug/l	
375-73-5	Perfluorobutanesulfonic acid	ND	0.0080	0.0020	ug/l	
355-46-4	Perfluorohexanesulfonic acid	ND	0.0080	0.0020	ug/l	
1763-23-1	Perfluorooctanesulfonic acid	ND	0.0080	0.0030	ug/l	
335-77-3	Perfluorodecanesulfonic acid	ND	0.0080	0.0020	ug/l	
754-91-6	PFOSA	ND	0.0080	0.0020	ug/l	
27619-97-2	6:2 Fluorotelomer sulfonate	ND	0.016	0.0040	ug/l	
39108-34-4	8:2 Fluorotelomer sulfonate	ND	0.016	0.0040	ug/l	

CAS No.	ID Standard Recoveries		Limits
	13C4-PFBA	98%	50-150%
	13C5-PFPeA	105%	50-150%
	13C5-PFHxA	105%	50-150%
	13C4-PFHpA	103%	50-150%
	13C8-PFOA	106%	50-150%
	13C9-PFNA	99%	50-150%
	13C6-PFDA	93%	50-150%
	13C7-PFUnDA	88%	50-150%
	13C2-PFDoDA	77%	50-150%
	13C2-PFTeDA	51%	50-150%
	13C3-PFBS	96%	50-150%
	13C3-PFHxS	97%	50-150%
	13C8-PFOS	89%	50-150%
	13C8-FOSA	85%	50-150%

Method Blank Summary

Job Number: FA67659
Account: EAENGMDS EA Engineering, Science & Technology
Project: Cannon AFB; Clovis, NM

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
OP76797-MB	2Q35934.D	1	09/13/19	NG	09/12/19	OP76797	S2Q561

The QC reported here applies to the following samples: **Method:** EPA 537M QSM5.1 B-15

FA67659-1, FA67659-2, FA67659-3, FA67659-4

CAS No.	ID Standard Recoveries		Limits
	d3-MeFOSAA	64%	50-150%
	13C2-4:2FTS	83%	50-150%
	13C2-6:2FTS	82%	50-150%
	13C2-8:2FTS	67%	50-150%

Blank Spike Summary

Job Number: FA67659
Account: EAENGMDS EA Engineering, Science & Technology
Project: Cannon AFB; Clovis, NM

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
OP76797-BS	2Q35933.D	1	09/13/19	NG	09/12/19	OP76797	S2Q561

The QC reported here applies to the following samples: **Method:** EPA 537M QSM5.1 B-15

FA67659-1, FA67659-2, FA67659-3, FA67659-4

CAS No.	Compound	Spike ug/l	BSP ug/l	BSP %	Limits
375-22-4	Perfluorobutanoic acid	0.16	0.154	96	72-133
2706-90-3	Perfluoropentanoic acid	0.16	0.136	85	71-130
307-24-4	Perfluorohexanoic acid	0.16	0.149	93	67-133
375-85-9	Perfluoroheptanoic acid	0.16	0.141	88	72-133
335-67-1	Perfluorooctanoic acid	0.16	0.145	91	71-133
375-95-1	Perfluorononanoic acid	0.16	0.142	89	67-131
335-76-2	Perfluorodecanoic acid	0.16	0.153	96	68-135
2058-94-8	Perfluoroundecanoic acid	0.16	0.149	93	67-133
307-55-1	Perfluorododecanoic acid	0.16	0.153	96	68-131
72629-94-8	Perfluorotridecanoic acid	0.16	0.141	88	65-140
376-06-7	Perfluorotetradecanoic acid	0.16	0.147	92	65-129
375-73-5	Perfluorobutanesulfonic acid	0.16	0.147	92	72-129
355-46-4	Perfluorohexanesulfonic acid	0.16	0.148	93	70-134
1763-23-1	Perfluorooctanesulfonic acid	0.16	0.141	88	65-140
335-77-3	Perfluorodecanesulfonic acid	0.16	0.149	93	52-133
754-91-6	PFOSA	0.16	0.148	93	63-137
27619-97-2	6:2 Fluorotelomer sulfonate	0.16	0.147	92	73-141
39108-34-4	8:2 Fluorotelomer sulfonate	0.16	0.145	91	65-140

CAS No.	ID Standard Recoveries	BSP	Limits
	13C4-PFBA	94%	50-150%
	13C5-PFPeA	100%	50-150%
	13C5-PFHxA	101%	50-150%
	13C4-PFHpA	99%	50-150%
	13C8-PFOA	101%	50-150%
	13C9-PFNA	96%	50-150%
	13C6-PFDA	90%	50-150%
	13C7-PFUnDA	88%	50-150%
	13C2-PFDoDA	82%	50-150%
	13C2-PFTeDA	80%	50-150%
	13C3-PFBS	93%	50-150%
	13C3-PFHxS	93%	50-150%
	13C8-PFOS	88%	50-150%
	13C8-FOSA	74%	50-150%

* = Outside of Control Limits.

Blank Spike Summary

Job Number: FA67659
Account: EAENGMDS EA Engineering, Science & Technology
Project: Cannon AFB; Clovis, NM

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
OP76797-BS	2Q35933.D	1	09/13/19	NG	09/12/19	OP76797	S2Q561

The QC reported here applies to the following samples: **Method:** EPA 537M QSM5.1 B-15

FA67659-1, FA67659-2, FA67659-3, FA67659-4

CAS No.	ID Standard Recoveries	BSP	Limits
	d3-MeFOSAA	64%	50-150%
	13C2-4:2FTS	85%	50-150%
	13C2-6:2FTS	81%	50-150%
	13C2-8:2FTS	72%	50-150%

* = Outside of Control Limits.

Matrix Spike/Matrix Spike Duplicate Summary

Job Number: FA67659
Account: EAENGMDS EA Engineering, Science & Technology
Project: Cannon AFB; Clovis, NM

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
OP76797-MS	2Q35940.D	1	09/13/19	NG	09/12/19	OP76797	S2Q561
OP76797-MSD	2Q35941.D	1	09/13/19	NG	09/12/19	OP76797	S2Q561
FA67788-18	2Q35939.D	1	09/13/19	NG	09/12/19	OP76797	S2Q561

The QC reported here applies to the following samples: **Method:** EPA 537M QSM5.1 B-15

FA67659-1, FA67659-2, FA67659-3, FA67659-4

CAS No.	Compound	FA67788-18 ug/l	Q	Spike ug/l	MS ug/l	MS %	Spike ug/l	MSD ug/l	MSD %	RPD	Limits Rec/RPD
375-22-4	Perfluorobutanoic acid	0.017	U	0.167	0.157	94	0.167	0.167	100	6	72-133/30
2706-90-3	Perfluoropentanoic acid	0.0083	U	0.167	0.139	83	0.167	0.146	88	5	71-130/30
307-24-4	Perfluorohexanoic acid	0.0083	U	0.167	0.153	92	0.167	0.160	96	4	67-133/30
375-85-9	Perfluoroheptanoic acid	0.0083	U	0.167	0.145	87	0.167	0.153	92	5	72-133/30
335-67-1	Perfluorooctanoic acid	0.0083	U	0.167	0.150	90	0.167	0.157	94	5	71-133/30
375-95-1	Perfluorononanoic acid	0.0083	U	0.167	0.143	86	0.167	0.154	92	7	67-131/30
335-76-2	Perfluorodecanoic acid	0.0083	U	0.167	0.158	95	0.167	0.166	100	5	68-135/30
2058-94-8	Perfluoroundecanoic acid	0.0083	U	0.167	0.151	91	0.167	0.160	96	6	67-133/30
307-55-1	Perfluorododecanoic acid	0.0083	U	0.167	0.156	94	0.167	0.162	97	4	68-131/30
72629-94-8	Perfluorotridecanoic acid	0.0083	U	0.167	0.139	83	0.167	0.149	89	7	65-140/30
376-06-7	Perfluorotetradecanoic acid	0.0083	U	0.167	0.149	89	0.167	0.154	92	3	65-129/30
375-73-5	Perfluorobutanesulfonic acid	0.0083	U	0.167	0.151	91	0.167	0.159	95	5	72-129/30
355-46-4	Perfluorohexanesulfonic acid	0.0083	U	0.167	0.149	89	0.167	0.158	95	6	70-134/30
1763-23-1	Perfluorooctanesulfonic acid	0.0083	U	0.167	0.148	89	0.167	0.159	95	7	65-140/30
335-77-3	Perfluorodecanesulfonic acid	0.0083	U	0.167	0.157	94	0.167	0.163	98	4	52-133/30
754-91-6	PFOSA	0.0083	U	0.167	0.154	92	0.167	0.159	95	3	63-137/30
27619-97-2	6:2 Fluorotelomer sulfonate	0.017	U	0.167	0.150	90	0.167	0.156	94	4	73-141/30
39108-34-4	8:2 Fluorotelomer sulfonate	0.017	U	0.167	0.150	90	0.167	0.158	95	5	65-140/30

CAS No.	ID Standard Recoveries	MS	MSD	FA67788-18	Limits
	13C4-PFBA	104%	101%	100%	50-150%
	13C5-PFPeA	109%	106%	106%	50-150%
	13C5-PFHxA	110%	106%	107%	50-150%
	13C4-PFHpA	107%	103%	104%	50-150%
	13C8-PFOA	109%	105%	107%	50-150%
	13C9-PFNA	104%	99%	101%	50-150%
	13C6-PFDA	96%	92%	93%	50-150%
	13C7-PFUnDA	97%	92%	95%	50-150%
	13C2-PFDoDA	91%	87%	87%	50-150%
	13C2-PFTeDA	92%	84%	86%	50-150%
	13C3-PFBS	101%	98%	97%	50-150%
	13C3-PFHxS	103%	98%	99%	50-150%
	13C8-PFOS	95%	90%	90%	50-150%
	13C8-FOSA	77%	84%	92%	50-150%

* = Outside of Control Limits.

Matrix Spike/Matrix Spike Duplicate Summary

Job Number: FA67659
Account: EAENGMDS EA Engineering, Science & Technology
Project: Cannon AFB; Clovis, NM

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
OP76797-MS	2Q35940.D	1	09/13/19	NG	09/12/19	OP76797	S2Q561
OP76797-MSD	2Q35941.D	1	09/13/19	NG	09/12/19	OP76797	S2Q561
FA67788-18	2Q35939.D	1	09/13/19	NG	09/12/19	OP76797	S2Q561

The QC reported here applies to the following samples: **Method:** EPA 537M QSM5.1 B-15

FA67659-1, FA67659-2, FA67659-3, FA67659-4

CAS No.	ID Standard Recoveries	MS	MSD	FA67788-18	Limits
	d3-MeFOSAA	71%	68%	69%	50-150%
	13C2-4:2FTS	93%	90%		50-150%
	13C2-6:2FTS	88%	86%		50-150%
	13C2-8:2FTS	79%	76%		50-150%

* = Outside of Control Limits.

Injection Standard Area Summary

Job Number: FA67659
Account: EAENGMDS EA Engineering, Science & Technology
Project: Cannon AFB; Clovis, NM

Check Std:	S2Q561-CC556	**Injection Date:**	09/13/19
Lab File ID:	2Q35931.D	**Injection Time:**	14:04
Instrument ID:	GCMS2Q	**Method:**	EPA 537M QSM5.1 B-15

	IS 1 AREA	RT	IS 2 AREA	RT
Initial Cal [a]	612215	6.99	71776	7.54
Check Std [b]	622191	7.07	77316	7.64
Upper Limit [c]	918323	8.07	107664	8.64
Lower Limit [d]	306108	6.07	35888	6.64

Lab Sample ID	IS 1 AREA	RT	IS 2 AREA	RT
OP76797-BS	514723	7.07	64539	7.64
OP76797-MB	512578	7.07	61795	7.64
FA67659-1	553366	7.07	68321	7.64
FA67659-2	517411	7.07	64168	7.64
FA67659-3	524352	6.99	61824	7.41
FA67659-4	532647	7.06	64865	7.62
FA67788-18	546969	7.07	66903	7.64
OP76797-MS	551539	7.08	68513	7.64
OP76797-MSD	553055	7.07	68671	7.64
ZZZZZZ	547256	7.07	68205	7.64

IS 1 = 13C2-PFOA
IS 2 = 13C4-PFOS

(a) Initial Cal is: S2Q554-ICC554 2Q35359.D 09/03/19 10:16
(b) Check Std Limit = -50 to + 50% of initial cal area.
(c) Upper Limit = + 50% of initial standard area; Retention time + 1 minutes of check standard.
(d) Lower Limit = -50% of initial standard area; Retention time -1 minutes of check standard.

Injection Standard Area Summary

Job Number: FA67659
Account: EAENGMDS EA Engineering, Science & Technology
Project: Cannon AFB; Clovis, NM

Check Std:	S2Q562-ICC562	**Injection Date:**	09/15/19
Lab File ID:	2Q35984.D	**Injection Time:**	11:21
Instrument ID:	GCMS2Q	**Method:**	EPA 537M QSM5.1 B-15

	IS 1 AREA	RT	IS 2 AREA	RT
Initial Cal [a]	519068	7.08	75696	7.65
Check Std [b]	519068	7.08	75696	7.65
Upper Limit [c]	778602	8.08	113544	8.65
Lower Limit [d]	259534	6.08	37848	6.65

Lab Sample ID	IS 1 AREA	RT	IS 2 AREA	RT
S2Q562-IBLK	554933	7.08	80257	7.65
S2Q562-IBLK	554933	7.08	80257	7.65
FA67659-3 [e]	584424	7.07	78393	7.62
OP76829-BS	390011	7.08	56035	7.65
OP76829-MB	484747	7.08	68321	7.65
ZZZZZZ	489951	7.08	68854	7.65
ZZZZZZ	521001	7.08	72877	7.65
ZZZZZZ	494562	7.08	70245	7.65
ZZZZZZ	498455	7.08	69467	7.65
ZZZZZZ	483535	7.08	68605	7.65
ZZZZZZ	470331	7.08	65247	7.65

IS 1 = 13C2-PFOA
IS 2 = 13C4-PFOS

(a) Initial Cal is: S2Q562-ICC562 2Q35984.D 09/15/19 11:21
(b) Check Std Limit = -50 to + 50% of initial cal area.
(c) Upper Limit = + 50% of initial standard area; Retention time + 1 minutes of check standard.
(d) Lower Limit = -50% of initial standard area; Retention time -1 minutes of check standard.
(e) Dilution required due to matrix interference.

Isotope Dilution Standard Recovery Summary

Job Number: FA67659
Account: EAENGMDS EA Engineering, Science & Technology
Project: Cannon AFB; Clovis, NM

Method: EPA 537M QSM5.1 B-15 **Matrix:** AQ

Samples and QC shown here apply to the above method

Lab Sample ID	Lab File ID	S1	S2	S3	S4	S5	S6	S7	S8
FA67659-1	2Q35935.D	93	101	103	103	107	102	97	94
FA67659-2	2Q35936.D	90	98	100	100	104	99	94	92
FA67659-3	2Q35991.D	105	106	107	112	116	120	116	87
FA67659-3	2Q35937.D	85	86	93	92	99	93	0*	0*
FA67659-4	2Q35938.D	94	99	100	98	104	102	92	95
OP76797-BS	2Q35933.D	94	100	101	99	101	96	90	88
OP76797-MB	2Q35934.D	98	105	105	103	106	99	93	88
OP76797-MS	2Q35940.D	104	109	110	107	109	104	96	97
OP76797-MSD	2Q35941.D	101	106	106	103	105	99	92	92
S2Q561-IBLK	2Q35930.D	96	103	103	102	104	101	94	100
S2Q562-IBLK	2Q35987.D	109	110	111	112	114	113	114	117

Isotope Dilution Standards	Recovery Limits
S1 = 13C4-PFBA	50-150%
S2 = 13C5-PFPeA	50-150%
S3 = 13C5-PFHxA	50-150%
S4 = 13C4-PFHpA	50-150%
S5 = 13C8-PFOA	50-150%
S6 = 13C9-PFNA	50-150%
S7 = 13C6-PFDA	50-150%
S8 = 13C7-PFUnDA	50-150%

Isotope Dilution Standard Recovery Summary

Job Number: FA67659
Account: EAENGMDS EA Engineering, Science & Technology
Project: Cannon AFB; Clovis, NM

Method: EPA 537M QSM5.1 B-15 **Matrix:** AQ

Samples and QC shown here apply to the above method

Lab Sample ID	Lab File ID	S9	S10	S11	S12	S13	S14	S15	S16
FA67659-1	2Q35935.D	83	72	94	98	95	76	87	73
FA67659-2	2Q35936.D	83	80	90	94	93	85	84	70
FA67659-3	2Q35991.D	76	68	107	114	104	105	123	140
FA67659-3	2Q35937.D	0*	0*	85	89	81	56	93	0*
FA67659-4	2Q35938.D	88	79	91	93	87	89	83	75
OP76797-BS	2Q35933.D	82	80	93	93	88	74	81	72
OP76797-MB	2Q35934.D	77	51	96	97	89	85	82	67
OP76797-MS	2Q35940.D	91	92	101	103	95	77	88	79
OP76797-MSD	2Q35941.D	87	84	98	98	90	84	86	76
S2Q561-IBLK	2Q35930.D	93	92	95	98	97	98	80	71
S2Q562-IBLK	2Q35987.D	112	112	109	110	111	118	107	104

Isotope Dilution Standards	Recovery Limits
S9 = 13C2-PFDoDA	50-150%
S10 = 13C2-PFTeDA	50-150%
S11 = 13C3-PFBS	50-150%
S12 = 13C3-PFHxS	50-150%
S13 = 13C8-PFOS	50-150%
S14 = 13C8-FOSA	50-150%
S15 = 13C2-6:2FTS	50-150%
S16 = 13C2-8:2FTS	50-150%

Initial Calibration Summary

Job Number: FA67659 **Sample:** S2Q554-ICC554
Account: EAENGMDS EA Engineering, Science & Technology **Lab FileID:** 2Q35359.D
Project: Cannon AFB; Clovis, NM

Initial Calibration Report

Method Path	D:\MassHunter\damethods
Method File	ID_090319_S2Q554.quantmethod.xml
Batch Name	D:\MassHunter\Data\ID_090319_S2Q554\QuantResults\s2q554.batch.bin
Last Calib Update	9/3/2019 11:06:15 AM

Level Name	Calibration Files	Acq. Date-Time	Level Last Update Time
1	D:\MassHunter\Data\ID_090319_S2Q554\2Q35354.d	9/3/2019 8:52:44 AM	9/3/2019 11:06:15 AM
2	D:\MassHunter\Data\ID_090319_S2Q554\2Q35355.d	9/3/2019 9:09:19 AM	9/3/2019 11:06:15 AM
3	D:\MassHunter\Data\ID_090319_S2Q554\2Q35356.d	9/3/2019 9:25:07 AM	9/3/2019 11:06:15 AM
4	D:\MassHunter\Data\ID_090319_S2Q554\2Q35357.d	9/3/2019 9:44:37 AM	9/3/2019 11:06:15 AM
5	D:\MassHunter\Data\ID_090319_S2Q554\2Q35358.d	9/3/2019 10:00:34 AM	9/3/2019 11:06:15 AM
6	D:\MassHunter\Data\ID_090319_S2Q554\2Q35359.d	9/3/2019 10:16:23 AM	9/3/2019 11:06:15 AM
7	D:\MassHunter\Data\ID_090319_S2Q554\2Q35360.d	9/3/2019 10:32:13 AM	9/3/2019 11:06:15 AM
8	D:\MassHunter\Data\ID_090319_S2Q554\2Q35361.d	9/3/2019 10:48:02 AM	9/3/2019 11:06:15 AM

Compound	Curve Fit	1	2	3	4	5	6	7	8	Avg RF	%RSD
S 13C4-PFBA	Linear	10637	11783	12166	12210	11616	12190	12151	11566	11790	4.554
S 13C5-PFPeA	Linear	8978	9888	10181	10254	9660	10181	10153	9610	9863	4.416
S 13C3-PFBS	Linear	1403	1542	1585	1597	1503	1583	1569	1492	1534	4.287
S 13C2-4:2FTS	Linear	7380	8120	8413	8535	8205	8914	9471	10086	8640	9.748
S 13C5-PFHxA	Linear	13200	14490	14914	15044	14282	14889	14849	13991	14457	4.314
S 13C3-HFPO-DA	Linear	2032	2323	2401	2350	2193	2277	2256	2062	2237	5.948
S 13C4-PFHpA	Linear	17870	19271	19961	20089	18844	19751	19510	18085	19173	4.366
S 13C3-PFHxS	Linear	1469	1595	1652	1647	1564	1650	1611	1489	1585	4.553
S 13C2-6:2FTS	Linear	9931	10772	11181	11303	10688	11501	11743	11673	11099	5.484
S 13C8-PFOA	Linear	22210	24187	25099	25240	23671	24668	23984	21647	23838	5.462
S 13C8-FOSA	Linear	7774	8386	8705	8698	8104	8257	7660	6676	8033	8.310
S 13C8-PFOS	Linear	2170	2306	2447	2448	2274	2385	2315	2145	2311	4.955
S 13C9-PFNA	Linear	23443	25159	26047	26453	24944	25620	25182	23252	25012	4.567
S d3-MeFOSAA	Linear	6326	6795	7098	7180	6811	6932	6838	6493	6809	4.195
S 13C6-PFDA	Linear	32302	34811	36186	36249	33996	35275	33900	30967	34211	5.396
S 13C2-8:2FTS	Linear	8373	8937	9347	9551	9057	9693	10229	10634	9478	7.630
S 13C7-PFUnDA	Linear	45675	48680	50324	51032	47732	49668	48360	44843	48289	4.479
S 13C2-PFDoDA	Linear	53842	57014	59078	59784	56641	58180	57615	54574	57091	3.612
S 13C2-PFTeDA	Linear	39301	41440	43106	43501	40300	41996	42941	41104	41711	3.508
I 13C2-PFOA				---------- ISTD ----------							
S M2-PFOA	Linear	1.0017	1.0018	1.0017	1.0009	1.0017	1.0020	1.0020	1.0023	1.0018	0.041
I 13C4-PFOS				---------- ISTD ----------							
S M4-PFOS	Linear	0.9999	1.0009	1.0022	1.0013	0.9979	0.9984	1.0025	1.0013	1.0006	0.170
I M4-PFBA				---------- ISTD ----------							
T PFBA	Linear	0.1904	0.1650	0.1730	0.1621	0.1649	0.1791	0.1589	0.1656	0.1699	6.156
I M5-PFPeA				---------- ISTD ----------							
T PFPeA	Linear	0.9852	0.8109	0.8420	0.8079	0.8214	0.8993	0.7919	0.8249	0.8479	7.574

Generated at 11:06 AM on 9/3/2019

Initial Calibration Summary

Job Number: FA67659 **Sample:** S2Q554-ICC554
Account: EAENGMDS EA Engineering, Science & Technology **Lab FileID:** 2Q35359.D
Project: Cannon AFB; Clovis, NM

Initial Calibration Report

Compound	Curve Fit	1	2	3	4	5	6	7	8	Avg RF	%RSD
I M5-PFHxA						ISTD					
T PFHxA	Linear	0.4088	0.3431	0.3364	0.3270	0.3259	0.3574	0.3143	0.3290	0.3427	8.653
I M4-PFHpA						ISTD					
T PFHpA	Linear	1.0162	0.8544	0.8950	0.8646	0.8794	0.9455	0.8384	0.8816	0.8969	6.447
I M8-PFOA						ISTD					
T ADONA	Linear	0.9142	0.7698	0.8109	0.7863	0.8069	0.8760	0.7963	0.8656	0.8282	6.127
T PFOA	Linear	0.6441	0.5583	0.5671	0.5405	0.5484	0.5902	0.5228	0.5475	0.5649	6.658
I M9-PFNA						ISTD					
T PFNA	Linear	0.6305	0.5486	0.5523	0.5289	0.5429	0.5941	0.5218	0.5380	0.5571	6.595
I M6-PFDA						ISTD					
T 9Cl-PF3ONS	Linear	0.0591	0.0538	0.0539	0.0517	0.0529	0.0591	0.0528	0.0562	0.0549	5.236
T PFDA	Linear	0.5190	0.4328	0.4411	0.4245	0.4392	0.4687	0.4203	0.4347	0.4475	7.227
I M7-PFUnDA						ISTD					
T PFUnDA	Linear	0.4869	0.4132	0.4257	0.4094	0.4218	0.4599	0.4109	0.4276	0.4319	6.348
I M2-PFDoDA						ISTD					
T 11Cl-PF3OUdS	Linear	0.1928	0.1631	0.1711	0.1644	0.1680	0.1821	0.1649	0.1707	0.1721	5.984
T PFDoDA	Linear	0.5359	0.4449	0.4601	0.4433	0.4537	0.4883	0.4373	0.4526	0.4645	7.054
I M2-PFTeDA						ISTD					
T PFTrDA	Linear	0.7991	0.6579	0.6713	0.6507	0.6719	0.7254	0.6354	0.6599	0.6840	7.815
T PFTeDA	Linear	0.7744	0.6119	0.6098	0.5802	0.5972	0.6396	0.5724	0.5917	0.6221	10.441
I M8-FOSA						ISTD					
T FOSA	Linear	0.5977	0.4922	0.5257	0.4879	0.5055	0.5463	0.4800	0.5006	0.5170	7.553
I M3-PFBS						ISTD					
T PFBS	Linear	1.7486	1.5044	1.5612	1.4664	1.4983	1.6242	1.4458	1.5007	1.5437	6.468
T PFPeS	Linear	1.0700	0.9267	0.9670	0.9211	0.9233	1.0259	0.8922	0.9225	0.9561	6.415
I M3-PFHxS						ISTD					
T PFHxS	Linear	1.4666	1.2484	1.2769	1.2317	1.2547	1.3460	1.1975	1.2633	1.2856	6.573
T PFHpS	Linear	1.4001	1.1747	1.2359	1.1621	1.1633	1.2689	1.1109	1.1258	1.2052	7.853
I M8-PFOS						ISTD					
T PFOS	Linear	1.3246	1.0449	1.0071	0.9698	0.9683	1.0357	0.9209	0.9668	1.0298	12.221
T PFNS	Linear	0.8411	0.7368	0.7780	0.7344	0.7530	0.8184	0.7175	0.7417	0.7651	5.737
T PFDS	Linear	0.5736	0.4899	0.4884	0.4650	0.4843	0.5116	0.4604	0.4814	0.4943	7.216
I M2-4:2FTS						ISTD					
T 4:2FTS	Avg RF	0.6690	0.5941	0.6101	0.5821	0.5896	0.6262	0.5165	0.4754	0.5829	10.491
I M2-6:2FTS						ISTD					

Generated at 11:06 AM on 9/3/2019

Initial Calibration Summary

Job Number: FA67659 **Sample:** S2Q554-ICC554
Account: EAENGMDS EA Engineering, Science & Technology **Lab FileID:** 2Q35359.D
Project: Cannon AFB; Clovis, NM

