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

ENTERED

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Colonel Heather L. Buono
Commander
110 E Alison Avenue Suite 1098
Cannon AFB NM 88103

Mr. John E. Kieling
Chief, Hazardous Waste Bureau
New Mexico Environment Department
2905 Rodeo Park Drive East Bldg 1
Santa Fe NM 87505-6063

Dear Mr. Kieling,

Cannon AFB is pleased to submit the revised *Groundwater Monitoring Field Sampling Plan, Melrose Air Force Range*. This revised report addresses all comments in your 16 February 2015 Notice of Disapproval. If you have any questions regarding this submittal, please contact Ms. Laura Peters, Restoration Program Manager, at (575) 784-0491.

Sincerely

Heather L. Buono

HEATHER L. BUONO, Colonel, USAF

Attachments:
1. Notice of Disapproval- 16 February 2015
2. MAFR Sampling Plan Revisions

cc:
NMED, Dave Cobrain
NMED, Neelam Dhawan
NMED, Naomi Davidson

TRINITY
ANALYSIS & DEVELOPMENT CORP.
Environmental & Engineering Services

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March 4, 2015

Ms. Laura Peters
ERP Manager
27 SOCES/CEIER
506 N Air Commando Way
Cannon AFB, NM 88103-5003

RE: **Response to New Mexico Environment Department Comments**
Notice of Disapproval (*Dated February 16, 2015***)**
Groundwater Monitoring Field Sampling Plan
Melrose Air Force Range, New Mexico
USACE Contract No.: W912PP-13-C-0033, Task Order 001

Dear Ms. Peters,

The New Mexico Environment Department (NMED) reviewed the October 2014 Groundwater Monitoring Field Sampling Plan, Melrose Air Force Range, Roosevelt and Curry Counties, New Mexico and issued a Notice of Disapproval (NOD) on February 16, 2015. The document was reviewed by Ms. Naomi Davidson and signed by Mr. John Kieling, Bureau Chief, Hazardous Waste Bureau.

Please find attached the revised Groundwater Monitoring Field Sampling Plan along with a Comment/Response Matrix and an electronic redline-strikeout version of the Field Sampling Plan that shows where all changes were made. If you have any questions or need further assistance, please do not hesitate to contact me at 850-613-6800.

Respectfully,
TRINITY Analysis & Development Corp.

Jonathan Kramer
Geologist/Project Manager

Attachment

Distribution List

Recipient	Hard Copies	Electronic Copies
Ms. Laura Peters ERP Manager 27 SOCES/ CEIER 506 N. Air Commando Way Cannon AFB, NM 88103-5003	2	2
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Trinity Analysis & Development Corp. 1002 N. Eglin Parkway Shalimar, Florida 32579	0	1

Comment/Response Matrix
Groundwater Monitoring Field Sampling Plan
Melrose Air Force Range

NMED		TRINITY		
No.	**Comment**	**Response**	**Page**	**Section (Location)**
1	*The SWMUs are listed rather than described in this section, with the exception of Site ST-506. Include brief descriptions of all SWMUs and include designations for all monitoring wells associated with each SWMU. Include a figure depicting all of the SWMUs.*	TRINITY added brief descriptions of all SWMUs in Section 1.2.1 and added Figure 3, Semiannual SWMU Monitoring Well Network Locations. TRINITY updated Abbreviations and Acronyms and Works Cited.	1-3 through 1-6	Section 1.2.1
			Figure 3	
2	*There are a number of wells at the Facility that are not included in the monitoring plan. Some of these wells have been plugged and abandoned; others have been used in previous monitoring events but for various reasons will not be sampled under the current monitoring work plan. These wells include MWL-1, MWL-2, MWL-3, MWQ-4, MWQ-5, MWQ-6, MWQ-7, MWQ-10, MWQ-11, MWQ-23, M117MW-001 through -004, MA02MW001S, and MA03MW001. Describe all wells at the facility and list reason(s) why each of the wells is not included in the work plan; this may be presented in the form of a table, if desired. Add all wells to Figure 1-2. Existing wells that will not be sampled must be identified using a different color or symbol than wells that twill be sampled or wells that have been plugged and abandoned.*	TRINITY added Figure 2, Annual Monitoring Well Network and Figure 3, Semiannual SWMU Monitoring Well Network Locations. Existing wells that are included in this Field Sampling Plan (FSP) are identified with a unique symbol on Figure 2. Inactive wells not included in this FSP are posted on Figure 2 and 3 with unique symbols. Abandoned wells are identified with a unique symbol on Figure 2 and Figure 3. Added Table 1-3, Inactive Wells. Table 1-3 describes the reasoning for not including the inactive wells in this FSP. TRINITY also added Section 1.3 to the document to further address the inactive wells.	1-6	Section 1.3
			Figure 2 and Figure 3 and Table 1-3	
3	*The Permittee must include a localized potentiometric surface map showing groundwater flow direction and groundwater elevations in each well from the most recent sampling event.*	TRINITY added Section 1.5.1 Groundwater Elevation, Gradient, and Flow Velocity. TRINITY added two groundwater flow maps: Figure 4 Groundwater Flow Direction, October 2014, Ogallala Aquifer (Southern High Plains Aquifer), and Figure 5 Groundwater Flow Direction, October 2014, Chinle Formation. These flow maps represent the most recent sampling event.	1-7 and 1-8	Section 1.5.1
			Figure 4 and Figure 5	
4	*The Permittee states, "The depth to groundwater will be measured from the top of well casing to the nearest 0.01 foot and always from the same reference point or survey mark on the well casing. If there is no reference mark, the measurement will be from the north side of the casing." The Permittee must collect all measurements from the highest point on the well casing rather than the north side if there is no reference mark. Revise the GWFSP accordingly. A similar comment was acknowledged by the Permittee in the response to NMED comments to the May 2011 work plan.*	Acknowledged. Added "...*highest point of*... " Page 2-1, Section 2-1, second paragraph, fourth sentence	2-1	Section 2.1 second paragraph, fourth sentence

Comment/Response Matrix
Groundwater Monitoring Field Sampling Plan
Melrose Air Force Range

NMED		TRINITY		
No.	**Comment**	**Response**	**Page**	**Section (Location)**
5	*Section 2.1 has no description of the proposed method to collect groundwater level measurements from wells containing dedicated pumps. Table 1-1 indicates that all wells on the groundwater sampling list have dedicated bladder pumps, and that several of the wells on the "water level only" list may contain a pump, as they are listed as unknown. Additionally, it is not clear whether the wells used only for water level measurements are accessible for that purpose, and whether they are closed, locked, or otherwise protected from damage. Described the accessibility of each well and how water levels will be measured in wells containing dedicated pumps.*	Added the following language to Page 2-1, Paragraph 1, "*All monitoring wells in the Semiannual-SWMU and Annual Groundwater Quality Well Networks are locked and require a key to be accessed. Keys may be obtained from Cannon AFB personnel. The Water Level Only wells are not locked and are accessible without a key. Water levels collected from monitoring wells with dedicated bladder pumps will be collected by lowering the water level indicator through the water level measurement port located adjacent to the discharge tube. The dedicated bladder pump systems are designed so that a water level can be measured from the survey reference point or highest point on the casing of the monitoring well. Although some water level only wells have dedicated submersible pumps, or construction is unknown, these wells are accessible and water levels can be measured from the top of casing.*"	2-1	Section 2.1
6	*Table 2-3 states that unpreserved Nitrite/Nitrate samples have a holding time of 48 hours. Describe how time constraints will be managed in order to allow the lab enough time to perform a Nitrite/Nitrate analysis within the holding time. If the short holding time requirement cannot be met, the Permittee could propose to add sulfuric acid as a preservative to extend the holding time.*	TRINITY added language in Section 2.4.3 advising that sample coolers must be shipped at the end of each day by overnight commercial courier to the laboratory to meet hold time requirements.	2-5	Section 2.4.3
7	*In Table 1-1, ensure consistency of significant digits throughout the table, including for the Easting, Northing, Top of Casing, and Ground Surface Columns.*	Corrected significant digits throughout the table.	Table 1-1	
8	*In Table 1-1, the Pump Column has "DSP" for MWL-8, which is undefined. If this is a typo, correct it; otherwise, define DSP.*	Defined Dedicated Submersible Pump (DSP) in notes.	Table 1-1	
9	*In Table 1-1, NMED is assuming the notation "bls" means below land surface; however, it must be defined.*	Defined below land surface (bls) in notes.	Table 1-1	
10	*In Appendix A, Groundwater Sampling Log, one of the field parameters listed is Salinity ‰. Either explain how this parameter will be measured, remove this Colum from the form, or explain that salinity will not be measured and that the column will be left blank.*	Added "*Salinity is a measurement based on temperature and conductivity and is calculated by the multi-parameter water quality meter.*" Section 2.2 Second paragraph, third sentence.	Appendix A 2-1	 Section 2.2 second paragraph
11	*In Appendix A, Groundwater Sampling Log, Depth to Water is in the fifth column. Explain how depth to water will be measured during purging.*	Added "*Drawdown will be measured during purging by lowering a water level indicator through the water level port located at the top of casing.*" Section 2.2 second Paragraph, fourth sentence.	Appendix A 2-1	 Section 2.2 second paragraph

Groundwater Monitoring
Field Sampling Plan
Melrose Air Force Range
Roosevelt and Curry Counties, New Mexico

Prepared For:
Cannon Air Force Base
Air Force Special Operations Command (AFSOC)
27th SOCES/CEIER
Cannon Air Force Base, NM 88103-5003

Prepared by
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Under Contract To
United States Army Corps of Engineers (USACE)
Albuquerque District
4101 Jefferson Plaza, NE
Albuquerque, NM 87109-3435

Contract Number
W912PP-13-C-0033, Task Order 001

February 2015

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Certification Page

February 2015
Groundwater Monitoring
Field Sampling Plan
Melrose Air Force Range
Roosevelt and Curry Counties, New Mexico

Prepared For:
Cannon Air Force Base
Air Force Special Operations Command (AFSOC)
27th SOCES/ CEIER
Cannon Air Force Base, NM 88103-5003

Prepared By:
Trinity Analysis & Development Corp.
1002 N. Eglin Parkway
Shalimar, FL 32579
(850) 613-6800

Under Contract To:
United States Army Corps of Engineers (USACE)
Albuquerque District

I hereby submit that this Groundwater Monitoring Field Sampling Plan, October 2014, for the Melrose Air Force Range was prepared by me.

02/26/2015

Jonathan M. Kramer
Geologist
Trinity Analysis & Development Corp.

Date

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Abbreviations and Acronyms

°C	Celsius
AFB	Air Force Base
AFCEC	Air Force Civil Engineer Center
AFSOC	Air Force Special Operations Command
AOC	Area of Concern
bls	below land surface
CEC	cation exchange capacity
COC	chain-of-custody
CZO	Operations Division
DO	dissolved oxygen
DoD	Department of Defense
DPT	direct-push technology
ELAP	Environmental Laboratory Accreditation Program
ERP	Environmental Restoration Program
FSP	Field Sampling Plan
GCAL	Gulf Coast Analytical Laboratories, Inc.
IATA	International Air Transport Association
IDW	investigation-derived waste
MAFR	Melrose Air Force Range
mL	milliliter
MS	matrix spike
MSD	matrix spike duplicate
mV	millivolts
NELAC	National Environmental Laboratory Accreditation Conference
NTU	nephelometric turbidity units
NMED	New Mexico Environment Department
ORP	oxidation reduction potential
PVC	polyvinyl chloride
QC	quality control
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
SOW	Special Operations Wing
SR	State Road
SWMU	Solid Waste Management Unit
TDS	total dissolved solids
TRINITY	Trinity Analysis & Development Corp.
USACE	U.S. Army Corps of Engineers

USDOT	U.S. Department of Transportation
UST	underground storage tank
UXO	unexploded ordnance
VOC	volatile organic compounds
µm	micron

1.0 Introduction

This Groundwater Monitoring Field Sampling Plan (FSP) for the Melrose Air Force Range (MAFR) has been prepared by Trinity Analysis & Development Corp. (TRINITY) on behalf of the Cannon Air Force Base (AFB) 27th Special Operations Wing (SOW) and Air Force Special Operations Command (AFSOC). The primary focus of this Groundwater Monitoring FSP is the annual and semiannual collection of groundwater samples.

TRINITY performed this work under contract to the U.S. Army Corps of Engineers (USACE), Albuquerque District, Contract W912PP-13-C-0033, Task Order 001. A work plan was previously prepared in general accordance with the USACE requirements for the preparation of sampling and analysis plans, EM200-1-3, February 1, 2001 (USACE, 2001). This FSP document was prepared for submission to the New Mexico Environment Department (NMED).

1.1 Project Background

In 1975, the Department of Defense (DoD) established the Environmental Restoration Program (ERP) to provide guidance and funding for the investigation and remediation of historical releases of hazardous substances, pollutants, or contaminants that pose toxicological risks at military installations that may have contaminated soil, groundwater, and/or surface water. Air Force Civil Engineer Center/Operations Division (AFCEC/CZO), in coordination with the Installation Management Flight, is responsible for oversight of the ERP sites at MAFR.

In accordance with a Resource Conservation and Recovery Act (RCRA) permit issued to Cannon AFB on December 30, 1994, an investigation of potential impacts that may have resulted from seven Solid Waste Management Units (SWMU) was conducted and included a Phase I RCRA Facility Investigation (RFI) for Melrose Air Force Range (Foster Wheeler, 1996) and a RCRA Facility Investigation Report Addendum (Foster Wheeler, 2003) both of which were completed and submitted to NMED. NMED reviewed the documents and provided a response dated February 1, 2006 which requested additional field investigation activities at MAFR.

On May 9, 2007, the Department of the Air Force requested deferral of additional work associated with the RFI requested by NMED for MAFR. The deferral was based on to the fact that the entire MAFR facility is an "*active bombing or test Range*." In a letter to Cannon AFB dated June 19, 2007, NMED approved deferment of additional work stating that "*…NMED will prepare a "corrective action-only" permit to be implemented once the Range is closed, transferring, or transferred*" (New Mexico Environment Department, 2007). When the Range is deactivated, additional assessment will likely be required.

1.2 Site Description and History

The MAFR is a bombing and air-to-ground gunnery Range under management of Cannon AFB within AFSOC. The MAFR is situated approximately eight miles southwest of the village of Melrose, and located predominately in Roosevelt County with a small parcel in Curry County, New Mexico (**Figures 1** and **2**). Access to the Range is achieved by traveling south from Melrose on New Mexico State Road (SR) 267 for approximately 9.3 miles, then west on Sundale Valley Road for approximately seven miles to the security gate.

During World War II, the area was used by the U.S. Army Air Corps (predecessor to the U.S. Air Force) for training. It has been continuously used by the U.S. Air Force since World War II. In 1952 the Range was expanded when the Air Force leased 7,771 acres of grassland for use as a

bombing and air-to-ground gunnery Range by the Tactical Air Command. Since 1952, the Range has been expanded several times including land purchases and leases and currently comprises 70,910 acres.

The Impact Area of the Range is located northeast of the physiographically prominent Mesa and consists of grasslands with a grid of access roads and bombing targets. The Impact Area is delineated by a historical boundary that previously delineated the extent of the entire Range (**Figure 2**). In 1990-91, the boundary of the Range was expanded through the acquisition of agricultural and Range land parcels on all sides. These parcels (leased lands) were part of Range property but were leased back to the prior owners for continued use as agricultural and Range land. Leaseholders used the unconfined aquifer for irrigation and livestock watering. On December 1, 2013, the leases were terminated for the safety of the lessee, thus discontinuing agricultural use on MAFR.

Live high-explosives-filled ordnance was used on the Range prior to 1969. Since then, practice bombs and inert full-scale bombs have been used at the Range. Practice bombs and inert bombs are known to contain only small explosive or pyrotechnic spotting charges. Additionally, live gun ammunition has been used continuously on the Range for target practice.

Over the years, portions of the MAFR have been used to dispose of a variety of military and industrial waste from MAFR and Cannon AFB. Wastes have included unexploded ordnance (UXO), exploded ordnance, scrap metal, paints, solvents, pesticides, herbicides, and putrescible waste. (Foster Wheeler, 1996; Foster Wheeler, 2003). MAFR currently has seven SWMUs located within its boundary (**Figure 2**). The SWMUs are described as follows:

- SWMU 114 – Expended Ordnance and Industrial Waste Burial Site (Motor Pool Trenches)
- SWMU 115 – Explosives-Contaminated Burial Site (Arroyo Burial Site)
- SWMU 117 – Domestic Waste Burial Site (Southeast of Main Building)
- SWMU 130 – World War II Cantonment Disposal Site (formerly Area of Concern (AOC) 1)
- SWMU 131 – Domestic Waste Burial Site (East of Fire Station; formerly AOC 2)
- SWMU 132 – Disposal/Burn Site (North Helicopter Pad; formerly AOC 3)
- SWMU 133 – Northwest Munitions Disposal Site (North Corner of Impact Area; formerly AOC 4)

Also located within the boundary of MAFR, adjacent to Building 3121, is Site ST-506. In November 1994, petroleum contaminated soil was discovered at the site during the excavation of two underground storage tanks (USTs). The USTs were associated with the former heating system at Building 3121 (United States Geological Survey, 1995). Monitoring well MAO2MW001D (SWMU-131) is located approximately 1500 feet to the northeast of ST-506; however, there is currently no groundwater monitoring associated with Site ST-506.

1.2.1 SWMU Descriptions & History

1.2.1.1 SWMU 114 – Expended Ordnance and Industrial Waste Burial Site

SWMU 114 is located in the southeast quarter of the southwest quarter of Section 15 and the northeast quarter of the northwest quarter of Section 22, Township 1 North, Range 30 East, in Roosevelt County, New Mexico (**Figure 3**). The site and surrounding area are flat with sparse desert scrub vegetation consisting of prairie grass and cactus.

According to historical RFI reports, the military used a series of eight unlined burial trenches at SWMU 114 to dispose of a variety of military and industrial waste from Melrose AFR and Cannon AFB. Trenches were approximately 20 to 40 feet in width, 100 to 200 feet in length and up to 40 feet in depth (Foster Wheeler, 1996; Foster Wheeler, 2003).

Exact dates and types of waste disposed at SWMU 114 are unknown. It is known, however, that between 1952 and 1962 drummed liquids were poured into the trenches and burned. Full drums of liquid, including possible unusable fuels, paints, sludge, and solvents may have also been placed in the trenches. For an unknown period of time, the military also disposed of an estimated 12,000 to 15,000 pounds per month of scrap metal from practice bombs and munitions in the trenches at SWMU 114 (Foster Wheeler, 1996; Foster Wheeler, 2003). According to the Phase I RCRA Facility Investigation for Melrose Air Force Range, Cannon Air Force Base, Clovis, New Mexico (Foster Wheeler, 1996) and a RCRA Facility Investigation Report Addendum for Melrose Bombing Range, Cannon Air Force Base, New Mexico (Foster Wheeler, 2003) the trenches at SWMU 114 were cleared of ordnance and have been backfilled and closed. However, one trench remains open.

According to historical RFI reports, four monitoring wells (M114MW001, M114MW002, MW114003, and M114MW004) were installed and sampled as part of the Phase I RFI. Groundwater at this location is present approximately 150 feet below land surface (bls). No organic compounds were detected above groundwater standards during the Phase I RFI. Elevated metals concentrations were attributed to high turbidity and natural conditions. Elevated anion concentrations were attributed to natural conditions. Migration of metals from the disposal site to groundwater was determined to be unlikely due to the high cation exchange capacity (CEC) of the surface and near surface soil and the alkaline nature of the formation. It was determined that groundwater at SWMU 114 has not been impacted by disposal activities at the site (Foster Wheeler, 1996; Foster Wheeler, 2003).

1.2.1.2 SWMU 115 – Explosives-Contaminated Burial Site (Arroyo Burial Site)

SWMU 115 is located in the northeast quarter of the northeast quarter of Section 33, Township 1 North, Range 30 East in Roosevelt County, New Mexico (**Figure 3**). The site lies within a small arroyo located in the south-central portion of Melrose AFR. According to historical RFI reports, SWMU 115 was used for the disposal and burial of UXO in 1989. UXO and other exploded ordnance were reportedly collected from the surrounding areas, pushed into the arroyo, and covered with a thin layer of soil. Storm water flows intermittently down the arroyo during heavy rains.

The ground surface at the site is relatively free of debris. The disposal area was 600 feet long, 15 to 20 feet wide, and 15 to 20 feet deep. The contents of SWMU 115 are believed to consist

entirely of UXO and other exploded ordnance, including 750-pound and 2,000-pound bombs covered with a thin layer of soil. Groundwater was reported present at approximately 25 to 30 feet bls. During the Phase I RFI, groundwater samples were collected using direct-push technology (DPT). No organics or explosives related compounds were detected in groundwater samples submitted for analysis. Elevated metals concentrations were attributed to elevated turbidity in the samples. It was determined that groundwater at SWMU 115 has not been impacted by disposal activities at the site (Foster Wheeler, 1996; Foster Wheeler, 2003).

1.2.1.3 SWMU 117 – Domestic Waste Burial Site (Southeast of Main Building)

SWMU 117 is located in the northeast quarter of the southwest quarter of Section 22, Township 1 North, Range 30 East, in Roosevelt County, New Mexico (**Figure 3**). This site is located southeast of the main control building at the Melrose AFR. The area is within a slight depression that receives storm water runoff from the surrounding area.

According to the historical RFI reports, this SWMU was formerly used to dispose of domestic waste from the control building, including such items as food waste and common household items. Other items possibly disposed in this area could include used oil and grease, solvents, batteries, pesticides, or herbicides (Foster Wheeler, 1996; Foster Wheeler, 2003). Disposal at the site appears to have begun circa 1973 as evident in aerial photographs. The area used for disposal at SWMU 117 was approximately 300 feet by 300 feet or approximately two acres. It is a closed site and currently covered by native grasses.

Groundwater was reportedly not encountered at a maximum depth of 182 feet during the Phase I RFI. The four borings were backfilled to the top of a potential confining layer (caliche) at approximately 41 feet bls with wells installed to intercept potential seasonal or perched groundwater. These four wells (M117MW001, M117MW002, M117MW003, and M117MW004) were historically dry and were abandoned at NMED's request (Trinity, 2013). Based on the lack of groundwater and the lack of significant contamination in soil samples it was concluded that contamination of groundwater at SWMU 117 was unlikely (Foster Wheeler, 1996; Foster Wheeler, 2003).

