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DEPARTMENT OF THE AIR FORCE
27TH SPECIAL OPERATIONS MISSION SUPPORT GROUP (AFSOC)
CANNON AIR FORCE BASE NEW MEXICO



MAR 07 2017

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Mr. John E. Kieling
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New Mexico Environment Department
2905 Rodeo Park Drive East Bldg 1
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Dear Mr. Kieling

Cannon AFB is pleased to submit the "CAFB Monitoring Well Work Plan". If you have any questions regarding this submittal, please contact Mr. Ronald A. Lancaster, Chief, Installation Management at (575) 784-1146.

Sincerely

DOUGLAS W. GILPIN, Colonel, USAF
Commander

Attachment:
CAFB Monitoring Well Work Plan

cc:
NMED, David Cobrain
NMED, Gabriel Acevedo
NMED, Neelam Dhawan

Monitoring Well Abandonment and Installation Work Plan – Cannon Air Force Base

Primary Purpose	<p>This work plan describes the abandonment of three groundwater monitoring wells and the installation of six groundwater monitoring wells at two sites at Cannon Air Force Base (AFB), Clovis, New Mexico. A site location map can be found on Figure 1-1.</p> <p>This work is being completed for the United States Air Force Civil Engineer Center (AFCEC) under the New Mexico - Arizona Group Performance-Based Remediation Contract (Contract Number FA8903-13-C-0008).</p> <p>During a groundwater sampling event at Cannon AFB in June 2016, monitoring wells MW-S, MW-T, and MW-U at Solid Waste Management Unit (SWMU) 113 (LF005) (as shown on Figure 1-2) could not be purged using low flow methods due to insufficient recharge. Upon further investigation, it was determined the water levels at these three wells have dropped below the bottom of their respective screens. Therefore, these wells are no longer suitable for monitoring groundwater and will be replaced.</p> <p>Additionally, the water levels at monitoring well MW-C at LF005, as shown on Figure 1-2, and MW-F and MW-G at SWMU 101 (SI101), as shown on Figure 1-3, are approximately 14 feet above the top of the screen at MW-C, and 30 feet above the top of the screen at MW-F and MW-G. Therefore, clustered wells will be installed adjacent to these wells that are screened across the water table in order to detect potential contamination in groundwater that is above the current screened intervals at these wells.</p>
Conceptual Model	<p>Groundwater at Cannon AFB is monitored for potential impacts from historical activities at landfills LF003, LF004, LF005, LF025, and/or sewage lagoon SI101. The six monitoring wells included in this work plan are being installed to comply with the approved landfill inspection work plan addendum (FPM/URS 2014). This work plan requires biennial groundwater sampling of 11 groundwater wells at Cannon AFB. The required monitoring wells included MW-C, MW-F, MW-G, MW-S, MW-T, and MW-U. Therefore, these replacement wells will be installed to sample the groundwater at the correct screened interval (at the soil/groundwater interface).</p>
Well Abandonment	<p>Monitoring wells MW-S, MW-T, and MW-U will be abandoned due to water levels dropping below the screening depth. A review of historical data showed the 4-inch Schedule 80 wells were installed by the United States Geological Survey to depths of about 366 feet with 40-foot sumps beneath 40-foot long screens.</p> <p>A drill rig with a 32-foot mast will be positioned next to the well such that the winch can be used to lower threaded tremie pipe to the bottom of the well. Batches of Portland cement/bentonite grout will be mixed at approximately 250 gallons at a time and pumped through the tremie pipe to the bottom of the well, filling the well from the bottom to the ground surface. After the well casing has been filled, the tremie pipe will be removed. The</p>