Initial Calibration Report

Compound	Curve Fit	1	2	3	4	5	6	7	8	Avg RF	%RSD
T 6:2FTS	Avg RF	0.6389	0.5100	0.5265	0.5046	0.5089	0.5372	0.4412	0.4098	0.5096	13.355
I M2-8:2FTS				----------	----------	ISTD	----------	----------			
T 8:2FTS	Avg RF	0.6557	0.5605	0.5654	0.5369	0.5515	0.5744	0.4662	0.4291	0.5425	12.744
I M3-MeFOSAA				----------	----------	ISTD	----------	----------			
T MeFOSAA	Linear	0.6869	0.5654	0.5347	0.5226	0.5177	0.5710	0.5040	0.5211	0.5529	10.662
T EtFOSAA	Linear	0.6294	0.4565	0.4749	0.4519	0.4560	0.5052	0.4546	0.4602	0.4861	12.453
I M3-HFPO-DA				----------	----------	ISTD	----------	----------			
T HFPO-DA	Quadratic	1.3137	1.0997	1.1482	1.1227	1.1590	1.2488	1.0721	1.0778	1.1553	7.387

(RedFont and #) = Outlier Flag; (I) = Internal Standard; (T) = Target; (S) = Surrogate; (M) = Matrix Spike

Generated at 11:06 AM on 9/3/2019

Initial Calibration Summary

Job Number: FA67659 **Sample:** S2Q554-ICC554
Account: EAENGMDS EA Engineering, Science & Technology **Lab FileID:** 2Q35359.D
Project: Cannon AFB; Clovis, NM

Initial Calibration Report

Compounds with Curve fitting not using Avg Response Factor:

Compound	Curve Fit	Curve Fit Formula	Curve Fit R2
S 13C4-PFBA	Linear	y = 11790.032827 * x	0.000000
T PFBA	Linear	y = 0.164731 * x	0.999246
S 13C5-PFPeA	Linear	y = 9862.929988 * x	0.000000
T PFPeA	Linear	y = 0.820803 * x	0.999178
T PFBS	Linear	y = 1.493895 * x	0.999315
S 13C3-PFBS	Linear	y = 1534.092473 * x	0.000000
S 13C2-4:2FTS	Linear	y = 8640.414874 * x	0.000000
S 13C5-PFHxA	Linear	y = 14457.444434 * x	0.000000
T PFHxA	Linear	y = 0.327016 * x	0.999111
T PFPeS	Linear	y = 0.919869 * x	0.999100
S 13C3-HFPO-DA	Linear	y = 2236.858270 * x	0.000000
T HFPO-DA	Quadratic	y = -0.012472 * x ^ 2 + 1.136983 * x	0.999069
S 13C4-PFHpA	Linear	y = 19172.542805 * x	0.000000
T PFHpA	Linear	y = 0.875230 * x	0.999121
T PFHxS	Linear	y = 1.253111 * x	0.999091
S 13C3-PFHxS	Linear	y = 1584.737269 * x	0.000000
T ADONA	Linear	y = 0.852028 * x	0.998393
T PFHpS	Linear	y = 1.127723 * x	0.999172
S 13C2-6:2FTS	Linear	y = 11098.862571 * x	0.000000
S 13C8-PFOA	Linear	y = 23838.195198 * x	0.000000
S M2-PFOA	Linear	y = 1.001782 * x	0.000000
T PFOA	Linear	y = 0.544096 * x	0.999170
S 13C8-FOSA	Linear	y = 8032.601750 * x	0.000000
T FOSA	Linear	y = 0.498072 * x	0.999140
T PFOS	Linear	y = 0.960176 * x	0.999160
S 13C8-PFOS	Linear	y = 2311.287644 * x	0.000000
S M4-PFOS	Linear	y = 1.000551 * x	0.000000
S 13C9-PFNA	Linear	y = 25012.286631 * x	0.000000
T PFNA	Linear	y = 0.536672 * x	0.999228
S d3-MeFOSAA	Linear	y = 6809.013544 * x	0.000000
T MeFOSAA	Linear	y = 0.519339 * x	0.999265
T 9Cl-PF3ONS	Linear	y = 0.055605 * x	0.998887
T EtFOSAA	Linear	y = 0.460441 * x	0.999503
T PFNS	Linear	y = 0.739489 * x	0.999191
S 13C6-PFDA	Linear	y = 34210.724532 * x	0.000000
T PFDA	Linear	y = 0.433037 * x	0.999409
S 13C2-8:2FTS	Linear	y = 9477.553417 * x	0.000000
T PFDS	Linear	y = 0.478333 * x	0.999312
S 13C7-PFUnDA	Linear	y = 48289.323492 * x	0.000000
T PFUnDA	Linear	y = 0.425343 * x	0.999316
T 11Cl-PF3OUdS	Linear	y = 0.169893 * x	0.999479
S 13C2-PFDoDA	Linear	y = 57091.010436 * x	0.000000
T PFDoDA	Linear	y = 0.450728 * x	0.999393

Generated at 11:06 AM on 9/3/2019

Initial Calibration Summary

Job Number: FA67659 **Sample:** S2Q554-ICC554
Account: EAENGMDS EA Engineering, Science & Technology **Lab FileID:** 2Q35359.D
Project: Cannon AFB; Clovis, NM

Initial Calibration Report

T PFTrDA	Linear	y = 0.657317 * x	0.999144
S 13C2-PFTeDA	Linear	y = 41711.062030 * x	0.000000
T PFTeDA	Linear	y = 0.589506 * x	0.999392

(RedFont and #) = Outlier Flag; (I) = Internal Standard; (T) = Target; (S) = Surrogate; (M) = Matrix Spike

Generated at 11:06 AM on 9/3/2019

Initial Calibration Verification

Job Number: FA67659 **Sample:** S2Q554-ICV554
Account: EAENGMDS EA Engineering, Science & Technology **Lab FileID:** 2Q35364.D
Project: Cannon AFB; Clovis, NM

Continuing Calibration Report

Batch: D:\MassHunter\Data\ID_090319_S2Q554\s2q554.batch.bin

Level ID:Calibration File
1:D:\MassHunter\Data\ID_090319_S2Q554\2Q35354.d
2:D:\MassHunter\Data\ID_090319_S2Q554\2Q35355.d
3:D:\MassHunter\Data\ID_090319_S2Q554\2Q35356.d
4:D:\MassHunter\Data\ID_090319_S2Q554\2Q35357.d
5:D:\MassHunter\Data\ID_090319_S2Q554\2Q35358.d
6:D:\MassHunter\Data\ID_090319_S2Q554\2Q35359.d
7:D:\MassHunter\Data\ID_090319_S2Q554\2Q35360.d
8:D:\MassHunter\Data\ID_090319_S2Q554\2Q35361.d

Data File: 2Q35364
Type : QC
Level : 6

Cpnd Name	Exp. Conc	Final Conc	Dev %	Area %
13C2-4:2FTS	20.000	19.708	-1.5	98.5
13C2-6:2FTS	20.000	19.855	-0.7	99.3
13C2-8:2FTS	20.000	19.487	-2.6	97.4
13C2-PFDoDA	20.000	19.931	-0.3	99.7
13C2-PFOA	---	--ISTD--		
13C2-PFTeDA	20.000	20.177	0.9	100.9
13C3-PFBS	20.000	19.605	-2.0	98.0
13C3-PFHxS	20.000	19.765	-1.2	98.8
13C4-PFBA	20.000	19.799	-1.0	99.0
13C4-PFHpA	20.000	19.957	-0.2	99.8
13C4-PFOS	---	--ISTD--		
13C5-PFHxA	20.000	20.004	0.0	100.0
13C5-PFPeA	20.000	19.976	-0.1	99.9
13C6-PFDA	20.000	19.884	-0.6	99.4
13C7-PFUnDA	20.000	19.838	-0.8	99.2
13C8-FOSA	20.000	19.638	-1.8	98.2
13C8-PFOA	20.000	20.161	0.8	100.8
13C8-PFOS	20.000	19.496	-2.5	97.5
13C9-PFNA	20.000	19.962	-0.2	99.8
4:2FTS	20.000	17.442	-12.8	87.2
6:2FTS	20.000	17.777	-11.1	88.9
8:2FTS	20.000	17.839	-10.8	89.2
d3-MeFOSAA	20.000	20.133	0.7	100.7
M2-PFOA	20.000	20.005	0.0	100.0
EtFOSAA	20.000	19.480	-2.6	97.4
FOSA	20.000	19.252	-3.7	96.3
MeFOSAA	20.000	19.336	-3.3	96.7
PFBA	20.000	18.704	-6.5	93.5
PFBS	20.000	16.496	-17.5	82.5
PFDA	20.000	17.937	-10.3	89.7
PFDoDA	20.000	19.618	-1.9	98.1
PFDS	20.000	18.752	-6.2	93.8
PFHpA	20.000	19.532	-2.3	97.7
PFHpS	20.000	18.686	-6.6	93.4
PFHxA	20.000	17.222	-13.9	86.1
PFHxS	20.000	16.237	-18.8	81.2
PFNA	20.000	17.689	-11.6	88.4

Initial Calibration Verification

Job Number: FA67659 **Sample:** S2Q554-ICV554
Account: EAENGMDS EA Engineering, Science & Technology **Lab FileID:** 2Q35364.D
Project: Cannon AFB; Clovis, NM

PFNS	20.000	18.458	-7.7	92.3
PFOA	20.000	18.962	-5.2	94.8
PFOS	20.000	19.031	-4.8	95.2
PFPeA	20.000	18.282	-8.6	91.4
PFPeS	20.000	17.772	-11.1	88.9
PFTeDA	20.000	17.647	-11.8	88.2
PFTrDA	20.000	21.149	5.7	105.7
PFUnDA	20.000	20.035	0.2	100.2
M4-PFOS	20.000	20.004	0.0	100.0
M4-PFBA	---	--ISTD--		
M5-PFPeA	---	--ISTD--		
M5-PFHxA	---	--ISTD--		
M4-PFHpA	---	--ISTD--		
M8-PFOA	---	--ISTD--		
M9-PFNA	---	--ISTD--		
M6-PFDA	---	--ISTD--		
M7-PFUnDA	---	--ISTD--		
M2-PFDoDA	---	--ISTD--		
M2-PFTeDA	---	--ISTD--		
M8-FOSA	---	--ISTD--		
M3-PFBS	---	--ISTD--		
M3-PFHxS	---	--ISTD--		
M8-PFOS	---	--ISTD--		
M2-4:2FTS	---	--ISTD--		
M2-6:2FTS	---	--ISTD--		
M2-8:2FTS	---	--ISTD--		
M3-MeFOSAA	---	--ISTD--		
11Cl-PF3OUdS	20.000	0.000	# -100.0	0.0
13C3-HFPO-DA	100.000	103.205	3.2	103.2
9Cl-PF3ONS	20.000	0.000	# -100.0	0.0
ADONA	20.000	0.000	# -100.0	0.0
HFPO-DA	100.000	0.000	# -100.0	0.0
M3-HFPO-DA	---	--ISTD--		

CC Criteria: +/- 30%

Initial Calibration Verification

Job Number: FA67659 **Sample:** S2Q554-ICV554
Account: EAENGMDS EA Engineering, Science & Technology **Lab FileID:** 2Q35365.D
Project: Cannon AFB; Clovis, NM

Continuing Calibration Report

Batch: D:\MassHunter\Data\ID_090319_S2Q554\s2q554.batch.bin

Level ID:Calibration File
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4:D:\MassHunter\Data\ID_090319_S2Q554\2Q35357.d
5:D:\MassHunter\Data\ID_090319_S2Q554\2Q35358.d
6:D:\MassHunter\Data\ID_090319_S2Q554\2Q35359.d
7:D:\MassHunter\Data\ID_090319_S2Q554\2Q35360.d
8:D:\MassHunter\Data\ID_090319_S2Q554\2Q35361.d

Data File: 2Q35365
Type : QC
Level : 6

Cpnd Name	Exp. Conc	Final Conc	Dev %	Area %
13C2-4:2FTS	20.000	19.395	-3.0	97.0
13C2-6:2FTS	20.000	19.803	-1.0	99.0
13C2-8:2FTS	20.000	19.139	-4.3	95.7
13C2-PFDoDA	20.000	20.563	2.8	102.8
13C2-PFOA	---	--ISTD--		
13C2-PFTeDA	20.000	20.847	4.2	104.2
13C3-PFBS	20.000	20.239	1.2	101.2
13C3-PFHxS	20.000	20.230	1.1	101.1
13C4-PFBA	20.000	20.458	2.3	102.3
13C4-PFHpA	20.000	20.601	3.0	103.0
13C4-PFOS	---	--ISTD--		
13C5-PFHxA	20.000	20.584	2.9	102.9
13C5-PFPeA	20.000	20.697	3.5	103.5
13C6-PFDA	20.000	20.397	2.0	102.0
13C7-PFUnDA	20.000	20.706	3.5	103.5
13C8-FOSA	20.000	21.442	7.2	107.2
13C8-PFOA	20.000	21.110	5.6	105.6
13C8-PFOS	20.000	20.253	1.3	101.3
13C9-PFNA	20.000	20.594	3.0	103.0
4:2FTS	20.000	0.000	# -100.0	0.0
6:2FTS	20.000	0.000	# -100.0	0.0
8:2FTS	20.000	0.000	# -100.0	0.0
d3-MeFOSAA	20.000	20.768	3.8	103.8
M2-PFOA	20.000	19.995	0.0	100.0
EtFOSAA	20.000	14.954	-25.2	74.8
FOSA	20.000	0.000	# -100.0	0.0
MeFOSAA	20.000	14.858	-25.7	74.3
PFBA	20.000	0.000	# -100.0	0.0
PFBS	20.000	16.239	-18.8	81.2
PFDA	20.000	16.509	-17.5	82.5
PFDoDA	20.000	16.183	-19.1	80.9
PFDS	20.000	0.000	# -100.0	0.0
PFHpA	20.000	15.991	-20.0	80.0
PFHpS	20.000	0.000	# -100.0	0.0
PFHxA	20.000	16.090	-19.5	80.5
PFHxS	20.000	16.374	-18.1	81.9
PFNA	20.000	16.988	-15.1	84.9

Initial Calibration Verification

Job Number: FA67659 **Sample:** S2Q554-ICV554
Account: EAENGMDS EA Engineering, Science & Technology **Lab FileID:** 2Q35365.D
Project: Cannon AFB; Clovis, NM

PFNS	20.000	0.000	# -100.0	0.0
PFOA	20.000	16.278	-18.6	81.4
PFOS	20.000	16.240	-18.8	81.2
PFPeA	20.000	0.000	# -100.0	0.0
PFPeS	20.000	0.000	# -100.0	0.0
PFTeDA	20.000	15.988	-20.1	79.9
PFTrDA	20.000	16.607	-17.0	83.0
PFUnDA	20.000	16.519	-17.4	82.6
M4-PFOS	20.000	20.049	0.2	100.2
M4-PFBA	---	--ISTD--		
M5-PFPeA	---	--ISTD--		
M5-PFHxA	---	--ISTD--		
M4-PFHpA	---	--ISTD--		
M8-PFOA	---	--ISTD--		
M9-PFNA	---	--ISTD--		
M6-PFDA	---	--ISTD--		
M7-PFUnDA	---	--ISTD--		
M2-PFDoDA	---	--ISTD--		
M2-PFTeDA	---	--ISTD--		
M8-FOSA	---	--ISTD--		
M3-PFBS	---	--ISTD--		
M3-PFHxS	---	--ISTD--		
M8-PFOS	---	--ISTD--		
M2-4:2FTS	---	--ISTD--		
M2-6:2FTS	---	--ISTD--		
M2-8:2FTS	---	--ISTD--		
M3-MeFOSAA	---	--ISTD--		
11Cl-PF3OUdS	20.000	17.069	-14.7	85.3
13C3-HFPO-DA	100.000	102.285	2.3	102.3
9Cl-PF3ONS	20.000	16.719	-16.4	83.6
ADONA	20.000	15.861	-20.7	79.3
HFPO-DA	20.000	17.507	-12.5	87.5
M3-HFPO-DA	---	--ISTD--		

CC Criteria: +/- 30%

Continuing Calibration Summary

Job Number: FA67659 **Sample:** S2Q561-CC556
Account: EAENGMDS EA Engineering, Science & Technology **Lab FileID:** 2Q35931.D
Project: Cannon AFB; Clovis, NM

Continuing Calibration Report

Batch: D:\MassHunter\Data\ID_091319_S2Q561\s2q561.batch.bin

Level ID:Calibration File
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4:D:\MassHunter\Data\ID_090319_S2Q554\2Q35357.d
5:D:\MassHunter\Data\ID_090319_S2Q554\2Q35358.d
6:D:\MassHunter\Data\ID_090319_S2Q554\2Q35359.d
7:D:\MassHunter\Data\ID_090319_S2Q554\2Q35360.d
8:D:\MassHunter\Data\ID_090319_S2Q554\2Q35361.d

Data File: 2Q35931
Type : QC
Level : 2

Cpnd Name	Exp. Conc	Final Conc	Dev %	Area %
13C2-4:2FTS	20.000	17.212	-13.9	86.1
13C2-6:2FTS	20.000	16.803	-16.0	84.0
13C2-8:2FTS	20.000	14.683	-26.6	73.4
13C2-PFDoDA	20.000	19.440	-2.8	97.2
13C2-PFOA	---	--ISTD--		
13C2-PFTeDA	20.000	19.338	-3.3	96.7
13C3-PFBS	20.000	19.968	-0.2	99.8
13C3-PFHxS	20.000	20.488	2.4	102.4
13C4-PFBA	20.000	20.174	0.9	100.9
13C4-PFHpA	20.000	21.421	7.1	107.1
13C4-PFOS	---	--ISTD--		
13C5-PFHxA	20.000	21.673	8.4	108.4
13C5-PFPeA	20.000	21.572	7.9	107.9
13C6-PFDA	20.000	19.792	-1.0	99.0
13C7-PFUnDA	20.000	20.842	4.2	104.2
13C8-FOSA	20.000	20.448	2.2	102.2
13C8-PFOA	20.000	21.690	8.4	108.4
13C8-PFOS	20.000	20.035	0.2	100.2
13C9-PFNA	20.000	21.075	5.4	105.4
4:2FTS	1.000	1.026	2.6	102.6
6:2FTS	1.000	0.961	-3.9	96.1
8:2FTS	1.000	1.001	0.1	100.1
d3-MeFOSAA	20.000	15.139	-24.3	75.7
M2-PFOA	20.000	20.011	0.1	100.1
EtFOSAA	1.000	0.992	-0.8	99.2
FOSA	1.000	0.971	-2.9	97.1
MeFOSAA	1.000	0.972	-2.8	97.2
PFBA	1.000	1.034	3.4	103.4
PFBS	1.000	0.975	-2.5	97.5
PFDA	1.000	1.015	1.5	101.5
PFDoDA	1.000	0.984	-1.6	98.4
PFDS	1.000	1.079	7.9	107.9
PFHpA	1.000	0.927	-7.3	92.7
PFHpS	1.000	1.107	10.7	110.7
PFHxA	1.000	0.995	-0.5	99.5
PFHxS	1.000	0.970	-3.0	97.0
PFNA	1.000	0.943	-5.7	94.3

Continuing Calibration Summary

Job Number: FA67659 **Sample:** S2Q561-CC556
Account: EAENGMDS EA Engineering, Science & Technology **Lab FileID:** 2Q35931.D
Project: Cannon AFB; Clovis, NM

PFNS	1.000	0.943	-5.7	94.3
PFOA	1.000	0.973	-2.7	97.3
PFOS	1.000	1.065	6.5	106.5
PFPeA	1.000	0.926	-7.4	92.6
PFPeS	1.000	1.016	1.6	101.6
PFTeDA	1.000	0.950	-5.0	95.0
PFTrDA	1.000	0.885	-11.5	88.5
PFUnDA	1.000	0.973	-2.7	97.3
M4-PFOS	20.000	19.970	-0.2	99.8
M4-PFBA	---	--ISTD--		
M5-PFPeA	---	--ISTD--		
M5-PFHxA	---	--ISTD--		
M4-PFHpA	---	--ISTD--		
M8-PFOA	---	--ISTD--		
M9-PFNA	---	--ISTD--		
M6-PFDA	---	--ISTD--		
M7-PFUnDA	---	--ISTD--		
M2-PFDoDA	---	--ISTD--		
M2-PFTeDA	---	--ISTD--		
M8-FOSA	---	--ISTD--		
M3-PFBS	---	--ISTD--		
M3-PFHxS	---	--ISTD--		
M8-PFOS	---	--ISTD--		
M2-4:2FTS	---	--ISTD--		
M2-6:2FTS	---	--ISTD--		
M2-8:2FTS	---	--ISTD--		
M3-MeFOSAA	---	--ISTD--		
11Cl-PF3OUdS	1.000	0.979	-2.1	97.9
13C3-HFPO-DA	100.000	96.274	-3.7	96.3
9Cl-PF3ONS	1.000	1.060	6.0	106.0
ADONA	1.000	0.853	-14.7	85.3
HFPO-DA	5.000	4.890	-2.2	97.8
M3-HFPO-DA	---	--ISTD--		

CC Criteria: +/- 30%

Continuing Calibration Summary

Job Number: FA67659 **Sample:** S2Q561-CC556
Account: EAENGMDS EA Engineering, Science & Technology **Lab FileID:** 2Q35932.D
Project: Cannon AFB; Clovis, NM

Continuing Calibration Report

Batch: D:\MassHunter\Data\ID_091319_S2Q561\s2q561.batch.bin

Level ID:Calibration File
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4:D:\MassHunter\Data\ID_090319_S2Q554\2Q35357.d
5:D:\MassHunter\Data\ID_090319_S2Q554\2Q35358.d
6:D:\MassHunter\Data\ID_090319_S2Q554\2Q35359.d
7:D:\MassHunter\Data\ID_090319_S2Q554\2Q35360.d
8:D:\MassHunter\Data\ID_090319_S2Q554\2Q35361.d

Data File: 2Q35932
Type : QC
Level : 6

Cpnd Name	Exp. Conc	Final Conc	Dev %	Area %
13C2-4:2FTS	20.000	19.195	-4.0	96.0
13C2-6:2FTS	20.000	18.229	-8.9	91.1
13C2-8:2FTS	20.000	16.329	-18.4	81.6
13C2-PFDoDA	20.000	20.523	2.6	102.6
13C2-PFOA	---	--ISTD--		
13C2-PFTeDA	20.000	20.262	1.3	101.3
13C3-PFBS	20.000	20.868	4.3	104.3
13C3-PFHxS	20.000	21.234	6.2	106.2
13C4-PFBA	20.000	21.127	5.6	105.6
13C4-PFHpA	20.000	22.060	10.3	110.3
13C4-PFOS	---	--ISTD--		
13C5-PFHxA	20.000	22.570	12.8	112.8
13C5-PFPeA	20.000	22.619	13.1	113.1
13C6-PFDA	20.000	20.105	0.5	100.5
13C7-PFUnDA	20.000	21.377	6.9	106.9
13C8-FOSA	20.000	19.687	-1.6	98.4
13C8-PFOA	20.000	22.060	10.3	110.3
13C8-PFOS	20.000	20.831	4.2	104.2
13C9-PFNA	20.000	21.632	8.2	108.2
4:2FTS	20.000	20.675	3.4	103.4
6:2FTS	20.000	20.053	0.3	100.3
8:2FTS	20.000	20.021	0.1	100.1
d3-MeFOSAA	20.000	15.801	-21.0	79.0
M2-PFOA	20.000	19.988	-0.1	99.9
EtFOSAA	20.000	20.656	3.3	103.3
FOSA	20.000	20.581	2.9	102.9
MeFOSAA	20.000	21.319	6.6	106.6
PFBA	20.000	21.472	7.4	107.4
PFBS	20.000	20.636	3.2	103.2
PFDA	20.000	21.435	7.2	107.2
PFDoDA	20.000	20.994	5.0	105.0
PFDS	20.000	21.937	9.7	109.7
PFHpA	20.000	19.680	-1.6	98.4
PFHpS	20.000	21.281	6.4	106.4
PFHxA	20.000	20.952	4.8	104.8
PFHxS	20.000	20.374	1.9	101.9
PFNA	20.000	19.944	-0.3	99.7

Continuing Calibration Summary

Job Number: FA67659 **Sample:** S2Q561-CC556
Account: EAENGMDS EA Engineering, Science & Technology **Lab FileID:** 2Q35932.D
Project: Cannon AFB; Clovis, NM

PFNS	20.000	21.322	6.6	106.6
PFOA	20.000	20.316	1.6	101.6
PFOS	20.000	19.971	-0.1	99.9
PFPeA	20.000	18.960	-5.2	94.8
PFPeS	20.000	21.776	8.9	108.9
PFTeDA	20.000	20.045	0.2	100.2
PFTrDA	20.000	19.181	-4.1	95.9
PFUnDA	20.000	20.740	3.7	103.7
M4-PFOS	20.000	20.038	0.2	100.2
M4-PFBA	---	--ISTD--		
M5-PFPeA	---	--ISTD--		
M5-PFHxA	---	--ISTD--		
M4-PFHpA	---	--ISTD--		
M8-PFOA	---	--ISTD--		
M9-PFNA	---	--ISTD--		
M6-PFDA	---	--ISTD--		
M7-PFUnDA	---	--ISTD--		
M2-PFDoDA	---	--ISTD--		
M2-PFTeDA	---	--ISTD--		
M8-FOSA	---	--ISTD--		
M3-PFBS	---	--ISTD--		
M3-PFHxS	---	--ISTD--		
M8-PFOS	---	--ISTD--		
M2-4:2FTS	---	--ISTD--		
M2-6:2FTS	---	--ISTD--		
M2-8:2FTS	---	--ISTD--		
M3-MeFOSAA	---	--ISTD--		
11Cl-PF3OUdS	20.000	21.359	6.8	106.8
13C3-HFPO-DA	100.000	98.636	-1.4	98.6
9Cl-PF3ONS	20.000	21.652	8.3	108.3
ADONA	20.000	18.777	-6.1	93.9
HFPO-DA	100.000	104.785	4.8	104.8
M3-HFPO-DA	---	--ISTD--		

CC Criteria: +/- 30%

Continuing Calibration Summary

Job Number: FA67659 **Sample:** S2Q561-CC556
Account: EAENGMDS EA Engineering, Science & Technology **Lab FileID:** 2Q35943.D
Project: Cannon AFB; Clovis, NM

Continuing Calibration Report

Batch: D:\MassHunter\Data\ID_091319_S2Q561\s2q561.batch.bin

Level ID:Calibration File
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6:D:\MassHunter\Data\ID_090319_S2Q554\2Q35359.d
7:D:\MassHunter\Data\ID_090319_S2Q554\2Q35360.d
8:D:\MassHunter\Data\ID_090319_S2Q554\2Q35361.d