1.2.1.4 SWMU 130 – World War II Cantonment Disposal Site

SWMU 130 is located in the northeast quarter of Section 17, Township 1 North, Range 30 East, in Roosevelt County, New Mexico (**Figure 3**). SWMU 130 was formerly referred to as AOC 1. According to historical RFI reports, the military used SWMU 130 as a sanitary landfill during World War II for a cantonment area (temporary housing area for troops). No documentation exists for specific wastes disposed at the site; however, it is possible that the waste stream included all items from domestic wastes to motor pool waste, UXO, munitions, batteries, oil and fuels, etc. The exact location of the disposal site is unknown; however approximately 50 acres were investigated during the Phase I RFI. Groundwater was reportedly present approximately 140 to 145 feet bls at SWMU 130. Four monitoring wells (MAO1MW001, MAO1MW002, MAO1MW003, and MAO1MW004) were installed and sampled as part of the Phase I RFI. No organic compounds were detected and only one metal (thallium) was detected above applicable groundwater standards. The elevated thallium concentration was attributed to natural conditions (Foster Wheeler, 1996; Foster Wheeler, 2003).

1.2.1.5 SWMU 131 – Domestic Waste Burial Site (East of Fire Station)

SWMU 131 is located in the northwest quarter of the southwest quarter of Section 22, Township 1 North, Range 30 East, in Roosevelt County, New Mexico (**Figure 3**). SWMU 131 was formerly referred to as AOC 2. This site is east of the Melrose AFR Fire Station and consists of approximately 0.5 acres. According to historical RFI reports, SWMU 131 was used for disposal and/or burning of wastes; however, the type and volume of wastes is unknown (Foster Wheeler, 2003). The suspected waste stream possibly included spent fuels, motor oil, batteries, paints, pesticides, and metals in addition to domestic waste. Waste first appears to have been disposed of at SWMU 131 circa 1966.

Two monitoring wells, a shallow (MAO2MW001S) and deep (MAO2MW001D), were installed in the investigative borings to depths of 50 and 185 feet bls, respectively. MAO2MW001S was installed above a confining layer (caliche) to intercept seasonal or perched groundwater. This shallow well was historically dry and was abandoned at NMED's request (Trinity, 2013). Groundwater was reportedly present in the deep well at approximately 105 feet bls.

The deep groundwater monitoring well, MAO2MW001D, was sampled as part of the RFI. No organic analytes were detected in the groundwater during the Phase I RFI. Selenium and thallium were reported at concentrations above applicable groundwater standards; however, due to a lack of selenium or thallium in overlying soil samples it was determined that groundwater had not been impacted by SWMU 131 (Foster Wheeler, 1996; Foster Wheeler, 2003).

1.2.1.6 SWMU 132 – Disposal / Burn Site (North Helicopter Pad)

SWMU 132 is located in the southwest quarter of Section 22, Township 1 North, Range 30 East, in Roosevelt County, New Mexico (**Figure 3**). SWMU 132 was formerly referred to as AOC 3. This site is less than 0.5 acres located north of the former helicopter pad at the Melrose AFR operations area. SWMU 132 was reportedly used for burning and/or disposal of unknown wastes types and quantities. Possible wastes included domestic waste, motor oil, metals, and residue from burning. Waste first appears to have been disposed of at SWMU 132 circa 1973.

During the Phase I RFI no groundwater was encountered during drilling to a total depth of 182 feet bls. The boring was backfilled to the top of a potential confining layer (caliche) at approximately 50 feet bls to intercept seasonal or perched groundwater. Due to land-use (helicopter pad) MAO3MW001 was installed flush mount. The well was dry during the Phase I RFI (1996) and during the RFI Addendum (2003) and therefore could not be sampled. Based on the lack of groundwater this well was abandoned at NMED's request. Also due to the lack of groundwater, it was determined to not have been impacted by the presence of SWMU 132 (Foster Wheeler, 1996; Foster Wheeler, 2003).

1.2.1.7 SWMU 133 – NW Munitions Disposal Site (NW Corner of Impact Area)

SWMU 133 is located in the northwestern corner of the impact area. SWMU 133 was formerly referred to as AOC 4. This site is located in the east-central part of Section 17 with some overlap into Section 16, Township 1 North, Range 30 East in Roosevelt County, New Mexico (**Figure 3**). The site is flat with native scrub vegetation and areas free of vegetation. According to historical RFI reports, SWMU 133 was used from 1952 to 1960 for disposal of exploded ordnance and UXO.

Groundwater was reportedly present at approximately 112 to 127 feet bls. During the Phase I RFI, groundwater samples were collected from three of four borings using DPT. Groundwater was not encountered in one of the borings. No organics were detected in groundwater. Concentrations of several metals exceeded applicable groundwater standards. A pattern of increased concentrations of five of the metals from west to east across the site might suggest impacts from SWMU 133 or from naturally occurring lateral changes in bedrock (Foster Wheeler, 1996; Foster Wheeler, 2003). Permanent monitoring wells were not installed due to the location of SWMU 133 in an overflight approach route along the northern portion of the active Impact Area. In a letter to Cannon AFB dated June 19, 2007 NMED stated, that "…NMED will prepare a "corrective action-only" permit to be implemented once the range is closed, transferring, or transferred." (NMED, 2007). When the Range is deactivated additional assessment will likely be required.

1.3 Inactive Wells

There are several wells located on Melrose AFR that were included in previous monitoring plans. However, due to well abandonment, inaccessibility, or well construction, these wells are not included in this FSP. The inactive wells are posted on **Figures 2** and **3**. These wells are further described in **Table 1-3**.

1.4 Project Description Objective

As an interim measure until the SWMUs are fully investigated, two separate monitoring well networks have been established and are periodically sampled, as follows:

- The Semiannual SWMU Groundwater Monitoring Network currently consists of 10 wells (**Table 1-1** and **Figure 3**). They are to be sampled in the spring (typically in April) and fall (typically in October). It should be noted that the schedule is highly dependent on access to the Range and that it is occasionally necessary to shift the schedule by several weeks to accommodate military training exercises/activities. All scheduling is coordinated by the Cannon AFB Environmental Restoration Manager. The current Environmental Restoration Manager is Ms. Laura Peters; she can be reached at 575-784-0491.
- The Annual Groundwater Monitoring Network currently consists of seven wells and is sampled in the spring in conjunction with the Semiannual SWMU Groundwater Monitoring Network (**Table 1-1** and **Figure 2**).

The water quality sampling and reporting described in this FSP is being performed to monitor for the presence or absence of potential contaminants, gauge the effectiveness of the Semiannual SWMU Groundwater Monitoring Network and the Annual Groundwater Monitoring Network, provide the foundation for correction or improvement to the monitoring program as necessary, and to document the site's influence on groundwater quality, if any.

Field activities associated with the water quality monitoring program will include the following:

- Water level measurements within each well. In addition to the Semiannual and Annual Groundwater Monitoring Network, 13 additional wells are utilized for the collection of groundwater elevation only (**Table 1-1** and **Figure 2**). Additional discussion concerning the groundwater level measurements is included in **Section 2.1** of this report.

- Groundwater sampling. Additional discussion concerning the groundwater sampling is included in **Section 2.2** through **Section 2.5**.
- Management of investigative derived waste (IDW) which is discussed in more detail in **Section 2.6**.

1.5 Geology/Hydrogeology

The stratigraphic units of interest at MAFR are the Chinle, Ogallala, and Blackwater Draw Formations. In eastern New Mexico, the Ogallala and Blackwater Draw Formations form the Southern High Plains Aquifer, which is part of a larger aquifer system extending from eastern New Mexico and Colorado into Texas, Oklahoma, Kansas, Nebraska, and South Dakota (Langman, 2004). The Chinle Formation (Triassic Period), the lowermost unit of interest, underlies the unconfined Southern High Plains Aquifer and is composed of red shales with interbedded sands (commonly referred to locally as "*redbeds*") deposited by low-energy streams in floodplains and deltas. The top of the Chinle Formation is marked by an erosional unconformity with up to several hundred feet of relief (Lee Wan and Associates, Inc., 1990). The Ogallala Formation (Tertiary Period) is the uppermost formation for the central and southern parts of MAFR and it lies unconformably over the upper unit of the Chinle Formation. The Blackwater Draw Formation (Quaternary Period) overlies the Ogallala Formation in the northern part of MAFR.

MAFR is located near the western margin of the Southern High Plains Aquifer of which the Ogallala Formation is the primary water bearing unit. The Southern High Plains Aquifer forms the primary aquifer for irrigation, livestock, and potable water in the vicinity of MAFR and throughout the eastern New Mexico region. In addition, there are several localized shallow water-bearing zones across the region used for irrigation purposes. No deeper aquifers are known to be in use in the vicinity of MAFR, because of poor water quality. Within New Mexico, groundwater in the Southern High Plains Aquifer generally flows eastward (Hart, 1985), which is considered the overall direction of regional flow in the unconfined aquifer.

The Southern High Plains Aquifer was mapped by Hart as unsaturated or saturated only in isolated channels in the area occupied by the southern and western portions of MAFR and as saturated in the northern portion (Hart, 1985). Hydrogeologically, the Chinle Formation provides regional confinement to the Southern High Plains Aquifer at its base, generally forming an impermeable aquitard (Fallin, 1989). For a more detailed discussion of the regional and site specific geology and hydrogeology please see the *April 2014 Geophysical and Downhole Camera Investigation Report, Melrose Air Force Range, Roosevelt and Curry Counties, New Mexico* (Trinity Analysis & Development Corp., 2014a).

1.5.1 Groundwater Elevation, Gradient, and Flow Velocity

Based on the findings of the Geophysical and Downhole Camera Investigation Report, Melrose Air Force Range, Roosevelt and Curry Counties, New Mexico (Trinity Analysis & Development Corp., 2014) monitoring wells MWQ-18, MWQ-21, and MWQ-24 are the only wells indicated to target the Ogallala Formation (Southern High Plains Aquifer). MWQ-22 is indicated to straddle the Ogallala/Chinle contact, and thus has not been included in groundwater flow determination maps. The majority of monitoring wells are indicated to target the Chinle Formation. Some wells (MWQ-2, -19, -20 and MA02MW001D) are set quite deep into the Chinle (50-120 feet). Water levels in these wells are measured at 15 to 55 feet above the

Ogallala/Chinle contact and some measure of confinement is likely, and thus have not been included in groundwater flow determination maps.

Monitoring wells around SWMU's 114 and 130 and MWQ-14 appear to target Chinle sediments at depths of approximately 25 to 45 feet below its contact with the Ogallala. Water levels in these wells are measured at altitudes below the contact and may represent 'first available water' at those locales. Two groundwater flow maps are presented as part of this FSP:

- **Figure 4** - Groundwater flow direction based on data collected by Trinity between October 20 and October 23, 2014 for the Ogallala Formation (Southern High Plains Aquifer).
- **Figure 5** - Groundwater flow direction based on data collected by Trinity between October 20 and 23, 2014 for the upper portion of the Chinle Formation.

Water-level contours for the Southern High Plains Aquifer indicate flow to be to the northeast; however, only three wells are screened in the Ogallala Formation. Several old windmill-driven wells have been utilized for the collection of groundwater elevations and in the past have been utilized for the determination of groundwater flow direction; however, it is not known if these wells are screened in the Chinle or Ogallala Formation, and thus have not been included in groundwater flow determination maps.

1.6 Potential Site Contaminants of Concern

Based on historical investigations previously conducted at MAFR (Foster Wheeler, 1996; Foster Wheeler, 2003), and the previously approved work plan (Tidewater, Inc. 2010) the following analytes were identified as potential analytes of concern:

- Cyanide
- Explosives
- Hexavalent Chromium
- Metals
- Nitrate and Nitrite
- Perchlorate
- volatile organic compounds (VOCs)

Additional indicator parameters include:

- Alkalinity
- Chloride
- Sulfate
- total dissolved solids (TDS)
- Field Parameters

1.7 Applicable Regulations/Standards

Applicable regulations and/or standards that pertain to activities associated with this FSP are detailed below:

- Sampling methods were developed in general accordance with Use of Low-Flow and Other Non-Traditional Sampling Techniques for RCRA Compliant Groundwater Monitoring (New Mexico Environment Department, 2001).
- The 2014 NMED Risk Assessment Guidance for Site Investigations and Remediation (New Mexico Environment Department, 2014) document will be used to determine whether potential site-related contaminants exceed groundwater screening guidelines.

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2.0 Field Sampling Plan

2.1 Water Level Measurements

Prior to groundwater sampling activities, a round of water levels will be collected from all accessible monitoring wells (**Table 1-1** and **Figures 2 and 3**) using an electronic water level indicator. All monitoring wells in the Semiannual-SWMU and Annual Groundwater Quality Well Networks are locked and require a key to be accessed. Keys may be obtained from Cannon AFB personnel. The Water Level Only wells are not locked and are accessible without a key. Water levels collected from monitoring wells with dedicated bladder pumps will be collected by lowering the water level indicator through the water level measurement port located adjacent to the discharge tube. The dedicated bladder pump systems are designed so that a water level can be measured from the survey reference point or highest point on the casing of the monitoring well. Although some Water Level Only wells have dedicated submersible pumps, or construction is unknown, these wells are accessible and water levels can be measured from the top of casing.

Water levels will be measured in the shortest time practical to minimize the effects of water table fluctuations. Water level measurements will be documented in a field logbook and using a Water Level Data Summary sheet (**Appendix A**). The depth to groundwater will be measured from the top of well casing to the nearest 0.01 foot and always from the same reference point or survey mark on the well casing. If there is no reference mark, the measurement will be from the highest point of the casing. Field procedures for water level measurements were developed in general accordance with guidance provided by NMED (New Mexico Environment Department, 2001.)

2.2 Groundwater Sampling

Prior to sample collection, the monitoring wells will be purged using low-flow sampling techniques using dedicated polyvinyl chloride (PVC) QED Well Wizard® bladder pumps (**Appendix B**). The dedicated bladder pumps at MAFR will be operated with a QED MP10H controller or equivalently compressed nitrogen. Well construction details and pump placement are presented in **Table 1-1**. Field procedures for low-flow sampling were developed in general accordance with guidance provided by NMED (New Mexico Environment Department, 2001.)

Field parameters will be monitored with a multi-parameter water quality meter with an attached flow through cell. The multi-parameter water quality meter will monitor dissolved oxygen (DO), temperature, pH, specific conductance, and oxidation reduction potential (ORP). Salinity is a measurement based on temperature and conductivity and will be calculated by the multi-parameter water quality meter. Turbidity will be measured using a standalone turbidity meter. Drawdown will be measured during purging by lowering a water level indicator through the water level measurement port located adjacent to the discharge tube. The multi-parameter water quality meter and the turbidity meter will be calibrated each day prior to sampling in accordance with the manufacture instructions.

Prior to recording stabilization parameters, the volume of the bladder and tubing must be purged. Stabilization parameters will be collected at a minimum of three minutes apart. Stabilization parameters will be recorded on a groundwater sampling log (**Appendix A**). Purging will continue until all field parameters have stabilized for three consecutive readings according to the following criteria:

- Turbidity: ≤ 10 nephelometric turbidity units (NTU) or ± 10% where > 10 NTUs;
- pH: ± 0.5 units
- Specific Conductance: ± 10% of reading
- DO: ± 10% of reading
- ORP: ± 10 millivolts (mV)
- Temperature: ± 10% of reading

2.2.1 Field and Laboratory Analysis

The current groundwater program provides for semiannual testing at 10 wells associated with the Semiannual SWMU Groundwater Monitoring Network and 7 wells associated with the Annual Groundwater Monitoring Network (**Figures 2 and 3**). **Table 2-1** and **Table 2-2** summarize testing requirements.

Table 2-1 Semiannual - SWMU Groundwater Quality Network

Analyte	Field Parameters [1]	VOCs [2]	Explosives [3]	Metals [4] (Total & Diss.)	Chromium (VI)	Cyanide	Mercury	Nitrite, Nitrate	Chloride, Sulfate	Perchlorate[5]	Alkalinity	TDS
Method	NA	EPA 8260B	EPA 8330	EPA 6020A	EPA 218.6	EPA 9012A	EPA 7470A	EPA 300.0	EPA 300.0	EPA 6860	SM 2320B	SM 2540C
M114MW001	x	x	x	x	x	x	x	x	x	x	x	x
M114MW002	x	x	x	x	x	x	x	x	x	x	x	x
M114MW003	x	x	x	x	x	x	x	x	x	x	x	x
M114MW004	x	x	x	x	x	x	x	x	x	x	x	x
MAO1MW001	x	x	x	x	x	x	x	x	x	x	x	x
MAO1MW002	x	x	x	x	x	x	x	x	x	x	x	x
MAO1MW003	x	x	x	x	x	x	x	x	x	x	x	x
MAO1MW004	x	x	x	x	x	x	x	x	x	x	x	x
MAO2MW001D	x	x	x	x	x	x	x	x	x	x	x	x
MWQ-24	x	x	x	x	x	x	x	x	x	x	x	x

[1] Field Parameters: Specific Conductance, Dissolved Oxygen, pH, Temperature, Turbidity, ORP
[2] VOCs: Target Compound List
[3] Explosives: 1,3,5-Trinitrobenzene, 1,3-Dinitrobenzene, 2,4,6-Trinitrotoluene, 2,4-Dinitrotoluene, 2,6-Dinitrotoluene, 2-Amino-4,6 dinitrotoluene, 2-Nitrotoluene, 3-Nitrotoluene, 4-Amino-2,6-dinitrotoluene, 4-Nitrotoluene, HMX, Nitrobenzene, RDX, Tetryl
[4] Metals: Target Analyte List
[5] For perchlorate, 6860 is the method approved by NMED and is utilized for routine analysis. However, the split samples are routinely analyzed utilizing 6850 as it has been problematic finding another laboratory that utilizes 6860.

Table 2-2 Annual - Groundwater Quality Network

Analyte	Field Parameters [1]	Metals [2] (Total & Diss.)	Chromium (VI)	Cyanide	Nitrite, Nitrate	Chloride, Sulfate	Perchlorate[4]	Alkalinity	TDS
Method	**NA**	**EPA 6020A**	**EPA 218.6**	**EPA 9012A**	**EPA 300.0**	**EPA 300.0**	**EPA 6860**	**SM 2320B**	**SM 2540C**
MWQ-2	x	x	x	x	x	x	x	x	x
MWQ-14	x	x	x	x	x	x	x	x	x
MWQ-18	x	x	x	x	x	x	x	x	x
MWQ-19	x	x	x	x	x	x	x	x	x
MWQ-20	x	x	x	x	x	x	x	x	x
MWQ-21	x	x	x	x	x	x	x	x	x
MWQ-22	x	x	x	x	x	x	x	x	x

[1] Field Parameters: Specific Conductance, Dissolved Oxygen, pH, Temperature, Turbidity, ORP
[2] Metals: Target Analyte List
[3] Analytical methods were changed Based on *Approval Annual Report December 2011 Melrose Air Force Range Roosevelt and Curry Counties, New Mexico*.
[4] For perchlorate, 6860 is the method approved by NMED and is utilized for routine analysis. However, the split samples are routinely analyzed utilizing 6850 as it has been problematic finding another laboratory that utilizes 6860.

In addition to a total metals sample, a dissolved metals sample will be collected for each well. The sample will be collected and immediately filtered in the field with a disposable 0.45 micron (µm) filter.

2.3 General Sample Requirements

2.3.1 Sample Containers and Preservation Techniques

The primary contract laboratory, Gulf Coast Analytical Laboratories, Inc. (GCAL) of Baton Rouge, Louisiana, will provide new, certified clean sample bottles for analyses according to previously specified requirements. GCAL is accredited in accordance with the National Environmental Laboratory Accreditation Conference (NELAC) (Certificate Number 01955), and the DoD Environmental Laboratory Accreditation Program (ELAP) (Certificate Number 1482). Sample containers will contain preservatives where applicable in the appropriate sample containers, placed there by the laboratory. Sample container requirements for the analyses anticipated and preservation requirements to be required for this project are summarized in **Table 2-3.**

Table 2-3 Sample Containers and Preservation

Analytical Parameters	Method	Container	Preservation	Maximum Holding Time
Alkalinity	SM 2320B	500-mL plastic or glass	Cool 4°C	14 days
Chloride	EPA 300.0	500-mL plastic or glass	Cool 4°C	28 days
Chromium (VI)	EPA 218.6	250-mL plastic or glass	Cool 4°C, buffer solution 9.3<pH<9.7	14 days
Cyanide	EPA 9012A	500-mL plastic or glass	Cool, ≤4 °C9, NaOH to pH>12, reducing agent	14 days
Explosives	EPA 8330	Two 1-liter wide mouth amber glass bottle, with Teflon lined cap	Cool 4°C	7 days until extraction, 40 days after extraction
Mercury	EPA 7470A	500-mL plastic or glass	Cool 4°C, HNO to pH<2	28 days
Metals (Total & Diss.)	EPA 6020A	500-mL plastic or glass	Cool 4°C, HNO to pH<2	6 months
Nitrite, Nitrate	EPA 300.0	500-mL plastic or glass	Cool 4°C	48 hours
Perchlorate	EPA 6860	125-mL plastic or glass	Cool 4°C	28 days
Perchlorate	EPA 6850	125-mL plastic or glass	Cool 4°C	28 days
Sulfate	EPA 300.0	500-mL plastic or glass	Cool 4°C	28 days
TDS	SM 2540C	500-mL plastic or glass	Cool 4°C	7 days
VOCs	EPA 8260B	Three 40-mL glass vials	Cool 4°C, HCL to pH<2	14 days

mL: milliliter

2.4 Field Operations Documentation

Field logbooks will be maintained to record site activities and field data in a neat, legible manner. Logbooks will be bound and pages consecutively numbered. Personnel will make logbook entries in indelible ink. The following information, at minimum, will be entered during project activities:

- Date and team location
- Weather
- Personnel onsite (including subcontractors) and work performed
- Equipment and instrument checks
- Injuries and/or illnesses
- Changes to work instructions
- Work stoppage
- Visitors
- Other relevant events

2.4.1 Sample Numbering System

Sample containers will be labeled utilizing existing well IDs. The sample identification number will be logged in the field log book and on the COC form.

QC samples are denoted by adding a QC extension at the end of the sample identification number. The extensions are shown in **Table 2-4**.

Table 2-4 QC Extensions

Order	Extension	Description
1	dis	dissolved phase (field filtered)
2	a	field duplicate
2	b	field split (to quality assurance lab)
2	c	trip blank
2	eqb	equipment blank
2	rin	rinsate
2	e	field blank
3	ms	matrix spike
3	msd	matrix spike duplicate

Quality assurance samples are discussed in more detail in **Section 3.0**, below.

2.4.2 Chain-of-Custody Records

The purpose of the COC is to provide continuous possession of samples from their origin to completion of analysis and archiving/disposal in the laboratory. This uninterrupted possession is required to maintain integrity of samples. The COC record is the documentation of this uninterrupted possession of the samples.