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	<p>well casing will be cutoff below grade and the surface completion (well casing, concrete pad, bollards, etc.) removed. Grout will be topped off as needed following settling of cement/grout mix. Typically, settling will occur within a 24 to 48 hour timeframe. Surface restoration may include, but is not limited to, placing topsoil within impacted areas to grade and reseeding. Daily field notes/logs will be completed in bound sequentially numbered field books and included in the report. Notes will include depth measurement, volume of cement/bentonite used to plug the well, and other field activities associated with the abandonment.</p> <p>The monitoring well abandonment and installation activities described hereafter, will be performed in accordance with New Mexico Environment Department (NMED) Groundwater Quality Bureau Monitoring Well Construction and Abandonment Guidelines Revision 1.1, March 2011 and the Cannon AFB Resource Conservation and Recovery Act Permit requirements. Notification of all monitoring well abandonment and installations will be provided to the NMED and will include copies of either the well plugging record or well installation record and log as specified in 19.27.4 New Mexico Administrative Code (NMAC).</p>
Drilling Approach	Six monitoring wells will be installed using sonic drilling methods to varying depths as specified in Table 1-1 . Sonic drilling utilizes a rotary vibratory drill. The drill head is capable of rotary motion as well as oscillation. The drill bit is physically vibrated up and down in addition to being pushed down and rotated. Sonic drilling provides a continuous undisturbed core sample to allow for accurate logging of subsurface soils.
Hydrogeologic and Geochemical Objectives	The monitoring wells are being installed as replacement wells for existing wells included in the biennial groundwater monitoring plan for landfills at Cannon AFB. Monitoring wells MW-F and MW-G evaluate potential impact from SI101 to groundwater. Monitoring wells MW-C, MW-S, MW-T, and MW-U evaluate potential impact from LF005 to groundwater.
Potential Groundwater Occurrence and Detection	Groundwater is anticipated to be encountered at depths ranging from 316 to 340 feet below ground surface (bgs) (approximately). As the wells are replacements for existing wells, the depth to groundwater was identified during the 2016 sampling event and is included in Table 1-1 .
Groundwater Screening and Characterization	No groundwater screening or characterization sampling is currently planned or anticipated.
Geophysical Logging	Soil cores will be extruded into clear plastic sleeves. The borings will be sampled continuously for lithology identification by an FPM or URS geologist and recorded in boring logs using the Unified Soil Classification System.
Well Completion	Monitoring wells are to be installed inside the sonic casing when target depth

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	<p>is reached. The well will be hung inside the casing, and filter pack will be placed by pouring sand in the casing and vibrated into place using the sonic rig. Monitoring wells are to be constructed using 4-inch inside diameter, schedule 80, flush-joint threaded polyvinyl chloride (PVC) risers. Screens will be a 0.010-inch stainless steel, wire-wrapped screen. Screen lengths for replacement wells MW-Sa, MW-Ta, and MW-Ua will be 40 feet. Screen lengths for clustered wells are 20 feet for MW-Ca and 35 feet for MW-Fa and MW-Ga. The screen lengths at MW-Sa, MW-Ta, and MW-Ua are based on the depth of water to the bottom of the Ogallala Formation. The screen lengths at MW-Ca, MW-Fa, and MW-Ga are based on the depth of water from the 2016 sampling event and the depth to the top of the screen in the existing wells. Surface completion will consist of a steel protective casing with locking lid and a 3-foot by 3-foot by 6-inch concrete pad set in the ground. Well construction details will be provided in a monitoring well construction log. A representative log is provided in Attachment A.</p> <p>All drilling equipment used in monitoring well installation is to be decontaminated prior to use, between samples, and at completion of installation. Standard environmental decontamination methods, such as steam cleaning or Alconox-hot water wash of rods with a clean water rinse, will be employed.</p> <p>Following well installations, the horizontal coordinates and elevation of the measuring point on the top of the well riser will be surveyed by a surveyor licensed in the State of New Mexico. Horizontal coordinates for all new monitoring wells will be measured to the nearest 1.0 foot and referenced to the State Plane Coordinate System. Elevations will be measured at the top of the well casing to the nearest 0.01 foot. All elevation measurements will be referenced to NAD 83. The measurement point on the top of the well casing will be clearly and permanently marked for future water level measurements. Monitoring well identification tags will be installed in accordance with applicable guidelines. The measuring point for monitoring wells shall always be the north rim of the top of casing. The measuring point should either be notched, or it should be noted that the north side of the casing is the reference point.</p>
Well Development	<p>The development of a newly installed monitoring well shall proceed only after the neat cement grout has been allowed to set for a minimum of 72 hours (if neat cement grout was used for the annular seal). Wells will be developed by pumping without using acids, flocculents, disinfectants, or dispersing agents. All purged water will be containerized. Well development will be completed by pumping and surging. During development, the pump inlet will be moved through the entire screened interval. The development procedure will continue until the following conditions are met:</p>