Data File: 2Q35943
Type : QC
Level : 6

Cpnd Name	Exp. Conc	Final Conc	Dev %	Area %
13C2-4:2FTS	20.000	18.969	-5.2	94.8
13C2-6:2FTS	20.000	17.975	-10.1	89.9
13C2-8:2FTS	20.000	16.204	-19.0	81.0
13C2-PFDoDA	20.000	20.170	0.9	100.9
13C2-PFOA	---	--ISTD--		
13C2-PFTeDA	20.000	19.885	-0.6	99.4
13C3-PFBS	20.000	20.880	4.4	104.4
13C3-PFHxS	20.000	21.082	5.4	105.4
13C4-PFBA	20.000	21.123	5.6	105.6
13C4-PFHpA	20.000	21.703	8.5	108.5
13C4-PFOS	---	--ISTD--		
13C5-PFHxA	20.000	22.388	11.9	111.9
13C5-PFPeA	20.000	22.512	12.6	112.6
13C6-PFDA	20.000	20.076	0.4	100.4
13C7-PFUnDA	20.000	21.303	6.5	106.5
13C8-FOSA	20.000	19.604	-2.0	98.0
13C8-PFOA	20.000	21.869	9.3	109.3
13C8-PFOS	20.000	20.830	4.2	104.2
13C9-PFNA	20.000	21.329	6.6	106.6
4:2FTS	20.000	20.996	5.0	105.0
6:2FTS	20.000	20.285	1.4	101.4
8:2FTS	20.000	20.382	1.9	101.9
d3-MeFOSAA	20.000	15.696	-21.5	78.5
M2-PFOA	20.000	20.002	0.0	100.0
EtFOSAA	20.000	20.906	4.5	104.5
FOSA	20.000	20.853	4.3	104.3
MeFOSAA	20.000	20.976	4.9	104.9
PFBA	20.000	21.245	6.2	106.2
PFBS	20.000	20.455	2.3	102.3
PFDA	20.000	21.213	6.1	106.1
PFDoDA	20.000	21.097	5.5	105.5
PFDS	20.000	22.142	10.7	110.7
PFHpA	20.000	19.869	-0.7	99.3
PFHpS	20.000	21.301	6.5	106.5
PFHxA	20.000	20.893	4.5	104.5
PFHxS	20.000	20.317	1.6	101.6
PFNA	20.000	19.828	-0.9	99.1

Continuing Calibration Summary

Job Number: FA67659 **Sample:** S2Q561-CC556
Account: EAENGMDS EA Engineering, Science & Technology **Lab FileID:** 2Q35943.D
Project: Cannon AFB; Clovis, NM

PFNS	20.000	21.033	5.2	105.2
PFOA	20.000	20.216	1.1	101.1
PFOS	20.000	19.780	-1.1	98.9
PFPeA	20.000	18.894	-5.5	94.5
PFPeS	20.000	21.099	5.5	105.5
PFTeDA	20.000	19.998	0.0	100.0
PFTrDA	20.000	19.473	-2.6	97.4
PFUnDA	20.000	20.467	2.3	102.3
M4-PFOS	20.000	20.070	0.3	100.3
M4-PFBA	---	--ISTD--		
M5-PFPeA	---	--ISTD--		
M5-PFHxA	---	--ISTD--		
M4-PFHpA	---	--ISTD--		
M8-PFOA	---	--ISTD--		
M9-PFNA	---	--ISTD--		
M6-PFDA	---	--ISTD--		
M7-PFUnDA	---	--ISTD--		
M2-PFDoDA	---	--ISTD--		
M2-PFTeDA	---	--ISTD--		
M8-FOSA	---	--ISTD--		
M3-PFBS	---	--ISTD--		
M3-PFHxS	---	--ISTD--		
M8-PFOS	---	--ISTD--		
M2-4:2FTS	---	--ISTD--		
M2-6:2FTS	---	--ISTD--		
M2-8:2FTS	---	--ISTD--		
M3-MeFOSAA	---	--ISTD--		
11Cl-PF3OUdS	20.000	21.572	7.9	107.9
13C3-HFPO-DA	100.000	96.062	-3.9	96.1
9Cl-PF3ONS	20.000	21.770	8.8	108.8
ADONA	20.000	18.846	-5.8	94.2
HFPO-DA	100.000	103.265	3.3	103.3
M3-HFPO-DA	---	--ISTD--		

CC Criteria: +/- 30%

Initial Calibration Summary

Job Number: FA67659 **Sample:** S2Q562-ICC562
Account: EAENGMDS EA Engineering, Science & Technology **Lab FileID:** 2Q35984.D
Project: Cannon AFB; Clovis, NM

Initial Calibration Report

Method Path	D:\MassHunter\damethods
Method File	ID_091519_S2Q562.quantmethod.xml
Batch Name	D:\MassHunter\Data\ID_091519_S2Q562\QuantResults\s2q562.batch.bin
Last Calib Update	9/15/2019 12:50:07 PM

Level Name	Calibration Files	Acq. Date-Time	Level Last Update Time
1	D:\MassHunter\Data\ID_091519_S2Q562\2Q35979.d	9/15/2019 9:58:03 AM	9/15/2019 12:50:07 PM
2	D:\MassHunter\Data\ID_091519_S2Q562\2Q35980.d	9/15/2019 10:13:52 AM	9/15/2019 12:50:07 PM
3	D:\MassHunter\Data\ID_091519_S2Q562\2Q35981.d	9/15/2019 10:29:54 AM	9/15/2019 12:50:07 PM
4	D:\MassHunter\Data\ID_091519_S2Q562\2Q35982.d	9/15/2019 10:50:10 AM	9/15/2019 12:50:07 PM
5	D:\MassHunter\Data\ID_091519_S2Q562\2Q35983.d	9/15/2019 11:05:59 AM	9/15/2019 12:50:07 PM
6	D:\MassHunter\Data\ID_091519_S2Q562\2Q35984.d	9/15/2019 11:21:47 AM	9/15/2019 12:50:07 PM
7	D:\MassHunter\Data\ID_091519_S2Q562\2Q35985.d	9/15/2019 11:37:38 AM	9/15/2019 12:50:07 PM
8	D:\MassHunter\Data\ID_091519_S2Q562\2Q35986.d	9/15/2019 11:53:27 AM	9/15/2019 12:50:07 PM

Compound	Curve Fit	1	2	3	4	5	6	7	8	Avg RF	%RSD
S 13C4-PFBA	Linear	11437	11333	11499	11103	11054	10822	10641	10499	11049	3.346
S 13C5-PFPeA	Linear	9476	9485	9558	9335	9211	9062	8929	8776	9229	3.090
S 13C3-PFBS	Linear	1539	1509	1523	1491	1460	1429	1409	1367	1466	4.113
S 13C2-4:2FTS	Linear	6580	6621	6647	6532	6572	6719	7108	8005	6848	7.327
S 13C5-PFHxA	Linear	13450	13371	13566	13261	13077	12776	12607	12269	13047	3.495
S 13C3-HFPO-DA	Linear	2507	2464	2416	2351	2363	2241	2136	1955	2304	8.017
S 13C4-PFHpA	Linear	17647	17393	17636	17261	16942	16507	15966	15426	16847	4.839
S 13C3-PFHxS	Linear	1604	1581	1608	1545	1527	1480	1459	1369	1522	5.408
S 13C2-6:2FTS	Linear	7861	7855	7983	7779	7719	7748	7953	8528	7928	3.274
S 13C8-PFOA	Linear	21410	21374	21777	20983	20722	19864	19158	18022	20414	6.359
S 13C8-FOSA	Linear	7267	7163	7232	6956	6792	6492	6014	5370	6661	10.091
S 13C8-PFOS	Linear	2324	2287	2333	2201	2205	2146	2057	1949	2188	6.130
S 13C9-PFNA	Linear	20965	20930	21328	20692	20364	19857	19264	18420	20228	4.879
S d3-MeFOSAA	Linear	3833	3857	3904	3805	3690	3641	3675	3594	3750	3.033
S 13C6-PFDA	Linear	27859	27782	27993	27408	26617	25997	24679	23328	26458	6.417
S 13C2-8:2FTS	Linear	5524	5478	5677	5523	5484	5593	6005	6731	5752	7.506
S 13C7-PFUnDA	Linear	41458	41269	41645	41339	39972	38801	37231	35135	39606	6.018
S 13C2-PFDoDA	Linear	46898	46589	46860	46310	45660	44879	43883	42790	45484	3.325
S 13C2-PFTeDA	Linear	32824	32403	32929	33262	32826	31888	31434	30824	32299	2.611
I 13C2-PFOA				---------- ISTD ----------							
S M2-PFOA	Linear	1.0018	1.0014	1.0023	1.0024	1.0012	1.0007	1.0024	1.0020	1.0018	0.062
I 13C4-PFOS				---------- ISTD ----------							
S M4-PFOS	Linear	0.9975	1.0021	1.0022	0.9994	1.0012	1.0007	0.9977	0.9915	0.9990	0.355
I M4-PFBA				---------- ISTD ----------							
T PFBA	Linear	0.1805	0.1780	0.1694	0.1703	0.1742	0.1858	0.1768	0.1805	0.1769	3.117
I M5-PFPeA				---------- ISTD ----------							
T PFPeA	Linear	0.9326	0.8616	0.8276	0.8338	0.8508	0.8982	0.8555	0.8715	0.8665	3.992

Generated at 12:50 PM on 9/15/2019

Initial Calibration Summary

Job Number: FA67659 **Sample:** S2Q562-ICC562
Account: EAENGMDS EA Engineering, Science & Technology **Lab FileID:** 2Q35984.D
Project: Cannon AFB; Clovis, NM

Initial Calibration Report

Compound	Curve Fit	1	2	3	4	5	6	7	8	Avg RF	%RSD
I M5-PFHxA						ISTD					
T PFHxA	Linear	0.3917	0.3597	0.3481	0.3417	0.3541	0.3826	0.3619	0.3675	0.3634	4.641
I M4-PFHpA						ISTD					
T PFHpA	Linear	0.9676	0.9280	0.8841	0.9010	0.9324	0.9902	0.9448	0.9553	0.9379	3.683
I M8-PFOA						ISTD					
T ADONA	Linear	0.8996	0.8539	0.8375	0.8635	0.8841	0.9616	0.9258	0.9756	0.9002	5.602
T PFOA	Linear	0.6536	0.5800	0.5694	0.5654	0.5780	0.6254	0.5814	0.5980	0.5939	5.164
I M9-PFNA						ISTD					
T PFNA	Linear	0.6131	0.5625	0.5479	0.5690	0.5812	0.6172	0.5832	0.5981	0.5840	4.167
I M6-PFDA						ISTD					
T 9Cl-PF3ONS	Linear	0.0722	0.0740	0.0687	0.0680	0.0691	0.0740	0.0730	0.0754	0.0718	3.914
T PFDA	Linear	0.4883	0.4543	0.4464	0.4652	0.4777	0.5068	0.4875	0.4929	0.4774	4.314
I M7-PFUnDA						ISTD					
T PFUnDA	Linear	0.4483	0.4355	0.4238	0.4372	0.4491	0.4786	0.4579	0.4695	0.4500	4.045
I M2-PFDoDA						ISTD					
T 11Cl-PF3OUdS	Linear	0.2091	0.2003	0.1947	0.1962	0.2038	0.2177	0.2077	0.2138	0.2054	3.979
T PFDoDA	Linear	0.5005	0.4782	0.4615	0.4770	0.4869	0.5188	0.4940	0.5030	0.4900	3.661
I M2-PFTeDA						ISTD					
T PFTrDA	Linear	0.6840	0.6543	0.6187	0.6460	0.6615	0.7150	0.6760	0.6850	0.6676	4.373
T PFTeDA	Linear	0.6794	0.6315	0.5901	0.6125	0.6227	0.6699	0.6354	0.6487	0.6363	4.623
I M8-FOSA						ISTD					
T FOSA	Linear	0.5534	0.5137	0.5091	0.5199	0.5388	0.5777	0.5439	0.5547	0.5389	4.368
I M3-PFBS						ISTD					
T PFBS	Linear	1.6770	1.6015	1.5379	1.5456	1.6014	1.7163	1.6113	1.6590	1.6187	3.841
T PFPeS	Linear	1.0377	0.9941	0.9812	0.9425	0.9940	1.0794	1.0060	1.0179	1.0066	4.021
I M3-PFHxS						ISTD					
T PFHxS	Linear	1.3947	1.2515	1.2492	1.2911	1.3385	1.3987	1.3149	1.3792	1.3272	4.571
T PFHpS	Linear	1.3158	1.1814	1.1531	1.1827	1.2313	1.3162	1.2175	1.2299	1.2285	4.910
I M8-PFOS						ISTD					
T PFOS	Linear	1.1636	1.0517	1.0285	1.0299	1.0079	1.0626	1.0228	1.0784	1.0557	4.668
T PFNS	Linear	0.8524	0.8143	0.7482	0.7769	0.7878	0.8420	0.7995	0.8117	0.8041	4.227
T PFDS	Linear	0.5295	0.5290	0.5041	0.5159	0.5287	0.5556	0.5328	0.5546	0.5313	3.281
I M2-4:2FTS						ISTD					
T 4:2FTS	Avg RF	0.7134	0.6522	0.6347	0.6402	0.6375	0.6610	0.5828	0.5204	0.6303	9.063
I M2-6:2FTS						ISTD					

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Initial Calibration Summary

Job Number: FA67659 **Sample:** S2Q562-ICC562
Account: EAENGMDS EA Engineering, Science & Technology **Lab FileID:** 2Q35984.D
Project: Cannon AFB; Clovis, NM

Initial Calibration Report

Compound	Curve Fit	1	2	3	4	5	6	7	8	Avg RF	%RSD
T 6:2FTS	Avg RF	0.6007	0.5430	0.5477	0.5472	0.5535	0.5700	0.4988	0.4445	0.5382	8.791
I M2-8:2FTS				----------	----------	ISTD	----------	----------			
T 8:2FTS	Avg RF	0.6407	0.6132	0.5755	0.5646	0.5854	0.6018	0.5273	0.4678	0.5720	9.438
I M3-MeFOSAA				----------	----------	ISTD	----------	----------			
T MeFOSAA	Linear	0.5945	0.5493	0.5244	0.5519	0.5701	0.6139	0.5711	0.5733	0.5686	4.868
T EtFOSAA	Linear	0.5613	0.5004	0.4546	0.4815	0.4943	0.5199	0.4826	0.4770	0.4965	6.510
I M3-HFPO-DA				----------	----------	ISTD	----------	----------			
T HFPO-DA	Quadratic	1.1115	1.0489	1.0499	1.0637	1.0510	1.1383	1.0681	1.0821	1.0767	3.028

(RedFont and #) = Outlier Flag; (I) = Internal Standard; (T) = Target; (S) = Surrogate; (M) = Matrix Spike

Generated at 12:50 PM on 9/15/2019

Initial Calibration Summary

Job Number: FA67659 **Sample:** S2Q562-ICC562
Account: EAENGMDS EA Engineering, Science & Technology **Lab FileID:** 2Q35984.D
Project: Cannon AFB; Clovis, NM

Initial Calibration Report

Compounds with Curve fitting not using Avg Response Factor:

Compound	Curve Fit	Curve Fit Formula	Curve Fit R2
S 13C4-PFBA	Linear	y = 11048.650773 * x	0.000000
T PFBA	Linear	y = 0.179913 * x	0.999831
S 13C5-PFPeA	Linear	y = 9229.047289 * x	0.000000
T PFPeA	Linear	y = 0.869028 * x	0.999856
T PFBS	Linear	y = 1.650883 * x	0.999708
S 13C3-PFBS	Linear	y = 1465.773422 * x	0.000000
S 13C2-4:2FTS	Linear	y = 6847.873146 * x	0.000000
S 13C5-PFHxA	Linear	y = 13047.413244 * x	0.000000
T PFHxA	Linear	y = 0.366762 * x	0.999830
T PFPeS	Linear	y = 1.017133 * x	0.999768
T HFPO-DA	Quadratic	y = 1.921148E-004 * x ^ 2 + 1.079996 * x	0.999816
S 13C3-HFPO-DA	Linear	y = 2304.057707 * x	0.000000
S 13C4-PFHpA	Linear	y = 16847.429970 * x	0.000000
T PFHpA	Linear	y = 0.954049 * x	0.999886
T PFHxS	Linear	y = 1.366923 * x	0.999445
S 13C3-PFHxS	Linear	y = 1521.834423 * x	0.000000
T ADONA	Linear	y = 0.964658 * x	0.999266
T PFHpS	Linear	y = 1.230085 * x	0.999734
S 13C2-6:2FTS	Linear	y = 7928.308611 * x	0.000000
S 13C8-PFOA	Linear	y = 20413.697735 * x	0.000000
S M2-PFOA	Linear	y = 1.001763 * x	0.000000
T PFOA	Linear	y = 0.595434 * x	0.999682
S 13C8-FOSA	Linear	y = 6660.747887 * x	0.000000
T FOSA	Linear	y = 0.553156 * x	0.999796
S 13C8-PFOS	Linear	y = 2187.808719 * x	0.000000
S M4-PFOS	Linear	y = 0.999047 * x	0.000000
T PFOS	Linear	y = 1.066577 * x	0.999335
S 13C9-PFNA	Linear	y = 20227.541356 * x	0.000000
T PFNA	Linear	y = 0.595644 * x	0.999776
S d3-MeFOSAA	Linear	y = 3749.995169 * x	0.000000
T MeFOSAA	Linear	y = 0.574038 * x	0.999757
T EtFOSAA	Linear	y = 0.479530 * x	0.999607
T 9Cl-PF3ONS	Linear	y = 0.074862 * x	0.999643
T PFNS	Linear	y = 0.810029 * x	0.999857
S 13C6-PFDA	Linear	y = 26457.929314 * x	0.000000
T PFDA	Linear	y = 0.492132 * x	0.999907
S 13C2-8:2FTS	Linear	y = 5751.882522 * x	0.000000
T PFDS	Linear	y = 0.550135 * x	0.999603
S 13C7-PFUnDA	Linear	y = 39606.128237 * x	0.000000
T PFUnDA	Linear	y = 0.467295 * x	0.999798
T 11Cl-PF3OUdS	Linear	y = 0.212621 * x	0.999745
T PFDoDA	Linear	y = 0.501565 * x	0.999850
S 13C2-PFDoDA	Linear	y = 45483.548848 * x	0.000000

Initial Calibration Summary

Job Number: FA67659 **Sample:** S2Q562-ICC562
Account: EAENGMDS EA Engineering, Science & Technology **Lab FileID:** 2Q35984.D
Project: Cannon AFB; Clovis, NM

Initial Calibration Report

T PFTrDA	Linear	y = 0.683900 * x	0.999837
S 13C2-PFTeDA	Linear	y = 32298.830149 * x	0.000000
T PFTeDA	Linear	y = 0.646540 * x	0.999811

(RedFont and #) = Outlier Flag; (I) = Internal Standard; (T) = Target; (S) = Surrogate; (M) = Matrix Spike

Generated at 12:50 PM on 9/15/2019

Initial Calibration Verification

Job Number: FA67659 **Sample:** S2Q562-ICV562
Account: EAENGMDS EA Engineering, Science & Technology **Lab FileID:** 2Q35988.D
Project: Cannon AFB; Clovis, NM

Continuing Calibration Report

Batch: D:\MassHunter\Data\ID_091519_S2Q562\s2q562.batch.bin

Level ID:Calibration File
1:D:\MassHunter\Data\ID_091519_S2Q562\2Q35979.d
2:D:\MassHunter\Data\ID_091519_S2Q562\2Q35980.d
3:D:\MassHunter\Data\ID_091519_S2Q562\2Q35981.d
4:D:\MassHunter\Data\ID_091519_S2Q562\2Q35982.d
5:D:\MassHunter\Data\ID_091519_S2Q562\2Q35983.d
6:D:\MassHunter\Data\ID_091519_S2Q562\2Q35984.d
7:D:\MassHunter\Data\ID_091519_S2Q562\2Q35985.d
8:D:\MassHunter\Data\ID_091519_S2Q562\2Q35986.d

Data File: 2Q35988
Type : QC
Level : 6

Cpnd Name	Exp. Conc	Final Conc	Dev %	Area %
13C2-4:2FTS	20.000	19.452	-2.7	97.3
13C2-6:2FTS	20.000	19.723	-1.4	98.6
13C2-8:2FTS	20.000	19.917	-0.4	99.6
13C2-PFDoDA	20.000	19.981	-0.1	99.9
13C2-PFOA	---	--ISTD--		
13C2-PFTeDA	20.000	20.333	1.7	101.7
13C3-PFBS	20.000	19.573	-2.1	97.9
13C3-PFHxS	20.000	19.871	-0.6	99.4
13C4-PFBA	20.000	19.674	-1.6	98.4
13C4-PFHpA	20.000	19.905	-0.5	99.5
13C4-PFOS	---	--ISTD--		
13C5-PFHxA	20.000	19.947	-0.3	99.7
13C5-PFPeA	20.000	19.898	-0.5	99.5
13C6-PFDA	20.000	20.151	0.8	100.8
13C7-PFUnDA	20.000	20.057	0.3	100.3
13C8-FOSA	20.000	20.206	1.0	101.0
13C8-PFOA	20.000	20.130	0.6	100.6
13C8-PFOS	20.000	19.711	-1.4	98.6
13C9-PFNA	20.000	20.183	0.9	100.9
4:2FTS	20.000	17.428	-12.9	87.1
6:2FTS	20.000	18.134	-9.3	90.7
8:2FTS	20.000	17.897	-10.5	89.5
d3-MeFOSAA	20.000	19.897	-0.5	99.5
M2-PFOA	20.000	19.973	-0.1	99.9
EtFOSAA	20.000	19.954	-0.2	99.8
FOSA	20.000	18.282	-8.6	91.4
MeFOSAA	20.000	19.071	-4.6	95.4
PFBA	20.000	18.185	-9.1	90.9
PFBS	20.000	15.888	-20.6	79.4
PFDA	20.000	17.173	-14.1	85.9
PFDoDA	20.000	19.095	-4.5	95.5
PFDS	20.000	17.646	-11.8	88.2
PFHpA	20.000	19.053	-4.7	95.3
PFHpS	20.000	17.956	-10.2	89.8
PFHxA	20.000	16.655	-16.7	83.3
PFHxS	20.000	15.750	-21.2	78.8
PFNA	20.000	17.035	-14.8	85.2

Initial Calibration Verification

Job Number: FA67659 **Sample:** S2Q562-ICV562
Account: EAENGMDS EA Engineering, Science & Technology **Lab FileID:** 2Q35988.D
Project: Cannon AFB; Clovis, NM

PFNS	20.000	17.765	-11.2	88.8
PFOA	20.000	18.292	-8.5	91.5
PFOS	20.000	18.090	-9.6	90.4
PFPeA	20.000	17.829	-10.9	89.1
PFPeS	20.000	17.070	-14.7	85.3
PFTeDA	20.000	17.315	-13.4	86.6
PFTrDA	20.000	20.879	4.4	104.4
PFUnDA	20.000	19.215	-3.9	96.1
M4-PFOS	20.000	20.015	0.1	100.1
M4-PFBA	---	--ISTD--		
M5-PFPeA	---	--ISTD--		
M5-PFHxA	---	--ISTD--		
M4-PFHpA	---	--ISTD--		
M8-PFOA	---	--ISTD--		
M9-PFNA	---	--ISTD--		
M6-PFDA	---	--ISTD--		
M7-PFUnDA	---	--ISTD--		
M2-PFDoDA	---	--ISTD--		
M2-PFTeDA	---	--ISTD--		
M8-FOSA	---	--ISTD--		
M3-PFBS	---	--ISTD--		
M3-PFHxS	---	--ISTD--		
M8-PFOS	---	--ISTD--		
M2-4:2FTS	---	--ISTD--		
M2-6:2FTS	---	--ISTD--		
M2-8:2FTS	---	--ISTD--		
M3-MeFOSAA	---	--ISTD--		
11Cl-PF3OUdS	20.000	0.000	# -100.0	0.0
13C3-HFPO-DA	100.000	99.412	-0.6	99.4
9Cl-PF3ONS	20.000	0.000	# -100.0	0.0
ADONA	20.000	0.000	# -100.0	0.0
HFPO-DA	100.000	0.000	# -100.0	0.0
M3-HFPO-DA	---	--ISTD--		

CC Criteria: +/- 30%

Initial Calibration Verification

Job Number: FA67659 **Sample:** S2Q562-ICV562
Account: EAENGMDS EA Engineering, Science & Technology **Lab FileID:** 2Q35989.D
Project: Cannon AFB; Clovis, NM

Continuing Calibration Report

Batch: D:\MassHunter\Data\ID_091519_S2Q562\s2q562.batch.bin

Level ID:Calibration File
1:D:\MassHunter\Data\ID_091519_S2Q562\2Q35979.d
2:D:\MassHunter\Data\ID_091519_S2Q562\2Q35980.d
3:D:\MassHunter\Data\ID_091519_S2Q562\2Q35981.d
4:D:\MassHunter\Data\ID_091519_S2Q562\2Q35982.d
5:D:\MassHunter\Data\ID_091519_S2Q562\2Q35983.d
6:D:\MassHunter\Data\ID_091519_S2Q562\2Q35984.d
7:D:\MassHunter\Data\ID_091519_S2Q562\2Q35985.d
8:D:\MassHunter\Data\ID_091519_S2Q562\2Q35986.d

Data File: 2Q35989
Type : QC
Level : 6

Cpnd Name	Exp. Conc	Final Conc	Dev %	Area %
13C2-4:2FTS	20.000	18.382	-8.1	91.9
13C2-6:2FTS	20.000	18.912	-5.4	94.6
13C2-8:2FTS	20.000	18.496	-7.5	92.5
13C2-PFDoDA	20.000	19.840	-0.8	99.2
13C2-PFOA	---	--ISTD--		
13C2-PFTeDA	20.000	20.239	1.2	101.2
13C3-PFBS	20.000	19.551	-2.2	97.8
13C3-PFHxS	20.000	19.599	-2.0	98.0
13C4-PFBA	20.000	19.676	-1.6	98.4
13C4-PFHpA	20.000	19.799	-1.0	99.0
13C4-PFOS	---	--ISTD--		
13C5-PFHxA	20.000	19.912	-0.4	99.6
13C5-PFPeA	20.000	19.868	-0.7	99.3
13C6-PFDA	20.000	20.044	0.2	100.2
13C7-PFUnDA	20.000	20.095	0.5	100.5
13C8-FOSA	20.000	21.249	6.2	106.2
13C8-PFOA	20.000	20.342	1.7	101.7
13C8-PFOS	20.000	19.599	-2.0	98.0
13C9-PFNA	20.000	20.107	0.5	100.5
4:2FTS	20.000	0.000	# -100.0	0.0
6:2FTS	20.000	0.000	# -100.0	0.0
8:2FTS	20.000	0.000	# -100.0	0.0
d3-MeFOSAA	20.000	20.223	1.1	101.1
M2-PFOA	20.000	20.014	0.1	100.1
EtFOSAA	20.000	16.181	-19.1	80.9
FOSA	20.000	0.000	# -100.0	0.0
MeFOSAA	20.000	15.722	-21.4	78.6
PFBA	20.000	0.000	# -100.0	0.0
PFBS	20.000	17.496	-12.5	87.5
PFDA	20.000	17.553	-12.2	87.8
PFDoDA	20.000	17.459	-12.7	87.3
PFDS	20.000	0.000	# -100.0	0.0
PFHpA	20.000	17.143	-14.3	85.7
PFHpS	20.000	0.000	# -100.0	0.0
PFHxA	20.000	17.244	-13.8	86.2
PFHxS	20.000	17.299	-13.5	86.5
PFNA	20.000	17.849	-10.8	89.2

Initial Calibration Verification

Job Number: FA67659 **Sample:** S2Q562-ICV562
Account: EAENGMDS EA Engineering, Science & Technology **Lab FileID:** 2Q35989.D
Project: Cannon AFB; Clovis, NM