2.4.3 Sample Packaging and Shipping Requirements

Samples for chemical analyses will be packed on ice in sealed coolers for transport to the laboratory to ensure a temperature of 4±2 degrees Celsius (°C) upon receipt by the contract laboratory. To meet hold time requirements, samples will be shipped at the end of each day by overnight commercial courier to the laboratory. The laboratory will be notified prior to sample shipments. The packaging of each cooler will follow these steps:

1. Line the cooler with two water tight plastic bags
2. Ensure sample lids are tight
3. Wrap glass sample containers and associated quality control (QC) samples in bubble wrap and place in the inner water tight plastic bag
4. Fill cooler with enough packing material to prevent breakage of glass bottles
5. Make sure the sample cooler has a temperature blank and trip blank (for shipment of VOC samples), and are properly packed
6. Seal inner water tight plastic bag
7. Place sufficient ice in cooler between the inner and outer water tight plastic bags to maintain the internal temperature at 4±2 °C during transport.
8. Seal outer water tight plastic bag
9. Place associated chain-of-custodies (COC) in a waterproof plastic bag, and tape it to the inside lid of the cooler.

10. Seal cooler with tape and custody seal and ship to laboratory. Upon receipt at the laboratory, laboratory personnel will open the cooler and immediately record the temperature of the cooler will be recorded immediately from the temperature blank.

Samples will be packed for shipping in waterproof ice chests and coolers. The sample containers must be individually sealed in plastic bags prior to packing them in the cooler with bubble wrap to prevent breakage during shipment. Wet ice is placed with the samples in the cooler to maintain the samples at a temperature of 4±2 °C during shipping. Prior to shipment, any melted ice will be drained, and fresh ice will be added. A temperature blank will also be included in every cooler containing samples shipped for chemical analysis. All samples will be shipped in accordance with International Air Transport Association (IATA) and U.S. Department of Transportation (USDOT) regulations.

The COC form (**Appendix A**) or an equivalent form that identifies the samples is signed as relinquished by the principal sampler or responsible party. A Cooler Receipt Form or an equivalent form must also be completed upon receipt of the shipment for all shipments sent to the contract laboratory for purposes of noting problems in sample packaging, COC, and sample preservation. The COC forms are sealed in a waterproof plastic bag which is then placed inside the cooler, typically by taping the bag to the inside lid of the cooler.

Following packing, the cooler lid is sealed with strapping tape. Two custody seals (signed and dated) are affixed about two corners of the cooler, across the seal of the lid, and additionally covered with clear tape.

2.5 Decontamination Procedures

All reusable equipment that comes into contact with potentially contaminated water or other material will be decontaminated prior to use at each sampling location. All equipment will be thoroughly decontaminated before use and between sampling locations. With all monitoring wells containing dedicated bladder pumps the only piece of equipment that should require decontamination should be the water level tape. For decontamination of the water level tape follow manufacturer's recommendations for cleaning instruments. However, at a minimum:

- Wipe down equipment body, probes, and cables with lab-grade detergent solution
- Rinse thoroughly with tap water
- Rinse thoroughly with analyte-free water
- Containerize all rinsing wastes, detergent wastes and other chemical wastes requiring off-site or regulated disposal. Treat as IDW; see **Section 2.6** below for more detail.

2.6 Investigative Derived Waste

IDW generated during groundwater sampling activities will include monitoring well purge water and decontamination water. All IDW collected during groundwater sampling will be temporarily containerized in a holding tank, buckets (with lids), or similar containers secured in the bed of the field vehicle. At the completion of daily field activities, the container(s) will be discharged into a bulk liquid storage tank located approximately 0.4 miles south of MWQ-1 and MWQ-2 adjacent to a Conex container and storage buildings (**Figure 2**).

Subsequent to each groundwater sampling event, a composite sample will be collected from the holding tank and analyzed for the following:

- pH (corrosivity)
- Flashpoint (flammability)
- TX-1005 (reactivity)

Wastes that have not been specifically listed (40 CFR §261.31, 40 CFR §261.32, or 40 CFR §261.33) may still be considered a hazardous waste if it exhibits one of the four characteristics defined in 40 CFR Part 261 Subpart C. Based on the analytical results from the composite sample collected from the holding tank, and from the groundwater sampling event, the IDW will be disposed of appropriately. Approval will be requested from NMED prior to disposal of any IDW from MAFR.

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3.0 Quality Assurance Samples

3.1 Field Quality Control Samples

To ensure that quality data are continuously produced during analysis and allow the eventual compliance review, systematic QC checks are incorporated into the sampling and analyses to show that procedures and test results remain reproducible and that the analytical method is actually measuring the concentration of target analytes in groundwater samples without unacceptable bias. Systematic QC checks include the scheduled analyses of field and laboratory replicates, standards, surrogates, spiked samples, and blanks. Frequency requirements for field QC samples are summarized in the table below.

Table 3-1 QC Check Frequency

QC Checks	Frequency
Field Duplicate	one for every ten environmental samples
Field Split	one for every 20 environmental samples
Matrix Spike(MS)/Matrix Spike Duplicate(MSD) (extra volume for lab)	one for every 20 environmental samples
Temperature Blank	each cooler
Trip Blank	Each cooler containing environmental samples for VOC analysis

3.1.1 Trip Blanks

A trip blank consists of a VOC sample vial filled in the laboratory with ASTM Type II reagent grade water, transported to the sampling site, handled like an environmental sample, and returned to the laboratory for analysis. These samples are not opened in the field and are submitted to the laboratory only when samples are collected for VOCs.

Trip blanks are used to assess the potential introduction of contaminants from sample containers or during the transportation, field exposure, and storage procedures. For this project, one trip blank will accompany each cooler that contains VOC samples for analysis by the laboratory.

3.1.2 Temperature Blanks

A temperature blank is a container of water that is packed and shipped with the field samples to the laboratory. The temperature blank should be a 100 mL plastic bottle filled with water and placed in a representative position inside the cooler. Upon arrival at the laboratory, the laboratory measures the temperature of the blank. This temperature reading is used to represent the conditions of the field samples. One temperature blank will accompany each cooler.

3.1.3 Field Duplicate Samples

A field duplicate sample is a second sample collected at the same location as the primary sample. These samples are collected simultaneously or in immediate succession, using identical recovery techniques, and treated in an identical manner during storage, transportation, and analysis. The field duplicate's sample identification is assigned an extension that identifies the sample as a field duplicate to the sample collector but is blind to the laboratory (See **Table 2-4** for more detail). The results from duplicate samples are used to assess precision of the sample collection

process. The frequency of collection for field duplicates is one field duplicate for every ten environmental samples collected.

3.1.4 Field Splits

A field split sample, also called a replicate sample, is a single sample divided into two equal parts for analysis. In the case of low-flow ground water sampling, split samples for VOC analysis will be collected immediately following the associated VOC grab samples. The sample containers are assigned an identification number in the field so they cannot be identified as replicate samples by the laboratory(s) personnel performing the analysis (See **Table 2-4** for more detail). Specific locations are designated for collection of field replicate samples prior to the beginning of sample collection. The sample results are used to assess precision.

The split samples will be collected from each matrix of concern where the anticipated concentrations of contaminants are near the cleanup target level (if this information is known). The frequency of collection for field split samples is one every 20 samples collected. The field split samples shall be analyzed by the same methods as the environmental samples which are sent to the primary laboratory, when possible.

Field split samples should be delivered to Accutest Laboratories, Inc., Orlando, FL. Accutest is accredited in accordance with the NELAC (Certificate Number E83510), and the DoD ELAP (Certificate Number L2229). The laboratory provided coolers, sample containers (including preservatives where applicable), custody seals, and COC documents.

3.2 Laboratory Quality Control Checks

3.2.1 Matrix Spike/Matrix Spike Duplicates

The MS is used to access the performance of the analytical method as applied to a particular matrix. MS and MSD are aliquots of samples spiked with known amounts of all target analytes. Additional volume will be collected in the field for laboratory analysis. The spiking occurs prior to sample preparation and analysis. Only project-specific samples shall be used as MS/MSD samples. The MS/MSD is designated on the COC form. The MS/MSD is used to document the bias of a method due to sample matrix. These sample results should not be used to control the analytical process. A minimum of one MS/MSD sample set shall be analyzed for every 20 site samples.

4.0 Reporting Requirements

A Draft Annual Groundwater Monitoring Report is due to Cannon AFB no later than January 31 of each year. Reports are due annually to NMED no later than February 27 of each year. As previously requested by NMED, annual reports are to be written and organized in general accordance with the NMED *Position Paper: General Reporting Requirements for Routine Groundwater Monitoring Activities at RCRA Sites* (NMED, 2003).

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FIGURES

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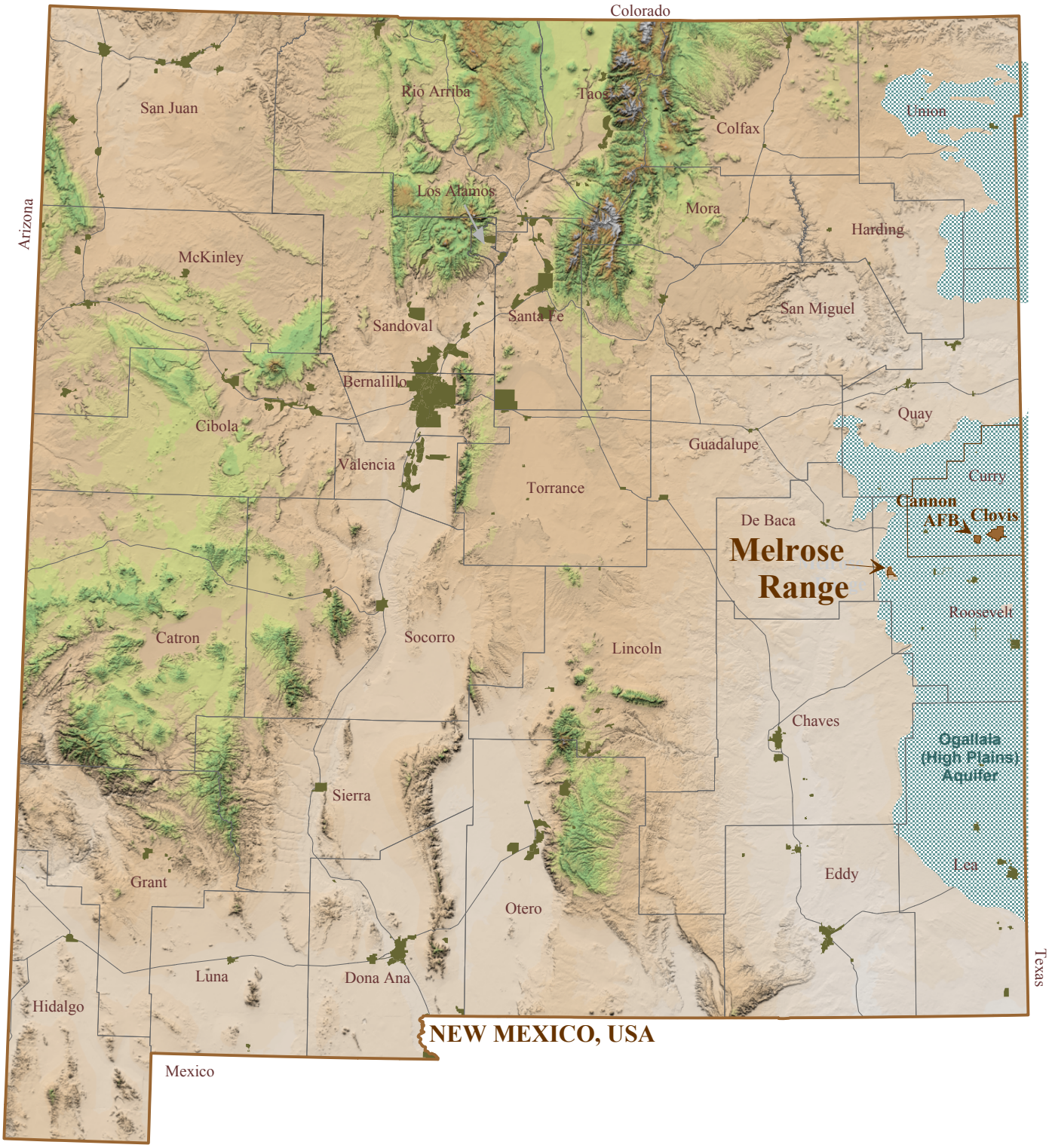


Source files: New Mexico Resource Geographic Information System Program

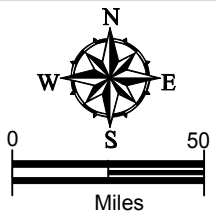
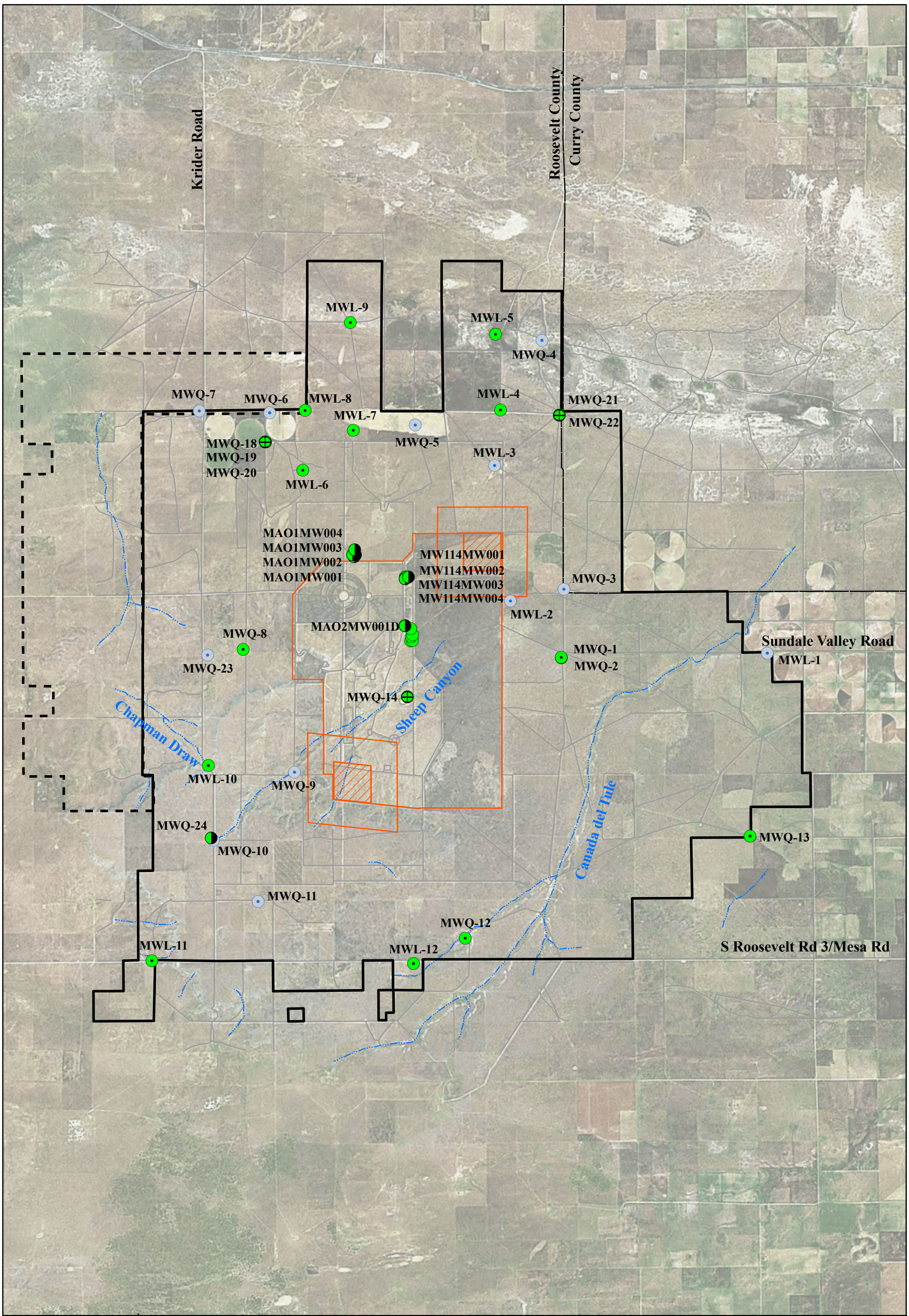


FIGURE 1
SITE LOCATION MAP
Melrose Air Force Range
Roosevelt and Curry Counties, New Mexico

Trinity Analysis and Development Corp.



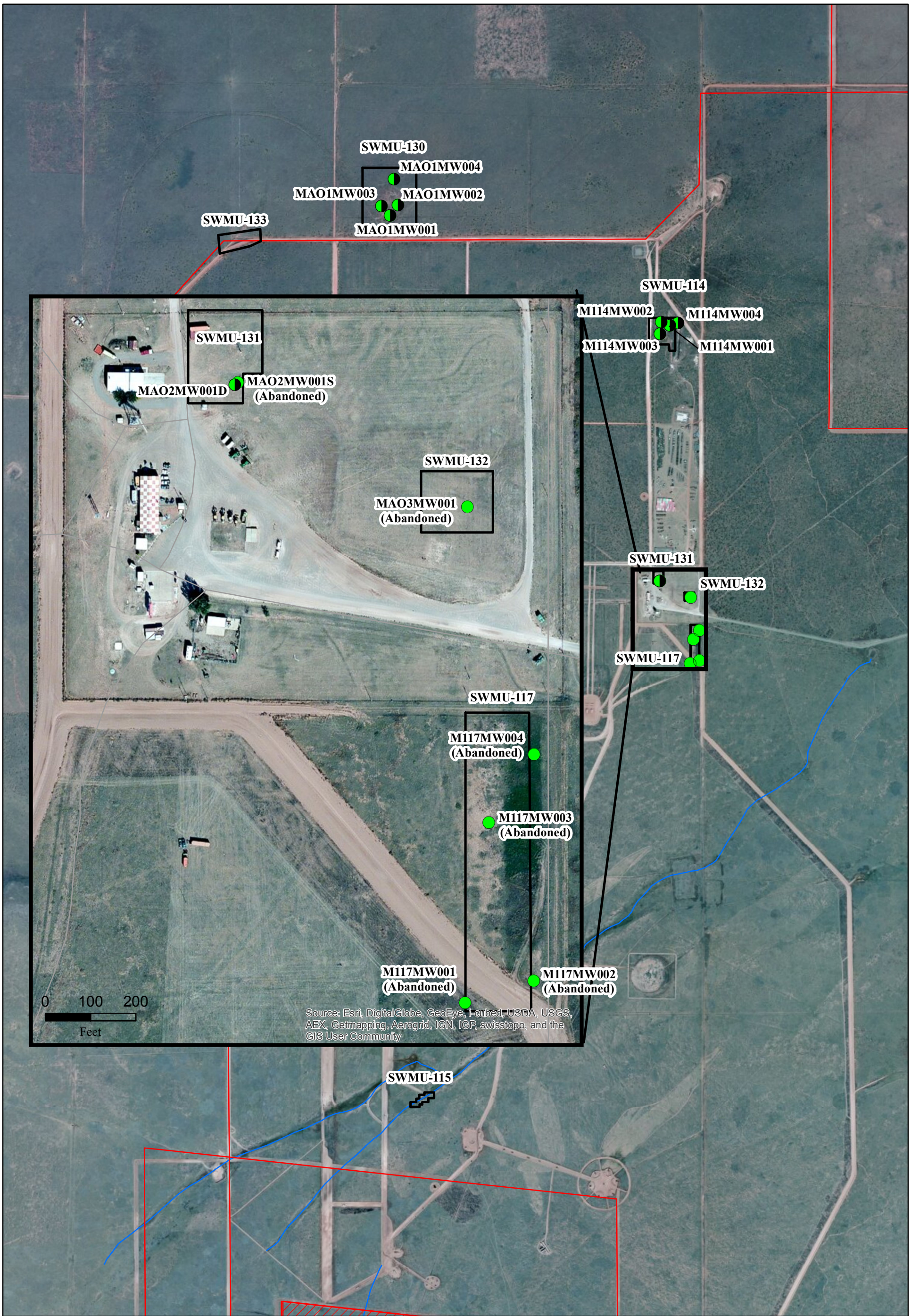
N
W E
S
0 1.5
Miles

Legend

- Annual Groundwater Quality Network
- Semiannual - SWMU Groundwater Quality Network
- Water Level Only
- Abandoned Wells (see Figure 3 for well designations)
- Inactive Wells
- Target Area
- Impact Area
- Installation Area, New Mexico Trust Land (to be aquired)
- Installation Area
- Ephemeral Draw

FIGURE 2
ANNUAL MONITORING WELL NETWORK
Melrose Air Force Range
Roosevelt and Curry Counties, New Mexico

Trinity Analysis & Development Corp.