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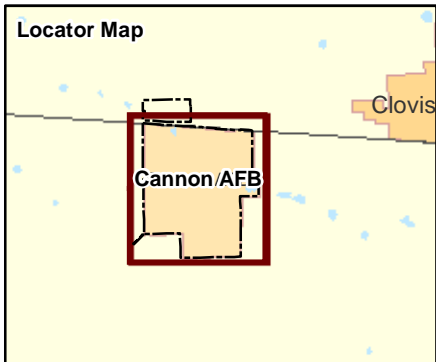
	<ul style="list-style-type: none">• Water is clear to the unaided eye, free of sand, and free of drilling fluids• Thickness of the accumulated sediment in the well is less than 5 percent of the length of the well screen• Temperature, pH, turbidity, and specific conductance values stabilize• A volume of water equal to five times the volume of standing water in the well and three times any potable water added during filter pack installation has been removed from the well. One well volume will be taken to be the sum of the volume of water within the annulus assuming 30 percent porosity in the annulus, and using the height of the water column in the well at the time just prior to development. <p>If after 4 hours of well development the groundwater is not clear and free of sand, AFCEC will be contacted for consultation and further instructions. After final development of each well, approximately 1 liter (or 32 ounces) of water from the well will be collected in a clear glass jar, labeled, and digitally photographed. The photograph will be submitted as part of the well development log. The photograph will be a suitably back-lit close-up to show the clarity of the water.</p> <p>The procedure for well development is outlined below:</p> <ol style="list-style-type: none">1. All equipment that comes into contact with the monitoring well will be decontaminated before and after use by placing the equipment into a wash tub containing Alconox or low-sudsing, non-phosphate detergent along with potable water, and scrubbed with a bristle brush or similar utensil. Equipment will be rinsed with tap water in a second wash tub.2. Verify that the water quality multi-meter (pH, temperature, conductivity), as well as nephelometric turbidity meter (or multi-parameter probe), and water level probe are operating properly. The electronic water quality instruments require daily calibration before use and must have the calibration verified at approximately the middle of that day's work. Calibration times and readings shall be recorded in the field log book. Specific instructions for calibrating the various water quality instruments are provided in instrument-specific instruction manuals.3. Monitoring wells shall be developed using a submersible pump to flush the screen, sand pack material, and borehole wall of fine
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	<p>sediment resulting from well drilling and installation activities. This procedure also allows for the removal of fine sediment which may have accumulated within the well casing.</p> <p>4. Determine the water column height in the well by measuring the well depth and the depth to water, referencing both measurements to the top of casing. Subtract the depth to water from the well depth to obtain the water column height. The volume of water in one well volume is calculated using the following equation:</p> $4\text{-inch well volume} = \text{water column height in well (feet)} \times 0.653 \text{ gallons/foot} = \text{gallons/one well casing volume}$ <p>5. Remove a minimum of three to five well casing volumes of water during repeated surging and water removal episodes. Well surging is the process of causing water to move through the screen and into and out of the sand pack and aquifer formation. Surge the well by gently raising and lowering the bailer or pump along the entire length of well screen. Remove water from throughout the entire water column by periodically lowering and raising the pump intake or bailer. Collect the development water in drums to be stored in the lay down area until analytical testing for investigation-derived waste (IDW) is completed.</p> <p>6. Measure and record the temperature, pH, nephelometric turbidity, and specific conductivity at the start of development and once for each well volume of water removed during development. Also observe and record the water clarity, color, and presence of odors.</p> <p>Continue to remove water and measure field parameters until three to five well casing volumes and three times any potable water added during filter pack installation have been removed, field parameters have stabilized to within 10 percent or 0.1 units for three consecutive measurements, and the water is as clear of sediment as practical. The turbidity goal during well development is less than or equal to 10 Nephelometric Turbidity Units (NTUs). However, turbidity measurements less than or equal to 50 NTUs are acceptable. Regardless of water clarity, a minimum of three to five well volumes of water shall be removed during the bailing/surging phase of well development. If the well is bailed dry, allow the water to recover and continue development.</p>
<p>Hydraulic Testing and Groundwater Sampling</p>	<p>No hydraulic testing is currently planned or anticipated.</p> <p>Groundwater samples collected will be collected from each well following development and analyzed for volatile organic compound (VOCs), target analyte list (TAL) metals (including mercury), chromium VI, perchlorate,</p>