PFNS	20.000	0.000	# -100.0	0.0
PFOA	20.000	17.338	-13.3	86.7
PFOS	20.000	16.853	-15.7	84.3
PFPeA	20.000	0.000	# -100.0	0.0
PFPeS	20.000	0.000	# -100.0	0.0
PFTeDA	20.000	17.299	-13.5	86.5
PFTrDA	20.000	18.159	-9.2	90.8
PFUnDA	20.000	17.789	-11.1	88.9
M4-PFOS	20.000	20.100	0.5	100.5
M4-PFBA	---	--ISTD--		
M5-PFPeA	---	--ISTD--		
M5-PFHxA	---	--ISTD--		
M4-PFHpA	---	--ISTD--		
M8-PFOA	---	--ISTD--		
M9-PFNA	---	--ISTD--		
M6-PFDA	---	--ISTD--		
M7-PFUnDA	---	--ISTD--		
M2-PFDoDA	---	--ISTD--		
M2-PFTeDA	---	--ISTD--		
M8-FOSA	---	--ISTD--		
M3-PFBS	---	--ISTD--		
M3-PFHxS	---	--ISTD--		
M8-PFOS	---	--ISTD--		
M2-4:2FTS	---	--ISTD--		
M2-6:2FTS	---	--ISTD--		
M2-8:2FTS	---	--ISTD--		
M3-MeFOSAA	---	--ISTD--		
11Cl-PF3OUdS	20.000	18.249	-8.8	91.2
13C3-HFPO-DA	100.000	97.923	-2.1	97.9
9Cl-PF3ONS	20.000	17.623	-11.9	88.1
ADONA	20.000	16.990	-15.0	85.0
HFPO-DA	20.000	19.528	-2.4	97.6
M3-HFPO-DA	---	--ISTD--		

CC Criteria: +/- 30%

Continuing Calibration Summary

Job Number: FA67659 **Sample:** S2Q562-CC562
Account: EAENGMDS EA Engineering, Science & Technology **Lab FileID:** 2Q36001.D
Project: Cannon AFB; Clovis, NM

Continuing Calibration Report

Batch: D:\MassHunter\Data\ID_091519_S2Q562\s2q562.batch.bin

Level ID:Calibration File
1:D:\MassHunter\Data\ID_091519_S2Q562\2Q35979.d
2:D:\MassHunter\Data\ID_091519_S2Q562\2Q35980.d
3:D:\MassHunter\Data\ID_091519_S2Q562\2Q35981.d
4:D:\MassHunter\Data\ID_091519_S2Q562\2Q35982.d
5:D:\MassHunter\Data\ID_091519_S2Q562\2Q35983.d
6:D:\MassHunter\Data\ID_091519_S2Q562\2Q35984.d
7:D:\MassHunter\Data\ID_091519_S2Q562\2Q35985.d
8:D:\MassHunter\Data\ID_091519_S2Q562\2Q35986.d

Data File: 2Q36001
Type : QC
Level : 6

Cpnd Name	Exp. Conc	Final Conc	Dev %	Area %
13C2-4:2FTS	20.000	19.509	-2.5	97.5
13C2-6:2FTS	20.000	19.753	-1.2	98.8
13C2-8:2FTS	20.000	19.905	-0.5	99.5
13C2-PFDoDA	20.000	19.834	-0.8	99.2
13C2-PFOA	---	--ISTD--		
13C2-PFTeDA	20.000	20.464	2.3	102.3
13C3-PFBS	20.000	19.196	-4.0	96.0
13C3-PFHxS	20.000	19.359	-3.2	96.8
13C4-PFBA	20.000	19.507	-2.5	97.5
13C4-PFHpA	20.000	19.956	-0.2	99.8
13C4-PFOS	---	--ISTD--		
13C5-PFHxA	20.000	19.920	-0.4	99.6
13C5-PFPeA	20.000	19.815	-0.9	99.1
13C6-PFDA	20.000	19.687	-1.6	98.4
13C7-PFUnDA	20.000	19.835	-0.8	99.2
13C8-FOSA	20.000	19.916	-0.4	99.6
13C8-PFOA	20.000	19.928	-0.4	99.6
13C8-PFOS	20.000	19.325	-3.4	96.6
13C9-PFNA	20.000	20.038	0.2	100.2
4:2FTS	20.000	21.061	5.3	105.3
6:2FTS	20.000	20.949	4.7	104.7
8:2FTS	20.000	20.986	4.9	104.9
d3-MeFOSAA	20.000	19.881	-0.6	99.4
M2-PFOA	20.000	19.977	-0.1	99.9
EtFOSAA	20.000	21.592	8.0	108.0
FOSA	20.000	20.861	4.3	104.3
MeFOSAA	20.000	21.091	5.5	105.5
PFBA	20.000	20.970	4.9	104.9
PFBS	20.000	20.866	4.3	104.3
PFDA	20.000	20.804	4.0	104.0
PFDoDA	20.000	20.761	3.8	103.8
PFDS	20.000	20.399	2.0	102.0
PFHpA	20.000	20.360	1.8	101.8
PFHpS	20.000	21.235	6.2	106.2
PFHxA	20.000	20.718	3.6	103.6
PFHxS	20.000	20.630	3.1	103.1
PFNA	20.000	20.672	3.4	103.4

Continuing Calibration Summary

Job Number: FA67659 **Sample:** S2Q562-CC562
Account: EAENGMDS EA Engineering, Science & Technology **Lab FileID:** 2Q36001.D
Project: Cannon AFB; Clovis, NM

PFNS	20.000	21.092	5.5	105.5
PFOA	20.000	20.798	4.0	104.0
PFOS	20.000	20.291	1.5	101.5
PFPeA	20.000	20.444	2.2	102.2
PFPeS	20.000	21.046	5.2	105.2
PFTeDA	20.000	20.525	2.6	102.6
PFTrDA	20.000	20.294	1.5	101.5
PFUnDA	20.000	20.615	3.1	103.1
M4-PFOS	20.000	19.995	0.0	100.0
M4-PFBA	---	--ISTD--		
M5-PFPeA	---	--ISTD--		
M5-PFHxA	---	--ISTD--		
M4-PFHpA	---	--ISTD--		
M8-PFOA	---	--ISTD--		
M9-PFNA	---	--ISTD--		
M6-PFDA	---	--ISTD--		
M7-PFUnDA	---	--ISTD--		
M2-PFDoDA	---	--ISTD--		
M2-PFTeDA	---	--ISTD--		
M8-FOSA	---	--ISTD--		
M3-PFBS	---	--ISTD--		
M3-PFHxS	---	--ISTD--		
M8-PFOS	---	--ISTD--		
M2-4:2FTS	---	--ISTD--		
M2-6:2FTS	---	--ISTD--		
M2-8:2FTS	---	--ISTD--		
M3-MeFOSAA	---	--ISTD--		
11Cl-PF3OUdS	20.000	20.172	0.9	100.9
13C3-HFPO-DA	100.000	86.467	-13.5	86.5
9Cl-PF3ONS	20.000	19.531	-2.3	97.7
ADONA	20.000	19.419	-2.9	97.1
HFPO-DA	100.000	109.770	9.8	109.8
M3-HFPO-DA	---	--ISTD--		

CC Criteria: +/- 30%

Run Sequence Report

Job Number: FA67659
Account: EAENGMDS EA Engineering, Science & Technology
Project: Cannon AFB; Clovis, NM

Run ID: S2Q554 **Method:** EPA 537M QSM5.1 B-1 **Instrument ID:** GCMS2Q

Lab Sample ID	Lab File ID	Date/Time Analyzed	Prep QC Batch	Client Sample ID
S2Q554-IC554	2Q35354.D	09/03/19 08:52	n/a	Initial cal 0.5
S2Q554-IC554	2Q35355.D	09/03/19 09:09	n/a	Initial cal 1.0
S2Q554-IC554	2Q35356.D	09/03/19 09:25	n/a	Initial cal 2.0
S2Q554-IC554	2Q35357.D	09/03/19 09:44	n/a	Initial cal 5.0
S2Q554-IC554	2Q35358.D	09/03/19 10:00	n/a	Initial cal 10
S2Q554-ICC554	2Q35359.D	09/03/19 10:16	n/a	Initial cal 20
S2Q554-IC554	2Q35360.D	09/03/19 10:32	n/a	Initial cal 50
S2Q554-IC554	2Q35361.D	09/03/19 10:48	n/a	Initial cal 100
S2Q554-IBLK	2Q35362.D	09/03/19 11:03	n/a	Method Blank
S2Q554-IBLK	2Q35362.D	09/03/19 11:03	n/a	Method Blank
S2Q554-ICV554	2Q35364.D	09/03/19 11:35	n/a	Initial cal verification 20
S2Q554-ICV554	2Q35365.D	09/03/19 11:51	n/a	Initial cal verification 20
OP76597-BS	2Q35366.D	09/03/19 12:07	OP76597	Blank Spike
OP76597-MB	2Q35367.D	09/03/19 12:23	OP76597	Method Blank
OP76597-MS	2Q35368.D	09/03/19 12:39	OP76597	Matrix Spike
ZZZZZZ	2Q35370.D	09/03/19 13:10	OP76597	(unrelated sample)
ZZZZZZ	2Q35371.D	09/03/19 13:26	OP76597	(unrelated sample)
ZZZZZZ	2Q35372.D	09/03/19 13:42	OP76597	(unrelated sample)
ZZZZZZ	2Q35373.D	09/03/19 13:58	OP76597	(unrelated sample)
ZZZZZZ	2Q35374.D	09/03/19 14:13	OP76597	(unrelated sample)
ZZZZZZ	2Q35375.D	09/03/19 14:29	OP76597	(unrelated sample)
ZZZZZZ	2Q35376.D	09/03/19 14:45	OP76597	(unrelated sample)
S2Q554-CC554	2Q35377.D	09/03/19 15:01	n/a	Continuing cal 20
ZZZZZZ	2Q35379.D	09/03/19 15:33	OP76597	(unrelated sample)
ZZZZZZ	2Q35380.D	09/03/19 15:48	OP76597	(unrelated sample)
ZZZZZZ	2Q35381.D	09/03/19 16:04	OP76597	(unrelated sample)
ZZZZZZ	2Q35382.D	09/03/19 16:20	OP76597	(unrelated sample)
ZZZZZZ	2Q35383.D	09/03/19 16:36	OP76597	(unrelated sample)
ZZZZZZ	2Q35384.D	09/03/19 16:52	OP76597	(unrelated sample)
ZZZZZZ	2Q35385.D	09/03/19 17:08	OP76597	(unrelated sample)
ZZZZZZ	2Q35386.D	09/03/19 17:23	OP76582	(unrelated sample)
ZZZZZZ	2Q35387.D	09/03/19 17:39	OP76582	(unrelated sample)
S2Q554-CC554	2Q35388.D	09/03/19 17:55	n/a	Continuing cal 20
S2Q554-CC554	2Q35390.D	09/03/19 18:27	n/a	Continuing cal 1.0
ZZZZZZ	2Q35391.D	09/03/19 18:42	OP76574	(unrelated sample)
ZZZZZZ	2Q35392.D	09/03/19 18:58	OP76574	(unrelated sample)
ZZZZZZ	2Q35393.D	09/03/19 19:14	OP76574	(unrelated sample)
ZZZZZZ	2Q35394.D	09/03/19 19:30	OP76574	(unrelated sample)
ZZZZZZ	2Q35395.D	09/03/19 19:46	OP76594	(unrelated sample)
ZZZZZZ	2Q35396.D	09/03/19 20:02	OP76575	(unrelated sample)
S2Q554-ECC554	2Q35397.D	09/03/19 20:17	n/a	Ending cal 20

Run Sequence Report

Job Number: FA67659
Account: EAENGMDS EA Engineering, Science & Technology
Project: Cannon AFB; Clovis, NM

Run ID: S2Q561 **Method:** EPA 537M BY ID **Instrument ID:** GCMS2Q

Lab Sample ID	Lab File ID	Date/Time Analyzed	Prep QC Batch	Client Sample ID
S2Q561-IBLK	2Q35930.D	09/13/19 13:48	n/a	Method Blank
S2Q561-IBLK	2Q35930.D	09/13/19 13:48	n/a	Method Blank
S2Q561-CC556	2Q35931.D	09/13/19 14:04	n/a	Continuing cal 1
S2Q561-CC556	2Q35932.D	09/13/19 14:20	n/a	Continuing cal 20
OP76797-BS	2Q35933.D	09/13/19 14:35	OP76797	Blank Spike
OP76797-MB	2Q35934.D	09/13/19 14:51	OP76797	Method Blank
FA67659-1	2Q35935.D	09/13/19 15:07	OP76797	CANON-WWTP-EFL-082919
FA67659-2	2Q35936.D	09/13/19 15:23	OP76797	CANON-WWTP-EFL-082919-D
FA67659-3	2Q35937.D	09/13/19 15:39	OP76797	CANON-WWTP-INF-082919
FA67659-4	2Q35938.D	09/13/19 15:54	OP76797	CANON-FB01-082919
FA67788-18	2Q35939.D	09/13/19 16:10	OP76797	(used for QC only; not part of job FA67659)
OP76797-MS	2Q35940.D	09/13/19 16:26	OP76797	Matrix Spike
OP76797-MSD	2Q35941.D	09/13/19 16:42	OP76797	Matrix Spike Duplicate
ZZZZZZ	2Q35942.D	09/13/19 16:58	OP76797	(unrelated sample)
S2Q561-CC556	2Q35943.D	09/13/19 17:14	n/a	Continuing cal 20
OP76796-BS	2Q35945.D	09/13/19 17:45	OP76796	Blank Spike
OP76796-MB	2Q35946.D	09/13/19 18:01	OP76796	Method Blank
ZZZZZZ	2Q35947.D	09/13/19 18:17	OP76796	(unrelated sample)
ZZZZZZ	2Q35948.D	09/13/19 18:33	OP76796	(unrelated sample)
FA67676-3	2Q35949.D	09/13/19 18:49	OP76796	(used for QC only; not part of job FA67659)
OP76796-MS	2Q35950.D	09/13/19 19:04	OP76796	Matrix Spike
FA67686-2	2Q35951.D	09/13/19 19:20	OP76796	(used for QC only; not part of job FA67659)
OP76796-DUP	2Q35952.D	09/13/19 19:36	OP76796	Duplicate
ZZZZZZ	2Q35953.D	09/13/19 19:52	OP76796	(unrelated sample)
ZZZZZZ	2Q35954.D	09/13/19 20:08	OP76796	(unrelated sample)
S2Q561-CC556	2Q35955.D	09/13/19 20:23	n/a	Continuing cal 20
ZZZZZZ	2Q35957.D	09/13/19 20:55	OP76796	(unrelated sample)
ZZZZZZ	2Q35958.D	09/13/19 21:11	OP76796	(unrelated sample)
ZZZZZZ	2Q35959.D	09/13/19 21:27	OP76796	(unrelated sample)
ZZZZZZ	2Q35960.D	09/13/19 21:43	OP76796	(unrelated sample)
ZZZZZZ	2Q35961.D	09/13/19 21:58	OP76796	(unrelated sample)
ZZZZZZ	2Q35962.D	09/13/19 22:14	OP76796	(unrelated sample)
ZZZZZZ	2Q35963.D	09/13/19 22:30	OP76796	(unrelated sample)
ZZZZZZ	2Q35964.D	09/13/19 22:46	OP76796	(unrelated sample)
S2Q561-CC556	2Q35965.D	09/13/19 23:02	n/a	Continuing cal 20
ZZZZZZ	2Q35967.D	09/13/19 23:33	OP76796	(unrelated sample)
ZZZZZZ	2Q35968.D	09/13/19 23:49	OP76796	(unrelated sample)
ZZZZZZ	2Q35969.D	09/14/19 00:05	OP76796	(unrelated sample)
ZZZZZZ	2Q35970.D	09/14/19 00:21	OP76796	(unrelated sample)
S2Q561-ECC556	2Q35971.D	09/14/19 00:37	n/a	Ending cal 20

Run Sequence Report

Job Number: FA67659
Account: EAENGMDS EA Engineering, Science & Technology
Project: Cannon AFB; Clovis, NM

Run ID: S2Q562 **Method:** EPA 537M QSM5.1 B-1 **Instrument ID:** GCMS2Q

Lab Sample ID	Lab File ID	Date/Time Analyzed	Prep QC Batch	Client Sample ID
S2Q562-IC562	2Q35978.D	09/15/19 09:41	n/a	Mass Calibration Verification
S2Q562-IC562	2Q35979.D	09/15/19 09:58	n/a	Initial cal 0.5
S2Q562-IC562	2Q35980.D	09/15/19 10:13	n/a	Initial cal 1.0
S2Q562-IC562	2Q35981.D	09/15/19 10:29	n/a	Initial cal 2.0
S2Q562-IC562	2Q35982.D	09/15/19 10:50	n/a	Initial cal 5.0
S2Q562-IC562	2Q35983.D	09/15/19 11:05	n/a	Initial cal 10
S2Q562-ICC562	2Q35984.D	09/15/19 11:21	n/a	Initial cal 20
S2Q562-IC562	2Q35985.D	09/15/19 11:37	n/a	Initial cal 50
S2Q562-IC562	2Q35986.D	09/15/19 11:53	n/a	Initial cal 100
S2Q562-IBLK	2Q35987.D	09/15/19 12:09	n/a	Method Blank
S2Q562-IBLK	2Q35987.D	09/15/19 12:09	n/a	Method Blank
S2Q562-ICV562	2Q35988.D	09/15/19 12:25	n/a	Initial cal verification 20
S2Q562-ICV562	2Q35989.D	09/15/19 12:40	n/a	Initial cal verification 20
FA67659-3	2Q35991.D	09/15/19 13:12	OP76797	CANON-WWTP-INF-082919
OP76829-BS	2Q35993.D	09/15/19 13:44	OP76829	Blank Spike
OP76829-MB	2Q35994.D	09/15/19 14:00	OP76829	Method Blank
ZZZZZZ	2Q35995.D	09/15/19 14:15	OP76829	(unrelated sample)
ZZZZZZ	2Q35996.D	09/15/19 14:31	OP76829	(unrelated sample)
ZZZZZZ	2Q35997.D	09/15/19 14:47	OP76829	(unrelated sample)
ZZZZZZ	2Q35998.D	09/15/19 15:03	OP76829	(unrelated sample)
ZZZZZZ	2Q35999.D	09/15/19 15:19	OP76829	(unrelated sample)
ZZZZZZ	2Q36000.D	09/15/19 15:34	OP76829	(unrelated sample)
S2Q562-CC562	2Q36001.D	09/15/19 15:50	n/a	Continuing cal 20
ZZZZZZ	2Q36003.D	09/15/19 16:22	OP76829	(unrelated sample)
ZZZZZZ	2Q36004.D	09/15/19 16:38	OP76829	(unrelated sample)
ZZZZZZ	2Q36005.D	09/15/19 16:54	OP76829	(unrelated sample)
ZZZZZZ	2Q36006.D	09/15/19 17:09	OP76829	(unrelated sample)
ZZZZZZ	2Q36007.D	09/15/19 17:25	OP76829	(unrelated sample)
ZZZZZZ	2Q36008.D	09/15/19 17:41	OP76829	(unrelated sample)
ZZZZZZ	2Q36009.D	09/15/19 17:57	OP76829	(unrelated sample)
ZZZZZZ	2Q36010.D	09/15/19 18:13	OP76829	(unrelated sample)
ZZZZZZ	2Q36011.D	09/15/19 18:28	OP76829	(unrelated sample)
ZZZZZZ	2Q36012.D	09/15/19 18:44	OP76829	(unrelated sample)
S2Q562-CC562	2Q36013.D	09/15/19 19:00	n/a	Continuing cal 20
ZZZZZZ	2Q36015.D	09/15/19 19:32	OP76829	(unrelated sample)
ZZZZZZ	2Q36016.D	09/15/19 19:48	OP76829	(unrelated sample)
FA67803-9	2Q36017.D	09/15/19 20:03	OP76829	(used for QC only; not part of job FA67659)
OP76829-MS	2Q36018.D	09/15/19 20:19	OP76829	Matrix Spike
OP76829-MSD	2Q36019.D	09/15/19 20:35	OP76829	Matrix Spike Duplicate
S2Q562-CC562	2Q36020.D	09/15/19 20:51	n/a	Continuing cal 20
OP76830-BS	2Q36022.D	09/15/19 21:22	OP76830	Blank Spike
OP76830-MB	2Q36023.D	09/15/19 21:38	OP76830	Method Blank
ZZZZZZ	2Q36024.D	09/15/19 21:54	OP76830	(unrelated sample)
ZZZZZZ	2Q36025.D	09/15/19 22:10	OP76830	(unrelated sample)
ZZZZZZ	2Q36026.D	09/15/19 22:26	OP76830	(unrelated sample)
ZZZZZZ	2Q36027.D	09/15/19 22:42	OP76830	(unrelated sample)

Run Sequence Report

Job Number: FA67659
Account: EAENGMDS EA Engineering, Science & Technology
Project: Cannon AFB; Clovis, NM

Run ID: S2Q562	**Method:** EPA 537M QSM5.1 B-1	**Instrument ID:** GCMS2Q

Lab Sample ID	Lab File ID	Date/Time Analyzed	Prep QC Batch	Client Sample ID
ZZZZZZ	2Q36028.D	09/15/19 22:57	OP76830	(unrelated sample)
S2Q562-CC562	2Q36032.D	09/16/19 00:01	n/a	Continuing cal 20
ZZZZZZ	2Q36035.D	09/16/19 00:48	OP76830	(unrelated sample)
S2Q562-CC562	2Q36043.D	09/16/19 02:55	n/a	Continuing cal 20
ZZZZZZ	2Q36045.D	09/16/19 03:26	OP76830	(unrelated sample)
S2Q562-ECC562	2Q36049.D	09/16/19 04:30	n/a	Ending cal 20

MS Semi-volatiles

Raw Data

Manual Integrations APPROVED (compounds with "m" flag)
Mike Eger 09/16/19 16:04

Perfluorinated Compounds by LC/MS/MS

Data File : 2Q35935.d
Operator : natashag
Acq. Method : 537_ID.m
Acq. Date-Time : 9/13/2019 3:07:29 PM
Sample Name : fa67659-1
Vial : Vial 15
DA Method File : ID_090619_S2Q556.quantmethod.xml
Batch Name : s2q561.batch.bin
Sample Information : op76797,S2Q561,120,,,1.0,1,water

Compound	RT	QIon	Resp.	Conc.	Units		Dev(Min)
Internal Standards							
13C2-PFOA	7.073	415.0 -> 370.0	553366	20.00	µg/L		0.000
13C4-PFOS	7.636	503.0 -> 80.0	68321	20.00	µg/L		0.000
M4-PFBA	2.228	217.0 -> 172.0	222090	20.00	µg/L		-0.025
M5-PFPeA	4.074	268.0 -> 223.0	198851	20.00	µg/L		-0.013
M5-PFHxA	5.414	318.0 -> 273.0	299318	20.00	µg/L		0.000
M4-PFHpA	6.343	367.0 -> 322.0	397767	20.00	µg/L		0.013
M8-PFOA	7.071	421.0 -> 376.0	511075	20.00	µg/L		0.000
M9-PFNA	7.665	472.0 -> 427.0	511068	20.00	µg/L		0.000
M6-PFDA	8.154	519.0 -> 474.0	662598	20.00	µg/L		0.014
M7-PFUnDA	8.666	570.0 -> 525.0	907357	20.00	µg/L		0.000
M2-PFDoDA	9.299	615.0 -> 570.0	960103	20.00	µg/L		0.012
M2-PFTeDA	10.525	715.0 -> 670.0	602107	20.00	µg/L		0.012
M8-FOSA	7.278	506.0 -> 78.0	122456	20.00	µg/L		0.000
M3-PFBS	4.355	302.0 -> 99.0	29027	20.00	µg/L		0.000
M3-PFHxS	6.373	402.0 -> 99.0	31213	20.00	µg/L		0.013
M8-PFOS	7.634	507.0 -> 99.0	43978	20.00	µg/L		0.000
M2-4:2FTS	5.322	329.0 -> 309.0	147515	20.00	µg/L		0.013
M2-6:2FTS	7.068	429.0 -> 409.0	192855	20.00	µg/L		0.000
M2-8:2FTS	8.202	529.0 -> 509.0	138790	20.00	µg/L		0.000
M3-MeFOSAA	7.744	573.0 -> 419.0	94177	20.00	µg/L		0.000
M3-HFPO-DA	5.706	287.0 -> 169.0	0	100.00	µg/L	m	0.013
System Monitoring Compounds							
13C2-4:2FTS	5.322	329.0 -> 309.0	147256	17.04	µg/L		0.013
Spiked Amount: 20.00	Range: 50.0 - 150.0%			Recovery = 85.2%			
13C2-6:2FTS	7.068	429.0 -> 409.0	192481	17.34	µg/L		0.000
Spiked Amount: 20.00	Range: 50.0 - 150.0%			Recovery = 86.7%			
13C2-8:2FTS	8.202	529.0 -> 509.0	138876	14.65	µg/L		0.000
Spiked Amount: 20.00	Range: 50.0 - 150.0%			Recovery = 73.3%			
13C2-PFDoDA	9.299	615.0 -> 570.0	953116	16.69	µg/L		0.012
Spiked Amount: 20.00	Range: 50.0 - 150.0%			Recovery = 83.5%			
13C2-PFTeDA	10.525	715.0 -> 670.0	600428	14.39	µg/L		0.012
Spiked Amount: 20.00	Range: 50.0 - 150.0%			Recovery = 72.0%			
13C3-PFBS	4.355	302.0 -> 99.0	28955	18.87	µg/L		0.000
Spiked Amount: 20.00	Range: 50.0 - 150.0%			Recovery = 94.4%			
13C3-PFHxS	6.373	402.0 -> 99.0	31159	19.66	µg/L		0.013
Spiked Amount: 20.00	Range: 50.0 - 150.0%			Recovery = 98.3%			
13C4-PFBA	2.228	217.0 -> 172.0	220258	18.68	µg/L		-0.025
Spiked Amount: 20.00	Range: 50.0 - 150.0%			Recovery = 93.4%			
13C4-PFHpA	6.343	367.0 -> 322.0	396631	20.69	µg/L		0.013
Spiked Amount: 20.00	Range: 50.0 - 150.0%			Recovery = 103.4%			
13C5-PFHxA	5.414	318.0 -> 273.0	298898	20.67	µg/L		0.000
Spiked Amount: 20.00	Range: 50.0 - 150.0%			Recovery = 103.4%			
13C5-PFPeA	4.074	268.0 -> 223.0	198836	20.16	µg/L		-0.013
Spiked Amount: 20.00	Range: 50.0 - 150.0%			Recovery = 100.8%			
13C6-PFDA	8.154	519.0 -> 474.0	661719	19.34	µg/L		0.014

Perfluorinated Compounds by LC/MS/MS

Compound	RT	QIon	Resp.	Conc.	Units		Dev(Min)
Spiked Amount: 20.00	Range: 50.0 - 150.0%			Recovery = 96.7%			
13C7-PFUnDA	8.666	570.0 -> 525.0	907482	18.79	µg/L		0.000
Spiked Amount: 20.00	Range: 50.0 - 150.0%			Recovery = 94.0%			
13C8-FOSA	7.278	506.0 -> 78.0	122317	15.23	µg/L		0.000
Spiked Amount: 20.00	Range: 50.0 - 150.0%			Recovery = 76.1%			
13C8-PFOA	7.071	421.0 -> 376.0	510251	21.40	µg/L		0.000
Spiked Amount: 20.00	Range: 50.0 - 150.0%			Recovery = 107.0%			
13C8-PFOS	7.634	507.0 -> 99.0	43887	18.99	µg/L		0.000
Spiked Amount: 20.00	Range: 50.0 - 150.0%			Recovery = 94.9%			
13C9-PFNA	7.665	472.0 -> 427.0	510464	20.41	µg/L		0.000
Spiked Amount: 20.00	Range: 50.0 - 150.0%			Recovery = 102.0%			
d3-MeFOSAA	7.744	573.0 -> 419.0	94102	13.82	µg/L		0.000
Spiked Amount: 20.00	Range: 50.0 - 150.0%			Recovery = 69.1%			
M2-PFOA	7.073	415.0 -> 370.0	554333	20.00	µg/L		0.000
Spiked Amount: 20.00	Range: 50.0 - 150.0%			Recovery = 100.0%			
M4-PFOS	7.636	503.0 -> 80.0	68376	20.00	µg/L		0.000
Spiked Amount: 20.00	Range: 50.0 - 150.0%			Recovery = 100.0%			
13C3-HFPO-DA	5.706	287.0 -> 169.0	0	0.00	µg/L	m	0.013
Spiked Amount: 100.00	Range: 50.0 - 150.0%			Recovery = NA%			
Target Compounds							**QValue**
4:2FTS	-	327.0 -> 307.0	-	N.D.			
6:2FTS	7.070	427.0 -> 407.0	60389	12.29	µg/L		97
8:2FTS	-	527.0 -> 507.0	-	N.D.			
EtFOSAA	-	584.0 -> 419.0	-	N.D.			
FOSA	-	498.0 -> 78.0	-	N.D.			
MeFOSAA	-	570.0 -> 419.0	-	N.D.			
PFBA	2.223	213.0 -> 169.0	4955	2.71	µg/L		100
PFBS	4.346	299.0 -> 80.0	8749	4.04	µg/L		72
PFDA	-	513.0 -> 469.0	-	N.D.			
PFDoDA	-	613.0 -> 569.0	-	N.D.			
PFDS	-	599.0 -> 80.0	-	N.D.			
PFHpA	6.346	363.0 -> 319.0	40803	2.34	µg/L		100
PFHpS	-	449.0 -> 80.0	-	N.D.			
PFHxA	5.416	313.0 -> 269.0	41195	8.42	µg/L		98
PFHxS	6.363	399.0 -> 80.0	1670	0.85	µg/L	m	98
PFNA	-	463.0 -> 419.0	-	N.D.			
PFNS	-	549.0 -> 80.0	-	N.D.			
PFOA	7.074	413.0 -> 369.0	7788	0.56	µg/L	m	99
PFOS	7.638	499.0 -> 80.0	3611	1.71	µg/L	m	100
PFPeA	4.078	263.0 -> 219.0	143394	17.57	µg/L		100
PFPeS	-	349.0 -> 80.0	-	N.D.			
PFTeDA	-	713.0 -> 669.0	-	N.D.			
PFTrDA	-	663.0 -> 619.0	-	N.D.			
PFUnDA	-	563.0 -> 519.0	-	N.D.			
11Cl-PF3OUdS	-	631.0 -> 451.0	-	N.D.			
9Cl-PF3ONS	-	531.0 -> 351.0	-	N.D.			
ADONA	-	377.0 -> 251.0	-	N.D.			
HFPO-DA	-	329.0 -> 169.0	-	N.D.			