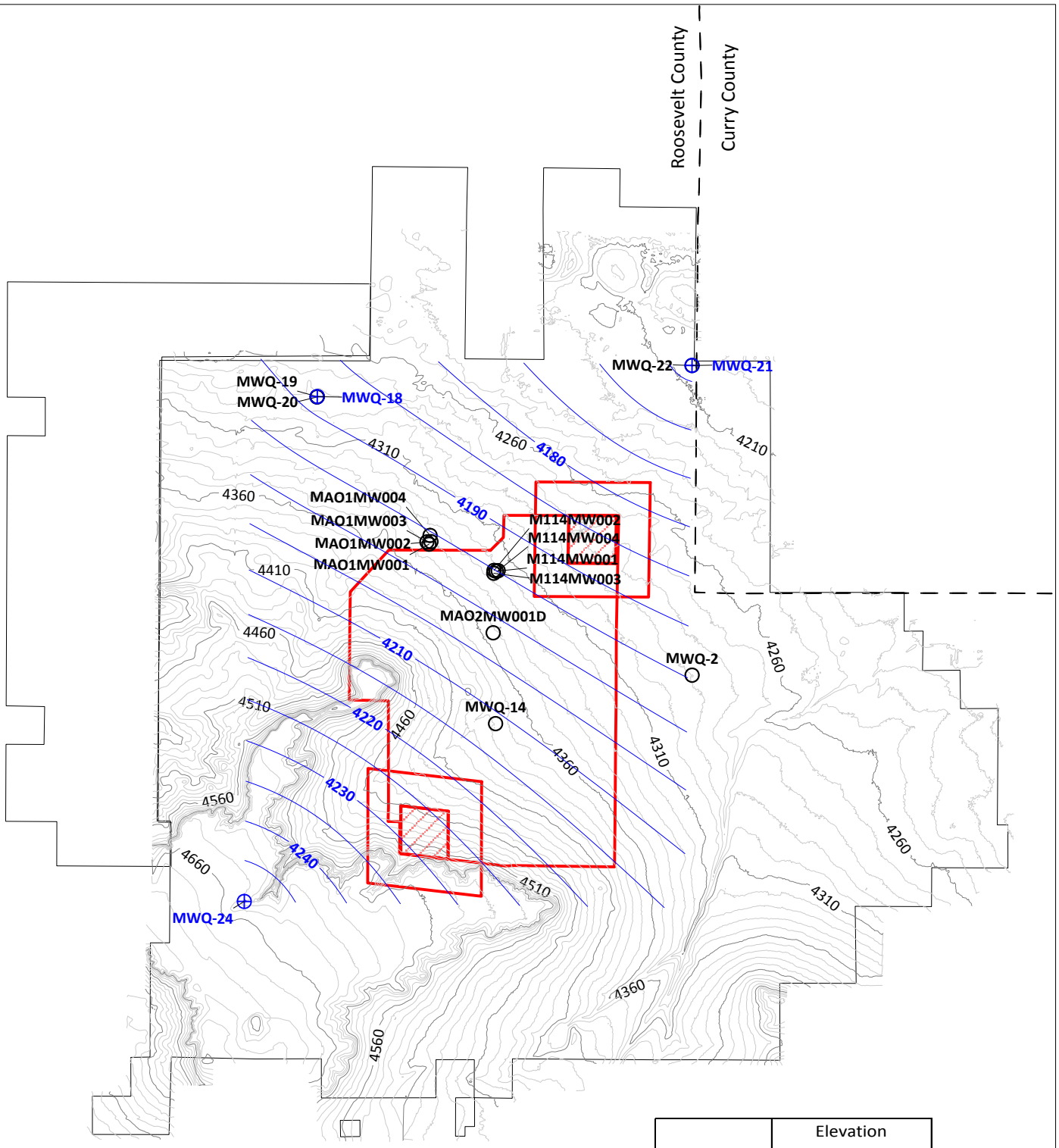
N
W E
S
0 1,500
Feet

Legend

- Semiannual - Monitoring Well
- Abandoned - Monitoring Well
- Target Area
- Impact Area

Note: MWQ-24 is included in the semi-annual monitoring network and is shown in Figure 7

FIGURE 3
SEMIANNUAL SWMU MONITORING WELL NETWORK LOCATIONS
Melrose Air Force Range
Roosevelt and Curry Counties, New Mexico



	Elevation (Feet NAVD)
MWQ-24	4598.99
MWQ-18	4188.16
MWQ-21	4163.34

Source: Cannon AFB GIS Database;
Topography data derived from 2005 LIDAR survey;
Vertical Accuracy: < 1 foot
Vertical Datum: NAVD88
Horizontal Accuracy: 0.37 feet
Horizontal Datum: UTM Zone 13N, WGS84
Contour Interval: 10 Feet

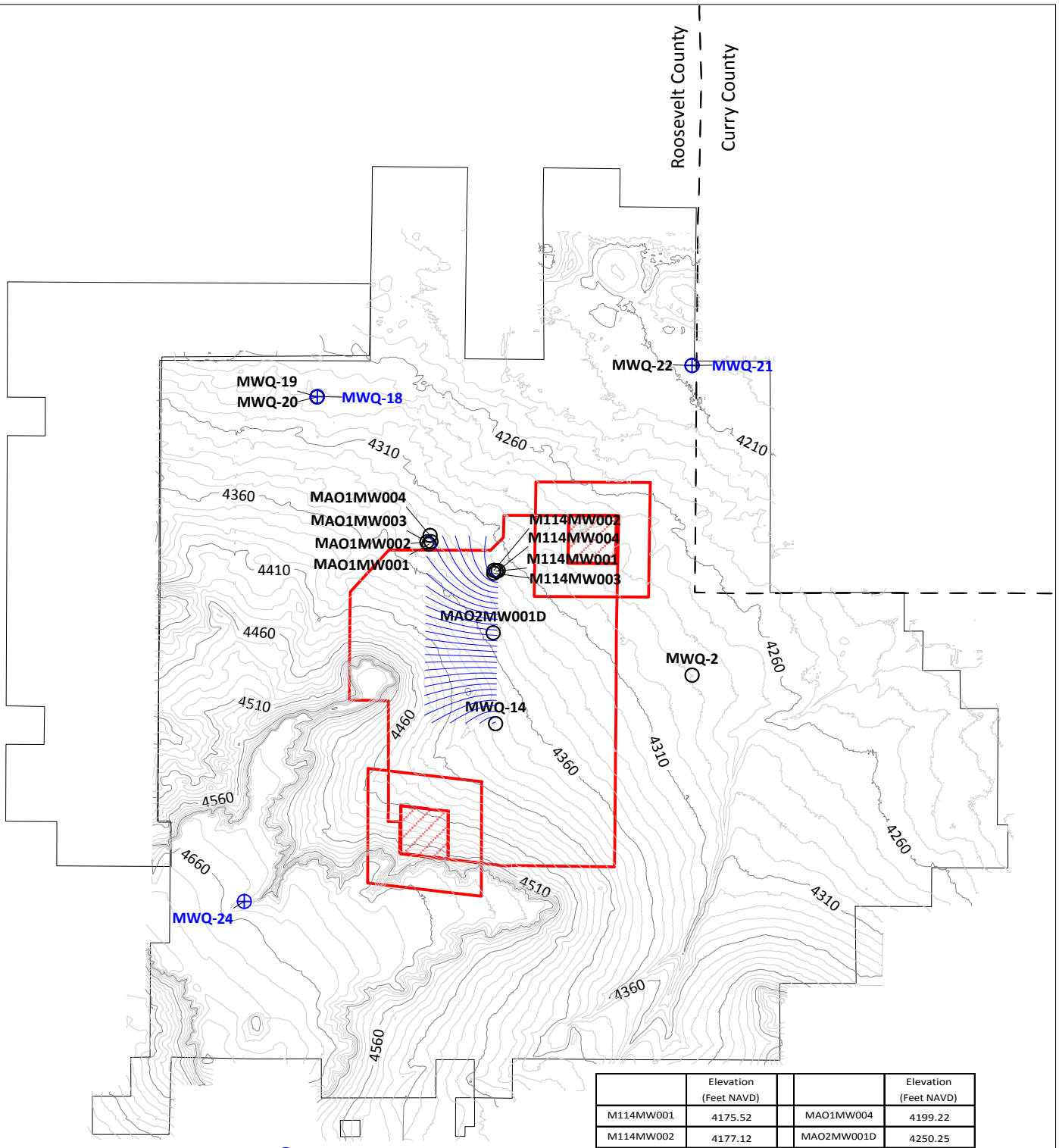
Ogallala Aquifer (Southern High Plains)

Chinle Formation

N
W E
S
0 10,000
Feet

FIGURE 4
GROUNDWATER FLOW DIRECTION
OCTOBER 2014
OGALLALA AQUIFER (SOUTHERN HIGH PLAINS AQUIFER)
Melrose Air Force Range
Roosevelt and Curry Counties, New Mexico

Trinity Analysis & Development Corp.



	Elevation (Feet NAVD)			Elevation (Feet NAVD)
M114MW001	4175.52		MAO1MW004	4199.22
M114MW002	4177.12		MAO2MW001D	4250.25
M114MW003	4177.68		MWQ-2	4171.99
M114MW004	4175.09		MWQ-14	ND
MAO1MW001	4201.98		MWQ-19	4176.09
MAO1MW002	4200.85		MWQ-20	4206.98
MAO1MW003	4201.65		MWQ-22	4,200.85

MWQ-14 April 23, 2014 water level (4316.47 Feet NAVD) utilized as the well was inaccessible due to live-fire exercise in vicinity of MWQ-14

Ogallala Aquifer (Southern High Plains)

Chinle Formation

Source: Cannon AFB GIS Database;
Topography data derived from 2005 LIDAR survey;
Vertical Accuracy: < 1 foot
Vertical Datum: NAVD88
Horizontal Accuracy: 0.37 feet
Horizontal Datum: UTM Zone 13N, WGS84
Contour Interval: 10 Feet

MWQ-2, MW-19, MWQ-20, & MAO2MW001D are exluded from the determination of flow in the upper Chinle Formation due to screen location in deeper confined portions of the Chinle Formation. MWQ-22 is excluded as it appears to stradle the Ogallala/Chinle contact.

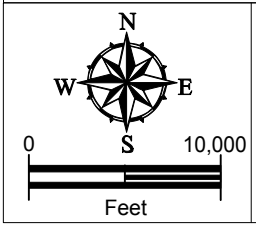


FIGURE 5
GROUNDWATER FLOW DIRECTION
OCTOBER 2014
CHINLE FORMATION
Melrose Air Force Range
Roosevelt and Curry Counties, New Mexico

Trinity Analysis & Development Corp.

TABLES

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TABLE 1-1
WELL CONSTRUCTION DETAILS
MELROSE AIR FORCE RANGE
ROOSEVELT AND CURRY COUNTIES, NEW MEXICO

	Well No.	Location (State Plane)[1]		Top of Casing[1]	Ground Surface	Well Type	Stickup from ground surface	Top of Screen	Bottom of Screen	Total Well Depth	Screen Length	Sump Length	Well I.D.	Well Material	Pump	Pump Intake Depth (ft. bls)	Formation Monitored
		Easting (ft)	Northing (ft)	ft NAVD	ft NAVD		ft	ft bls	ft bls	ft bls	ft	ft	inches				
Semiannual-SWMU GW Quality Well Network	M114MW001	706827.67	1203539.67	4327.21	4324.38	MW	2.83	159.39	179.39	179.72	20.00	0.33	4.0	PVC	DBP	176.72	Chinle
	M114MW002	706680.51	1203596.93	4328.11	4325.36	MW	2.75	162.11	182.11	182.44	20.00	0.33	4.0	PVC	DBP	179.44	Chinle
	M114MW003	706662.30	1203400.50	4329.62	4326.87	MW	2.75	159.62	179.62	179.95	20.00	0.33	4.0	PVC	DBP	176.95	Chinle
	M114MW004	706963.35	1203578.69	4324.99	4322.74	MW	2.25	161.42	181.42	181.75	20.00	0.33	4.0	PVC	DBP	178.75	Chinle
	MAO1MW001	702193.70	1205363.35	4344.68	4342.68	MW	2.00	141.56	161.56	161.89	20.00	0.33	4.0	PVC	DBP	158.89	Chinle
	MAO1MW002	702321.76	1205536.48	4343.58	4341.28	MW	2.30	145.31	155.31	155.64	10.00	0.33	4.0	PVC	DBP	152.64	Chinle
	MAO1MW003	702047.46	1205516.57	4345.33	4342.58	MW	2.75	139.36	159.36	159.69	20.00	0.33	4.0	PVC	DBP	156.69	Chinle
	MAO1MW004	702257.89	1205963.87	4342.91	4340.31	MW	2.60	140.08	160.08	160.41	20.00	0.33	4.0	PVC	DBP	157.41	Chinle
	MAO2MW001D	706656.33	1199306.69	4355.90	4353.19	MW	2.71	161.95	181.95	182.28	20.00	0.33	4.0	PVC	DBP	179.28	Chinle
	MWQ-24	689675.49	1180704.95	4644.95	4643.32	MW	1.63	42.80	62.80	63.12	20.00	0.32	4.0	PVC	DBP	60.12	Ogallala
Annual GW Quality Well Network	MWQ-2	720370.93	1196505.43	4293.72	4290.43	MW	3.29	220.64	230.64	235.54	10.00	4.90	2.0	PVC	DBP	225.71	Chinle
	MWQ-14	706871.58	1193064.56	4382.11	4380.77	MW	1.34	90.70	110.70	119.93	20.00	9.23	2.0	PVC	DBP	100.66	Chinle
	MWQ-18	694417.52	1215441.23	4290.17	4288.32	MW	1.85	119.00	139.00	152.00	20.00	13.00	2.0	PVC	DBP	128.15	Ogallala
	MWQ-19	694417.52	1215441.00	4290.13	4288.32	MW	1.81	200.70	221.07	226.00	20.00	4.30	2.0	PVC	DBP	210.19	Chinle
	MWQ-20	694399.63	1215417.04	4290.26	4288.01	MW	2.25	256.00	296.00	297.82	40.00	1.82	2.0	PVC	DBP	275.75	Chinle
	MWQ-21	720195.67	1217791.91	4209.26	4207.40	MW	1.86	40.70	60.70	64.40	20.00	3.70	2.0	PVC	DBP	54.14	Ogallala
	MWQ-22	720195.85	1217791.78	4209.12	4207.42	MW	1.70	90.70	150.70	153.65	60.00	2.95	2.0	PVC	DBP	120.30	Ogallala/Chinle
Water Level Only	MWQ-1	720367.74	1196501.97	4293.60	4290.53	MW	2.77	UNK	UNK	136.50	UNK	UNK	2.00	PVC	none	NA	UNK
	MWQ-8	692464.50	1197219.55	4469.71	4468.60	Supply	1.10	UNK	UNK	117.00	UNK	UNK	4.00	Steel	none	NA	UNK
	MWQ-12	712235.10	1172236.04	4405.77	4405.44	Supply	UNK	UNK	UNK	UNK	UNK	UNK	6.00	UNK	UNK	NA	UNK
	MWQ-13	736665.25	1180908.47	4280.51	4279.17	Supply	UNK	UNK	UNK	UNK	UNK	UNK	6.00	UNK	UNK	NA	UNK
	MWL-4	715033.16	1218237.91	4220.77	4217.47	Supply	3.20	UNK	UNK	59.80	UNK	UNK	4.00	Steel	none	NA	UNK
	MWL-5	714597.21	1224854.49	4196.32	4194.28	Supply	1.72	UNK	UNK	35.00	UNK	UNK	6.00	PVC	none	NA	UNK
	MWL-6	697695.65	1212918.66	4304.80	4303.52	Supply	1.22	UNK	UNK	136.00	UNK	UNK	6.00	Steel	none	NA	UNK
	MWL-7	702121.36	1216423.71	4258.43	4256.28	Supply	2.15	UNK	UNK	108.90	UNK	UNK	6.00	Steel	none	NA	UNK
	MWL-8	697907.88	1218188.04	4262.06	4259.52	Supply	2.28	UNK	UNK	114.00	UNK	UNK	6.00	Steel	DSP	UNK	UNK
	MWL-9	701865.19	1225896.35	4241.74	4239.60	Supply	UNK	UNK	UNK	49.60	UNK	UNK	6.00	Steel	none	NA	UNK
	MWL-10	689066.62	1187189.66	4573.45	4572.87	Supply	UNK	UNK	UNK	UNK	UNK	UNK	6.00	Steel	UNK	NA	UNK
	MWL-11	684248.92	1169768.42	4579.80	4578.04	Supply	0.83	UNK	UNK	UNK	UNK	UNK	6.00	Steel	UNK	NA	UNK
	MWL-12	707038.74	1169558.06	4446.85	4445.95	Supply	UNK	UNK	UNK	UNK	UNK	UNK	6.00	Steel	UNK	NA	UNK

[1] With the exception of MWQ-24 which was surveyed on September 16, 2013 all wells were surveyed or resurveyed by Lydick, Inc. between December 4, 2012 and January 2, 2013. Land surveying was completed using the New Mexico East State Plane North American Datum (NAD) 83 and North American Vertical Datum (NAVD) 88 (adjusted) in decimal feet. All horizontal coordinates were measured to the nearest fiftieth of a foot. All vertical coordinates were measured to the nearest tenth of a foot. bls = below land surface; DBP = dedicated bladder pump; DSP = dedicated submersible pump; ft = feet or foot; GW = groundwater; ID = inner diameter; MW = monitoring well; NA = not applicable; No.= number; PVC= polyvinyle chloride; UNK= unknown; ~=approximate

TABLE 1-3
INACTIVE WELLS
MELROSE AIR FORCE RANGE
ROOSEVELT AND CURRY COUNTIES, NEW MEXICO

Well No.	Location (State Plane)[1]		Top of Casing[1]	Well Type	Top of Screen	Bottom of Screen	Total Well Depth	Well I.D.	Well Material	Pump	Formation Monitored	Reason for Inactive Status
	Easting (ft)	Northing (ft)	ft NAVD		ft bls	ft bls	ft bls	inches				
MWQ-23	689359.37	1196710.78	4498.43	Supply	UNK	UNK	UNK	6.0	Steel	DSP	Ogallala	NMED Guidance[2]. MWQ-24 was installed August 2013 as a replacement.
MWQ-3	720584.37	1202483.91	4270.78	Supply	90.70	110.70	119.93	2.0	Steel	DSP	Ogallala	Unable to collect water levels due to electrical wires. NMED Guidance[2]
MWQ-4	718665.24	1224301.96	4202.69	Supply	119.00	139.00	152.00	2.0	Steel	DSP	Ogallala	Solar powered stock pond well. Unable to collect representative static water levels due to the DSP running. NMED Guidance[2]
MWQ-5	707559.27	1216915.19	4234.22	Supply	201.00	221.00	230.00	2.0	Steel	DSP	Ogallala	Old center pivot well. Unable to collect water levels. NMED Guidance[2]
MWQ-6	694796.10	1217958.83	4273.00	Supply	256.00	296.00	297.82	2.0	Steel	DSP	Ogallala	Unable to collect water levels due to electrical wires. NMED Guidance[2]
MWQ-7	688613.19	1218117.07	4262.68	Supply	41.00	61.00	66.30	2.0	Steel	DSP	Ogallala	Old center Pivot well. Plug rusted in-place. NMED Guidance[2]
MWQ-9	696653.62	1186440.97	4490.64	Supply	UNK	UNK	UNK	~4 ft	none	none	UNK	Hand dug well. This well is dry.
MWQ-10	689875.24	1180475.78	4642.32	Supply	90.70	150.70	153.65	2.0	Steel	DSP	Ogallala	USGS previously lost water level tape in this well. NMED Guidance[2]
MWQ-11	693783.78	1175090.62	4666.10	Supply	UNK	UNK	UNK	6.0	Steel	DSP	Ogallala	Unable to collect water levels due to electrical wires.
MWL-1	738425.62	1196901.96	4226.02	Supply	UNK	UNK	NA	6.0	Steel	DSP	Ogallala	Unable to collect water levels due to electrical wires.
MWL-2	715905.50	1201457.72	4291.95	Supply	UNK	UNK	NA	UNK	UNK	UNK	Ogallala	Located in Impact Area. No access.
MWL-3	714515.51	1213337.34	4226.98	Supply	UNK	UNK	NA	UNK	UNK	UNK	Ogallala	Located in Impact Area. No access.
M117MW001	707165.34	1197940.69	4359.75	MW	UNK	UNK	~50	4.0	PVC	none	Ogallala	Abandoned 10-5-2011
M117MW002	707316.92	1197989.26	4357.67	MW	UNK	UNK	~50	4.0	PVC	none	Ogallala	Abandoned 10-5-2011
M117MW003	707217.53	1198339.13	4355.55	MW	UNK	UNK	~50	4.0	PVC	none	Ogallala	Abandoned 10-5-2011
M117MW004	707317.84	1198489.29	4353.88	MW	UNK	UNK	~50	4.0	PVC	none	Ogallala	Abandoned 10-5-2011
MAO2MW001S	706662.83	1199311.35	4355.78	MW	UNK	UNK	49.55	4.0	PVC	none	Ogallala	Abandoned 10-5-2011
MAO3MW001	707170.57	1199036.28	4350.11	MW	UNK	UNK	~50	4.0	PVC	none	Ogallala	Abandoned 10-5-2011

[1] With the exception of the abandoned wells, all wells were surveyed or resurveyed by Lydick, Inc. between December 4, 2012 and January 2, 2013. Land surveying was completed using the New Mexico East State Plane North American Datum (NAD) 83 and North American Vertical Datum (NAVD) 88 (adjusted) in decimal feet. All horizontal coordinates were measured to the nearest fiftieth of a foot. All vertical coordinates were measured to the nearest tenth of a foot. [2] When NMED provided a review of the *Final Report Initial Baseline Groundater Monitoring, Melrose Air Force Range, New Mexico, June 2009 (URS, 2009),* NMED stated *"NMED discourages including stock wells with steel casings in the Groundwater Quality Well Network, e.g., MWL-6, MWQ-4, MWQ-5, MWQ-6, MWQ-7, and MWQ-8..."* bls = below land surface; DSP = dedicated submersible pump; ft = feet or foot; MW = monitoring well; NA = not applicable; No. = number; NMED = New Mexico Environment Department; PVC = polyvinyl chloride; UNK = unknown; USGS = United States Geological Survey

APPENDIX A
Field Forms

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GROUNDWATER SAMPLING LOG

☐ SYSTEM ON ☐ SYSTEM OFF ☐ NOT APPLICABLE (NO SYSTEM)

SITE NAME:	SITE LOCATION:	DATE:

WELL NO:	SAMPLE ID:	FREE PRODUCT: Y N DEPTH TO PRODUCT (ft BTOC):	FIELD DUPLICATE: Y N DUPLICATE ID:

PURGING DATA

WELL DIAMETER (inches):	TUBING DIAMETER (inches):	WELL SCREEN INTERVAL DEPTH: feet to feet	STATIC DEPTH TO WATER (feet):	PURGE PUMP TYPE OR BAILER:

WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH – STATIC DEPTH TO WATER) x WELL CAPACITY
(only fill out if applicable)
= (feet – feet) x gallons/foot = gallons

EQUIPMENT VOLUME PURGE: 1 EQUIPMENT VOL. = PUMP VOLUME + (TUBING CAPACITY x TUBING LENGTH) + FLOW CELL VOLUME
(only fill out if applicable)
= gallons + (gallons/foot x feet) + gallons = gallons

INITIAL PUMP OR TUBING DEPTH IN WELL (feet):	FINAL PUMP OR TUBING DEPTH IN WELL (feet):	PURGING INITIATED AT:	PURGING ENDED AT:	TOTAL VOLUME PURGED (gallons):

Time	Volume Purged (gallons)	Cum. Volume Purged (gallons)	Purge Rate (gpm)	Depth to Water (ft BTOC)	pH (SU)	Temp. (°C)	Spec. Cond. (mS/cm)	Dissolved Oxygen (mg/L)	Salinity (‰)	ORP (mV)	Color/ Odor (describe)	Turbidity (NTUs)

WELL CAPACITY (gal/ft): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06; **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6"** = 1.47; **12"** = 5.88
TUBING INSIDE DIA. CAPACITY (gal/ft): **1/8"** = 0.0006; **3/16"** = 0.0014; **1/4"** = 0.0026; **5/16"** = 0.004; **3/8"** = 0.006; **1/2"** = 0.010; **5/8"** = 0.016

PURGING EQUIPMENT CODES: **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **PP =** Peristaltic Pump; **O** = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION:	SAMPLER(S) SIGNATURE(S):	SAMPLE TIME:

PUMP OR TUBING DEPTH IN WELL (feet):	TUBING MATERIAL CODE:	FIELD-FILTERED: Y N Filtration Equipment Type:	FILTER SIZE: _____ µm

FIELD DECONTAMINATION: PUMP Y N TUBING Y N (replaced)

SAMPLE CONTAINER SPECIFICATION				INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
# CONTAINERS	MATERIAL CODE	VOLUME	PRESERVATIVE USED			

FIELD EQUIPMENT IDENTIFICATION

H20 QUALITY PARAMETER	
Model:	SN#:
TURBIDIMETER	
Model:	SN#:
OTHER	

REMARKS:

MATERIAL CODES: **AG** = Amber Glass; **CG** = Clear Glass; **PE** = Polyethylene; **PP** = Polypropylene; **S** = Silicone; **T** = Teflon; **O** = Other (Specify)

SAMPLING EQUIPMENT CODES: **APP** = After Peristaltic Pump; **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **RFPP** = Reverse Flow Peristaltic Pump; **SM** = Straw Method (Tubing Gravity Drain); **O** = Other (Specify)

NOTES:

☐ well needs repair_____ ☐ needs well tag _____ ☐ locking cap: _____ ☐ other comment: _____

☐ DI Water Lot # _____ ☐ MS / MSD _____ ☐ Equip blk _____ ☐ Ambient blk _____ ☐ Trip blk _____

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Environmental & Engineering Services

Page _____ of _____

Project Number: _____

Chain of Custody Number (1): _____

Chain of Custody and Analytical Request

Project Name / Site Name:

Facility:

Client Name:

Project Manager:

Collected by:

Turn Around Time

- 24 Hour ☐
- 7 Day ☐
- Standard ☐
- Other ☐

Field Sample ID (30 Characters Max)	ERPIMS LOCID (15 Characters Max)	Date Collected (dd-mm-yyyy)	Time Collected (Military) (hhmm)	Sample Depth (beginning - ending)	Sample Code (2)	Sample Number (3)	Sample Matrix (4)	Sample Method (5)	Number of Containers									Sampler's Initals	Ambient Blank Lot Control Number	Equipment Blank Lot Control Number	Trip Blank Lot Control Number	Cooler ID (Alphabetical Notation)
				-																		
				-																		
				-																		
				-																		
				-																		
				-																		
				-																		
				-																		
				-																		
				-																		
				-																		

Comments:

Custody Transfers Prior to Receipt by Laboratory

Relinquished By (Signed)	Date	Time	Received by (Signed)	Date	Time
1.			1.		
2.			2.		
3.			3.		