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	chloride, nitrate/nitrite, sulfate, ammonia, total organic carbon (TOC), and field water quality parameters (pH, dissolved oxygen [DO], specific conductance, turbidity, and temperature). All analytical methods and sampling methods identified in the approved landfill work plan addendum (FPM/URS 2014) will be utilized.	
Investigation Derived Waste and Waste Characterization	<p>IDW will consist of soil cuttings, decontamination water, and purge water. Excess soil generated during the well installation activities will be containerized in an on-site roll-off box. A soil sample will be composited and submitted to the laboratory for analysis. Analytical results for soil will be compared to applicable screening standards. If analytical results from the soil IDW indicate contamination is below applicable screening standards, the soil IDW will be disposed of properly in accordance with local and federal regulations. Soil IDW determined to be hazardous will be shipped to a licensed waste disposal facility using a licensed waste disposal contractor.</p> <p>Decontamination water and purge water generated during monitoring well development and sampling will be containerized in 55-gallon drums or large polyethylene tanks. Since the decontamination fluids will start as clean potable water, decontamination fluids will likely contain minimal contamination. A water sample will be collected from each of the drums/storage tanks and submitted to the laboratory for analysis. Analytical results for water will be compared to applicable screening standards.</p>	
Schedule	Dig permit meeting	March 30, 2017
	Mobilization of equipment Well Installation Monitoring Well Abandonment Well Sampling	April 3, 2017 – May 26, 2017
References	FPM/URS 2014. Final Work Plan Addendum for Landfills and Institutional Control Inspection Sites. Cannon Air Force Base, New Mexico. June 16.	

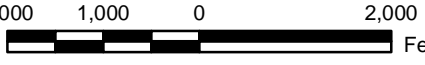


Legend

- Base Boundary
- Site Boundary

Map projection: NAD83 State Plane Feet
New Mexico East (FIPS 3001)

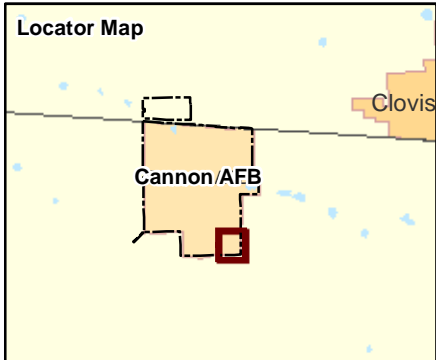







2,000 1,000 0 2,000 Feet

Site Location Map
Cannon Air Force Base, New Mexico

Drawn By: DPG	Date: 11/30/2016	Project No. 23446539	
Checked By: MS	Revision: 0		Figure 1-1