= Qualifier out of range, m = manually integrated, + = Area summed

Appendix I

Laboratory Reports for DBS&A Sampling

DBS&A
Daniel B. Stephens & Associates, Inc.

This appendix is provided as a separate file on the report CD.

Appendix J

Records for DBS-1

DBS&A
Daniel B. Stephens & Associates, Inc.

92 ACCESS AGREEMENT

Juan

This Agreement is made by ~~John~~ Jimenez ("Owner") and Daniel B. Stephens & Associates, Inc. ("Contractor") on behalf of the New Mexico Environment Department. Owner and Contractor agree to the terms set forth below in this Agreement.

Juan JJ

1. ~~John~~ Jimenez and the property located at Intersection CR 5 & CRK (NE) SE qrtr, S1, T_N R35E (the "Property"). The Contractor plans to install a groundwater monitor well on the Property. Owner agrees to give the Contractor access to the Property for the following purposes:

   - Drilling and monitor well installation on the property. The monitor well will be installed to facilitate ongoing investigation activities associated with PFAS contamination at Cannon Air Force Base. The Property Owner will be contacted prior to completion of any work. The property will be restored, as close as possible, to pre-entry conditions following removal of the installed well.
   - Routine groundwater monitoring and general well maintenance or repair, if required. Monitoring activities will include gauging fluid levels in the monitor well and collecting groundwater samples for laboratory analysis on a regular basis.

   Access and use of the Property for the purposes described above will be coordinated by the Contractor with the Owner a minimum of 4 days in advance of any activity covered by this Agreement. The well will be located as shown on Exhibit A attached to this Agreement to the extent practicable. Contractor will make a diligent and concerted effort to refrain from interfering with areas outside the immediate work area. All work will be conducted in an efficient, courteous manner and with minimal disruption and inconvenience to the patrons, invitees, employees, agents and representatives of the Owner.

2. The Contractor's activities and work on the Property will be conducted consistent with Occupational Health and Safety Regulations (See 29 CFR Section 1910.120) and that all appropriate actions will be taken to assure the safety of the patrons, invitees, employees, agents and representatives of the Owner.

   Owner may observe activities on the Property, consistent with Occupational Health and Safety Regulations (see 29 CFR § 1910.120). Should the property owner choose to collect and analyze split samples, the Owner is responsible for the provision of, and costs associated with any equipment, accessories, and laboratory costs required for such split samples.

3. The Contractor agrees to send Owner a copy of the results of analysis from any sampling activities conducted on the Property at no charge to Owner.

4. The well installation on the Property will be placed to minimize interference with the movement of vehicles and other regular activities on the Property. Following completion of the project, the Contractor will properly abandon the well. The Contractor will otherwise return the property as close as possible to the pre-entrance condition.

5. The Contractor will provide written and/or oral notice to Owner of its entrance onto the Property. The notice shall be given to Owner below:

Name: ~~John~~ Juan Jimenez
Address Line 1: 1000 W. Brady Ave, Clovis, NM. 88101 Office
Address Line 2: 5200 S. Prince, Clovis, NM 88101 Res.
Email: juan@sileros.com
Work phone: (575) 799-6072

6. The Contractor agrees to indemnify and hold harmless and to insure Owner against liability, claims, damages, losses or expenses, only to the extent that the liability, damages, losses, or costs are caused by, or arise out of, the acts or omissions of the Contractor or its officers, employees, or agents. Contractor further agrees to indemnify and hold Owner harmless from any and all claims arising for damage to person or property arising from or related to its activities on the Property.

7. This Agreement is binding upon and is for the benefit of the parties and each of their authorized officers, employees, contractors, and representatives.

~~John~~ Juan Jimenez

By _____

Dated 12-07-2021

Daniel B. Stephens & Associates, Inc.

By _____

Dated 12/07/21

John R. D Antonio, Jr., P.E.
State Engineer

Roswell Office
1900 WEST SECOND STREET
ROSWELL, NM 88201

STATE OF NEW MEXICO
OFFICE OF THE STATE ENGINEER

Trn Nbr: 715559
File Nbr: CC 02631

Dec. 28, 2021

DANIEL B STEPHENS & ASSOCIATES
6020 ACADEMY RD NE STE 100
ALBUQUERQUE, NM 87109

Greetings:

Your approved copy of the above numbered permit to drill a well for non consumptive purposes is enclosed You must obtain an additional permit if you intend to use the water It is your responsibility to provide the contracted well driller with a copy of the permit that must be made available during well drilling activities.

Carefully review the attached conditions of approval for all specific permit requirements

* If use of this well is temporary in nature and the well will be plugged at the end of the well usage, the OSE must initially approve of the plugging. If plugging approval is not conditioned in this permit, the applicant must submit a Plugging Plan of Operations for approval prior to the well being plugged The Plugging Record must be properly completed and submitted to the OSE within 30 days of the well plugging

* If the final intended purpose and condition requires a well ID tag and meter installation, the applicant must immediately send a completed meter report form to this office

* The well record and log must be submitted within 30 days of the completion of the well or if the attempt was a dry hole

* This permit expires and will be cancelled if no well is drilled and/or a well log is not received by the date set forth in the conditions of approval

Appropriate forms can be downloaded from the OSE website www ose state nm us.

Sincerely,

Azucena Ramirez
(575)622-6521

Enclosure

explore

File No. CC-2631 POD1

NEW MEXICO OFFICE OF THE STATE ENGINEER

WR-07 APPLICATION FOR PERMIT TO DRILL

A WELL WITH NO WATER RIGHT

(check applicable box):

For fees, see State Engineer website: http://www.ose.state.nm.us/

Purpose:	☐ Pollution Control And/Or Recovery	☐ Ground Source Heat Pump
☐ Exploratory Well (Pump test)	☐ Construction Site/Public Works Dewatering	☐ Other(Describe):
☒ Monitoring Well	☐ Mine Dewatering	

A separate permit will be required to apply water to beneficial use regardless if use is consumptive or nonconsumptive.

☒ Temporary Request Requested Start Date: 01/10/2022 Requested End Date: Unknown

Plugging Plan of Operations Submitted? ☐ Yes ☒ No

1 APPLICANT(S)

Name: New Mexico Environment Department	Name:
Contact or Agent: check here if Agent ☒ Patrice Feltman, Daniel B. Stephens & Associates	Contact or Agent: check here if Agent ☐
Mailing Address: 6020 Academy Rd. NE, Ste 100	Mailing Address:
City: Albuquerque	City:
State: NM Zip Code: 87109	State: Zip Code:
Phone: 505-353-9135 ☐ Home ☐ Cell Phone (Work):	Phone: ☐ Home ☐ Cell Phone (Work):
E-mail (optional): pfeltman@geo-logic.com	E-mail (optional):

OSE DIT DEC 14 2021 AM 9:46

FOR OSE INTERNAL USE Application for Permit, Form WR-07, Rev 11/17/16

File No.: CC-2631	Trn. No.: 715559	Receipt No.: 2-4405
Trans Description (optional): MON		
Sub-Basin: CC	PCW/LOG Due Date: 12/28/22	

2. WELL(S) Describe the well(s) applicable to this application.

Location Required: Coordinate location must be reported in NM State Plane (NAD 83), UTM (NAD 83), or Latitude/Longitude (Lat/Long - WGS84).
District II (Roswell) and District VII (Cimarron) customers, provide a PLSS location in addition to above.

☐ NM State Plane (NAD83) (Feet)
☐ NM West Zone
☐ NM East Zone
☐ NM Central Zone

☐ UTM (NAD83) (Meters)
☐ Zone 12N
☐ Zone 13N

☒ Lat/Long (WGS84) (to the nearest 1/10th of second)

Well Number (if known):	X or Easting or Longitude:	Y or Northing or Latitude:	Provide if known: -Public Land Survey System (PLSS) (*Quarters or Halves , Section, Township, Range*) OR - Hydrographic Survey Map & Tract; OR - Lot, Block & Subdivision; OR Land Grant Name
CC-2631 POD1 DBS-1	103° 12' 53.97" W	34° 20' 17.46" N	

NOTE: If more well locations need to be described, complete form WR-08 (Attachment 1 – POD Descriptions)
Additional well descriptions are attached: ☐ Yes ☐ No **If yes, how many**_____

Other description relating well to common landmarks, streets, or other:
The well site is approximately 2,100 feet north of the intersection of CR 5 and CR K, on the west side of CR K

Well is on land owned by: Juan Jimenez

Well Information: NOTE: If more than one (1) well needs to be described, provide attachment. **Attached?** ☐ Yes ☒ No
If yes, how many_____

Approximate depth of well (feet): 380	Outside diameter of well casing (inches): 5
Driller Name: TBD	Driller License Number: TBD

3. ADDITIONAL STATEMENTS OR EXPLANATIONS

Daniel B. Stephens & Associates, Inc. has been contracted by the New Mexico Environment Department (NMED) to investigate a confirmed contaminant plume. The investigation will be conducted to determine the horizontal extent of the contamination in the area. The well is designated DBS-1 in the attached figure.

The duration of the monitoring is not known. The well will be plugged and abandoned when the site is closed by the NMED

OSE DII DEC 14 2021 AM 8:46

FOR OSE INTERNAL USE

Application for Permit, Form WR-07

File No.: CC-2631	Trn No.: 715559

4. SPECIFIC REQUIREMENTS: The applicant must include the following, as applicable to each well type. Please check the appropriate boxes, to indicate the information has been included and/or attached to this application.

Exploratory:	**Pollution Control and/or Recovery:**	**Construction De-Watering:**	**Mine De-Watering:**
☐ Include a description of any proposed pump test, if applicable.	☐ Include a plan for pollution control/recovery. that includes the following: ☐ A description of the need for the pollution control or recovery operation. ☐ The estimated maximum period of time for completion of the operation. ☐ The annual diversion amount. ☐ The annual consumptive use amount. ☐ The maximum amount of water to be diverted and injected for the duration of the operation. ☐ The method and place of discharge.	☐ Include a description of the proposed dewatering operation, ☐ The estimated duration of the operation, ☐ The maximum amount of water to be diverted, ☐ A description of the need for the dewatering operation, and, ☐ A description of how the diverted water will be disposed of.	☐ Include a plan for pollution control/recovery, that includes the following: ☐ A description of the need for mine dewatering. ☐ The estimated maximum period of time for completion of the operation. ☐ The source(s) of the water to be diverted. ☐ The geohydrologic characteristics of the aquifer(s). ☐ The maximum amount of water to be diverted per annum ☐ The maximum amount of water to be diverted for the duration of the operation. ☐ The quality of the water. ☐ The method of measurement of water diverted. ☐ The recharge of water to the aquifer. ☐ Description of the estimated area of hydrologic effect of the project. ☐ The method and place of discharge. ☐ An estimation of the effects on surface water rights and underground water rights from the mine dewatering project. ☐ A description of the methods employed to estimate effects on surface water rights and underground water rights. ☐ Information on existing wells, rivers, springs, and wetlands within the area of hydrologic effect.
Monitoring: ☒ Include the reason for the monitoring well, and, ☒ The duration of the planned monitoring.	☐ The method of measurement of water produced and discharged. ☐ The source of water to be injected. ☐ The method of measurement of water injected. ☐ The characteristics of the aquifer. ☐ The method of determining the resulting annual consumptive use of water and depletion from any related stream system. ☐ Proof of any permit required from the New Mexico Environment Department. ☐ An access agreement if the applicant is not the owner of the land on which the pollution plume control or recovery well is to be located.	**Ground Source Heat Pump:** ☐ Include a description of the geothermal heat exchange project, ☐ The number of boreholes for the completed project and required depths. ☐ The time frame for constructing the geothermal heat exchange project, and, ☐ The duration of the project. ☐ Preliminary surveys, design data, and additional information shall be included to provide all essential facts relating to the request.	

ACKNOWLEDGEMENT

I, We (name of applicant(s)), Patrice Feltman, Daniel B. Stephens & Associates
Print Name(s)

affirm that the foregoing statements are true to the best of (my, our) knowledge and belief.

Patrice Feltman Digitally signed by Patrice Feltman Date: 2021.12.09 13:49:35 -07'00'
Applicant Signature

Applicant Signature

ACTION OF THE STATE ENGINEER

This application is:

☑ approved ☐ partially approved ☐ denied

provided it is not exercised to the detriment of any others having existing rights, and is not contrary to the conservation of water in New Mexico nor detrimental to the public welfare and further subject to the attached conditions of approval.

Witness my hand and seal this 28th day of December 20 21, for the State Engineer,

OSE DIT DEC 14 2021 AM 9:46

John R. D'Antonio, P.E., State Engineer

By: K. Parekh
Signature

Kashyap Parekh
Print

Title: Water Resources Manager
Print

FOR OSE INTERNAL USE

Application for Permit, Form WR-07

File No.: CC-2631	Trn No.: 715559

NEW MEXICO STATE ENGINEER OFFICE
PERMIT TO EXPLORE

SPECIFIC CONDITIONS OF APPROVAL

17 16 Construction of a water well by anyone without a valid New Mexico Well Driller License is illegal, and the landowner shall bear the cost of plugging the well by a licensed New Mexico well driller This does not apply to driven wells, the casing of which does not exceed two and three eighths inches outside diameter

17 1A Depth of the well shall not exceed the thickness of the valley fill

17 4 No water shall be appropriated and beneficially used under this permit

17 6 The well authorized by this permit shall be plugged completely using the following method per Rules and Regulations Governing Well Driller Licensing, Construction, Repair and Plugging of Wells; Subsection C of 19.27.4.30 NMAC unless an alternative plugging method is proposed by the well owner and approved by the State Engineer upon completion of the permitted use All pumping appurtenance shall be removed from the well prior to plugging To plug a well, the entire well shall be filled from the bottom upwards to ground surface using a tremie pipe The bottom of the tremie shall remain submerged in the sealant throughout the entire sealing process; other placement methods may be acceptable and approved by the state engineer The well shall be plugged with an office of the state engineer approved sealant for use in the plugging of non artesian wells The well driller shall cut the casing off at least four (4) feet below ground surface and fill the open hole with at least two vertical feet of approved sealant The driller must fill or cover any open annulus with sealant Once the sealant has cured, the well driller or well owner may cover the seal with soil A Plugging Report for said well shall be filed with the Office of the State Engineer in a District Office within 30 days of completion of the plugging

NEW MEXICO STATE ENGINEER OFFICE
PERMIT TO EXPLORE

SPECIFIC CONDITIONS OF APPROVAL (Continued)

17-7 The Permittee shall utilize the highest and best technology available to ensure conservation of water to the maximum extent practical

17 B The well shall be drilled by a driller licensed in the State of New Mexico in accordance with 72-12 12 NMSA 1978 A licensed driller shall not be required for the construction of a well driven without the use of a drill rig, provided that the casing shall not exceed two and three-eighths (2 3/8) inches outside diameter

17-C The well driller must file the well record with the State Engineer and the applicant within 30 days after the well is drilled or driven It is the well owner's responsibility to ensure that the well driller files the well record
The well driller may obtain the well record form from any District Office or the Office of the State Engineer website

17-P The well shall be constructed, maintained, and operated to prevent inter aquifer exchange of water and to prevent loss of hydraulic head between hydrogeologic zones

17-Q The State Engineer retains jurisdiction over this permit

17-R Pursuant to section 72-8-1 NMSA 1978, the permittee shall allow the State Engineer and OSE representatives entry upon private property for the performance of their respective duties, including access to the ditch or acequia to measure flow and also to the well for meter reading and water level measurement

NEW MEXICO STATE ENGINEER OFFICE
PERMIT TO EXPLORE

SPECIFIC CONDITIONS OF APPROVAL (Continued)

LOG The Point of Diversion CC 02631 POD1 must be completed and the Well Log filed on or before 12/28/2022

SHOULD THE PERMITTEE CHANGE THE PURPOSE OF USE TO OTHER THAN MONITORING PURPOSES, AN APPLICATION SHALL BE ACQUIRED FROM THE OFFICE OF THE STATE ENGINEER

ACTION OF STATE ENGINEER

Notice of Intention Rcvd: Date Rcvd Corrected:
Formal Application Rcvd: 12/14/2021 Pub of Notice Ordered:
Date Returned Correction: Affidavit of Pub Filed:

This application is approved provided it is not exercised to the detriment of any others having existing rights, and is not contrary to the conservation of water in New Mexico nor detrimental to the public welfare of the state; and further subject to the specific conditions listed previously

Witness my hand and seal this 28 day of Dec A D , 2021

John R. D Antonio, Jr., P.E. , State Engineer

By: K. Parekh
KASHYAP PAREKH

Trn Desc: CC 02631 POD1 File Number: CC 02631
Trn Number: 715559

OFFICE OF THE STATE ENGINEER/INTERSTATE STREAM COMMISSION – ROSWELL OFFICE

OFFICIAL RECEIPT NUMBER: 2 - 44075 DATE: 12-14-21 FILE NO.: new

TOTAL: 5.00 RECEIVED: five DOLLARS CHECK NO.: 106474 CASH: _____

PAYOR: Daniel Stephus + Assoc ADDRESS: 6020 Academy Rd NE Ste #D CITY: ABQ STATE: NM

ZIP: 87109 RECEIVED BY: ym

INSTRUCTIONS: Indicate the number of actions to the left of the appropriate type of filing. Complete the receipt information. **Original** to payor; **pink** copy to Program Support/ASD; and **yellow** copy for Water Rights. If a mistake is made, void the original and all copies and submit to Program Support/ASD as part of your daily deposit.

A. Ground Water Filing Fees

___	1.	Change of Ownership of Water Right	$ 2.00
___	2.	Application to Appropriate or Supplement Domestic 72-12-1 Well	$ 125.00
___	3.	Application to Repair or Deepen 72-12-1 Well	$ 75.00
___	4.	Application for Replacement 72-12-1 Well	$ 75.00
___	5.	Application to Change Purpose of Use 72-12-1 Well	$ 75.00
___	6.	Application for Stock Well/Temp. Use	$ 5.00
___	7	Application to Appropriate Irrigation, Municipal, or Commercial Use	$ 25.00
___	8.	Declaration of Water Right	$ 1.00
___	9.	Application for Additional Point of Diversion Non 72-12-1 Per Well	$ 25.00
___	10.	Application to Change Place or Purpose of Use Non 72-12-1 Well	$ 25.00
___	11.	Application to Change Point of Diversion and Place and/or Purpose of Use from Surface Water to Ground Water	$ 50.00
___	12.	Application to Change Point of Diversion and Place and/or Purpose of Use from Ground Water to Ground Water	$ 50.00
___	13.	Application to Change Point of Diversion of Non 72-12-1 Well	$ 25.00
___	14.	Application to Repair or Deepen Non 72-12-1 Well	$ 5.00
1	15.	Application for Test, Expl. Observ. Well	$ 5.00
___	16.	Application for Extension of Time	$ 25.00
___	17	Proof of Application to Beneficial Use	$ 25.00
___	18.	Notice of Intent to Appropriate	$ 25.00

B. Surface Water Filing Fees

___	1.	Change of Ownership of a Water Right	$ 5.00
___	2.	Declaration of Water Right	$ 10.00
___	3.	Amended Declaration	$ 25.00
___	4.	Application to Change Point of Diversion and Place and/or Purpose of Use from Surface Water to Surface Water	$ 200.00
___	5.	Application to Change Point of Diversion and Place and/or Purpose of Use from Ground Water to Surface Water	$ 200.00
___	6.	Application to Change Point of Diversion	$ 100.00
___	7	Application to Change Place and/or Purpose of Use	$ 100.00
___	8.	Application to Appropriate	$ 25.00
___	9.	Notice of Intent to Appropriate	$ 25.00
___	10.	Application for Extension of Time	$ 50.00
___	11.	Supplemental Well to a Surface Right	$ 100.00
___	12.	Return Flow Credit	$ 100.00
___	13.	Proof of Completion of Works	$ 25.00
___	14.	Proof of Application of Water to Beneficial Use	$ 25.00
___	15.	Water Development Plan	$ 100.00
___	16.	Declaration of Livestock Water Impoundment	$ 10.00
___	17	Application for Livestock Water Impoundment	$ 10.00

All fees are non-refundable.

C. Well Driller Fees

___	1.	Application for Well Driller's License	$ 50.00
___	2.	Application for Renewal of Well Driller's License	$ 50.00
___	3.	Application to Amend Well Driller's License	$ 50.00

D. Reproduction of Documents

___ @ 0.25¢ $_____

___ Map(s) @ $3.00 $_____

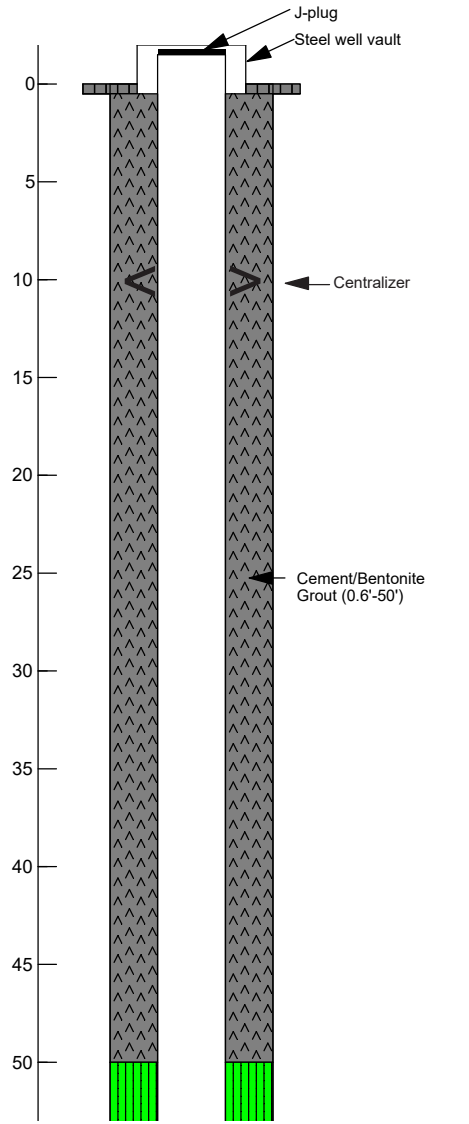
E. Certification $_____

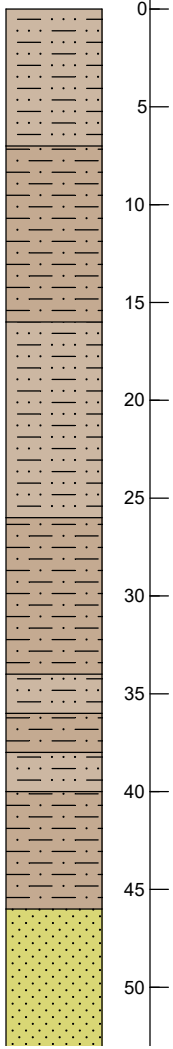
F. Other $_____

G. Comments:

mail

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Graphic Log	PID reading (ppm)	Sample Recovery (%)	Sample Interval (ft bgs)	USCS Symbol	Lithology Interval	Comments and Lithology
	NA	100	0-16	SC	0-7	Clayey sand - yellowish red (5YR 5/6), fine grained, well sorted, subrounded, moderate plasticity, loose to medium dense, damp, no odor, calcium carbonate.
				CL	7-16	Sandy clay - brown (7.5YR 4/4), fine grained, well sorted, subrounded, moderate plasticity, loose to medium dense, slightly moist, no odor, increasing calcium carbonate with depth.
		100	16-26	SC	16-18	Clayey sand - yellowish red (5YR 5/6), fine grained, well sorted, subrounded, moderate plasticity, loose to medium dense, damp, no odor.
				SC	18-26	Clayey sand - yellowish red (5YR 5/6), fine grained, well sorted, subrounded, moderate plasticity, loose to medium dense, damp, no odor, increasing calcium carbonate with depth.
		100	26-36	CL	26-34	Sandy clay - as above.
				SC	34-36	Clayey sand - brown (7.5YR 4/4), fine grained, well sorted, subrounded, low plasticity, partially cemented (calcium carbonate rich), dry, no odor.
		100	36-48	CL	36-38	Sandy clay - yellowish red (5YR 5/6), fine grained, well sorted, subrounded, moderate plasticity, loose to medium dense, slightly moist, no odor, increasing calcium carbonate with depth.
				SC	38-40	Clayey sand - brown (7.5YR 4/4), fine grained, well sorted, subrounded, low plasticity, partially cemented (calcium carbonate rich), dry, no odor.
				CL	40-46	Sandy clay - pink (5YR 7/4), fine grained, well sorted, subrounded, moderate plasticity, loose to medium dense, slightly moist, no odor, increasing calcium carbonate with depth.
				SP	46-48	Sand - light reddish brown (5YR 6/4), very fine to fine grained, poorly graded, loose with some cemented gravels and cobbles, round to subround, very little fines, damp, no odor.
		100	48-61	SP	48-56	Sand - light reddish brown (5YR 6/4), very fine to fine grained, poorly graded, loose with some cemented gravels and cobbles, round to subround, very little fines, damp, no odor.