Sample Delivery Details / Laboratory Receipt

Delivered Directly to Lab: _____ Shipped: No.: _____

Method of Shipment: _____ Airbill Number: _____

Analytical Lab: _____ Delivery Location: _____

Lab Recipient: _____ Delivery Date/Time: _____

1.) Chain of Custody Number = site name (e.g., SS-125) and then date (yymmdd) collected + custody number (e.g. **SS1251207201**)…July 20, 2012. (12 Characters Max; No Dashes)

2.) Sample Type Codes: **N** = Normal Sample, **TB** = Trip Blank (-c) Sample, **FD** = Field Duplicate (-a) Samples, **FR** = Field Replicate (-b) Samples, **EB** = Equipment Blank (-d) Samples, **MS** = Matrix Spike (-ms), **SD** = Matrix Spike Duplicate (-sd), **AB** = Ambient Blank (-e)

3.) Sample Number: Unique sample number collected from a particular location per day. (e.g. Groundwater sample collected from MW-01 on 07/20/12 = 1, if sampled again on 07/20/12 = 2, etc.)

4.) Matrix Codes: **GS** = Soil Gas, **WG** = Ground Water , **WS** = Surface Water **SO** = Soil, **SE** = Sediment, **SL** = Sludge, **SS**= Suface Soil Samples, **WQ** = Aqueous Blank Samples (trip, equipment, ambient, etc.), **SQ**= Soil Blanks

5.) Sample Method Codes: **CS** = Compsite Sample, **E2** = Elec. Submersible Pump (1982 +), **G** = Grab, **H** = Hollow Stem Auger, **PP** = Peristaltic Pump, **W** = Swab or Wipe. (See handout for more methods)

6.) Sample Analysis Requested: Analytical method requested and number of containers provided for each.

7.) Quality assurance samples are assigned by date and the number (ddmmyynn) of the associated QC sample (01, 02, etc). (E.g., The first equipment blank, trip blank, or ambient blank collected on July 20, 2012 in association with samples on the COC will be designated **20071201** in the Blank Lot Control Number field).

NOTES: Trip Blanks shall correspond to the first well sampled with VOCs, for example: ST069-MW-08S-c. ERPIMS LOCID for TB, EB and AB are designated as **FIELDQC** samples.

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ANALYSIS & DEVELOPMENT CORP.
Environmental & Engineering Services

WATER-LEVEL DATA SUMMARY

Project Name/Number	**Date**
	Field Personnel #1
Site Name	**Field Personnel #2**
Client	**Field Personnel #3**
Survey Datum (NGVD)	**Weather (previous 24 hours)**
Measuring Device	

Well Number	Time (hhmm)	Measuring Point		Depth to Water (ft, TOC)	Elevation of Water (ft, NGVD)
		Description	Elevation (ft, NGVD)		

Notes: NGVD = National Geodetic Vertical Datum
TOC = Top of Well Casing

Comments/Observations

APPENDIX B
Dedicated Bladder Pump Diagram

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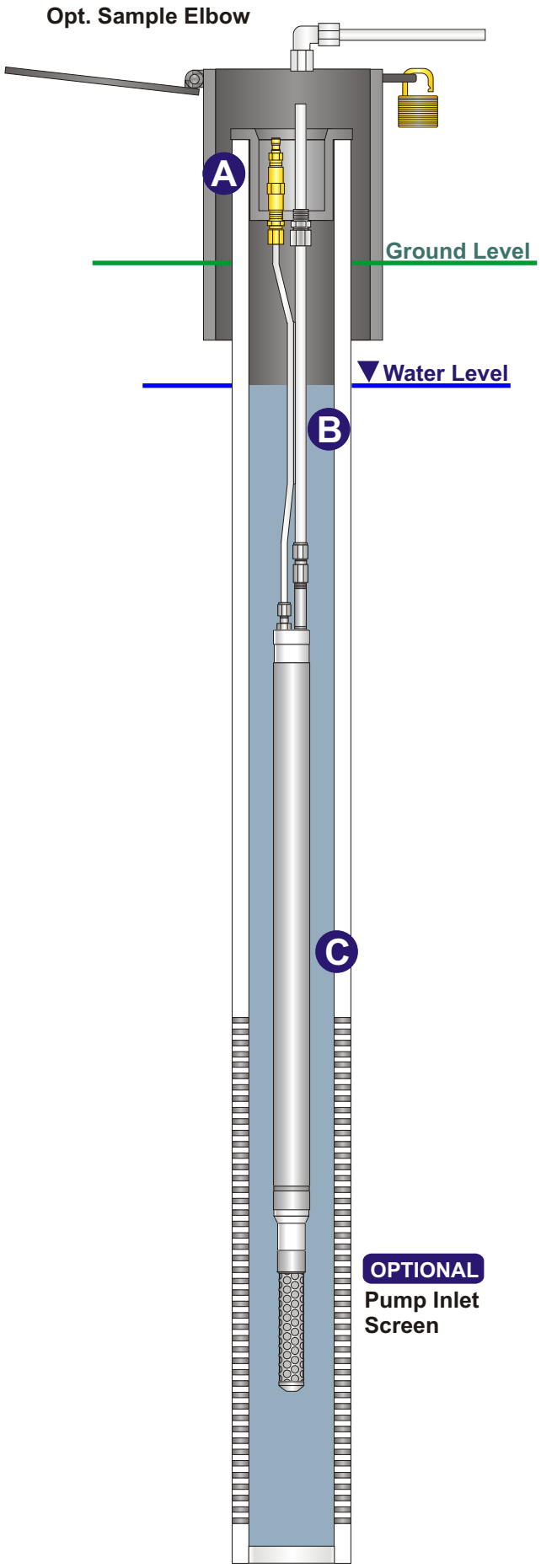
WELL WIZARD®
Dedicated Monitoring Systems

SYSTEM "A" Bladder Pump Only



System Components

- **A** Well Cap
- **B** Pump Tubing
- **C** Pump

Options:

Pump Inlet Screen

REV. 8-25-04

TRINITY
ANALYSIS & DEVELOPMENT CORP.
Environmental & Engineering Services

1002 N. Eglin Parkway
Shalimar, FL 32579
Office: (850) 613-6800
Fax: (850) 613-6764

February 26, 2015

Ms. Laura Peters
ERP Manager
27 SOCES/CEIER
506 N Air Commando Way
Cannon AFB, NM 88103-5003

RE: **Response to New Mexico Environment Department Comments**
Notice of Disapproval (*Dated February 16, 2015***)**
Groundwater Monitoring Field Sampling Plan
Melrose Air Force Range, New Mexico
USACE Contract No.: W912PP-13-C-0033, Task Order 001

Dear Ms. Peters,

The New Mexico Environment Department (NMED) reviewed the October 2014 Groundwater Monitoring Field Sampling Plan, Melrose Air Force Range, Roosevelt and Curry Counties, New Mexico and issued a Notice of Disapproval (NOD) on February 16, 2015. The document was reviewed by Ms. Naomi Davidson and signed by Mr. John Kieling, Bureau Chief, Hazardous Waste Bureau.

A copy of the NOD is attached for your convenience along with a Comment/Response Matrix and an electronic redline-strikeout version of the Work Plan that shows where all changes were made to the Work Plan. Upon approval from NMED, TRINITY will produce/deliver hard copies of the approved Groundwater Monitoring Field Sampling Plan. If you have any questions or need further assistance, please do not hesitate to contact me at 850-613-6800.

Respectfully,
TRINITY Analysis & Development Corp.

Jonathan Kramer
Geologist/Project Manager

Attachment

Distribution List

Recipient	Hard Copies	Electronic Copies
Ms. Laura Peters ERP Manager 27 SOCES/ CEIER 506 N. Air Commando Way Cannon AFB, NM 88103-5003	4	4
Mr. John McBee Project Manager Albuquerque District, Corps of Engineers 4101 Jefferson Plaza, NE Albuquerque, NM 87109-3435	1	1
Trinity Analysis & Development Corp. 1002 N. Eglin Parkway Shalimar, Florida 32579	0	1

NEW MEXICO ENVIRONMENT DEPARTMENT

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RYAN FLYNN
Cabinet Secretary
BUTCH TONGATE
Deputy Secretary

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

February 16, 2015

Heather L. Buono, Colonel
Commander, 27th Special Operations Mission Support Group
27 SOMSG/CC
110 E. Alison Avenue, Suite 1098
Cannon AFB, NM 88103

RE: DISAPPROVAL
GROUNDWATER MONITORING FIELD SAMPLING PLAN
MELROSE AIR FORCE RANGE, NEW MEXICO
EPA ID # NM7572124454
HWB-MELR-14-001

Dear Col. Buono:

The New Mexico Environment Department (NMED) has received the Melrose Air Force Range (Permittee) *Groundwater Monitoring Field Sampling Plan, Melrose Air Force Range, Roosevelt and Curry Counties, New Mexico* (GWFSP) dated October 2014. NMED has reviewed the GWFSP and hereby issues this Disapproval with the following comments.

Section 1.2, Site Description and History, page 1-2

1. The SWMUs are listed rather than described in this section, with the exception of Site ST-506. Include brief descriptions of all SWMUs and include designations for all monitoring wells associated with each SWMU. Include a figure depicting all of the SWMUs.

Section 1.3, Project Description Objective, page 1-3

2. There are a number of wells at the Facility that are not included in the monitoring plan. Some of these wells have been plugged and abandoned; others have been used in previous monitoring events but for various reasons will not be sampled under the current monitoring work plan. These wells include MWL-1, MWL-2, MWL-3, MWQ-4, MWQ-5, MWQ-6, MWQ-7, MWQ-10, MWQ-11, MWQ-23, M117MW-001 through -004, MA02MW001S, and MA03MW001. Describe all wells at the facility, and list the reason(s) why each of the wells

is not included in the work plan; this may be presented in the form of a table, if desired. Add all wells to Figure 1-2. Existing wells that will not be sampled must be identified using a different color or symbol than wells that will be sampled or wells that have been plugged and abandoned.

Section 1.4, Geology/Hydrogeology, Page 1-3

3. The Permittee must include a localized potentiometric surface map showing groundwater flow direction and groundwater elevations in each well from the most recent sampling event.

Section 2.1, Water Level Measurements, Page 2-1

4. The Permittee states, "The depth to groundwater will be measured from the top of well casing to the nearest 0.01 foot and always from the same reference point or survey mark on the well casing. If there is no reference mark, the measurement will be from the north side of the casing." The Permittee must collect all measurements from the highest point on the well casing rather than the north side if there is no reference mark. Revise the GWFSP accordingly. A similar comment was acknowledged by the Permittee in the response to NMED comments to the May 2011 work plan.

5. Section 2.1 has no description of the proposed method to collect groundwater level measurements from wells containing dedicated pumps. Table 1-1 indicates that all wells on the groundwater sampling list have dedicated bladder pumps, and that several of the wells on the "water level only" list may contain a pump, as they are listed as unknown. Additionally, it is not clear whether the wells used only for water level measurements are accessible for that purpose, and whether they are closed, locked, or otherwise protected from damage. Describe the accessibility of each well and how water levels will be measured in wells containing dedicated pumps.

Section 2.3.1, Sample Containers and Preservation Techniques, Page 2-3

6. Table 2-3 states that unpreserved Nitrite/Nitrate samples have a holding time of 48 hours. Describe how time constraints will be managed in order to allow the lab enough time to perform a Nitrite/Nitrate analysis within the holding time. If the short holding time requirement cannot be met, the Permittee could propose to add sulfuric acid as a preservative to extend the holding time.

Table 1-1

7. In Table 1-1, ensure consistency of significant digits throughout the table, including for the Easting, Northing, Top of Casing, and Ground Surface columns.

8. In Table 1-1, the Pump column has "DSP" for MWL-8, which is undefined. If this is a typo, correct it; otherwise, define DSP.

9. In Table 1-1, NMED is assuming the notation "bls" means below land surface; however, it must be defined.

Appendix A, Field Forms

10. In Appendix A, Groundwater Sampling Log, one of the field parameters listed is Salinity ‰. Either explain how this parameter will be measured, remove this column from the form, or explain that salinity will not be measured and that the column will be left blank.

11. In Appendix A, Groundwater Sampling Log, Depth to Water is in the fifth column. Explain how depth to water will be measured during well purging.

A revised groundwater monitoring Work Plan that corrects all of the deficiencies noted in this Disapproval must be submitted to NMED no later than **April 16, 2015**. The revised Work Plan must be accompanied by a response letter that details where the Disapproval comments were addressed that cross-references NMED's numbered comments. The Permittee must also submit an electronic redline-strikeout version of the Work Plan that shows where all changes were made to the Work Plan.

If you have any questions regarding this letter, please contact Naomi Davidson at (505) 476-6022.

Sincerely,

John E. Kieling
Chief
Hazardous Waste Bureau

cc: N. Davidson, NMED HWB
N. Dhawan, NMED HWB
D. Cobrain, NMED HWB
B. Wear, NMED HWB
B. Chavez, CAFB
R. Lancaster, CAFB
L. Peters, CAFB

File: MELR 2014 and Reading, Groundwater Monitoring Field Sampling Plan

Comment/Response Matrix
Groundwater Monitoring Field Sampling Plan
Melrose Air Force Range

NMED		TRINITY		
No.	**Comment**	**Response**	**Page**	**Section (Location)**
1	*The SWMUs are listed rather than described in this section, with the exception of Site ST-506. Include brief descriptions of all SWMUs and include designations for all monitoring wells associated with each SWMU. Include a figure depicting all of the SWMUs.*	TRINITY added brief descriptions of all SWMUs in Section 1.2.1 and added Figure 3, Semiannual SWMU Monitoring Well Network Locations. TRINITY updated Abbreviations and Acronyms and Works Cited.	1-3 through 1-6	Section 1.2.1
			Figure 3	
2	*There are a number of wells at the Facility that are not included in the monitoring plan. Some of these wells have been plugged and abandoned; others have been used in previous monitoring events but for various reasons will not be sampled under the current monitoring work plan. These wells include MWL-1, MWL-2, MWL-3, MWQ-4, MWQ-5, MWQ-6, MWQ-7, MWQ-10, MWQ-11, MWQ-23, M117MW-001 through -004, MA02MW001S, and MA03MW001. Describe all wells at the facility and list reason(s) why each of the wells is not included in the work plan; this may be presented in the form of a table, if desired. Add all wells to Figure 1-2. Existing wells that will not be sampled must be identified using a different color or symbol than wells that twill be sampled or wells that have been plugged and abandoned.*	TRINITY added Figure 2, Annual Monitoring Well Network and Figure 3, Semiannual SWMU Monitoring Well Network Locations. Existing wells that are included in this Field Sampling Plan (FSP) are identified with a unique symbol on Figure 2. Inactive wells not included in this FSP are posted on Figure 2 and 3 with unique symbols. Abandoned wells are identified with a unique symbol on Figure 2 and Figure 3. Added Table 1-3, Inactive Wells. Table 1-3 describes the reasoning for not including the inactive wells in this FSP. TRINITY also added Section 1.3 to the document to further address the inactive wells.	1-6	Section 1.3
			Figure 2 and Figure 3 and Table 1-3	
3	*The Permittee must include a localized potentiometric surface map showing groundwater flow direction and groundwater elevations in each well from the most recent sampling event.*	TRINITY added Section 1.5.1 Groundwater Elevation, Gradient, and Flow Velocity. TRINITY added two groundwater flow maps: Figure 4 Groundwater Flow Direction, October 2014, Ogallala Aquifer (Southern High Plains Aquifer), and Figure 5 Groundwater Flow Direction, October 2014, Chinle Formation. These flow maps represent the most recent sampling event.	1-7 and 1-8	Section 1.5.1
			Figure 4 and Figure 5	
4	*The Permittee states, "The depth to groundwater will be measured from the top of well casing to the nearest 0.01 foot and always from the same reference point or survey mark on the well casing. If there is no reference mark, the measurement will be from the north side of the casing." The Permittee must collect all measurements from the highest point on the well casing rather than the north side if there is no reference mark. Revise the GWFSP accordingly. A similar comment was acknowledged by the Permittee in the response to NMED comments to the May 2011 work plan.*	Acknowledged. Added "...*highest point of*... " Page 2-1, Section 2-1, second paragraph, fourth sentence	2-1	Section 2.1 second paragraph, fourth sentence

Comment/Response Matrix
Groundwater Monitoring Field Sampling Plan
Melrose Air Force Range

NMED		TRINITY		
No.	**Comment**	**Response**	**Page**	**Section (Location)**
5	*Section 2.1 has no description of the proposed method to collect groundwater level measurements from wells containing dedicated pumps. Table 1-1 indicates that all wells on the groundwater sampling list have dedicated bladder pumps, and that several of the wells on the "water level only" list may contain a pump, as they are listed as unknown. Additionally, it is not clear whether the wells used only for water level measurements are accessible for that purpose, and whether they are closed, locked, or otherwise protected from damage. Described the accessibility of each well and how water levels will be measured in wells containing dedicated pumps.*	Added the following language to Page 2-1, Paragraph 1, "*All monitoring wells in the Semiannual-SWMU and Annual Groundwater Quality Well Networks are locked and require a key to be accessed. Keys may be obtained from Cannon AFB personnel. The Water Level Only wells are not locked and are accessible without a key. Water levels collected from monitoring wells with dedicated bladder pumps will be collected by lowering the water level indicator through the water level measurement port located adjacent to the discharge tube. The dedicated bladder pump systems are designed so that a water level can be measured from the survey reference point or highest point on the casing of the monitoring well. Although some water level only wells have dedicated submersible pumps, or construction is unknown, these wells are accessible and water levels can be measured from the top of casing.*"	2-1	Section 2.1
6	*Table 2-3 states that unpreserved Nitrite/Nitrate samples have a holding time of 48 hours. Describe how time constraints will be managed in order to allow the lab enough time to perform a Nitrite/Nitrate analysis within the holding time. If the short holding time requirement cannot be met, the Permittee could propose to add sulfuric acid as a preservative to extend the holding time.*	TRINITY added language in Section 2.4.3 advising that sample coolers must be shipped at the end of each day by overnight commercial courier to the laboratory to meet hold time requirements.	2-5	Section 2.4.3
7	*In Table 1-1, ensure consistency of significant digits throughout the table, including for the Easting, Northing, Top of Casing, and Ground Surface Columns.*	Corrected significant digits throughout the table.	Table 1-1	
8	*In Table 1-1, the Pump Column has "DSP" for MWL-8, which is undefined. If this is a typo, correct it; otherwise, define DSP.*	Defined Dedicated Submersible Pump (DSP) in notes.	Table 1-1	
9	*In Table 1-1, NMED is assuming the notation "bls" means below land surface; however, it must be defined.*	Defined below land surface (bls) in notes.	Table 1-1	
10	*In Appendix A, Groundwater Sampling Log, one of the field parameters listed is Salinity ‰. Either explain how this parameter will be measured, remove this Colum from the form, or explain that salinity will not be measured and that the column will be left blank.*	Added "*Salinity is a measurement based on temperature and conductivity and is calculated by the multi-parameter water quality meter.*" Section 2.2 Second paragraph, third sentence.	Appendix A 2-1	 Section 2.2 second paragraph
11	*In Appendix A, Groundwater Sampling Log, Depth to Water is in the fifth column. Explain how depth to water will be measured during purging.*	Added "*Drawdown will be measured during purging by lowering a water level indicator through the water level port located at the top of casing.*" Section 2.2 second Paragraph, fourth sentence.	Appendix A 2-1	 Section 2.2 second paragraph

Groundwater Monitoring
Field Sampling Plan
Melrose Air Force Range
Roosevelt and Curry Counties, New Mexico

Prepared For:
Cannon Air Force Base
Air Force Special Operations Command (AFSOC)
27th SOCES/CEANR
Cannon Air Force Base, NM 88103-5003

Prepared by
Trinity Analysis & Development Corp.
1002 North Eglin Parkway
Shalimar, FL 32579
(850) 613-6800

Under Contract To
United States Army Corps of Engineers (USACE)
Albuquerque District
4101 Jefferson Plaza, NE
Albuquerque, NM 87109-3435

Contract Number
W912PP-13-C-0033, Task Order 001

~~October 2014~~February 2015

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Certification Page

~~October 2014~~February 2015
Groundwater Monitoring
Field Sampling Plan
Melrose Air Force Range
Roosevelt and Curry Counties, New Mexico

Prepared For:
Cannon Air Force Base
Air Force Special Operations Command (AFSOC)
27th SOCES/CEANR
Cannon Air Force Base, NM 88103-5003~~Air Force Special Operations Command~~
~~*And*~~
~~**27th Special Operations Wing**~~

Prepared By:
Trinity Analysis & Development Corp.
1002 N. Eglin Parkway
Shalimar, FL 32579
(850) 613-6800

Under Contract To:
United States Army Corps of Engineers (USACE)
Albuquerque District

I hereby submit that this Groundwater Monitoring Field Sampling Plan, October 2014, for the Melrose Air Force Range was prepared by me.