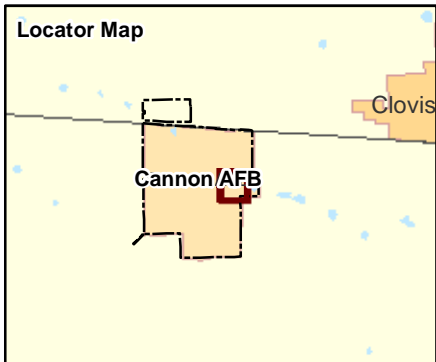
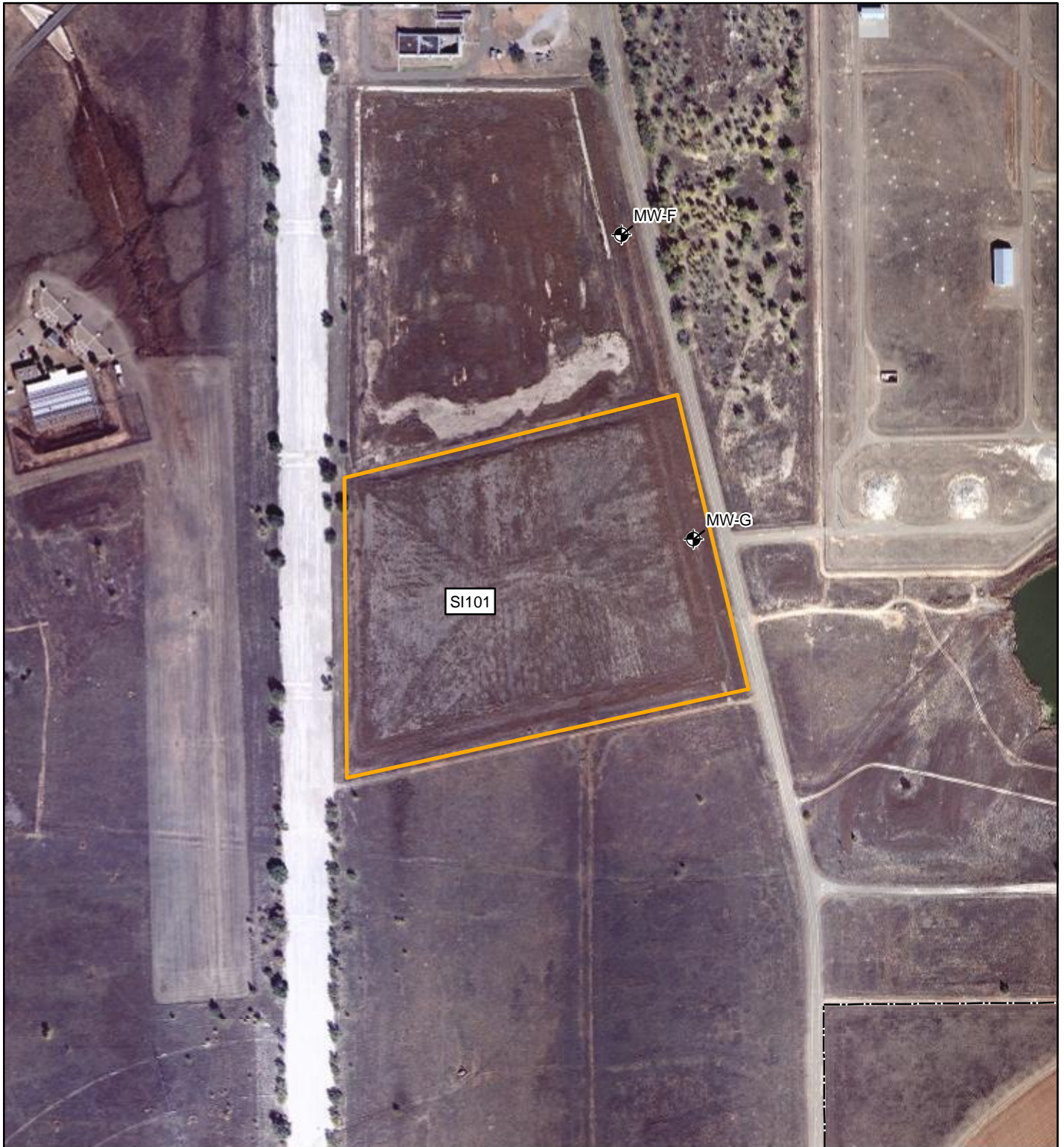
- Legend**
-  Monitoring Well
 -  Base Boundary
 -  Site Boundary