Geologist: J. Fisher
Driller: Yellow Jacket Drilling
Well completion date: 2/26/2022

Drilling method: Sonic core
Borehole diameter: 9.25"
Sampling method: Core

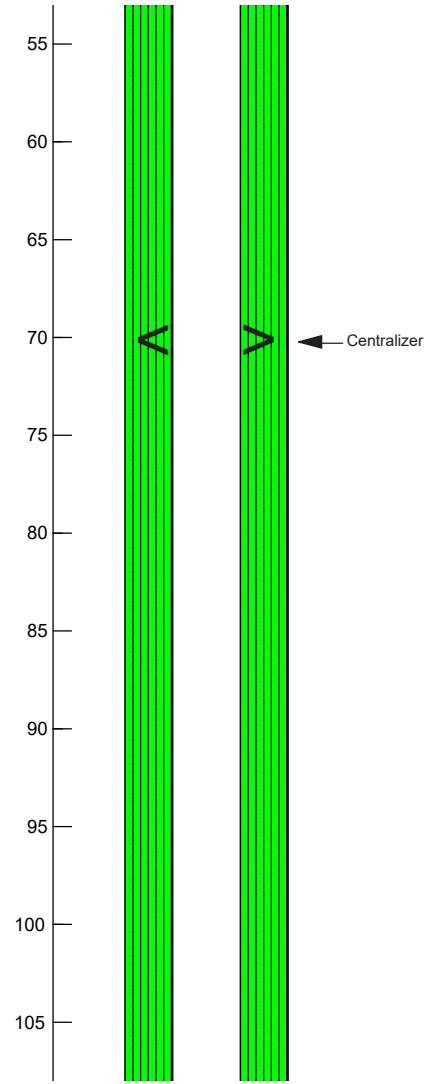
DTW= Depth to water, measured in feet below ground surface
New Mexico State Plane East NAD83
Northing: 1216555.366 Elevation: 4,177.350
Easting: 879094.298

NMED PFAS INVESTIGATION
CANNON AFB

DBS-1 Lithologic Log and Well Completion Diagram

Daniel B. Stephens & Associates, Inc.
6/21/2022 JN DB21.1060

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Graphic Log	PID reading (ppm)	Sample Recovery (%)	Sample Interval (ft bgs)	USCS Symbol	Lithology Interval	Comments and Lithology
				SC	56-61	Clayey sand - light reddish brown (5YR 6/4), fine grained, well sorted, subrounded, low plasticity, increasing cemented gravels and cobbles with depth up to 8", (calcium carbonate rich), dry to damp, no odor.
		100	61-66	SP	61-66	Sand - light reddish brown (5YR 6/4), very fine to fine grained, poorly graded, loose with some cemented gravels and cobbles, round to subround, very little fines, damp, no odor.
		100	66-76	SP	66-76	Sand - as above.
		100	76-88	SP	76-88	Sand - loose, less cementation, otherwise as above.
		100	88-104	SP	88-104	Sand - as above.
		100	104-116	SP	104-116	Sand - as above.

Geologist: J. Fisher
Driller: Yellow Jacket Drilling
Well completion date: 2/26/2022

Drilling method: Sonic core
Borehole diameter: 9.25"
Sampling method: Core

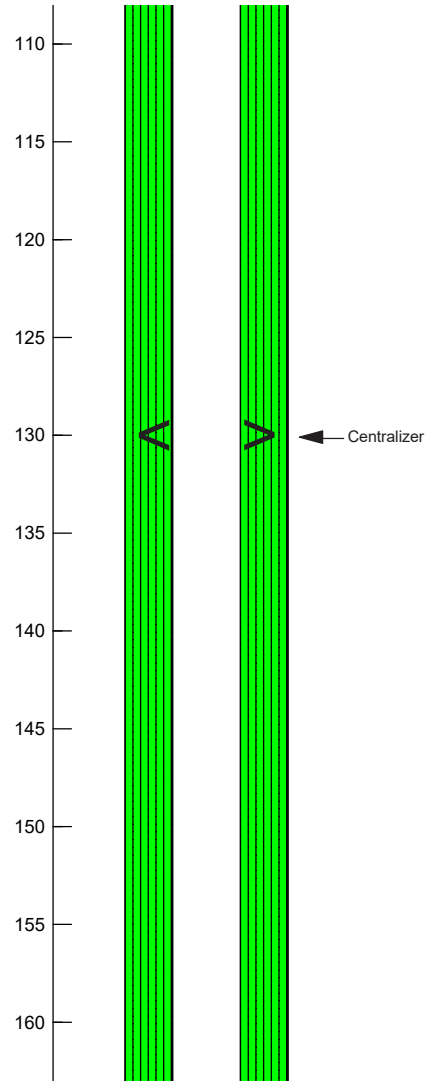
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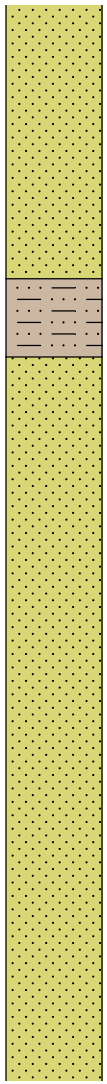
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CANNON AFB

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Daniel B. Stephens & Associates, Inc.
6/21/2022 JN DB21.1060

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Graphic Log	PID reading (ppm)	Sample Recovery (%)	Sample Interval (ft bgs)	USCS Symbol	Lithology Interval	Comments and Lithology
		100	116-126	SW/SP	116-122	Sand - light brown (7.5YR 6/3), fine to medium grained, moderately to well graded, loose, non-plastic, subangular to subround, damp to moist, no odor.
				SC	122-126	Sandy clay - reddish brown (5YR 5/4), fine grained, well sorted, subrounded, moderate plasticity, loose to medium dense, damp, no odor.
		100	126-136	SP	126-136	Sand - light reddish brown (5YR 6/4), very fine to fine grained, poorly graded, loose with sparse cemented gravels and cobbles, round to subround, very little fines, damp, no odor.
		100	136-146	SP	136-146	Sand - as above.
		100	146-156	SP	146-156	Sand - as above.
		100	156-164	SP	156-164	Sand - as above.

Geologist: J. Fisher
Driller: Yellow Jacket Drilling
Well completion date: 2/26/2022

Drilling method: Sonic core
Borehole diameter: 9.25"
Sampling method: Core

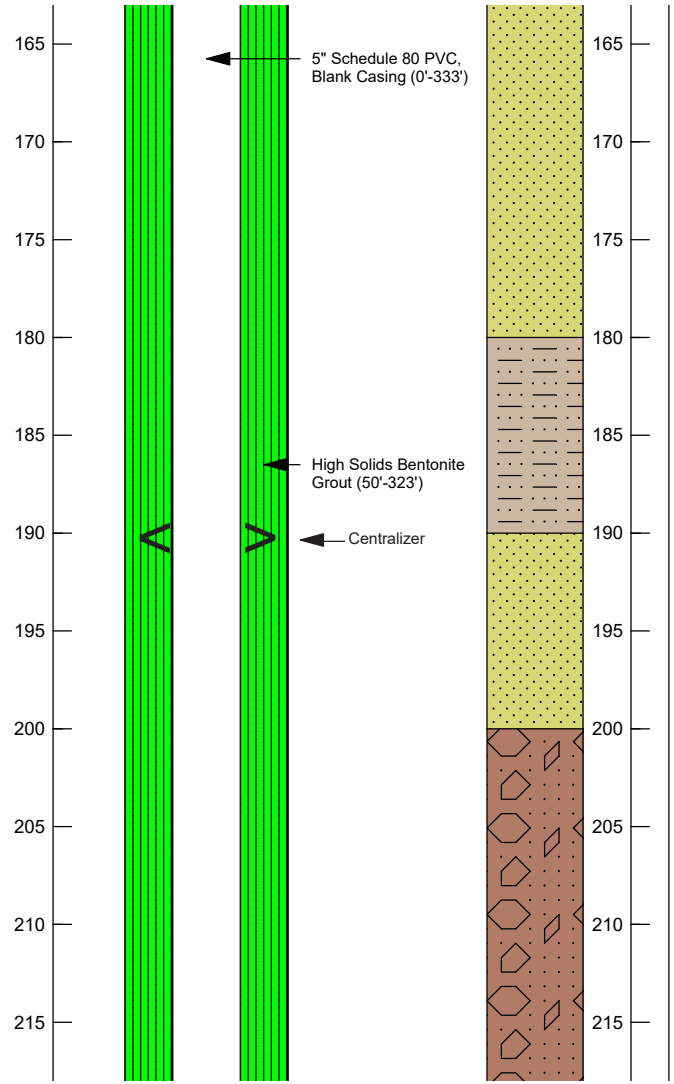
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New Mexico State Plane East NAD83
Northing: 1216555.366 Elevation: 4,177.350
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NMED PFAS INVESTIGATION
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Graphic Log	PID reading (ppm)	Sample Recovery (%)	Sample Interval (ft bgs)	USCS Symbol	Lithology Interval	Comments and Lithology
		100	164-173	SP	164-173	Sand - as above.
		100	173-180	SP	173-175	Sand - as above, but very dry
				SP	175-180	Sand - light reddish brown (5YR 6/4), very fine to fine grained, poorly graded, loose, increasing cemented gravels and cobbles, round to subround, very little fines, damp, no odor.
		100	180-190	SC	180-190	Clayey sand, reddish brown (5YR 5/4), very fine to fine grained sand, some cementation, mostly loose, slightly plastic when wet.
		100	190-197	SP	190-196	Sand - light reddish brown (5YR 6/4), very fine to fine grained, poorly graded, loose with sparse cemented gravels and cobbles, round to subround, very little fines, damp, no odor.
				SW	196-197	Sand - as above, but fine to medium grained, well graded, subround to subangular.
		100	197-206	SP	197-200	Sand - light reddish brown (5YR 6/4), very fine to fine grained, poorly graded, loose with sparse cemented gravels and cobbles, round to subround, very little fines, damp, no odor.
				SW/GW	200-206	Gravelly sand with cobbles - brown (7.5YR 5/4), fine to coarse grained, well graded, loose, subround to subangular, very little to no fines, 25% subround gravels and cobbles up to 3", damp to moist, no odor.
		100	206-216	SW/GW	206-208	Sand - as above.
				SW/GW	208-213	Gravelly sand with cobbles - pinkish gray (7.5YR 7/2), fine to coarse grained, moderately well graded, loose, subround to subangular, very little fines, 25% subround gravels and cobbles up to 4", damp to moist, no odor.
				SW/GW	213-222	Gravelly sand with cobbles - brown (7.5YR 5/4), fine to coarse grained, well graded, loose, subround to subangular, very little to no fines, 25% subround gravels and cobbles up to 3", damp to moist, no odor.
		100	216-225			

Geologist: J. Fisher
Driller: Yellow Jacket Drilling
Well completion date: 2/26/2022

Drilling method: Sonic core
Borehole diameter: 9.25"
Sampling method: Core

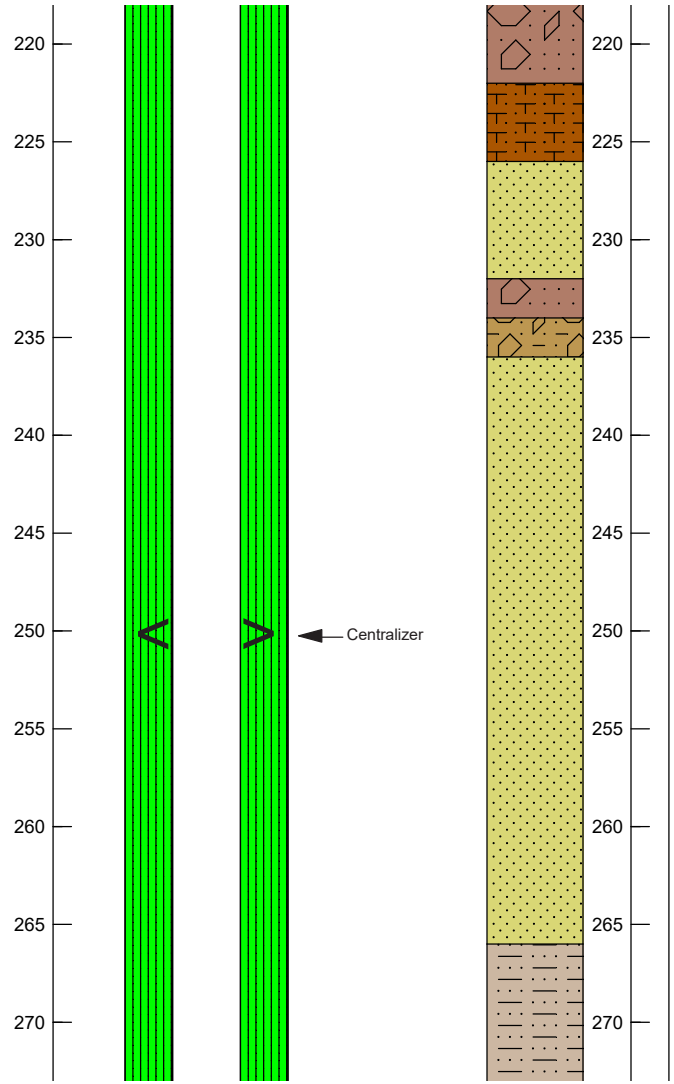
DTW= Depth to water, measured in feet below ground surface
New Mexico State Plane East NAD83
Northing: 1216555.366 Elevation: 4,177.350
Easting: 879094.298

NMED PFAS INVESTIGATION
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DBS-1 Lithologic Log and Well Completion Diagram

Daniel B. Stephens & Associates, Inc.
6/21/2022 JN DB21.1060

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Graphic Log	PID reading (ppm)	Sample Recovery (%)	Sample Interval (ft bgs)	USCS Symbol	Lithology Interval	Comments and Lithology
				SM	222-225	Silty sand with gravel - light yellowish brown (10YR 6/4), very fine to med. grained, poorly graded, loose, subround, 25% subround gravels and cobbles up to 3", dry, no odor.
		100	225-230	SM	225-226	Silty sand with gravel - as above.
				SP	226-230	Sand - light reddish brown (5YR 6/4), very fine to fine grained, poorly graded, loose with sparse cemented gravels and cobbles, round to subround, very little fines, damp, no odor.
		100	230-236	SP	230-232	Sand - light reddish brown (5YR 6/4), very fine to fine grained, poorly graded, sparse gravels and cobbles, round to subround, abundant calcium carbonate, damp, no odor.
				SW/GW	232-234	Gravelly sand with cobbles - brown, fine to coarse grained, moderately well graded, loose, subround to subangular, very little fines, 25% subround gravels and cobbles up to 4", damp to moist, no odor.
				CH	234-236	Clay with gravel and cobbles - reddish brown (5YR 4/4), little sand content, 25-30% subround gravels and cobbles up to 4", very plastic, hard, damp to moist, no odor.
		100	236-246	SP	236-246	Sand - yellowish red (5YR 5/6), very fine to fine grained, poorly graded, loose with sparse cemented gravels and cobbles, round to subround, very little fines, damp, no odor.
		100	246-256	SP	246-256	Sand - as above.
		100	256-261	SP	256-261	Sand - as above.
		100	261-266	SP	261-266	Sand - as above with increasing fines.
		100	266-276	SC	266-276	Clayey sand with silt - reddish brown (5YR 4/4), very fine to fine grained, poorly graded, slightly plastic when wet, some calcium carbonate cemented gravels/cobbles up to 2 1/2", damp, no odor.

Geologist: J. Fisher
Driller: Yellow Jacket Drilling
Well completion date: 2/26/2022

Drilling method: Sonic core
Borehole diameter: 9.25"
Sampling method: Core

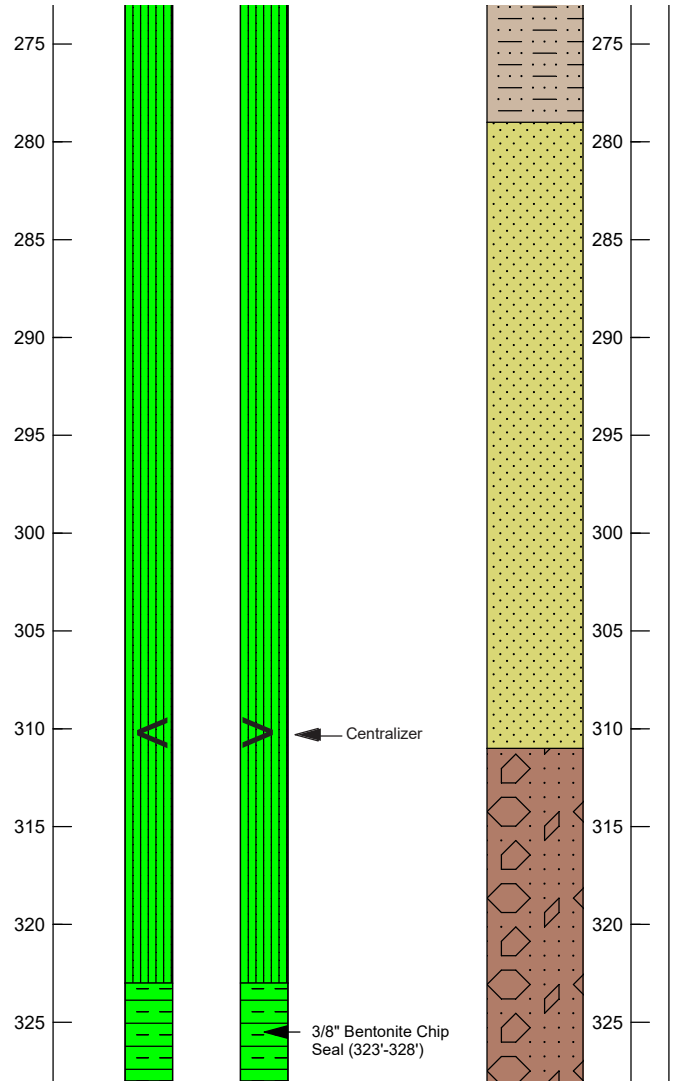
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Northing: 1216555.366 Elevation: 4,177.350
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Daniel B. Stephens & Associates, Inc.
6/21/2022 JN DB21.1060

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Graphic Log	PID reading (ppm)	Sample Recovery (%)	Sample Interval (ft bgs)	USCS Symbol	Lithology Interval	Comments and Lithology
		100	276-279	SC	276-279	Clayey sand - as above.
		100	279-293	SP	279-283	Sand - light reddish brown (5YR 5/4), very fine to fine grained, poorly graded, loose with sparse cemented gravels and cobbles, round to subround, very little fines, damp, no odor.
				SW	283-293	Sand - light reddish brown (5YR 5/4), fine to coarse grained, well graded, round to subround, loose with cemented subround gravels and cobbles up to 3", very little fines, damp, no odor.
		100	293-300	SP	293-300	Sand - light reddish brown (5YR 5/4), very fine to fine grained, poorly graded, loose with sparse cemented gravels and cobbles, round to subround, very little fines, damp, no odor.
		100	300-313	SW	300-308	Sand - light reddish brown (5YR 5/4), fine to coarse grained, well graded, round to subround, loose with cemented subround gravels and cobbles up to 3", very little fines, damp, no odor.
				SW	308-311	Sand - brown (7.5YR 5/4) fine to coarse grained, moderately well graded, round to subround, loose with sparse cemented subround gravels and cobbles up to 2", very little fines, damp, no odor
				SW/GW	311-313	Gravelly sand with cobbles - reddish brown (5YR 5/4), fine to coarse grained, moderately well graded, loose, subround to subangular, very little fines, 25% subround gravels and cobbles up to 4", damp to moist, no odor.
		100	313-323	SW/GW	313-323	Gravelly sand with cobbles - as above.
		100	323-333	SW/GW	323-330	Sand - as above, but very dry.

Geologist: J. Fisher
Driller: Yellow Jacket Drilling
Well completion date: 2/26/2022

Drilling method: Sonic core
Borehole diameter: 9.25"
Sampling method: Core

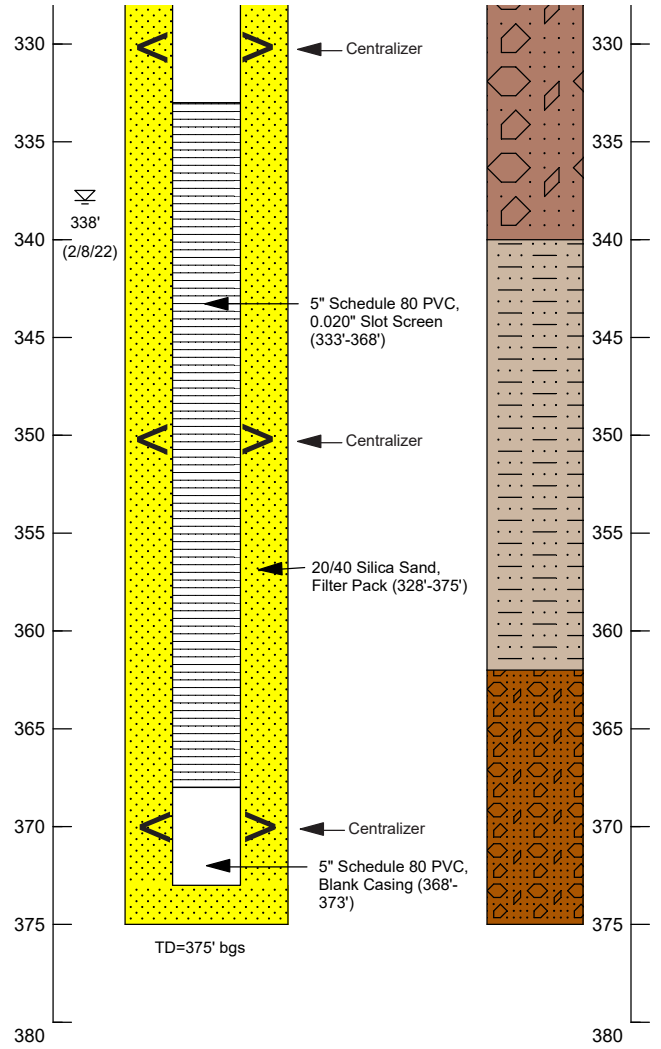
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Graphic Log	PID reading (ppm)	Sample Recovery (%)	Sample Interval (ft bgs)	USCS Symbol	Lithology Interval	Comments and Lithology
				SP	330-335	Gravelly sand with cobbles - as above, but with increased fines.
		100	333-345			
				SW/GW	335-340	Gravelly sand with cobbles - reddish brown (5YR 5/4), fine to coarse grained, moderately well graded, loose, subround to subangular, very little fines, 25% subround gravels and cobbles up to 4", moist, no odor.
				SC	340-345	Clayey sand with gravel and cobbles - reddish brown (5YR 4/3), sand is fine to coarse grained, well graded, plastic, hard, 30-35% subround gravels and cobbles up to 4", wet, no odor. Water @~340'.
		100	345-355	SC	345-355	Clayey sand with gravel and cobbles - reddish brown (5YR 4/3), sand is fine to coarse grained, well graded, plastic, hard, 30-35% subround gravels and cobbles up to 4", wet, no odor.
		100	355-364	SC	355-362	Clayey sand and gravel - with increased clay content, wet, no odor.
				SW/GW	362-364	Sand with gravel - reddish brown (5YR 4/3), fine to coarse grained, well graded, subround to subangular, loose, 20% fine gravels up to 1/4", little fines, wet, no odor.
		100	364-376	SW/GW	364-375	Sand with gravel - as above.

Geologist: J. Fisher
Driller: Yellow Jacket Drilling
Well completion date: 2/26/2022

Drilling method: Sonic core
Borehole diameter: 9.25"
Sampling method: Core

DTW= Depth to water, measured in feet below ground surface
New Mexico State Plane East NAD83
Northing: 1216555.366 Elevation: 4,177.350
Easting: 879094.298

NMED PFAS INVESTIGATION
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DBS-1 Lithologic Log and Well Completion Diagram

Daniel B. Stephens & Associates, Inc.
6/21/2022 JN DB21.1060

CobbFendley

April 08. 2022

John R. Bunch P.G.
Geologist
Daniel B. Stephens & Associates, Inc.
6020 Academy Road. NE, Suite 100
Albuquerque, New Mexico 87109

Survey Report – Curry County, NM - Well Survey

The following is a summary of the results obtained during our recent field surveys on the requested boring locations and associated features:

***Curry County,* MWs Site Data: Surveyed on March 16, 2022**
New Mexico State Plane Coordinates – NAD 83, Eastern Zone
NAVD 88 Elevations

Point ID	Northing	Easting	Elevation	Feature
1000	1216555.366	879094.298	4177.719 4177.350	MW-1 Top of PVC

NOTE:
Horizontal values shown are to the center of the monitoring wells. Vertical values are to the top of lid and top of north edge of PVC casing.

I, William T. Goss, New Mexico Professional Surveyor No. 16006, do hereby certify that this Survey Report was prepared by me or under my direct supervision based on an actual survey on the ground as described herein; that I am responsible for this survey; and that the survey and report meet the minimum standards for surveying in New Mexico.

William T. Goss, NMPS No. 16006 — Date: 4-12-2022



CobbFendley

SITE MAP



3820 Academy Parkway North NE| Albuquerque, New Mexico 87109 | 505.508.0786 | fax 505.508.0837 | www.cobbfendley.com

Appendix K

Data Quality Assessment Reports

DBS&A
Daniel B. Stephens & Associates, Inc.

Appendix K1. Data Quality Assessment
Vista Analytical Laboratory
Work Order No. 2107270

K1-1. Introduction

This data quality assessment was performed to confirm that the data quality objectives (DQOs) for the NMED Phase 1 PFAS investigation project were met. This report summarizes the results of the review of analytical data for 28 groundwater samples, 4 duplicate samples, 2 field blanks, and 2 trip blanks. The samples were collected by Daniel B. Stephens & Associates, Inc. (DBS&A) from agricultural (irrigation, livestock) wells and residential wells southeast of Cannon Air Force Base (AFB), Clovis, New Mexico on July 20 and 21, 2021. Also included in the assessment were quality control (QC) samples analyzed by the laboratory.

As discussed in the Phase 1 report, only Mr. Arthur Schaap gave permission for sampling results from his wells to be used in the Phase 1 report. Most of the results of the off-base sampling are being held confidential at the request of the landowners who allowed samples to be collected from their wells.

The samples were collected in accordance with standard operating procedures (SOPs) for sampling with potential impacts of per- and polyfluoroalkyl substances (PFAS). Samples were collected in new, clean containers supplied by the laboratory. Containers for aqueous samples were pre-preserved with Trizma and ammonium acetate, as appropriate. Upon collection, samples were stored on ice in coolers with appropriate chain-of-custody documents. Samples were hand-delivered to Hall Environmental Analytical Laboratory (HEAL) in Albuquerque on July 22, 2021. HEAL subcontracted the PFAS analysis to Vista Analytical Laboratory (Vista) in El Dorado Hills, California, and transferred the samples for PFAS analysis via FedEx to Vista on July 23, 2021. The samples were received by Vista on July 27, 2021.