02/26/2015

Jonathan M. Kramer
Geologist
Trinity Analysis & Development Corp.

Date

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Appendix A Field Forms
Appendix B Dedicated Bladder Pump Diagrams

Abbreviations and Acronyms

°C	Celsius
AFB	Air Force Base
AFCEC	Air Force Civil Engineer Center
AFSOC	Air Force Special Operations Command
AOC	Area of Concern
bls	below land surface
CEC	cation exchange capacity
COC	chain-of-custody
CZO	Operations Division
DO	dissolved oxygen
DoD	Department of Defense
DPT	direct-push technology
ELAP	Environmental Laboratory Accreditation Program
ERP	Environmental Restoration Program
FSP	Field Sampling Plan
GCAL	Gulf Coast Analytical Laboratories, Inc.
IATA	International Air Transport Association
IDW	investigation-derived waste
MAFR	Melrose Air Force Range
mL	milliliter
MS	matrix spike
MSD	matrix spike duplicate
mV	millivolts
NELAC	National Environmental Laboratory Accreditation Conference
NTU	nephelometric turbidity units
NMED	New Mexico Environment Department
ORP	oxidation reduction potential
PVC	polyvinyl chloride
QC	quality control
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
SOW	Special Operations Wing
SR	State Road
SWMU	Solid Waste Management Unit
TDS	total dissolved solids
TRINITY	Trinity Analysis & Development Corp.
USACE	U.S. Army Corps of Engineers

USDOT	U.S. Department of Transportation
UST	underground storage tank
UXO	unexploded ordnance
VOC	volatile organic compounds
µm	micron

1.0 Introduction

This Groundwater Monitoring Field Sampling Plan (FSP) for the Melrose Air Force Range (MAFR) has been prepared by Trinity Analysis & Development Corp. (TRINITY) on behalf of the Cannon Air Force Base (AFB) 27th Special Operations Wing (SOW) and Air Force Special Operations Command (AFSOC). The primary focus of this Groundwater Monitoring FSP is the annual and semiannual collection of groundwater samples.

TRINITY performed this work under contract to the U.S. Army Corps of Engineers (USACE), Albuquerque District, Contract W912PP-13-C-0033, Task Order 001. A work plan was previously prepared in general accordance with the USACE requirements for the preparation of sampling and analysis plans, EM200-1-3, February 1, 2001 (USACE, 2001). This FSP document was prepared for submission to the New Mexico Environment Department (NMED).

1.1 Project Background

In 1975, the Department of Defense (DoD) established the Environmental Restoration Program (ERP) to provide guidance and funding for the investigation and remediation of historical releases of hazardous substances, pollutants, or contaminants that pose toxicological risks at military installations that may have contaminated soil, groundwater, and/or surface water. Air Force Civil Engineer Center/Operations Division (AFCEC/CZO), in coordination with the Installation Management Flight, is responsible for oversight of the ERP sites at MAFR.

In accordance with a Resource Conservation and Recovery Act (RCRA) permit issued to Cannon AFB on December 30, 1994, an investigation of potential impacts that may have resulted from seven Solid Waste Management Units (SWMU) was conducted and included a Phase I RCRA Facility Investigation (RFI) for Melrose Air Force Range (Foster Wheeler, 1996) and a RCRA Facility Investigation Report Addendum (Foster Wheeler, 2003) both of which were completed and submitted to NMED. NMED reviewed the documents and provided a response dated February 1, 2006 which requested additional field investigation activities at MAFR.

On May 9, 2007, the Department of the Air Force requested deferral of additional work associated with the RFI requested by NMED for MAFR. The deferral was based on to the fact that the entire MAFR facility is an "*active bombing or test Range*." In a letter to Cannon AFB dated June 19, 2007, NMED approved deferment of additional work stating that "*…NMED will prepare a "corrective action-only" permit to be implemented once the Range is closed, transferring, or transferred*" (New Mexico Environment Department, 2007). When the Range is deactivated, additional assessment will likely be required.

1.2 Site Description and History

The MAFR is a bombing and air-to-ground gunnery Range under management of Cannon AFB within AFSOC. The MAFR is situated approximately eight miles southwest of the village of Melrose, and located predominately in Roosevelt County with a small parcel in Curry County, New Mexico (**Figures 1~~-1~~** and **~~1-~~2**). Access to the Range is achieved by traveling south from Melrose on New Mexico State Road (SR) 267 for approximately 9.3 miles, then west on Sundale Valley Road for approximately seven miles to the security gate.

During World War II, the area was used by the U.S. Army Air Corps (predecessor to the U.S. Air Force) for training. It has been continuously used by the U.S. Air Force since World War II. In 1952 the Range was expanded when the Air Force leased 7,771 acres of grassland for use as a

bombing and air-to-ground gunnery Range by the Tactical Air Command. Since 1952, the Range has been expanded several times including land purchases and leases and currently comprises 70,910 acres.

The Impact Area of the Range is located northeast of the physiographically prominent Mesa and consists of grasslands with a grid of access roads and bombing targets. The Impact Area is delineated by a historical boundary that previously delineated the extent of the entire Range (**Figure ~~1-~~22**). In 1990-91, the boundary of the Range was expanded through the acquisition of agricultural and Range land parcels on all sides. These parcels (leased lands) were part of Range property but were leased back to the prior owners for continued use as agricultural and Range land. Leaseholders used the unconfined aquifer for irrigation and livestock watering. On December 1, 2013, the leases were terminated for the safety of the lessee, thus discontinuing agricultural use on MAFR.

Live high-explosives-filled ordnance was used on the Range prior to 1969. Since then, practice bombs and inert full-scale bombs have been used at the Range. Practice bombs and inert bombs are known to contain only small explosive or pyrotechnic spotting charges. Additionally, live gun ammunition has been used continuously on the Range for target practice.

Over the years, portions of the MAFR have been used to dispose of a variety of military and industrial waste from MAFR and Cannon AFB. Wastes have included unexploded ordnance (UXO), exploded ordnance, scrap metal, paints, solvents, pesticides, herbicides, and putrescible waste. (Foster Wheeler, 1996; Foster Wheeler, 2003). MAFR currently has seven SWMUs located within its boundary (**Figure ~~1-~~22**). The SWMUs are described as follows:

- SWMU 114 – Expended Ordnance and Industrial Waste Burial Site (Motor Pool Trenches)
- SWMU 115 – Explosives-Contaminated Burial Site (Arroyo Burial Site)
- SWMU 117 – Domestic Waste Burial Site (Southeast of Main Building)
- SWMU 130 – World War II Cantonment Disposal Site (formerly Area of Concern (AOC) 1)
- SWMU 131 – Domestic Waste Burial Site (East of Fire Station; formerly AOC 2)
- SWMU 132 – Disposal/Burn Site (North Helicopter Pad; formerly AOC 3)
- SWMU 133 – Northwest Munitions Disposal Site (North Corner of Impact Area; formerly AOC 4)

Also located within the boundary of MAFR, adjacent to Building 3121, is Site ST-506. In November 1994, petroleum contaminated soil was discovered at the site during the excavation of two underground storage tanks (USTs). The USTs were associated with the former heating system at Building 3121 (United States Geological Survey, 1995). Monitoring well MAO2MW001D (SWMU-131) is located approximately 1500 feet to the northeast of ST-506; however, there is currently no groundwater monitoring associated with Site ST-506.

1.2.1 SWMU Descriptions & History

1.2.1.1 SWMU 114 – Expended Ordnance and Industrial Waste Burial Site

SWMU 114 is located in the southeast quarter of the southwest quarter of Section 15 and the northeast quarter of the northwest quarter of Section 22, Township 1 North, Range 30 East, in Roosevelt County, New Mexico (**Figure 3**). The site and surrounding area are flat with sparse desert scrub vegetation consisting of prairie grass and cactus.

According to historical RFI reports, the military used a series of eight unlined burial trenches at SWMU 114 to dispose of a variety of military and industrial waste from Melrose AFR and Cannon AFB. Trenches were approximately 20 to 40 feet in width, 100 to 200 feet in length and up to 40 feet in depth (Foster Wheeler, 1996; Foster Wheeler, 2003).

Exact dates and types of waste disposed at SWMU 114 are unknown. It is known, however, that between 1952 and 1962 drummed liquids were poured into the trenches and burned. Full drums of liquid, including possible unusable fuels, paints, sludge, and solvents may have also been placed in the trenches. For an unknown period of time, the military also disposed of an estimated 12,000 to 15,000 pounds per month of scrap metal from practice bombs and munitions in the trenches at SWMU 114 (Foster Wheeler, 1996; Foster Wheeler, 2003). According to the Phase I RCRA Facility Investigation for Melrose Air Force Range, Cannon Air Force Base, Clovis, New Mexico (Foster Wheeler, 1996) and a RCRA Facility Investigation Report Addendum for Melrose Bombing Range, Cannon Air Force Base, New Mexico (Foster Wheeler, 2003) the trenches at SWMU 114 were cleared of ordnance and have been backfilled and closed. However, one trench remains open.

According to historical RFI reports, four monitoring wells (M114MW001, M114MW002, MW114003, and M114MW004) were installed and sampled as part of the Phase I RFI. Groundwater at this location is present approximately 150 feet below land surface (bls). No organic compounds were detected above groundwater standards during the Phase I RFI. Elevated metals concentrations were attributed to high turbidity and natural conditions. Elevated anion concentrations were attributed to natural conditions. Migration of metals from the disposal site to groundwater was determined to be unlikely due to the high cation exchange capacity (CEC) of the surface and near surface soil and the alkaline nature of the formation. It was determined that groundwater at SWMU 114 has not been impacted by disposal activities at the site (Foster Wheeler, 1996; Foster Wheeler, 2003).

1.2.1.2 SWMU 115 – Explosives-Contaminated Burial Site (Arroyo Burial Site)

SWMU 115 is located in the northeast quarter of the northeast quarter of Section 33, Township 1 North, Range 30 East in Roosevelt County, New Mexico (**Figure 3**). The site lies within a small arroyo located in the south-central portion of Melrose AFR. According to historical RFI reports, SWMU 115 was used for the disposal and burial of UXO in 1989. UXO and other exploded ordnance were reportedly collected from the surrounding areas, pushed into the arroyo, and covered with a thin layer of soil. Storm water flows intermittently down the arroyo during heavy rains.

The ground surface at the site is relatively free of debris. The disposal area was 600 feet long, 15 to 20 feet wide, and 15 to 20 feet deep. The contents of SWMU 115 are believed to consist

entirely of UXO and other exploded ordnance, including 750-pound and 2,000-pound bombs covered with a thin layer of soil. Groundwater was reported present at approximately 25 to 30 feet bls. During the Phase I RFI, groundwater samples were collected using direct-push technology (DPT). No organics or explosives related compounds were detected in groundwater samples submitted for analysis. Elevated metals concentrations were attributed to elevated turbidity in the samples. It was determined that groundwater at SWMU 115 has not been impacted by disposal activities at the site (Foster Wheeler, 1996; Foster Wheeler, 2003).

1.2.1.3 SWMU 117 – Domestic Waste Burial Site (Southeast of Main Building)

SWMU 117 is located in the northeast quarter of the southwest quarter of Section 22, Township 1 North, Range 30 East, in Roosevelt County, New Mexico (**Figure 3**). This site is located southeast of the main control building at the Melrose AFR. The area is within a slight depression that receives storm water runoff from the surrounding area.

According to the historical RFI reports, this SWMU was formerly used to dispose of domestic waste from the control building, including such items as food waste and common household items. Other items possibly disposed in this area could include used oil and grease, solvents, batteries, pesticides, or herbicides (Foster Wheeler, 1996; Foster Wheeler, 2003). Disposal at the site appears to have begun circa 1973 as evident in aerial photographs. The area used for disposal at SWMU 117 was approximately 300 feet by 300 feet or approximately two acres. It is a closed site and currently covered by native grasses.

Groundwater was reportedly not encountered at a maximum depth of 182 feet during the Phase I RFI. The four borings were backfilled to the top of a potential confining layer (caliche) at approximately 41 feet bls with wells installed to intercept potential seasonal or perched groundwater. These four wells (M117MW001, M117MW002, M117MW003, and M117MW004) were historically dry and were abandoned at NMED's request (Trinity, 2013). Based on the lack of groundwater and the lack of significant contamination in soil samples it was concluded that contamination of groundwater at SWMU 117 was unlikely (Foster Wheeler, 1996; Foster Wheeler, 2003).

1.2.1.4 SWMU 130 – World War II Cantonment Disposal Site

SWMU 130 is located in the northeast quarter of Section 17, Township 1 North, Range 30 East, in Roosevelt County, New Mexico (**Figure 3**). SWMU 130 was formerly referred to as AOC 1. According to historical RFI reports, the military used SWMU 130 as a sanitary landfill during World War II for a cantonment area (temporary housing area for troops). No documentation exists for specific wastes disposed at the site; however, it is possible that the waste stream included all items from domestic wastes to motor pool waste, UXO, munitions, batteries, oil and fuels, etc. The exact location of the disposal site is unknown; however approximately 50 acres were investigated during the Phase I RFI. Groundwater was reportedly present approximately 140 to 145 feet bls at SWMU 130. Four monitoring wells (MAO1MW001, MAO1MW002, MAO1MW003, and MAO1MW004) were installed and sampled as part of the Phase I RFI. No organic compounds were detected and only one metal (thallium) was detected above applicable groundwater standards. The elevated thallium concentration was attributed to natural conditions (Foster Wheeler, 1996; Foster Wheeler, 2003).

1.2.1.5 SWMU 131 – Domestic Waste Burial Site (East of Fire Station)

SWMU 131 is located in the northwest quarter of the southwest quarter of Section 22, Township 1 North, Range 30 East, in Roosevelt County, New Mexico (**Figure 3**). SWMU 131 was formerly referred to as AOC 2. This site is east of the Melrose AFR Fire Station and consists of approximately 0.5 acres. According to historical RFI reports, SWMU 131 was used for disposal and/or burning of wastes; however, the type and volume of wastes is unknown (Foster Wheeler, 2003). The suspected waste stream possibly included spent fuels, motor oil, batteries, paints, pesticides, and metals in addition to domestic waste. Waste first appears to have been disposed of at SWMU 131 circa 1966.

Two monitoring wells, a shallow (MAO2MW001S) and deep (MAO2MW001D), were installed in the investigative borings to depths of 50 and 185 feet bls, respectively. MAO2MW001S was installed above a confining layer (caliche) to intercept seasonal or perched groundwater. This shallow well was historically dry and was abandoned at NMED's request (Trinity, 2013). Groundwater was reportedly present in the deep well at approximately 105 feet bls.

The deep groundwater monitoring well, MAO2MW001D, was sampled as part of the RFI. No organic analytes were detected in the groundwater during the Phase I RFI. Selenium and thallium were reported at concentrations above applicable groundwater standards; however, due to a lack of selenium or thallium in overlying soil samples it was determined that groundwater had not been impacted by SWMU 131 (Foster Wheeler, 1996; Foster Wheeler, 2003).

1.2.1.6 SWMU 132 – Disposal / Burn Site (North Helicopter Pad)

SWMU 132 is located in the southwest quarter of Section 22, Township 1 North, Range 30 East, in Roosevelt County, New Mexico (**Figure 3**). SWMU 132 was formerly referred to as AOC 3. This site is less than 0.5 acres located north of the former helicopter pad at the Melrose AFR operations area. SWMU 132 was reportedly used for burning and/or disposal of unknown wastes types and quantities. Possible wastes included domestic waste, motor oil, metals, and residue from burning. Waste first appears to have been disposed of at SWMU 132 circa 1973.

During the Phase I RFI no groundwater was encountered during drilling to a total depth of 182 feet bls. The boring was backfilled to the top of a potential confining layer (caliche) at approximately 50 feet bls to intercept seasonal or perched groundwater. Due to land-use (helicopter pad) MAO3MW001 was installed flush mount. The well was dry during the Phase I RFI (1996) and during the RFI Addendum (2003) and therefore could not be sampled. Based on the lack of groundwater this well was abandoned at NMED's request. Also due to the lack of groundwater, it was determined to not have been impacted by the presence of SWMU 132 (Foster Wheeler, 1996; Foster Wheeler, 2003).

1.2.1.7 SWMU 133 – NW Munitions Disposal Site (NW Corner of Impact Area)

SWMU 133 is located in the northwestern corner of the impact area. SWMU 133 was formerly referred to as AOC 4. This site is located in the east-central part of Section 17 with some overlap into Section 16, Township 1 North, Range 30 East in Roosevelt County, New Mexico (**Figure 3**). The site is flat with native scrub vegetation and areas free of vegetation. According to historical RFI reports, SWMU 133 was used from 1952 to 1960 for disposal of exploded ordnance and UXO.

Groundwater was reportedly present at approximately 112 to 127 feet bls. During the Phase I RFI, groundwater samples were collected from three of four borings using DPT. Groundwater was not encountered in one of the borings. No organics were detected in groundwater. Concentrations of several metals exceeded applicable groundwater standards. A pattern of increased concentrations of five of the metals from west to east across the site might suggest impacts from SWMU 133 or from naturally occurring lateral changes in bedrock (Foster Wheeler, 1996; Foster Wheeler, 2003). Permanent monitoring wells were not installed due to the location of SWMU 133 in an overflight approach route along the northern portion of the active Impact Area. In a letter to Cannon AFB dated June 19, 2007 NMED stated, that "…NMED will prepare a "corrective action-only" permit to be implemented once the range is closed, transferring, or transferred." (NMED, 2007). When the Range is deactivated additional assessment will likely be required.

1.3 Inactive Wells

There are several wells located on Melrose AFR that were included in previous monitoring plans. However, due to well abandonment, inaccessibility, or well construction, these wells are not included in this FSP. The inactive wells are posted on **Figures 2** and **3**. These wells are further described in **Table 1-3**.

~~1.3~~1.4 Project Description Objective

As an interim measure until the SWMUs are fully investigated, two separate monitoring well networks have been established and are periodically sampled, as follows:

- The Semiannual SWMU Groundwater Monitoring Network currently consists of 10 wells (**Table 1-1** and **Figure ~~1-2~~3**). They are to be sampled in the spring (typically in April) and fall (typically in October). It should be noted that the schedule is highly dependent on access to the Range and that it is occasionally necessary to shift the schedule by several weeks to accommodate military training exercises/activities. All scheduling is coordinated by the Cannon AFB Environmental Restoration Manager. The current Environmental Restoration Manager is Ms. Laura Peters; she can be reached at 575-784-0491.
- The Annual Groundwater Monitoring Network currently consists of seven wells and is sampled in the spring in conjunction with the Semiannual SWMU Groundwater Monitoring Network (**Table 1-1** and **Figure ~~1-2~~2**).

The water quality sampling and reporting described in this FSP is being performed to monitor for the presence or absence of potential contaminants, gauge the effectiveness of the Semiannual SWMU Groundwater Monitoring Network and the Annual Groundwater Monitoring Network, provide the foundation for correction or improvement to the monitoring program as necessary, and to document the site's influence on groundwater quality, if any.

Field activities associated with the water quality monitoring program will include the following:

- Water level measurements within each well. In addition to the Semiannual and Annual Groundwater Monitoring Network, ~~14~~ 13 additional wells are utilized for the collection of groundwater elevation only (**Table 1-1** and **Figure ~~1-2~~2**). Additional discussion concerning the groundwater level measurements is included in **Section 2.1** of this report.

- Groundwater sampling. Additional discussion concerning the groundwater sampling is included in **Section 2.2** through **Section 2.5**.
- Management of investigative derived waste (IDW) which is discussed in more detail in **Section 2.6**.

~~1.4~~1.5 Geology/Hydrogeology

The stratigraphic units of interest at MAFR are the Chinle, Ogallala, and Blackwater Draw Formations. In eastern New Mexico, the Ogallala and Blackwater Draw Formations form the Southern High Plains Aquifer, which is part of a larger aquifer system extending from eastern New Mexico and Colorado into Texas, Oklahoma, Kansas, Nebraska, and South Dakota (Langman, 2004). The Chinle Formation (Triassic Period), the lowermost unit of interest, underlies the unconfined Southern High Plains Aquifer and is composed of red shales with interbedded sands (commonly referred to locally as "*redbeds*") deposited by low-energy streams in floodplains and deltas. The top of the Chinle Formation is marked by an erosional unconformity with up to several hundred feet of relief (Lee Wan and Associates, Inc., 1990). The Ogallala Formation (Tertiary Period) is the uppermost formation for the central and southern parts of MAFR and it lies unconformably over the upper unit of the Chinle Formation. The Blackwater Draw Formation (Quaternary Period) overlies the Ogallala Formation in the northern part of MAFR.

MAFR is located near the western margin of the Southern High Plains Aquifer of which the Ogallala Formation is the primary water bearing unit. The Southern High Plains Aquifer forms the primary aquifer for irrigation, livestock, and potable water in the vicinity of MAFR and throughout the eastern New Mexico region. In addition, there are several localized shallow water-bearing zones across the region used for irrigation purposes. No deeper aquifers are known to be in use in the vicinity of MAFR, because of poor water quality. Within New Mexico, groundwater in the Southern High Plains Aquifer generally flows eastward (Hart, 1985), which is considered the overall direction of regional flow in the unconfined aquifer.

The Southern High Plains Aquifer was mapped by Hart as unsaturated or saturated only in isolated channels in the area occupied by the southern and western portions of MAFR and as saturated in the northern portion (Hart, 1985). Hydrogeologically, the Chinle Formation provides regional confinement to the Southern High Plains Aquifer at its base, generally forming an impermeable aquitard (Fallin, 1989). For a more detailed discussion of the regional and site specific geology and hydrogeology please see the *April 2014 Geophysical and Downhole Camera Investigation Report, Melrose Air Force Range, Roosevelt and Curry Counties, New Mexico* (Trinity Analysis & Development Corp., 2014a).

1.5.1 Groundwater Elevation, Gradient, and Flow Velocity

Based on the findings of the Geophysical and Downhole Camera Investigation Report, Melrose Air Force Range, Roosevelt and Curry Counties, New Mexico (Trinity Analysis & Development Corp., 2014) monitoring wells MWQ-18, MWQ-21, and MWQ-24 are the only wells indicated to target the Ogallala Formation (Southern High Plains Aquifer). MWQ-22 is indicated to straddle the Ogallala/Chinle contact, and thus has not been included in groundwater flow determination maps. The majority of monitoring wells are indicated to target the Chinle Formation. Some wells (MWQ-2, -19, -20 and MA02MW001D) are set quite deep into the Chinle (50-120 feet). Water levels in these wells are measured at 15 to 55 feet above the

Ogallala/Chinle contact and some measure of confinement is likely, and thus have not been included in groundwater flow determination maps.