Map projection: NAD83 State Plane Feet
New Mexico East (FIPS 3001)



LF005 Location Map
Cannon Air Force Base, New Mexico

Drawn By: DPG	Date: 12/1/2016	Project No. 23446539	Figure 1-2
Checked By: MS	Revision: 0		



- Legend**
-  Monitoring Well
 -  Base Boundary
 -  Site Boundary

Map projection: NAD83 State Plane Feet
New Mexico East (FIPS 3001)



SI101 Location Map Cannon Air Force Base, New Mexico			
Drawn By: DPG	Date: 12/1/2016	Project No. 23446539	Figure 1-3
Checked By: MS	Revision: 0		

**TABLE 1-1
WELL ABANDONMENT AND INSTALLATION
CANNON AFB, NEW MEXICO**

Well Identification	TOC Elevation (feet amsl) (NAVD 88)	Top of Screen (feet bgs)	Bottom of Screen (feet bgs)	Screen Length (feet)	Sump Length (feet)	Bottom of Well (feet bgs)	Boring Depth (feet bgs)	April 2016 Groundwater Elevation (feet bgs)
MW-C	4268.90	346.60	361.60	15	--	361.60	362.00	332.26
MW-F	4280.84	349.55	364.55	15	5	369.55	375.00	316.36
MW-G	4281.55	350.90	365.90	15	--	365.90	372.00	320.03
MW-S	4265.75	284.87	324.87	40	40	364.87	365.00	335.06
MW-T	4265.72	284.57	324.57	40	40	364.57	365.00	340.42
MW-U	4267.30	284.14	324.14	40	40	364.14	365.00	329.42
MW-Ca ¹	TBD	327.00	347.00	20	--	347.00	TBD	332.26
MW-Fa ¹	TBD	315.00	350.00	35	--	350.00	TBD	316.36
MW-Ga ¹	TBD	315.00	350.00	35	--	350.00	TBD	320.03
MW-Sa ²	TBD	325.00	365.00	40	--	370.00	TBD	335.06
MW-Ta ²	TBD	325.00	365.00	40	--	370.00	TBD	340.42
MW-Ua ²	TBD	325.00	365.00	40	--	370.00	TBD	329.42

Notes:

¹ Indicates clustered well.

² Indicates replacement well.

Shaded boxes indicate well has not yet been installed. Boxes containing values are proposed depths and screen intervals.

Existing wells were measured using NAVD 88 system, however, newly installed wells will be measured using North American Datum (NAD) 83 system.

Acronyms and Abbreviations:

NAVD 88 = North American Vertical Datum of 1988

AFB = Air Force Base

TBD = to be determined


amsl = above mean sea level

bgs = below ground surface

MONITORING WELL CONSTRUCTION LOG

Project Name _____
Location _____
Installed By _____
Inspected By _____
Method of Installation _____
Remarks _____

Piez./Well No. _____
Project No. _____
Date _____ **Time** _____

		AGS Elevation (feet)	
Type of guard posts			_____ / _____
	Elevation of top of		_____ / _____
	Height of riser above ground		_____ / _____
Generalized Stratigraphy		Ground	_____ / _____
	I.D./Type of surface casing	BGS Elevation (feet)	_____ / _____
	Type of surface seal		_____ / _____
	Depth of surface		_____ / _____
	I.D./Type of riser pipe		_____ / _____
	Type of backfill		_____ / _____
	Depth to top of seal		_____ / _____
	Type of seal		_____ / _____
	Depth of top of filter pack		_____ / _____
	Depth of top of screen		_____ / _____
	Type of filter		_____ / _____
	I.D./Type of screen		_____ / _____
	Screen slot size		_____ / _____
	Depth of bottom of screen section		_____ / _____
	Type of backfill below observation well		_____ / _____
	Depth of bottom of boring		_____ / _____
	Diameter of boring		_____ / _____