The samples submitted to HEAL were managed under HEAL Order No. 2017B96. HEAL performed general chemistry analyses (major ions, metals, alkalinity, etc.). Vista managed the samples as Work Order (WO) 2107270 and analyzed the samples for PFAS using U.S. Environmental Protection Agency (EPA) methods 533 and 537 with isotope dilution/LC-MSMS

method compliant with Table B-15 of DoD QSM 5.3 (Aqueous). Vista is certified to perform the requested analyses under DoD ELAP - A2LA Accredited - ISO/IEC 17025:2005, Certificate No. 3091.01. This data quality assessment addresses samples and associated QC samples analyzed for PFAS by Vista under WO 2107270. The portion of the laboratory report that is not being held confidential at landowner request is provided in Appendix I to the Phase I Report for the Cannon site.

The analytical data were evaluated in general accordance with *Data Validation Guidelines Module 3: Data Validation Procedure for Per- and Polyfluoroalkyl Substances Analysis by QSM Table B-15* (DOD, 2020).

The analytical method that was used by Vista during this project provide guidance on procedures and method acceptance criteria that, in some areas, differ from that given in the validation guidelines. Where differences exist between the methods and the validation guidelines, the data reviewers followed the acceptance criteria given in the methods. However, where the laboratory data package presented laboratory-derived acceptance criteria, these criteria were used to evaluate the data, unless the criteria were considered inadequate.

The report for WO 2107270 is a summary data package, which include a case narrative, sample results and summarized results for select QC parameters. The data quality review applied to this laboratory report represented an abbreviated assessment of the quality of the data set. The review is intended to identify and present those problems and quality control deficiencies that could be readily identified from the summary data package.

K1-2. Data Quality Assessment

Data quality assessment was based on the following parameters:

- Data package completeness
- Chain of custody variances
- Sample preservation and holding times
- Extracted internal standards (EIS)
- Blank samples
- Laboratory control sample (LCS) and LCS duplicates (LCSDs)
- Field duplicates

- Matrix spike (MS) and MS duplicates (MSDs)
- Overall assessment

The following subsections summarize the findings of the data evaluation performed.

K1-2.1 Data Package Completeness

The data package was complete and included a case narrative, an inventory of samples received and analyzed, results sheets for field and laboratory samples analyzed, a list of data qualifiers and abbreviations used, a list of laboratory certifications and accredited test methods, chain of custody documents, and laboratory sample log-in checklists. All samples were analyzed as requested and results were presented for all target analytes requested.

K1-2.2 Chain-of-Custody Variances

No issues were identified related to the chain of custody. Copies of both the original and transfer chain of custody documents are provided in the laboratory report in Appendix I.

K1-2.3 Sample Preservation and Holding Times

Sample containers for PFAS analysis were pre-preserved by HEAL (ammonium acetate for method 533 and Trizma buffer for method 537.1). Samples were delivered to HEAL on regular ice, per DBS&A procedure for samples for PFAS analysis. HEAL forwarded the samples to Vista using Blue Ice, which is not recommended for samples to be analyzed for PFAS. Based on the lack of analyte detections in the trip blanks and field blanks, the use of Blue Ice does not appear to have affected sample integrity. Samples were received at Vista in good condition and within the recommended temperature requirements.

The samples were extracted and analyzed within the technical holding times in accordance with Vista's SOPs.

K1-2.4 Extracted Internal Standards (EIS)

The laboratory adds EISs to all samples, standards, blanks, and QC samples. EIS recoveries are used to correct for bias associated with matrix interferences, sample preparation efficiencies, injection volume variances, chromatographic behavior, and mass spectrometry ionization efficiency. One measure of analytical accuracy is the calculated percent recovery (%R) of each

EIS. The %Rs of EISs were within acceptance limits (50 to 150 percent) for all samples, blanks, and QC samples, except for the following:

Sample ID	Date Collected	Surrogate(s)	%R	Associated Analyte(s)
Field Blank	7/20/2021	13C2-4:2 FTS	43.4	4:2 FTS = ND
Field Blank	7/21/2021	13C2-4:2 FTS d5-EtFOSAA	43.9 47.6	4:2 FTS = ND EtFOSAA = ND
Trip Blank 1	7/22/2021	13C3-HFPO-DA 13C2-4:2 FTS d5-EtFOSAA	44.6 44.8 43.0	HFPO-DA = ND 4:2 FTS = ND EtFOSAA = ND
Trip Blank 2	7/22/2021	13C2-4:2 FTS d5-EtFOSAA	43.9 47.6	4:2 FTS = ND EtFOSAA = ND
Method Blank 2	—	d5-EtFOSAA	49.9	EtFOSAA = ND

ND = Target analyte not detected in blank sample

K1-2.5 Blank Samples

A total of 2 trip blanks, 1 in each cooler containing samples, and 2 field blanks, 1 for each day of sampling, were prepared in the field during the sampling effort. The laboratory analyzed 2 method blank samples with this sample group. No PFAS were detected in the trip blanks, the field blanks, or the laboratory method blanks.

K1-2.6 Laboratory Control Samples and LCS Duplicates

Vista analyzed 2 LCS/LCSDs with the sample group. The LCS/LCSD is a sample of analyte-free water to which known quantities of the target analytes are added. The samples are then analyzed and analyte recoveries are measured. The %Rs of analytes added to both of the LCS/LCSD samples were all within the acceptance limits established for each analyte. The %Rs of surrogates added to the samples were also within acceptance limits (50 to 150 percent).

Precision of duplicate results is calculated by using the relative percent difference (RPD). The RPDs for each of the target analytes for both of the LCS/LCSD samples was 30 percent or less and met the precision objective for aqueous samples.

K1-2.7 Field Duplicates

Duplicate samples were collected at four sample locations during the sampling event. The analytical results of the primary and duplicate samples for each of the target analytes detected

were compared using the RPD. The maximum RPDs for the four sets of results ranged from 6.7 to 26.2 (Table K1-1) and were all less than the acceptance limit of 30.

As discussed in the NMED Phase 1 PFAS report, only Mr. Arthur Schaap gave permission for sampling results from his wells to be used in the Phase 1 report. Most of the results of the off-base sampling are being held confidential at the request of the landowners who allowed samples to be collected from their wells.

K1-2.8 Matrix Spike/Matrix Spike Duplicate Analysis

Due to an oversight by field personnel, additional sample volume required for MS/MSD analysis was not collected, so MS/MSD analysis was not performed.

K1-3. Overall Assessment

Laboratory data for a total of 28 groundwater samples from agricultural and residential wells located off-base southeast of Cannon AFB were evaluated to confirm that the DQOs for the NMED Phase 1 PFAS Investigation project were met. The portion of the laboratory report which is not being held confidential is provided in Appendix I. The data quality assessment indicates that overall quality of the laboratory data is acceptable and meets the DQOs for this project.

K1-3.1 Precision

Precision is a measure of how closely values from measurements of a primary and duplicate sample agree with each other. Precision for aqueous samples is measured through the calculation of the RPD between the following results: (1) primary and duplicate samples, (2) MS and MSDs, and (3) LCSs and LCSDs. The precision objective for aqueous samples is an RPD of 30 percent or less, where results are reported at greater than 5 times the quantitation limit. For solid samples (soil and sediment), the precision objective is an RDP of 50 percent or less.

No field duplicates or additional sample volume for MS/MSD analyses were collected. No LCSD was analyzed with this sample group. No RPDs could be calculated for this sample group.

K1-3.2 Accuracy

Accuracy is the degree of agreement between an observed value and an accepted reference or true value. Accuracy in the field is assessed through the use of field reagent blanks as negative

controls and through the adherence to all sample handling, preservation, and holding time requirements. The objective for field reagent blanks is that no target compounds are detected above the laboratory method reporting limits (RLs).

Laboratory accuracy is assessed through the analysis of laboratory method blanks as negative controls, LCSs, OPRs, or laboratory fortified blanks (LFBs) as clean matrix positive controls, MS/MSDs as sample matrix positive controls, surrogate spike recoveries, and recovery of extracted internal standard compounds for the isotope dilution method. Method blanks should not contain any target compounds above the reporting limits. For the LCS, OPRs, and extracted internal standards, the accuracy objectives, as measured by %Rs, were the control limits provided in the laboratory SOPs.

- No target analytes were detected in the field blank, the equipment blank, or the laboratory method blank.
- %R for target analytes in the OPR and surrogates in all samples analyzed met acceptance limits.
- Holding times were met for sample extraction and analysis.

The laboratory case narrative indicates that initial calibration and continuing calibration verifications for this work order met the method acceptance criteria.

K1-3.3 Sensitivity

The sensitivity of analytical data is demonstrated by laboratory method RLs, which are generally based on the low point of calibration. For this project, the laboratory achieved RLs of 4 nanograms per liter (ng/L) or less for aqueous samples. No sample dilution was required. All results were reported to two significant figures if less than 10 ng/L. Results below the RLs but above the method detection limits (MDLs) were also reported and qualified as estimates.

K1-3.4 Comparability

Comparability is the degree to which different methods or data agree or can be represented as similar, and expresses the confidence with which one data set can be compared to another. Comparability is dependent upon the proper design of the sampling program and is satisfied by ensuring that the protocols described in the reference methods are followed and that proper sampling techniques are used. Planned analytical data will be comparable when similar sampling and analytical methods are used in future events.

K1-3.5 Representativeness

Representativeness is the degree to which data accurately and precisely represents a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition. Representativeness is ensured through the design of the sampling program and was satisfied by ensuring that field personnel used proper sampling techniques per field SOPs. Within the laboratory, representativeness is ensured by the use of appropriate reference methods, conformance to the approved analytical procedures described in the laboratory SOPs, and adherence to sample holding times.

K1-3.6 Completeness

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under correct, normal conditions. "Normal conditions" are defined as the conditions expected if the sampling plan was implemented as planned. Field completeness is a measure of the number of valid samples obtained during the project. A generic field completeness objective is greater than 90 percent, which was achieved for this project.

Laboratory completeness is a measure of the amount of valid measurements obtained from all the measurements taken in the project. A generic laboratory completeness objective is greater than 95 percent, which was achieved for this task. All laboratory results are considered usable for all project purposes; no laboratory results were rejected.

References

Department of Defense (DOD). 2020. *Data validation guidelines Module 3: Data validation procedure for per- and polyfluoroalkyl substances analysis by QSM Table B-15*. May 2020.

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U.S. Environmental Protection Agency (EPA). 2018. *Data review and validation guidelines for perfluoroalkyl substances (PFASs) analyzed using EPA method 537*. November 2018.

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Table K1-1. Evaluation of PFAS Results for Duplicate Samples, Off-Base
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Analyte	Concentration (ng/L)		RPD	Concentration (ng/L)		RPD
	COS-11	COS-11 DUP		COS-15	COS-15 DUP	
	7/21/2021			7/21/2021		
PFBA	538	539	0.2	116	118	1.7
PFPeA	1,460	1,900	26.2	412	410	-0.5
PFHxA	2,600	2,490	-4.3	461	463	0.4
PFHpA	987	982	-0.5	173	167	-3.5
PFOA	2,300	2,030	-12.5	443	418	-5.8
PFNA	25.8	22.6	-13.2	6.54	6.62	1.2
PFDA	<3.97	<3.81	—	<4.13	<4.06	—
PFUnA	<3.97	<3.81	—	<4.13	<4.06	—
PFDoA	<3.97	<3.81	—	<4.13	<4.06	—
PFTrDA	<3.97	<3.81	—	<4.13	<4.06	—
PFTeDA	<3.97	<3.81	—	<4.13	<4.06	—
PFBS	414	373	-10.4	104	108	3.8
PFPeS	581	540	-7.3	137	131	-4.5
PFHxS	9,260	11,400	20.7	1,360	1,370	0.7
PFHpS	654	624	-4.7	51.6	57.6	11.0
PFOS	15,100	13,500	-11.2	1,700	1,790	5.2
4:02 FTS	64.1	68.6	6.8	19.1	21.8	13.2
6:02 FTS	3,740	3,580	-4.4	772	754	-2.4
8:02 FTS	8.97	7.67	-15.6	<4.13	<4.06	—
MeFOSAA	<3.97	<3.81	—	<4.13	<4.06	—
EtFOSAA	<3.97	<3.81	—	<4.13	<4.06	—
HFPO-DA	<3.97	<3.81	—	<4.13	<4.06	—
PFMPA	<3.97	<3.81	—	<4.13	<4.06	—
PFMBA	<3.97	<3.81	—	<4.13	<4.06	—
NFDHA	<3.97	<3.81	—	<4.13	<4.06	—
11Cl-PF3OUdS	<3.97	<3.81	—	<4.13	<4.06	—

Note: Two duplicate results are being held confidential at request of landowners.
Analyses performed by Vista Analytical Laboratory.
Refer to Table 1 in the Phase I Report for a list of PFAS names.
Analytical method is PFAS Isotope Dilution Table B-15
ng/L = Nanograms per liter
RPD = Relative percent difference
— = Not calculated

Table K1-1. Evaluation of PFAS Results for Duplicate Samples, Off-Base
Page 2 of 2

Analyte	Concentration (ng/L)		RPD	Concentration (ng/L)		RPD
	COS-11	COS-11 DUP		COS-15	COS-15 DUP	
	7/21/2021			7/21/2021		
9Cl-PF3ONS	<3.97	<3.81	—	<4.13	<4.06	—
PFEESA	<3.97	<3.81	—	<4.13	<4.06	—
ADONA	<3.97	<3.81	—	<4.13	<4.06	—

Note: Two duplicate results are being held confidential at request of landowners.
Analyses performed by Vista Analytical Laboratory.
Refer to Table 1 in the Phase I Report for a list of PFAS names.
Analytical method is PFAS Isotope Dilution Table B-15
ng/L = Nanograms per liter
RPD = Relative percent difference
— = Not calculated

Appendix K2. Data Quality Assessment
Vista Analytical Laboratory
Work Order No. 2112095

K2-1. Introduction

This data quality assessment was performed to confirm that the data quality objectives (DQOs) for the NMED Phase 1 PFAS investigation project were met. This report summarizes the result of the review of analytical data for 16 groundwater samples, 2 duplicate samples, and 4 field blanks. The samples were collected by Daniel B. Stephens & Associates, Inc. (DBS&A) from monitor wells on Cannon Air Force Base (AFB), Clovis, New Mexico on December 6 through 9, 2021. Also included in the assessment were quality control (QC) samples analyzed by the laboratory.

The samples were collected in accordance with standard operating procedures (SOPs) for sampling with potential impacts of per- and polyfluoroalkyl substances (PFAS). Samples were collected in new, clean containers supplied by the laboratory. Containers for aqueous samples were pre-preserved with Trizma and ammonium acetate, as appropriate. Upon collection, samples were stored on ice in coolers with appropriate chain-of-custody documents. Samples were hand-delivered to Hall Environmental Analytical Laboratory (HEAL) in Albuquerque on December 10, 2021. HEAL subcontracted the PFAS analysis to Vista Analytical Laboratory (Vista) in El Dorado Hills, California, and transferred the samples for PFAS analysis via Federal Express to Vista on December 13, 2021. The samples were received by Vista on December 14, 2021.

The samples submitted to HEAL were managed under HEAL Order No. 2112792. HEAL performed general chemistry analyses (major ions, metals, alkalinity, etc.). Vista managed the samples as Work Order (WO) 2112095 and analyzed the samples for PFAS using U.S. Environmental Protection Agency (EPA) methods 533 and 537 with isotope dilution/LC-MSMS method compliant with Table B-15 of DoD QSM 5.3 (Aqueous). Vista is certified to perform the requested analyses under DoD ELAP - A2LA Accredited - ISO/IEC 17025:2005, Certificate No. 3091.01. This data quality assessment addresses samples and associated QC samples analyzed for PFAS by Vista under WO 2112095. The complete laboratory report is provided in Appendix I.

The analytical data were evaluated in general accordance with *Data Validation Guidelines Module 3: Data Validation Procedure for Per- and Polyfluoroalkyl Substances Analysis by QSM Table B-15* (DOD, 2020).

The analytical method that was used by Vista during this project provide guidance on procedures and method acceptance criteria that, in some areas, differ from that given in the validation guidelines. Where differences exist between the methods and the validation guidelines, the data reviewers followed the acceptance criteria given in the methods. However, where the laboratory data package presented laboratory-derived acceptance criteria, these criteria were used to evaluate the data, unless the criteria were considered inadequate.

The report for WO 2112095 is a summary data package, which include a case narrative, sample results and summarized results for select QC parameters. The data quality review applied to this laboratory report represented an abbreviated assessment of the quality of the data set. The review is intended to identify and present those problems and quality control deficiencies that could be readily identified from the summary data package.

K2-2. Data Quality Assessment

Data quality assessment was based on the following parameters:

- Data package completeness
- Chain of custody variances
- Sample preservation and holding times
- Extracted internal standards (EIS)
- Blank samples
- Laboratory control sample (LCS) and LCS duplicates (LCSDs)
- Field duplicates
- Matrix spike (MS) and MS duplicates (MSDs)
- Overall assessment

The laboratory reported that five samples (MW-Ga, MW-Na, MW-Sa, MW-Ua, and MW-Ua DUP) contained particulates and were centrifuged prior to extraction. This does not affect the data generated from these samples.

The following subsections summarize the findings of the data evaluation performed.

K2-2.1 Data Package Completeness

The data package was complete and included a case narrative, an inventory of samples received and analyzed, results sheets for field and laboratory samples analyzed, a list of data qualifiers and abbreviations used, a list of laboratory certifications and accredited test methods, chain of custody documents, and laboratory sample log-in checklists. All samples were analyzed as requested and results were presented for all target analytes requested.

K2-2.2 Chain-of-Custody Variances

No issues were identified related to the chain of custody. Copies of both the original and transfer chain of custody documents are provided in the laboratory report in Appendix I.

K2-2.3 Sample Preservation and Holding Times

Sample containers for PFAS analysis were pre-preserved by HEAL (ammonium acetate for method 533 and Trizma buffer for method 537.1). Samples were delivered to HEAL on regular ice, per DBS&A procedure for samples for PFAS analysis. HEAL forwarded the samples to Vista using Blue Ice, which is not recommended for samples to be analyzed for PFAS. Based on the lack of analyte detections in the field blanks, the use of Blue Ice does not appear to have affected sample integrity. Samples were received at Vista in good condition and within the recommended temperature requirements.

The samples were extracted and analyzed within the technical holding times in accordance with Vista's SOPs.

K2-2.4 Extracted Internal Standards

EISs are added to all field samples and QC samples by the laboratory. EIS recoveries are used to correct for bias associated with matrix interferences, sample preparation efficiencies, injection volume variances, chromatographic behavior, and mass spectrometry ionization efficiency. One measure of analytical accuracy is the calculated percent recoveries (%R) of each EIS. The %Rs of EISs were within acceptance limits (50-150 percent) for all field samples and QC samples, except for the following:

Sample ID	Date Collected	Surrogate(s)	%R	Associated Analyte(s)
MW-Na	12/7/2021	13C3-PFBA	36.0	PFBA = ND
MW-Ua	12/8/2021	13C3-PFBA	44.2	PFBA = 14.5
MW-Ua (DUP)	12/8/2021	13C3-PFBA	47.1	PFBA = 14.1

ND = Target analyte not detected in blank sample

K2-2.5 Blank Samples

A total of f4 field blanks, 1 for each day of sampling, were prepared in the field during the sampling effort. No trip blanks were submitted with these samples. The laboratory analyzed 2 method blank samples with this sample group. No PFAS were detected in the field blanks or the laboratory method blanks.

K2-2.6 Laboratory Control Samples (LCS) and LCS Duplicates

Vista analyzed one LCS/LCSD with this sample group. The LCS/LCSD is a sample of analyte-free water to which known quantities of the target analytes are added. The samples are then analyzed and analyte recoveries are measured. The %Rs of analytes added to the LCS and LCSD were all within the acceptance limits established for each analyte. The %Rs of surrogates added to these QC samples were also within acceptance limits (50 to 150 percent).

Precision of duplicate results is calculated using the relative percent difference (RPD). The RPDs for each of the target analytes for the LCS/LCSD samples was 30 percent or less and met the precision objective for aqueous samples.

Vista also analyzed an ongoing performance and recovery (OPR) sample, which is sometimes referred to as an LCS. The %Rs of analytes added to the OPR were all within the acceptance limits established for each analyte. The %Rs of surrogates added to the samples were also within acceptance limits (50 to 150 percent).

K2-2.7 Field Duplicate

Duplicate samples were collected at 2 sample locations during the sampling event. The analytical results of the primary and duplicate samples for each of the target analytes detected were compared using the RPD. The maximum RPDs for the four sets of results ranged from 6.7 to 26.2 (Table K2-1) and met the precision objective for aqueous samples.

K2-2.8 Matrix Spike/Matrix Spike Duplicate Analysis

MS/MSD analysis was performed using additional sample volume collected from well MW-D. %Rs and RPDs met QC objectives for all target analytes, with the following exceptions:

Analyte	MS %R	MSD %R	%R Limits	RPD	RPD Limit	Sample Result (ng/L)
PFBA	143	133	73-129	7.25 [a]	30	346
PFPeA	113 [a]	131	72-129	14.8 [a]	30	1,200
PFHxA	-117 [a]	68.2	72-129	759	30	1,260
PFHpA	188	151	72-130	21.8 [a]	30	561
PFOA	31.2	116 [a]	71-133	115	30	1,800
PFPeS	71.6 [a]	164	71-127	78.4	30	285
PFHxS	281	205	68-131	31.3	30	5,820
PFOS	-35.2	99.8 [a]	65-140	418	30	2,190
6:2 FTS	579	366	64-140	45.1	30	1,610

[a] Result met QC limit

K2-3. Overall Assessment

Laboratory data for a total of 16 groundwater samples collected from monitor wells at Cannon AFB were evaluated to confirm that the (DQOs) for the NMED Phase 1 PFAS investigation project were met. The data quality assessment indicates that overall quality of the laboratory data is acceptable and meets the DQOs for this project.

K2-3.1 Precision

Precision is a measure of how closely values from measurements of a primary and duplicate sample agree with each other. Precision for aqueous samples is measured by calculating the RPD for the following results: (1) primary and duplicate samples, (2) MSs and MSDs, and (3) LCSs and LCSDs. The precision objective for aqueous samples is an RPD of 30 percent or less, where results are reported at greater than 5 times the quantitation limit. For solid samples (soil and sediment), the precision objective is an RDP of 50 percent or less. With only a few exceptions, described above, the analytical results met the DQO for precision.

K2-3.2 Accuracy

Accuracy is the degree of agreement between an observed value and an accepted reference or true value. Accuracy in the field is assessed through the use of field reagent blanks as negative controls and through the adherence to all sample handling, preservation, and holding time requirements. The objective for field reagent blanks is that no target compounds are detected above the laboratory method reporting limits (RLs).

Laboratory accuracy is assessed through the analysis of laboratory method blanks as negative controls, LCSs, OPRs, or laboratory fortified blanks (LFBs) as clean matrix positive controls, MS/MSDs as sample matrix positive controls, and recovery of EIS compounds for the isotope dilution method. Method blanks should not contain any target compounds above the reporting limits. For the LCS, OPRs, and extracted internal standards, the accuracy objectives, as measured by %Rs, were the control limits provided in the laboratory SOPs.

- No target analytes were detected in the field blanks or the laboratory method blank.
- %R for target analytes in the LCS, LCSD, OPR and EISs in all samples analyzed met acceptance limits.
- %R for nine target analytes in the MS and/or MSD did not meet the acceptance limits established for those analytes.
- Holding times were met for sample extraction and analysis.

The laboratory case narrative indicates that initial calibration and continuing calibration verifications for this work order met the method acceptance criteria.

K2-3.3 Sensitivity

The sensitivity of analytical data is demonstrated by laboratory RLs, which are generally based on the low point of calibration. For this project, the laboratory achieved RLs of 4 nanograms per liter (ng/L) or less for aqueous samples. Where required, dilution and reanalysis of specific analytes and associated EISs were performed and highlighted by the laboratory with a D qualifier. All results were reported to two significant figures if less than 10 ng/L. Results below the RLs but above the method detection limits (MDLs) were also reported and qualified by the laboratory as estimates.

K2-3.4 Comparability

Comparability is the degree to which different methods or data agree or can be represented as similar and expresses the confidence with which one data set can be compared to another. Comparability is dependent upon the proper design of the sampling program and is satisfied by ensuring that the protocols described in the reference methods are followed and that proper sampling techniques are used. Planned analytical data will be comparable when similar sampling and analytical methods are used in future events.

K2-3.5 Representativeness

Representativeness is the degree to which data accurately and precisely represents a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition. Representativeness is ensured through the design of the sampling program and was satisfied by ensuring that field personnel used proper sampling techniques per field SOPs. Within the laboratory, representativeness is ensured by the use of appropriate reference methods, conformance to the approved analytical procedures described in the laboratory SOPs, and adherence to sample holding times.

K2-3.6 Completeness

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under correct, normal conditions. "Normal conditions" are defined as the conditions expected if the sampling plan was implemented as planned. Field completeness is a measure of the number of valid samples obtained during the project. A generic field completeness objective is greater than 90 percent, which was achieved for this project.

Laboratory completeness is a measure of the amount of valid measurements obtained from all the measurements taken in the project. A generic laboratory completeness objective is greater than 95 percent, which was achieved for this task. All laboratory results are considered usable for all project purposes; no laboratory results were rejected.

References

Department of Defense (DOD). 2020. *Data validation guidelines Module 3: Data validation procedure for per- and polyfluoroalkyl substances analysis by QSM Table B-15*. May 2020.

Hall Environmental Analysis Laboratory (HEAL). 2022. Cannon AFB PFAS, Order No. 2112792. Revised report issued May 26, 2022.