Monitoring wells around SWMU's 114 and 130 and MWQ-14 appear to target Chinle sediments at depths of approximately 25 to 45 feet below its contact with the Ogallala. Water levels in these wells are measured at altitudes below the contact and may represent 'first available water' at those locales. Two groundwater flow maps are presented as part of this FSP:

- **Figure 4** - Groundwater flow direction based on data collected by Trinity between October 20 and October 23, 2014 for the Ogallala Formation (Southern High Plains Aquifer).
- **Figure 5** - Groundwater flow direction based on data collected by Trinity between October 20 and 23, 2014 for the upper portion of the Chinle Formation.

Water-level contours for the Southern High Plains Aquifer indicate flow to be to the northeast; however, only three wells are screened in the Ogallala Formation. Several old windmill-driven wells have been utilized for the collection of groundwater elevations and in the past have been utilized for the determination of groundwater flow direction; however, it is not known if these wells are screened in the Chinle or Ogallala Formation, and thus have not been included in groundwater flow determination maps.

~~1.5~~1.6 Potential Site Contaminants of Concern

Based on historical investigations previously conducted at MAFR (Foster Wheeler, 1996; Foster Wheeler, 2003), and the previously approved work plan (Tidewater, Inc. 2010) the following analytes were identified as potential analytes of concern:

- Cyanide
- Explosives
- Hexavalent Chromium
- Metals
- Nitrate and Nitrite
- Perchlorate
- volatile organic compounds (VOCs)

Additional indicator parameters include:

- Alkalinity
- Chloride
- Sulfate
- total dissolved solids (TDS)
- Field Parameters

~~1.6~~1.7 Applicable Regulations/Standards

Applicable regulations and/or standards that pertain to activities associated with this FSP are detailed below:

- Sampling methods were developed in general accordance with Use of Low-Flow and Other Non-Traditional Sampling Techniques for RCRA Compliant Groundwater Monitoring (New Mexico Environment Department, 2001).
- The ~~2012~~ 2014 NMED Risk Assessment Guidance for Site Investigations and Remediation (New Mexico Environment Department, ~~2012~~2014) document will be used to determine whether potential site-related contaminants exceed groundwater screening guidelines.

2.0 Field Sampling Plan

2.1 Water Level Measurements

Prior to groundwater sampling activities, a round of water levels will be collected from all accessible monitoring wells (**Table 1-1** and **~~Figure 1-2~~Figures 2 and 3**) using an electronic water level indicator. All monitoring wells in the Semiannual-SWMU and Annual Groundwater Quality Well Networks are locked and require a key to be accessed. Keys may be obtained from Cannon AFB personnel. The Water Level Only wells are not locked and are accessible without a key. Water levels collected from monitoring wells with dedicated bladder pumps will be collected by lowering the water level indicator through the water level measurement port located adjacent to the discharge tube. The dedicated bladder pump systems are designed so that a water level can be measured from the survey reference point or highest point on the casing of the monitoring well. Although some Water Level Only wells have dedicated submersible pumps, or construction is unknown, these wells are accessible and water levels can be measured from the top of casing.

Water levels will be measured in the shortest time practical to minimize the effects of water table fluctuations. Water level measurements will be documented in a field logbook and using a Water Level Data Summary sheet (**Appendix A**). The depth to groundwater will be measured from the top of well casing to the nearest 0.01 foot and always from the same reference point or survey mark on the well casing. If there is no reference mark, the measurement will be from the ~~north side~~highest ~~of~~point of the casing. Field procedures for water level measurements were developed in general accordance with guidance provided by NMED (New Mexico Environment Department, 2001.)

2.2 Groundwater Sampling

Prior to sample collection, the monitoring wells will be purged using low-flow sampling techniques using dedicated polyvinyl chloride (PVC) QED Well Wizard® bladder pumps (**Appendix B**). The dedicated bladder pumps at MAFR will be operated with a QED MP10H controller or equivalently compressed nitrogen. Well construction details and pump placement are presented in **Table 1-1**. Field procedures for low-flow sampling were developed in general accordance with guidance provided by NMED (New Mexico Environment Department, 2001.)

Field parameters will be monitored with a multi-parameter water quality meter with an attached flow through cell. The multi-parameter water quality meter will monitor dissolved oxygen (DO), temperature, pH, specific conductance, and oxidation reduction potential (ORP). Salinity is a measurement based on temperature and conductivity and will be calculated by the multi-parameter water quality meter. Turbidity will be measured using a standalone turbidity meter. Drawdown will be measured during purging by lowering a water level indicator through the water level measurement port located adjacent to the discharge tube. The multi-parameter water quality meter and the turbidity meter will be calibrated each day prior to sampling in accordance with the manufacture instructions.

Prior to recording stabilization parameters, the volume of the bladder and tubing must be purged. Stabilization parameters will be collected at a minimum of three minutes apart. Stabilization parameters will be recorded on a groundwater sampling log (**Appendix A**). Purging will continue until all field parameters have stabilized for three consecutive readings according to the following criteria:

- Turbidity: ≤ 10 nephelometric turbidity units (NTU) or ± 10% where > 10 NTUs;
- pH: ± 0.5 units
- Specific Conductance: ± 10% of reading
- DO: ± 10% of reading
- ORP: ± 10 millivolts (mV)
- Temperature: ± 10% of reading

2.2.1 Field and Laboratory Analysis

The current groundwater program provides for semiannual testing at 10 wells associated with the Semiannual SWMU Groundwater Monitoring Network and 7 wells associated with the Annual Groundwater Monitoring Network (**Figures ~~1~~ ~~2~~2 and 3**). **Table 2-1** and **Table 2-2** summarize testing requirements.

Table 2-1 Semiannual - SWMU Groundwater Quality Network

Analyte	Field Parameters [1]	VOCs [2]	Explosives [3]	Metals [4] (Total & Diss.)	Chromium (VI)	Cyanide	Mercury	Nitrite, Nitrate	Chloride, Sulfate	Perchlorate[5]	Alkalinity	TDS
Method	**NA**	**EPA 8260B**	**EPA 8330**	**EPA 6020A**	**EPA 218.6**	**EPA 9012A**	**EPA 7470A**	**EPA 300.0**	**EPA 300.0**	**EPA 6860**	**SM 2320B**	**SM 2540C**
M114MW001	x	x	x	x	x	x	x	x	x	x	x	x
M114MW002	x	x	x	x	x	x	x	x	x	x	x	x
M114MW003	x	x	x	x	x	x	x	x	x	x	x	x
M114MW004	x	x	x	x	x	x	x	x	x	x	x	x
MAO1MW001	x	x	x	x	x	x	x	x	x	x	x	x
MAO1MW002	x	x	x	x	x	x	x	x	x	x	x	x
MAO1MW003	x	x	x	x	x	x	x	x	x	x	x	x
MAO1MW004	x	x	x	x	x	x	x	x	x	x	x	x
MAO2MW001D	x	x	x	x	x	x	x	x	x	x	x	x
MWQ-24	x	x	x	x	x	x	x	x	x	x	x	x

[1] Field Parameters: Specific Conductance, Dissolved Oxygen, pH, Temperature, Turbidity, ORP
[2] VOCs: Target Compound List
[3] Explosives: 1,3,5-Trinitrobenzene, 1,3-Dinitrobenzene, 2,4,6-Trinitrotoluene, 2,4-Dinitrotoluene, 2,6-Dinitrotoluene, 2-Amino-4,6 dinitrotoluene, 2-Nitrotoluene, 3-Nitrotoluene, 4-Amino-2,6-dinitrotoluene, 4-Nitrotoluene, HMX, Nitrobenzene, RDX, Tetryl
[4] Metals: Target Analyte List
[5] For perchlorate, 6860 is the method approved by NMED and is utilized for routine analysis. However, the split samples are routinely analyzed utilizing 6850 as it has been problematic finding another laboratory that utilizes 6860.

Table 2-2 Annual - Groundwater Quality Network

Analyte	Field Parameters [1]	Metals [2] (Total & Diss.)	Chromium (VI)	Cyanide	Nitrite, Nitrate	Chloride, Sulfate	Perchlorate[4]	Alkalinity	TDS
Method	NA	EPA 6020A	EPA 218.6	EPA 9012A	EPA 300.0	EPA 300.0	EPA 6860	SM 2320B	SM 2540C
MWQ-2	x	x	x	x	x	x	x	x	x
MWQ-14	x	x	x	x	x	x	x	x	x
MWQ-18	x	x	x	x	x	x	x	x	x
MWQ-19	x	x	x	x	x	x	x	x	x
MWQ-20	x	x	x	x	x	x	x	x	x
MWQ-21	x	x	x	x	x	x	x	x	x
MWQ-22	x	x	x	x	x	x	x	x	x

[1] Field Parameters: Specific Conductance, Dissolved Oxygen, pH, Temperature, Turbidity, ORP
[2] Metals: Target Analyte List
[3] Analytical methods were changed Based on *Approval Annual Report December 2011 Melrose Air Force Range Roosevelt and Curry Counties, New Mexico*.
[4] For perchlorate, 6860 is the method approved by NMED and is utilized for routine analysis. However, the split samples are routinely analyzed utilizing 6850 as it has been problematic finding another laboratory that utilizes 6860.

In addition to a total metals sample, a dissolved metals sample will be collected for each well. The sample will be collected and immediately filtered in the field with a disposable 0.45 micron (µm) filter.

2.3 General Sample Requirements

2.3.1 Sample Containers and Preservation Techniques

The primary contract laboratory, Gulf Coast Analytical Laboratories, Inc. (GCAL) of Baton Rouge, Louisiana, will provide new, certified clean sample bottles for analyses according to previously specified requirements. GCAL is accredited in accordance with the National Environmental Laboratory Accreditation Conference (NELAC) (Certificate Number 01955), and the DoD Environmental Laboratory Accreditation Program (ELAP) (Certificate Number 1482). Sample containers will contain preservatives where applicable in the appropriate sample containers, placed there by the laboratory. Sample container requirements for the analyses anticipated and preservation requirements to be required for this project are summarized ~~below~~in **Table 2-3.**~~:~~

Table 2-3 Sample Containers and Preservation

Analytical Parameters	Method	Container	Preservation	Maximum Holding Time
Alkalinity	SM 2320B	500-mL plastic or glass	Cool 4°C	14 days
Chloride	EPA 300.0	500-mL plastic or glass	Cool 4°C	28 days
Chromium (VI)	EPA 218.6	250-mL plastic or glass	Cool 4°C, buffer solution 9.3<pH<9.7	14 days
Cyanide	EPA 9012A	500-mL plastic or glass	Cool, ≤4 °C9, NaOH to pH>12, reducing agent	14 days
Explosives	EPA 8330	Two 1-liter wide mouth amber glass bottle, with Teflon lined cap	Cool 4°C	7 days until extraction, 40 days after extraction
Mercury	EPA 7470A	500-mL plastic or glass	Cool 4°C, HNO to pH<2	28 days
Metals (Total & Diss.)	EPA 6020A	500-mL plastic or glass	Cool 4°C, HNO to pH<2	6 months
Nitrite, Nitrate	EPA 300.0	500-mL plastic or glass	Cool 4°C	48 hours
Perchlorate	EPA 6860	125-mL plastic or glass	Cool 4°C	28 days
Perchlorate	EPA 6850	125-mL plastic or glass	Cool 4°C	28 days
Sulfate	EPA 300.0	500-mL plastic or glass	Cool 4°C	28 days
TDS	SM 2540C	500-mL plastic or glass	Cool 4°C	7 days
VOCs	EPA 8260B	Three 40-mL glass vials	Cool 4°C, HCL to pH<2	14 days

mL: milliliter

2.4 Field Operations Documentation

Field logbooks will be maintained to record site activities and field data in a neat, legible manner. Logbooks will be bound and pages consecutively numbered. Personnel will make logbook entries in indelible ink. The following information, at minimum, will be entered during project activities:

- Date and team location
- Weather
- Personnel onsite (including subcontractors) and work performed
- Equipment and instrument checks
- Injuries and/or illnesses
- Changes to work instructions
- Work stoppage
- Visitors
- Other relevant events

2.4.1 Sample Numbering System

Sample containers will be labeled utilizing existing well IDs. The sample identification number will be logged in the field log book and on the COC form.

QC samples are denoted by adding a QC extension at the end of the sample identification number. The extensions are shown in **Table 2-4**.

Table 2-4 QC Extensions

Order	Extension	Description
1	dis	dissolved phase (field filtered)
2	a	field duplicate
2	b	field split (to quality assurance lab)
2	c	trip blank
2	eqb	equipment blank
2	rin	rinsate
2	e	field blank
3	ms	matrix spike
3	msd	matrix spike duplicate

Quality assurance samples are discussed in more detail in **Section 3.0**, below.

2.4.2 Chain-of-Custody Records

The purpose of the COC is to provide continuous possession of samples from their origin to completion of analysis and archiving/disposal in the laboratory. This uninterrupted possession is required to maintain integrity of samples. The COC record is the documentation of this uninterrupted possession of the samples.

2.4.3 Sample Packaging and Shipping Requirements

Samples for chemical analyses will be packed on ice in sealed coolers for transport to the laboratory to ensure a temperature of 4±2 degrees Celsius (°C) upon receipt by the contract laboratory. To meet hold time requirements, ~~S~~samples will be shipped at the end of each day by overnight commercial courier to the laboratory. The laboratory will be notified prior to sample shipments. The packaging of each cooler will follow these steps:

1. Line the cooler with two water tight plastic bags
2. Ensure sample lids are tight
3. Wrap glass sample containers and associated quality control (QC) samples in bubble wrap and place in the inner water tight plastic bag
4. Fill cooler with enough packing material to prevent breakage of glass bottles
5. Make sure the sample cooler has a temperature blank and trip blank (for shipment of VOC samples), and are properly packed
6. Seal inner water tight plastic bag
7. Place sufficient ice in cooler between the inner and outer water tight plastic bags to maintain the internal temperature at 4±2 °C during transport.
8. Seal outer water tight plastic bag
9. Place associated chain-of-custodies (COC) in a waterproof plastic bag, and tape it to the inside lid of the cooler.

10. Seal cooler with tape and custody seal and ship to laboratory. Upon receipt at the laboratory, laboratory personnel will open the cooler and immediately record the temperature of the cooler will be recorded immediately from the temperature blank.

Samples will be packed for shipping in waterproof ice chests and coolers. The sample containers must be individually sealed in plastic bags prior to packing them in the cooler with bubble wrap to prevent breakage during shipment. Wet ice is placed with the samples in the cooler to maintain the samples at a temperature of 4±2 °C during shipping. Prior to shipment, any melted ice will be drained, and fresh ice will be added. A temperature blank will also be included in every cooler containing samples shipped for chemical analysis. All samples will be shipped in accordance with International Air Transport Association (IATA) and U.S. Department of Transportation (USDOT) regulations.

The COC form (**Appendix A**) or an equivalent form that identifies the samples is signed as relinquished by the principal sampler or responsible party. A Cooler Receipt Form or an equivalent form must also be completed upon receipt of the shipment for all shipments sent to the contract laboratory for purposes of noting problems in sample packaging, COC, and sample preservation. The COC forms are sealed in a waterproof plastic bag which is then placed inside the cooler, typically by taping the bag to the inside lid of the cooler.

Following packing, the cooler lid is sealed with strapping tape. Two custody seals (signed and dated) are affixed about two corners of the cooler, across the seal of the lid, and additionally covered with clear tape.

2.5 Decontamination Procedures

All reusable equipment that comes into contact with potentially contaminated water or other material will be decontaminated prior to use at each sampling location. All equipment will be thoroughly decontaminated before use and between sampling locations. With all monitoring wells containing dedicated bladder pumps the only piece of equipment that should require decontamination should be the water level tape. For decontamination of the water level tape follow manufacturer's recommendations for cleaning instruments. However, at a minimum:

- Wipe down equipment body, probes, and cables with lab-grade detergent solution
- Rinse thoroughly with tap water
- Rinse thoroughly with analyte-free water
- Containerize all rinsing wastes, detergent wastes and other chemical wastes requiring off-site or regulated disposal. Treat as IDW; see **Section 2.6** below for more detail.

2.6 Investigative Derived Waste

IDW generated during groundwater sampling activities will include monitoring well purge water and decontamination water. All IDW collected during groundwater sampling will be temporarily containerized in a holding tank, buckets (with lids), or similar containers secured in the bed of the field vehicle. At the completion of daily field activities, the container(s) will be discharged into a bulk liquid storage tank located approximately 0.4 miles south of MWQ-1 and MWQ-2 adjacent to a Conex container and storage buildings (**Figure ~~1-2~~2**).

Subsequent to each groundwater sampling event, a composite sample will be collected from the holding tank and analyzed for the following:

- pH (corrosivity)
- Flashpoint (flammability)
- TX-1005 (reactivity)

Wastes that have not been specifically listed (40 CFR §261.31, 40 CFR §261.32, or 40 CFR §261.33) may still be considered a hazardous waste if it exhibits one of the four characteristics defined in 40 CFR Part 261 Subpart C. Based on the analytical results from the composite sample collected from the holding tank, and from the groundwater sampling event, the IDW will be disposed of appropriately. Approval will be requested from NMED prior to disposal of any IDW from MAFR.

3.0 Quality Assurance Samples

3.1 Field Quality Control Samples

To ensure that quality data are continuously produced during analysis and allow the eventual compliance review, systematic QC checks are incorporated into the sampling and analyses to show that procedures and test results remain reproducible and that the analytical method is actually measuring the concentration of target analytes in groundwater samples without unacceptable bias. Systematic QC checks include the scheduled analyses of field and laboratory replicates, standards, surrogates, spiked samples, and blanks. Frequency requirements for field QC samples are summarized in the table below.

Table 3-1 QC Check Frequency

QC Checks	Frequency
Field Duplicate	one for every ten environmental samples
Field Split	one for every 20 environmental samples
Matrix Spike(MS)/Matrix Spike Duplicate(MSD) (extra volume for lab)	one for every 20 environmental samples
Temperature Blank	each cooler
Trip Blank	Each cooler containing environmental samples for VOC analysis

3.1.1 Trip Blanks

A trip blank consists of a VOC sample vial filled in the laboratory with ASTM Type II reagent grade water, transported to the sampling site, handled like an environmental sample, and returned to the laboratory for analysis. These samples are not opened in the field and are submitted to the laboratory only when samples are collected for VOCs.

Trip blanks are used to assess the potential introduction of contaminants from sample containers or during the transportation, field exposure, and storage procedures. For this project, one trip blank will accompany each cooler that contains VOC samples for analysis by the laboratory.

3.1.2 Temperature Blanks

A temperature blank is a container of water that is packed and shipped with the field samples to the laboratory. The temperature blank should be a 100 mL plastic bottle filled with water and placed in a representative position inside the cooler. Upon arrival at the laboratory, the laboratory measures the temperature of the blank. This temperature reading is used to represent the conditions of the field samples. One temperature blank will accompany each cooler.

3.1.3 Field Duplicate Samples

A field duplicate sample is a second sample collected at the same location as the primary sample. These samples are collected simultaneously or in immediate succession, using identical recovery techniques, and treated in an identical manner during storage, transportation, and analysis. The field duplicate's sample identification is assigned an extension that identifies the sample as a field duplicate to the sample collector but is blind to the laboratory (See **Table 2-4** for more detail). The results from duplicate samples are used to assess precision of the sample collection

process. The frequency of collection for field duplicates is one field duplicate for every ten environmental samples collected.

3.1.4 Field Splits

A field split sample, also called a replicate sample, is a single sample divided into two equal parts for analysis. In the case of low-flow ground water sampling, split samples for VOC analysis will be collected immediately following the associated VOC grab samples. The sample containers are assigned an identification number in the field so they cannot be identified as replicate samples by the laboratory(s) personnel performing the analysis (See **Table 2-4** for more detail). Specific locations are designated for collection of field replicate samples prior to the beginning of sample collection. The sample results are used to assess precision.

The split samples will be collected from each matrix of concern where the anticipated concentrations of contaminants are near the cleanup target level (if this information is known). The frequency of collection for field split samples is one every 20 samples collected. The field split samples shall be analyzed by the same methods as the environmental samples which are sent to the primary laboratory, when possible.

Field split samples should be delivered to Accutest Laboratories, Inc., Orlando, FL. Accutest is accredited in accordance with the NELAC (Certificate Number E83510), and the DoD ELAP (Certificate Number L2229). The laboratory provided coolers, sample containers (including preservatives where applicable), custody seals, and COC documents.

3.2 Laboratory Quality Control Checks

3.2.1 Matrix Spike/Matrix Spike Duplicates

The MS is used to access the performance of the analytical method as applied to a particular matrix. MS and MSD are aliquots of samples spiked with known amounts of all target analytes. Additional volume will be collected in the field for laboratory analysis. The spiking occurs prior to sample preparation and analysis. Only project-specific samples shall be used as MS/MSD samples. The MS/MSD is designated on the COC form. The MS/MSD is used to document the bias of a method due to sample matrix. These sample results should not be used to control the analytical process. A minimum of one MS/MSD sample set shall be analyzed for every 20 site samples.

4.0 Reporting Requirements

A Draft Annual Groundwater Monitoring Report is due to Cannon AFB no later than January 31 of each year. Reports are due annually to NMED no later than February 27 of each year. As previously requested by NMED, annual reports are to be written and organized in general accordance with the NMED *Position Paper: General Reporting Requirements for Routine Groundwater Monitoring Activities at RCRA Sites* (NMED, 2003).