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Table K2-1. Evaluation of PFAS Results for Duplicate Samples, Cannon AFB
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Analyte	Concentration (ng/L)		RPD	Concentration (ng/L)		RPD
	MW-Ua	MW-Ua DUP		MW-D	MW-D (DUP)	
	12/8/2021			12/9/2021		
PFBA	14.5	14.1	-2.8	346	358	3.4
PFPeA	17.6	16.6	-5.8	1,200	1,190	-0.8
PFBS	18.3	18.4	0.5	162	159	-1.9
4:2 FTS	<3.96	<3.91	—	26.6	23.8	-11.1
PFHxA	15.3	14.5	-5.4	1,260	1,220	-3.2
PFPeS	1.60 J	1.60 J	0.0	285	289	1.4
HFPO-DA	<3.96	<3.91	—	<3.89	<4.00	—
PFHpA	<3.96	<3.91	—	561	583	3.8
ADONA	<3.96	<3.91	—	<3.89	<4.00	—
PFHxS	<3.96	<3.91	—	5,820	5,790	-0.5
6:2 FTS	<3.96	<3.91	—	1,620	1,580	-2.5
PFOA	<3.96	<3.91	—	1,800	1,740	-3.4
PFHpS	<3.96	<3.91	—	102	110	7.5
PFNA	<3.96	<3.91	—	28.1	27.3	-2.9
PFOS	<3.96	<3.91	—	2,190	2,250	2.7
9Cl-PF3ONS	<3.96	<3.91	—	<3.89	<4.00	—
PFDA	<3.96	<3.91	—	<3.89	<4.00	—
8:2 FTS	<3.96	<3.91	—	<3.89	<4.00	—
MeFOSAA	<3.96	<3.91	—	<3.89	<4.00	—
EtFOSAA	<3.96	<3.91	—	<3.89	<4.00	—
PFUnA	<3.96	<3.91	—	<3.89	<4.00	—
11Cl-PF3OUdS	<3.96	<3.91	—	<3.89	<4.00	—
PFDoA	<3.96	<3.91	—	<3.89	<4.00	—
PFTrDA	<3.96	<3.91	—	<3.89	<4.00	—
PFTeDA	<3.96	<3.91	—	<3.89	<4.00	—
PFMBA	<3.96	<3.91	—	<3.89	<4.00	—
PFMPA	<3.96	<3.91	—	<3.89	<4.00	—

Analyses performed by Vista Analytical Laboratory.
Refer to Table 1 in the Phase I Report for a list of PFAS names.
Analytical method is PFAS Isotope Dilution Table B-15
ng/L = Nanograms per liter
RPD = Relative percent difference
— = Not calculated

Table K2-1. Evaluation of PFAS Results for Duplicate Samples, Cannon AFB
Page 2 of 2

Analyte	Concentration (ng/L)		RPD	Concentration (ng/L)		RPD
	MW-Ua	MW-Ua DUP		MW-D	MW-D (DUP)	
	12/8/2021			12/9/2021		
PFEESA	<3.96	<3.91	—	<3.89	<4.00	—
NFDHA	<3.96	<3.91	—	<3.89	<4.00	—

Analyses performed by Vista Analytical Laboratory.
Refer to Table 1 in the Phase I Report for a list of PFAS names.
Analytical method is PFAS Isotope Dilution Table B-15
ng/L = Nanograms per liter
RPD = Relative percent difference
— = Not calculated

Appendix K3. Data Quality Assessment
Vista Analytical Laboratory
Work Order No. 2202244

K3-1. Introduction

This data quality assessment was performed to confirm that the data quality objectives (DQOs) for the NMED Phase 1 PFAS investigation project were met. This report summarizes the results of the review of analytical data for 3 soil samples, 1 duplicate sample, and 8 equipment blanks. The samples were collected by Daniel B. Stephens & Associates, Inc. (DBS&A) on February 8 through 15, 2022 during the installation of new monitor well DBS-1 near Cannon Air Force Base (AFB), Clovis, New Mexico,. Also included in the assessment were quality control (QC) samples analyzed by the laboratory.

The samples were collected in accordance with standard operating procedures (SOPs) for sampling with potential impacts of per- and polyfluoroalkyl substances (PFAS). Samples were collected in new, clean containers supplied by the laboratory. Containers for aqueous samples were pre-preserved with Trizma and ammonium acetate, as appropriate. Upon collection, samples were stored on ice in coolers with appropriate chain-of-custody documents. Samples were hand-delivered to Hall Environmental Analytical Laboratory (HEAL) in Albuquerque on February 17, 2022. HEAL subcontracted the PFAS analysis to Vista Analytical Laboratory (Vista) in El Dorado Hills, California, and transferred the samples for PFAS analysis via FedEx to Vista on February 17, 2022. The samples were received by Vista on February 22, 2022.

The samples submitted to HEAL were managed under HEAL Order No. 2202893. HEAL performed general chemistry analyses (major ions, metals, alkalinity, etc.). Vista managed the samples as Work Order (WO) 2202244 and analyzed the samples for PFAS using U.S. Environmental Protection Agency (EPA) methods 533 and 537 with isotope dilution/LC-MSMS method compliant with Table B-15 of DoD QSM 5.3 (Aqueous). Vista is certified to perform the requested analyses under DoD ELAP - A2LA Accredited - ISO/IEC 17025:2005, Certificate No. 3091.01. This data quality assessment addresses samples and associated QC samples analyzed for PFAS by Vista under WO 2202244. The complete laboratory report is provided in Appendix I.

The analytical data were evaluated in general accordance with *Data Validation Guidelines Module 3: Data Validation Procedure for Per- and Polyfluoroalkyl Substances Analysis by QSM Table B-15* (DOD, 2020).

The analytical method that was used by Vista during this project provide guidance on procedures and method acceptance criteria that, in some areas, differ from that given in the validation guidelines. Where differences exist between the methods and the validation guidelines, the data reviewers followed the acceptance criteria given in the methods. However, where the laboratory data package presented laboratory-derived acceptance criteria, these criteria were used to evaluate the data, unless the criteria were considered inadequate.

The report for WO 2112095 is a summary data package, which include a case narrative, sample results and summarized results for select QC parameters. The data quality review applied to this laboratory report represented an abbreviated assessment of the quality of the data set. The review is intended to identify and present those problems and quality control deficiencies that could be readily identified from the summary data package.

K3-2. Data Quality Assessment

Data quality assessment was based on the following parameters:

- Data package completeness
- Chain of custody variances
- Sample preservation and holding times
- Extracted internal standards (EIS)
- Blank samples
- Laboratory control sample (LCS) and LCS duplicates (LCSDs)
- Field duplicates
- Matrix spike (MS) and MS duplicates (MSDs)
- Overall assessment

The following subsections summarize the findings of the data evaluation performed.

K3-2.1 Data Package Completeness

The data package was complete and included a case narrative, an inventory of samples received and analyzed, results sheets for field and laboratory samples analyzed, a list of data qualifiers and abbreviations used, a list of laboratory certifications and accredited test methods, chain of custody documents, and laboratory sample log-in checklists. All samples were analyzed as requested and results were presented for all target analytes requested.

K3-2.2 Chain-of-Custody Variances

No issues were identified related to the chain of custody. Copies of both the original and transfer chain of custody documents are provided in the laboratory report in Appendix I.

K3-2.3 Sample Preservation and Holding Times

Sample containers for PFAS analysis were pre-preserved by HEAL (ammonium acetate for method 533 and Trizma buffer for method 537.1). Samples were delivered to HEAL on regular ice, per DBS&A procedure for samples for PFAS analysis. HEAL forwarded the samples to Vista using Blue Ice, which is not recommended for samples to be analyzed for PFAS. Based on the lack of analyte detections in the field samples and most of the rinsate samples, the use of Blue Ice does not appear to have affected sample integrity. Samples were received at Vista in good condition and within the recommended temperature requirements.

The samples were extracted and analyzed within the technical holding times in accordance with Vista's SOPs.

K3-2.4 Extracted Internal Standards (EIS)

The laboratory adds EISs to all samples, standards, blanks, and QC samples. EIS recoveries are used to correct for bias associated with matrix interferences, sample preparation efficiencies, injection volume variances, chromatographic behavior, and mass spectrometry ionization efficiency. One measure of analytical accuracy is the calculated percent recoveries (%R) of the EISs, which were within acceptance limits (50 to 150 percent) for all samples, blanks, and QC samples (LCS/LCSD, OPR), except for the following:

Sample ID	Date Collected	Surrogate(s)	%R	Associated Analyte(s)
Method Blank 1	—	d3-MeFOSAA d5-EtFOSAA 13C2-PFDoA	43.0 43.5 42.2	None detected
OPR	—	d3-MeFOSAA d5-EtFOSAA 13C2-PFDoA	43.6 46.1 46.8	None detected
DBS-1 335'	2/8/2022	d3-MeFOSAA 13C2-PFDoA	48.7 45.5	None detected
DBS-1 335' DUP	2/8/2022	d3-MeFOSAA d5-EtFOSAA 13C2-PFDoA	46.3 46.1 44.2	None detected

K3-2.5 Blank Samples

Due to an oversight by field staff, no trip blanks and no field blanks were submitted with these samples. A total of 8 equipment rinsate blanks were collected in the field during the sampling effort. The laboratory analyzed two method blank samples with this sample group. No PFAS were detected in the laboratory method blanks. PFAS detected in the equipment rinsate samples included the following:

Analyte	Rinsate 1	Rinsate 2	Rinsate 3	Rinsate 4	Rinsate 5	Rinsate 6	Rinsate 7	Rinsate 8
PFBA	2.48 J	ND	ND	ND	ND	ND	ND	ND
PFHxA	4.01 J	ND	ND	ND	ND	ND	ND	ND
PFHpA	1.31 J	ND	1.18 J	ND	ND	0.995 J	ND	ND
PFOA	2.35 J	ND	ND	ND	ND	ND	ND	ND
PFDA	1.94 J	ND	ND	ND	ND	ND	ND	ND
PFOS	1.21 J	ND	ND	ND	ND	ND	ND	ND

ND = Analyte not detected
J = Analyte positively identified; result is an estimate

K3-2.6 Laboratory Control Samples and LCS Duplicates

Vista analyzed 1 LCS/LCSD with this sample group. The LCS/LCSD is a sample of analyte-free water to which known quantities of the target analytes are added. The samples are then analyzed and analyte recoveries are measured. The %Rs of analytes added to the LCS and LCSD

were all within the acceptance limits established for each analyte. The %Rs of surrogates added to the LCS/LCSD were also within acceptance limits (50 to 150 percent).

Precision of duplicate results is calculated using the relative percent difference (RPD). Except for HFPO-DA (RPD = 34.8 compared to limit of 30), the RPDs for each of the other target analytes for the LCS/LCSD samples was 30 percent or less and met the precision objective for aqueous samples. The analyte, HFPO-DA, was not detected in associated samples.

Vista also analyzed an Ongoing Performance and Recovery (OPR) sample, which is sometimes referred to as an LCS. Except for 11Cl-PF3OUdS (%R = 148 compared to acceptance limits of 65-135), the %Rs of other analytes added to the OPR were all within the acceptance limits established for each analyte. The analyte, 11Cl_PF3OUdS, was not detected in associated samples. The %Rs of surrogates added to the OPR were also within acceptance limits (50-150 percent).

K3-2.7 Field Duplicate Samples

One duplicate sample was collected during the soil sampling event. No target compounds were detected in either the primary samples or duplicate sample (Table K3-1).

K3-2.8 Matrix Spike/Matrix Spike Duplicate Analysis

MS/MSD analysis was performed using additional sample volume collected from DBS-1 340'. Percent recoveries and RPDs met QC objectives for all target analytes, with the following exceptions:

Analyte	MS %R	MSD %R	%R Limits	RPD	RPD Limit	Sample Result (ng/L)
11Cl_PF3OUdS	163	147	65-135	10.3 [a]	30	ND
HFPO-DA	74.3 [a]	104 [a]	65-135	33.3	30	ND

[a] Result met QC limit

K3-3. Overall Assessment

Laboratory data for a total of three soil and eight equipment rinsate samples from new monitor well DBS-1 near Cannon AFB were evaluated to confirm that the DQOs for the NMED Phase 1

PFAS investigation project were met. The data quality assessment indicates that overall quality of the laboratory data is acceptable and meets the DQOs for this project.

K3-3.1 Precision

Precision is a measure of how closely values from measurements of a primary and duplicate sample agree with each other. Precision for aqueous samples is measured through the calculation of the RPD between the following results: (1) primary and duplicate samples, (2) MSs and MSDs, and (3) LCSs and LCSDs. The precision objective for aqueous samples is an RPD of 30 percent or less, where results are reported at greater than 5 times the quantitation limit. For solid samples (soil and sediment), the precision objective is an RDP of 50 percent or less. With only a few exceptions, described above, the analytical results met the DQO for precision. Those analytes that did not meet the DQOs were not detected in the field samples.

K3-3.2 Accuracy

Accuracy is the degree of agreement between an observed value and an accepted reference or true value. Accuracy in the field is assessed through the use of field reagent blanks as negative controls and through the adherence to all sample handling, preservation, and holding time requirements. The objective for field reagent blanks is that no target compounds are detected above the laboratory method reporting limits (RLs).

Laboratory accuracy is assessed through the analysis of laboratory method blanks as negative controls, LCSs, OPRs, or laboratory fortified blanks (LFBs) as clean matrix positive controls, MS/MSDs as sample matrix positive controls, and recovery of EIS compounds for the isotope dilution method. Method blanks should not contain any target compounds above the reporting limits. For the LCS, OPRs, and EISs, the accuracy objectives, as measured by %Rs, were the control limits provided in the laboratory SOPs. With the few exceptions identified above, these accuracy objectives were met. Those analytes that did not meet the DQOs were not detected in the field samples.

- No target analytes were detected in either of the laboratory method blanks.
- %Rs for target analytes in the LCS and LCSD met acceptance limits. The RPD for HFPO-DA exceeded the acceptance limit, but was not detected in the associated samples.
- %Rs for 11CL-PF3OUdS in the OPR, MS. and MSD did not meet acceptance limits, but was not detected in the primary samples.

- Up to six target analytes were detected in three of the eight equipment rinsate samples, but no target analytes were detected in the associated soil samples.
- Holding times were met for sample extraction and analysis.

The laboratory case narrative indicates that initial calibration and continuing calibration verifications for this work order met the method acceptance criteria.

K3-3.3 Sensitivity

The sensitivity of analytical data is demonstrated by laboratory RLs, which are generally based on the low point of calibration. For this project, the laboratory achieved RLs of 4 nanograms per liter (ng/L) or less for aqueous samples. Where required, dilution and reanalysis of specific analytes and associated EISs were performed and highlighted by the laboratory with a D qualifier. All results were reported to two significant figures if less than 10 ng/L. Results below the RLs, but above the method detection limits (MDLs) were also reported and qualified by the laboratory as estimates.

K3-3.4 Comparability

Comparability is the degree to which different methods or data agree or can be represented as similar and expresses the confidence with which one data set can be compared to another. Comparability is dependent upon the proper design of the sampling program and is satisfied by ensuring that the protocols described in the reference methods are followed and that proper sampling techniques are used. Planned analytical data will be comparable when similar sampling and analytical methods are used in future events.

K3-3.5 Representativeness

Representativeness is the degree to which data accurately and precisely represents a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition. Representativeness is ensured through the design of the sampling program and was satisfied by ensuring that field personnel used proper sampling techniques per the field SOPs. Within the laboratory, representativeness is ensured by the use of appropriate reference methods, conformance to the approved analytical procedures described in the laboratory SOPs, and adherence to sample holding times.

K3-3.6 Completeness

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under correct, normal conditions. "Normal conditions" are defined as the conditions expected if the sampling plan was implemented as planned. Field completeness is a measure of the number of valid samples obtained during the project. A generic field completeness objective is greater than 90 percent, which was achieved for this project.

Laboratory completeness is a measure of the amount of valid measurements obtained from all the measurements taken in the project. A generic laboratory completeness objective is greater than 95 percent, which was achieved for this task. All laboratory results are considered usable for all project purposes; no laboratory results were rejected.

References

Department of Defense (DOD). 2020. *Data validation guidelines Module 3: Data validation procedure for per- and polyfluoroalkyl substances analysis by QSM Table B-15*. May 2020.

Hall Environmental Analysis Laboratory (HEAL). 2022. Cannon AFB PFAS, Order No. 2202893. April 3, 2022.

Vista Analytical Laboratory (Vista). 2022. Vista Work Order 2202244. Prepared for Hall Environmental Analysis Laboratory, Project 2202893. March 3, 2022.

Table K3-1. Evaluation of PFAS Results for Duplicate Samples, Soil at DBS-1
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Analyte	Concentration (ng/L)		RPD
	MW-Ua	MW-Ua DUP	
	12/8/2021		
PFBA	<1.99	<1.99	—
PFPeA	<1.99	<1.99	—
PFHxA	<1.99	<1.99	—
PFHpA	<1.99	<1.99	—
PFOA	<1.99	<1.99	—
PFNA	<1.99	<1.99	—
PFDA	<1.99	<1.99	—
PFUnA	<1.99	<1.99	—
PFDoA	<1.99 H	<1.99 H	—
PFTrDA	<1.99	<1.99	—
PFTeDA	<1.99	<1.99	—
PFBS	<1.99	<1.99	—
PFPeS	<1.99	<1.99	—
PFHxS	<1.99	<1.99	—
PFHpS	<1.99	<1.99	—
PFOS	<1.99	<1.99	—
4:02 FTS	<1.99	<1.99	—
6:02 FTS	<1.99	<1.99	—
8:02 FTS	<1.99	<1.99	—
MeFOSAA	<1.99 H	<1.99 H	—
EtFOSAA	<1.99	<1.99 H	—
HFPO-DA	<1.99	<1.99	—
PFMPA	<1.99	<1.99	—
PFMBA	<1.99	<1.99	—
NFDHA	<1.99	<1.99	—
11Cl-PF3OUdS	<1.99	<1.99	—
9Cl-PF3ONS	<1.99	<1.99	—

Analyses performed by Vista Analytical Laboratory.
Refer to Table 1 in the Phase I Report for a list of PFAS names.
Analytical method is PFAS Isotope Dilution Table B-15
ng/L = Nanograms per liter
RPD = Relative percent difference
— = Not calculated

Table K3-1. Evaluation of PFAS Results for Duplicate Samples, Soil at DBS-1
Page 2 of 2

Analyte	Concentration (ng/L)		RPD
	MW-Ua	MW-Ua DUP	
	12/8/2021		
PFEESA	<1.99	<1.99	—
ADONA	<1.99	<1.99	—

Analyses performed by Vista Analytical Laboratory.
Refer to Table 1 in the Phase I Report for a list of PFAS names.
Analytical method is PFAS Isotope Dilution Table B-15
ng/L = Nanograms per liter
RPD = Relative percent difference
— = Not calculated

Appendix K4. Data Quality Assessment
Vista Analytical Laboratory
Work Order No. 2203045

K4-1. Introduction

This data quality assessment was performed to confirm that the data quality objectives (DQOs) for the NMED Phase 1 PFAS investigation project were met. This report summarizes the results of the review of analytical data for 1 groundwater sample, 1 equipment rinsate, and 1 field blank. The samples were collected by Daniel B. Stephens & Associates, Inc. (DBS&A) from new monitor well DBS-1 near Cannon Air Force Base (AFB), Clovis, New Mexico, on February 27, 2022. Also included in the assessment were quality control (QC) samples analyzed by the laboratory.

The samples were collected in accordance with standard operating procedures (SOPs) for sampling with potential impacts of per- and polyfluoroalkyl substances (PFAS). Samples were collected in new, clean containers supplied by the laboratory. Containers for aqueous samples were pre-preserved with Trizma and ammonium acetate, as appropriate. Upon collection, samples were stored on ice in coolers with appropriate chain-of-custody documents. Samples were hand-delivered to Hall Environmental Analytical Laboratory (HEAL) in Albuquerque on March 2, 2022. HEAL subcontracted the PFAS analysis to Vista Analytical Laboratory (Vista) in El Dorado Hills, California, and transferred the samples for PFAS analysis via FedEx to Vista on March 3, 2022. The samples were received by Vista on March 4, 2022.

The samples submitted to HEAL were managed under HEAL Order No. 2203173. HEAL performed general chemistry analyses (major ions, metals, alkalinity, etc.). Vista managed the samples as Work Order 2203045 and analyzed the samples for PFAS using U.S. Environmental Protection Agency (EPA) methods 533 and 537 with isotope dilution/LC-MSMS method compliant with Table B-15 of DoD QSM 5.3 (Aqueous). Vista is certified to perform the requested analyses under DoD ELAP - A2LA Accredited - ISO/IEC 17025:2005, Certificate No. 3091.01. This data quality assessment addresses samples and associated QC samples analyzed for PFAS by Vista under Work Order 2203045. The complete laboratory report is provided in Appendix I.

The analytical data were evaluated in general accordance with *Data Validation Guidelines Module 3: Data Validation Procedure for Per- and Polyfluoroalkyl Substances Analysis by QSM Table B-15* (DOD, 2020).

The analytical method that was used by Vista during this project provide guidance on procedures and method acceptance criteria that, in some areas, differ from that given in the validation guidelines. Where differences exist between the methods and the validation guidelines, the data reviewers followed the acceptance criteria given in the methods. However, where the laboratory data package presented laboratory-derived acceptance criteria, these criteria were used to evaluate the data, unless the criteria were considered inadequate.

The report for Work Order 2203045 is a summary data package, which include a case narrative, sample results and summarized results for select QC parameters. The data quality review applied to this laboratory report represented an abbreviated assessment of the quality of the data set. The review is intended to identify and present those problems and QC deficiencies that could be readily identified from the summary data package.

K4-2. Data Quality Assessment

Data quality assessment was based on the following parameters:

- Data package completeness
- Chain of custody variances
- Sample preservation and holding times
- Extracted internal standards (EIS)
- Blank samples
- Laboratory control sample (LCS) and LCS duplicates (LCSDs)
- Field duplicates
- Matrix spike (MS) and MS duplicates (MSDs)
- Overall assessment

The following subsections summarize the findings of the data evaluation performed.

K4-2.1 Data Package Completeness

The data package was complete and included a case narrative, an inventory of samples received and analyzed, results sheets for field and laboratory samples analyzed, a list of data qualifiers and abbreviations used, a list of laboratory certifications and accredited test methods, chain of custody documents, and laboratory sample log-in checklists. All samples were analyzed as requested and results were presented for all target analytes requested.

K4-2.2 Chain-of-Custody Variances

No issues were identified related to the chain of custody. Copies of both the original and transfer chain of custody documents are provided in the laboratory report in Appendix I.

K4-2.3 Sample Preservation and Holding Times

Sample containers for PFAS analysis were pre-preserved by HEAL (ammonium acetate for method 533 and Trizma buffer for method 537.1). Samples were delivered to HEAL on regular ice, per DBS&A procedure for samples for PFAS analysis. HEAL forwarded the samples to Vista using Blue Ice, which is not recommended for samples to be analyzed for PFAS. Based on the lack of analyte detections in the field blank, the use of Blue Ice does not appear to have affected sample integrity. Samples were received at Vista in good condition and within the recommended temperature requirements.

The samples were extracted and analyzed within the technical holding times in accordance with Vista's SOPs.

K4-2.4 Extracted Internal Standards

EISs are added to all field samples and QC samples by the laboratory. EIS recoveries are used to correct for bias associated with matrix interferences, sample preparation efficiencies, injection volume variances, chromatographic behavior, and mass spectrometry ionization efficiency. One measure of analytical accuracy is the calculated percent recoveries (%Rs) of each EIS. The %Rs of all EISs were within acceptance limits (50 to 150 percent) for all field samples and QC samples.

K4-2.5 Blank Samples

A total of 1 equipment rinsate sample and 1 field blank were prepared in the field during the sampling effort. No trip blanks were submitted with this sample group. The laboratory analyzed

1 method blank sample with this sample group. No target analytes were detected in these QC samples.

K4-2.6 Laboratory Control Samples and LCS Duplicates

Vista analyzed an ongoing precision and recovery (OPR) sample with the sample group. The OPR is similar to an LCS in that known quantities of the target analytes are added to a control sample, after which the sample is analyzed and analyte recoveries are measured. The %Rs of analytes added to the sample were all within acceptance limits for each analyte.

No LCSDs were analyzed with the sample group.

K4-2.7 Field Duplicates

Due to an oversight on part of field staff, no duplicate samples were collected during this sampling event.

K4-2.8 Matrix Spike and Matrix Spike Duplicates

Due to an oversight on part of field staff, no additional sample volume for MS/MSD analysis was collected during this sampling event.

K4-3. Overall Assessment

Laboratory data for a groundwater sample from newly installed new monitor well DBS-1 were evaluated to confirm that the DQOs for the NMED Phase 1 PFAS investigation project were met. The complete laboratory report is provided in Appendix I. The data quality assessment indicates that overall quality of the laboratory data is acceptable and meets the DQOs for this project.

K4-3.1 Precision

Precision is a measure of how closely values from measurements of a primary and duplicate sample agree with each other. Precision for aqueous samples is measured by calculating the relative percent difference (RPD) between the following results: (1) primary and duplicate samples, (2) MS and MSDs, and (3) LCS and LCSDs. The precision objective for aqueous samples is an RPD of 30 percent or less, where results are reported at greater than 5 times the

quantitation limit. For solid samples (soil and sediment), the precision objective is an RDP of 50 percent or less.

No field duplicates or additional sample volume for MS/MSD analyses were collected. No LCSD was analyzed with this sample group. No RPDs could be calculated for this sample group.

K4-3.2 Accuracy

Accuracy is the degree of agreement between an observed value and an accepted reference or true value. Accuracy in the field is assessed through the use of field reagent blanks as negative controls and through the adherence to all sample handling, preservation, and holding time requirements. The objective for field reagent blanks is that no target compounds are detected above the laboratory method reporting limits (RLs).

Laboratory accuracy is assessed through the analysis of laboratory method blanks as negative controls, LCSs, OPRs, or laboratory fortified blanks (LFBs) as clean matrix positive controls, MS/MSDs as sample matrix positive controls, surrogate spike recoveries, and recovery of extracted internal standard compounds for the isotope dilution method. Method blanks should not contain any target compounds above the RLs. For the LCS, OPRs, and extracted internal standards, the accuracy objectives, as measured by %Rs, were the control limits provided in the laboratory SOPs.

- No target analytes were detected in the field blank, the equipment blank, or the laboratory method blank.
- %R for target analytes in the OPR and surrogates in all samples analyzed met acceptance limits.
- Holding times were met for sample extraction and analysis.

The laboratory case narrative indicates that initial calibration and continuing calibration verifications for this work order met the method acceptance criteria.

K4-3.3 Sensitivity

The sensitivity of analytical data is demonstrated by laboratory method RLs, which are generally based on the low point of calibration. For this project, the laboratory achieved RLs of 4 nanograms per liter (ng/L) or less for aqueous samples. No sample dilution was required. All results were reported to two significant figures if less than 10 ng/L. Results below the RLs but

above the method detection limits (MDLs) were also reported and qualified by the laboratory as estimates.

K4-3.4 Comparability

Comparability is the degree to which different methods or data agree or can be represented as similar, and expresses the confidence with which one data set can be compared to another. Comparability is dependent upon the proper design of the sampling program and is satisfied by ensuring that the protocols described in the reference methods are followed and that proper sampling techniques are used. Planned analytical data will be comparable when similar sampling and analytical methods are used in future events.

K4-3.5 Representativeness

Representativeness is the degree to which data accurately and precisely represents a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition. Representativeness is ensured through the design of the sampling program and was satisfied by ensuring that field personnel used proper sampling techniques per field SOPs. Within the laboratory, representativeness is ensured by the use of appropriate reference methods, conformance to the approved analytical procedures described in the laboratory SOPs, and adherence to sample holding times.

K4-3.6 Completeness

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under correct, normal conditions. "Normal conditions" are defined as the conditions expected if the sampling plan was implemented as planned. Field completeness is a measure of the number of valid samples obtained during the project. A generic field completeness objective is greater than 90 percent, which was achieved for this project.

Laboratory completeness is a measure of the amount of valid measurements obtained from all the measurements taken in the project. A generic laboratory completeness objective is greater than 95 percent, which was achieved for this task. All laboratory results are considered usable for all project purposes; no laboratory results were rejected.

References

Department of Defense (DOD). 2020. *Data validation guidelines Module 3: Data validation procedure for per- and polyfluoroalkyl substances analysis by QSM Table B-15*. May 2020.

Hall Environmental Analysis Laboratory (HEAL). 2022. Cannon AFB PFAS, Order No. 2203173. April 5, 2022.

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