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FIGURES

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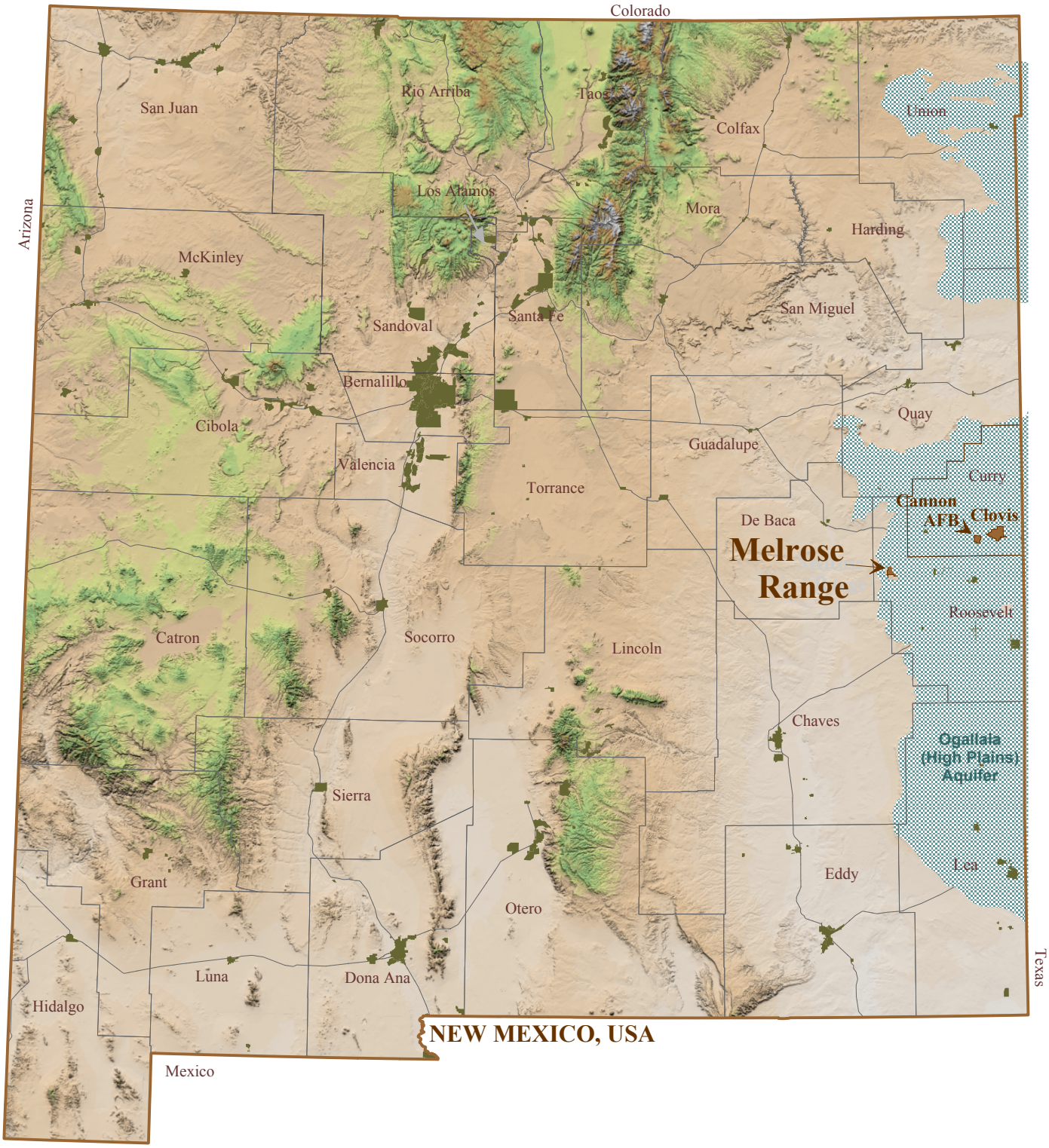


Source files: New Mexico Resource Geographic Information System Program

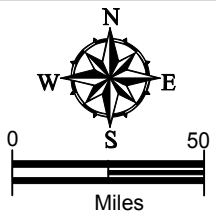
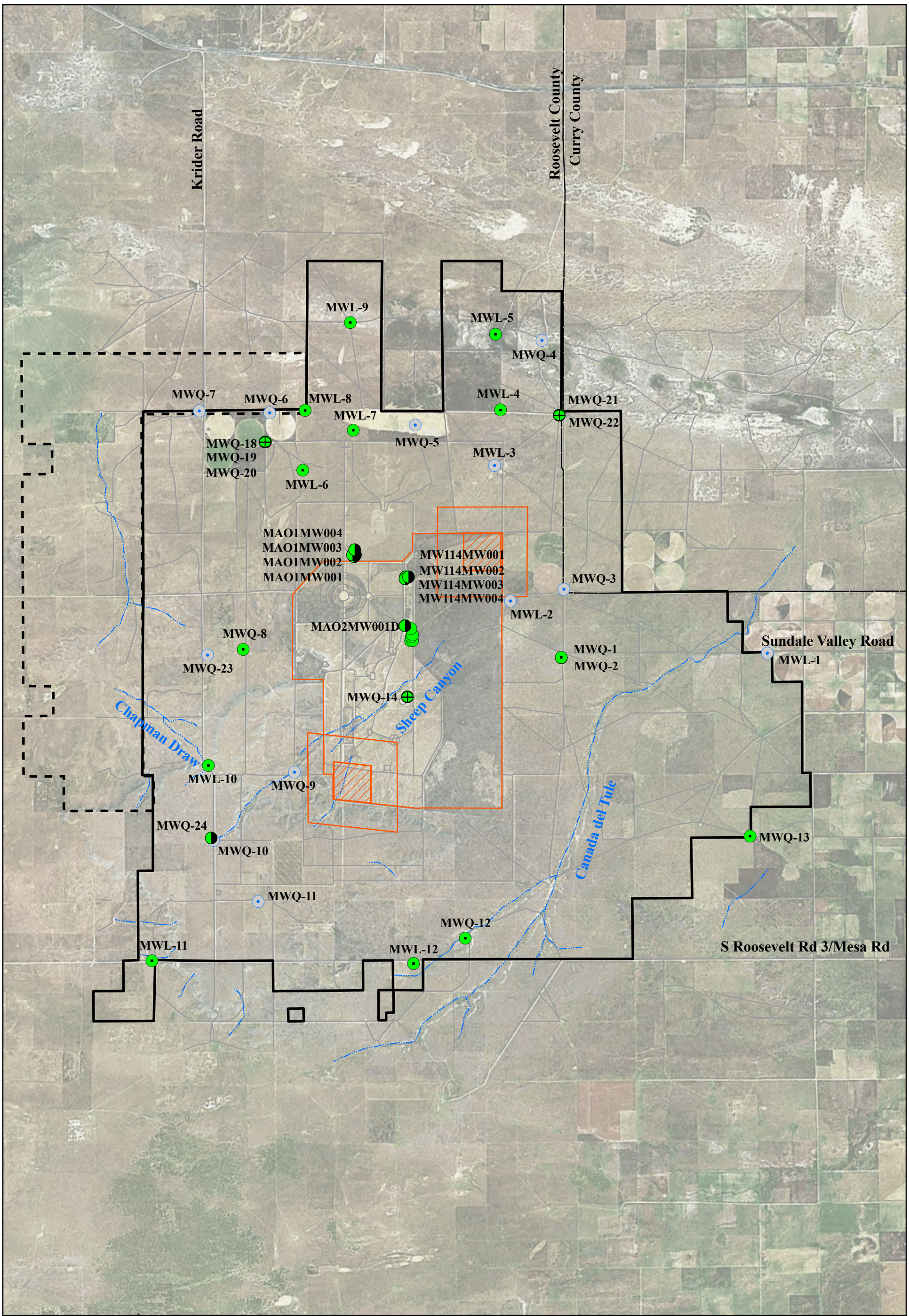


FIGURE 1
SITE LOCATION MAP
Melrose Air Force Range
Roosevelt and Curry Counties, New Mexico

Trinity Analysis and Development Corp.



N
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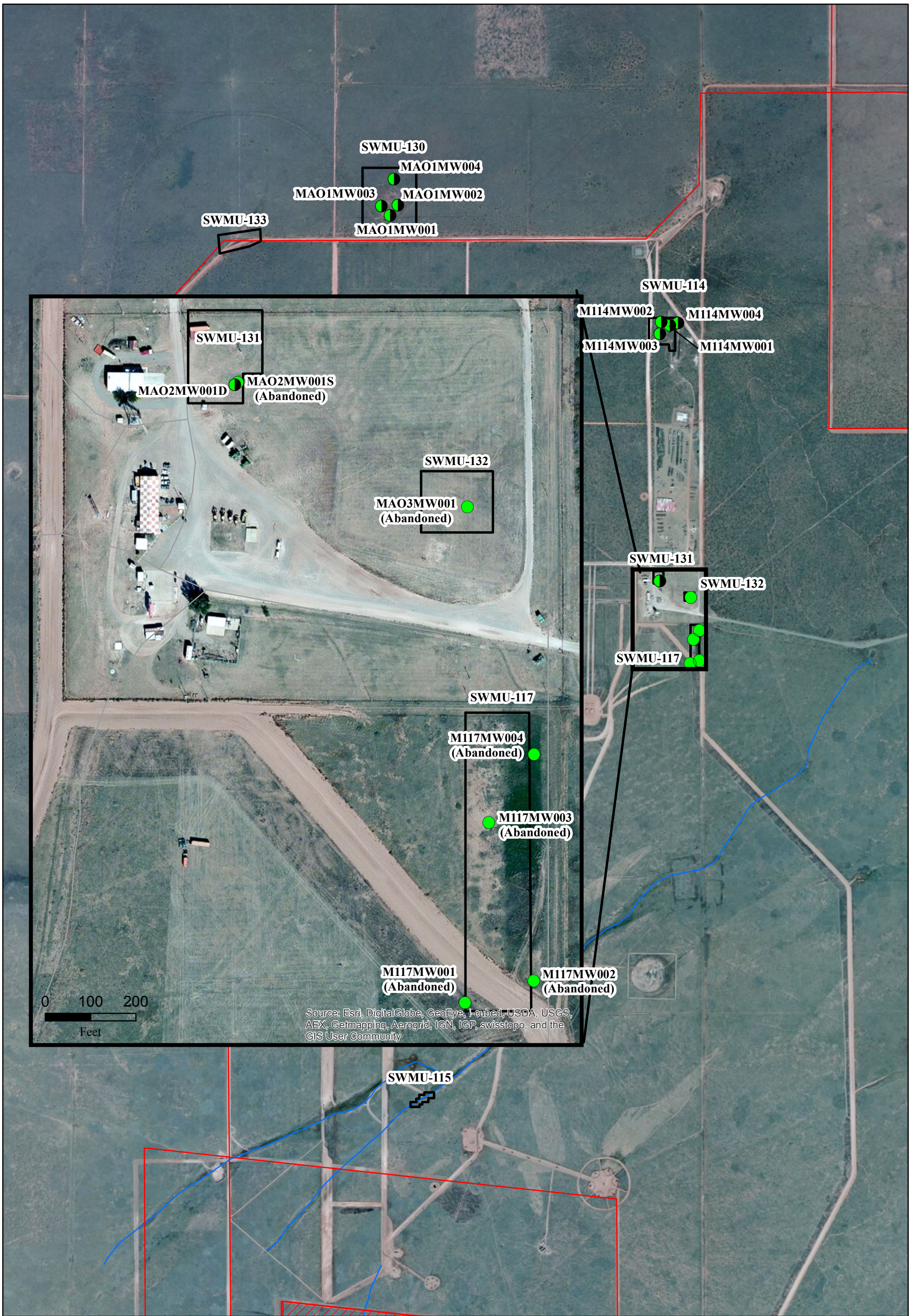
Miles

Legend

- Annual Groundwater Quality Network
- Semiannual - SWMU Groundwater Quality Network
- Water Level Only
- Abandoned Wells (see Figure 3 for well designations)
- Inactive Wells
- Target Area
- Impact Area
- Installation Area, New Mexico Trust Land (to be aquired)
- Installation Area
- Ephemeral Draw

FIGURE 2
ANNUAL MONITORING WELL NETWORK
Melrose Air Force Range
Roosevelt and Curry Counties, New Mexico

Trinity Analysis & Development Corp.



N
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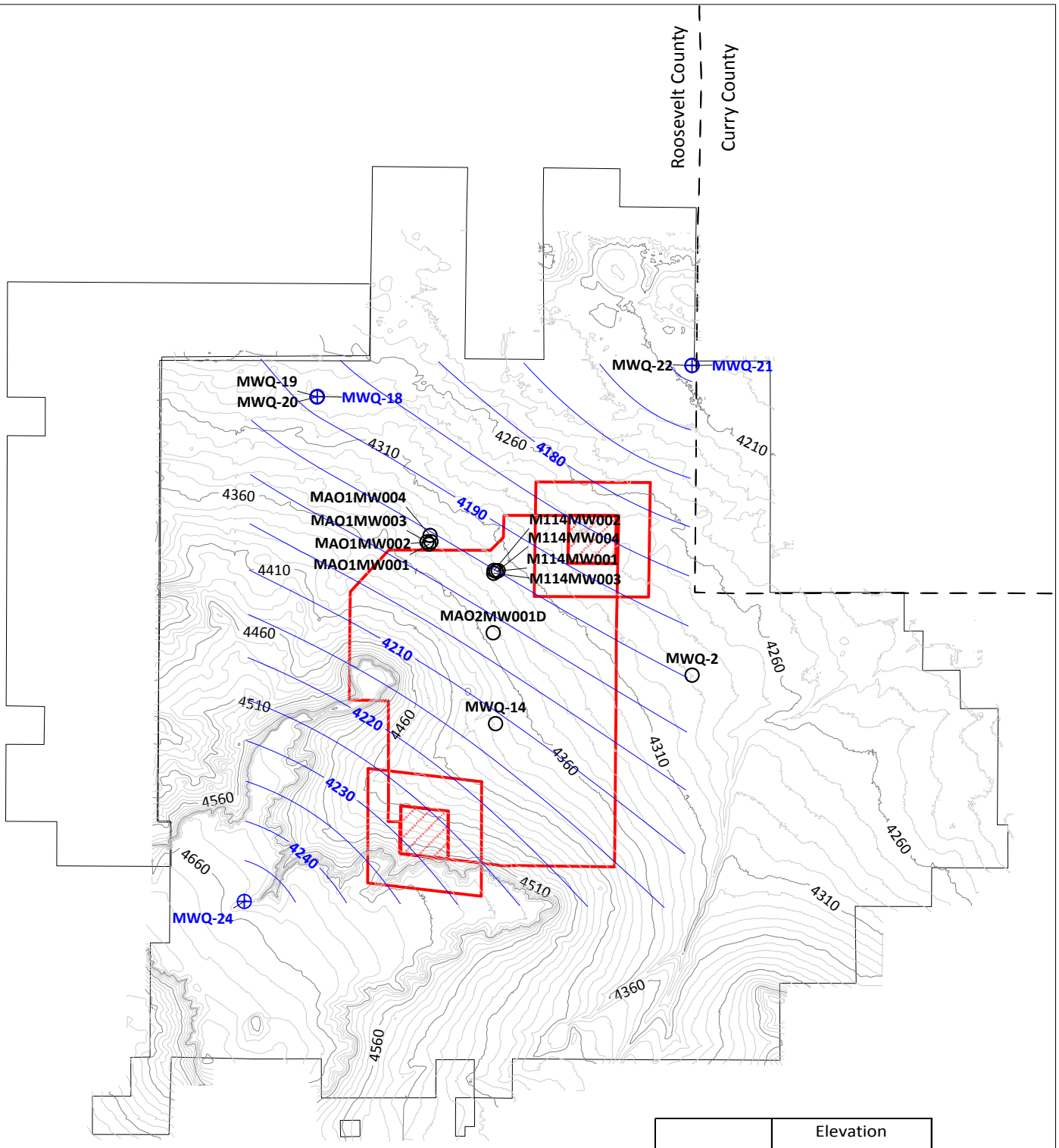
Feet

Legend

- Semiannual - Monitoring Well
- Abandoned - Monitoring Well
- Target Area
- Impact Area

Note: MWQ-24 is included in the semi-annual monitoring network and is shown in Figure 7

FIGURE 3
SEMIANNUAL SWMU MONITORING WELL NETWORK LOCATIONS
Melrose Air Force Range
Roosevelt and Curry Counties, New Mexico



	Elevation (Feet NAVD)
MWQ-24	4598.99
MWQ-18	4188.16
MWQ-21	4163.34

Source: Cannon AFB GIS Database;
Topography data derived from 2005 LIDAR survey;
Vertical Accuracy: < 1 foot
Vertical Datum: NAVD88
Horizontal Accuracy: 0.37 feet
Horizontal Datum: UTM Zone 13N, WGS84
Contour Interval: 10 Feet

Ogallala Aquifer (Southern High Plains)

Chinle Formation

N
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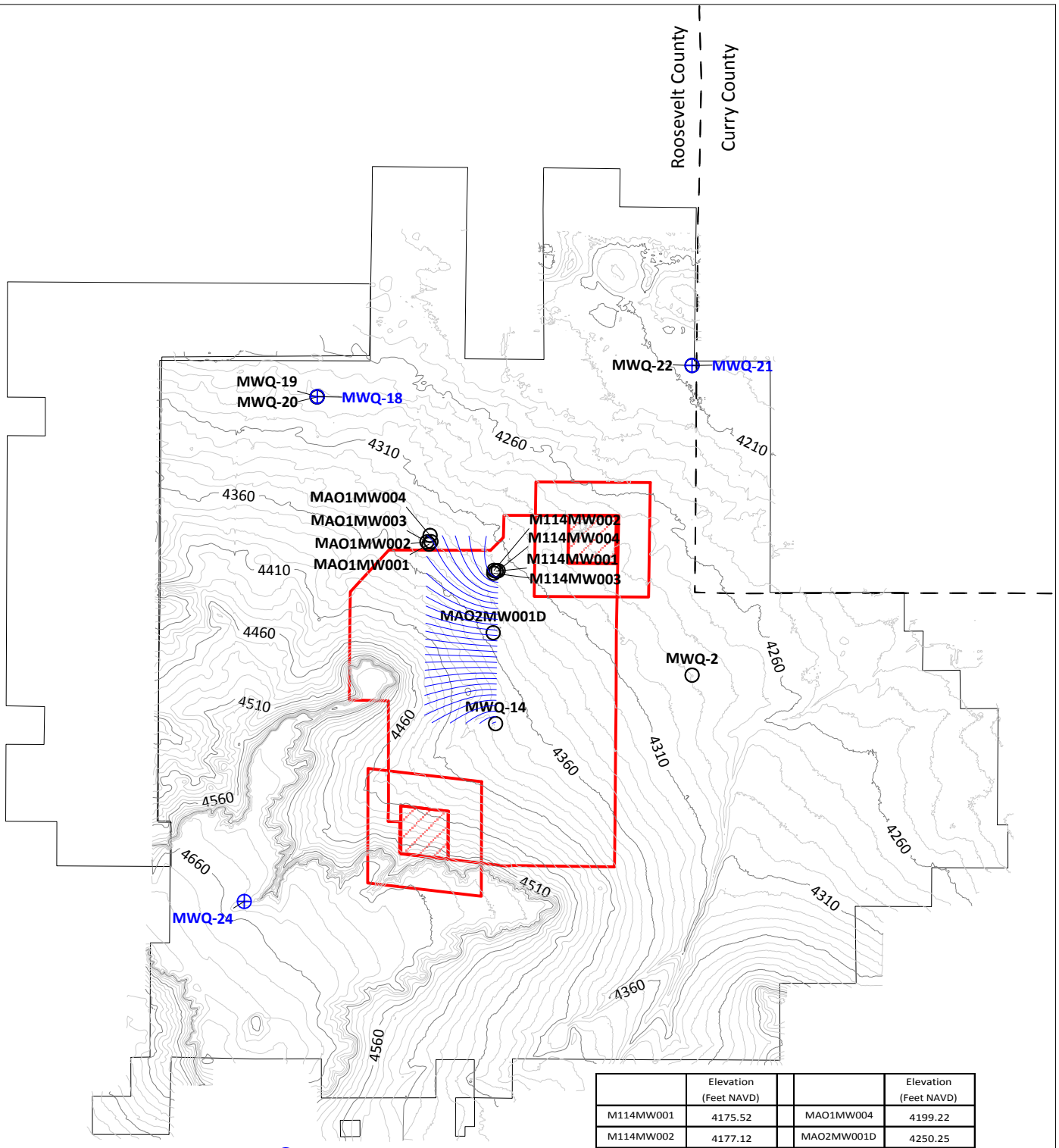
Feet

FIGURE 4
GROUNDWATER FLOW DIRECTION
OCTOBER 2014
OGALLALA AQUIFER (SOUTHERN HIGH PLAINS AQUIFER)
Melrose Air Force Range
Roosevelt and Curry Counties, New Mexico

Trinity Analysis & Development Corp.



	Elevation (Feet NAVD)			Elevation (Feet NAVD)
M114MW001	4175.52		MAO1MW004	4199.22
M114MW002	4177.12		MAO2MW001D	4250.25
M114MW003	4177.68		MWQ-2	4171.99
M114MW004	4175.09		MWQ-14	ND
MAO1MW001	4201.98		MWQ-19	4176.09
MAO1MW002	4200.85		MWQ-20	4206.98
MAO1MW003	4201.65		MWQ-22	4,200.85

MWQ-14 April 23, 2014 water level (4316.47 Feet NAVD) utilized as the well was inaccessible due to live-fire exercise in vicinity of MWQ-14

Ogallala Aquifer (Southern High Plains)

Chinle Formation

Source: Cannon AFB GIS Database;
Topography data derived from 2005 LIDAR survey;
Vertical Accuracy: < 1 foot
Vertical Datum: NAVD88
Horizontal Accuracy: 0.37 feet
Horizontal Datum: UTM Zone 13N, WGS84
Contour Interval: 10 Feet

MWQ-2, MW-19, MWQ-20, & MAO2MW001D are exluded from the determination of flow in the upper Chinle Formation due to screen location in deeper confined portions of the Chinle Formation. MWQ-22 is excluded as it appears to stradle the Ogallala/Chinle contact.

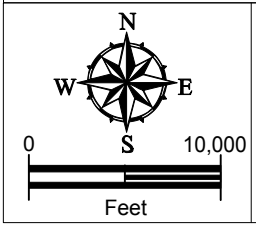


FIGURE 5
GROUNDWATER FLOW DIRECTION
OCTOBER 2014
CHINLE FORMATION
Melrose Air Force Range
Roosevelt and Curry Counties, New Mexico

Trinity Analysis & Development Corp.

TABLES

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TABLE 1-1
WELL CONSTRUCTION DETAILS
MELROSE AIR FORCE RANGE
ROOSEVELT AND CURRY COUNTIES, NEW MEXICO

	Well No.	Location (State Plane)[1]		Top of Casing[1]	Ground Surface	Well Type	Stickup from ground surface	Top of Screen	Bottom of Screen	Total Well Depth	Screen Length	Sump Length	Well I.D.	Well Material	Pump	Pump Intake Depth (ft. bls)	Formation Monitored
		Easting (ft)	Northing (ft)	ft NAVD	ft NAVD		ft	ft bls	ft bls	ft bls	ft	ft	inches				
Semiannual-SWMU GW Quality Well Network	M114MW001	706827.67	1203539.67	4327.21	4324.38	MW	2.83	159.39	179.39	179.72	20.00	0.33	4.0	PVC	DBP	176.72	Chinle
	M114MW002	706680.51	1203596.93	4328.11	4325.36	MW	2.75	162.11	182.11	182.44	20.00	0.33	4.0	PVC	DBP	179.44	Chinle
	M114MW003	706662.30	1203400.50	4329.62	4326.87	MW	2.75	159.62	179.62	179.95	20.00	0.33	4.0	PVC	DBP	176.95	Chinle
	M114MW004	706963.35	1203578.69	4324.99	4322.74	MW	2.25	161.42	181.42	181.75	20.00	0.33	4.0	PVC	DBP	178.75	Chinle
	MAO1MW001	702193.70	1205363.35	4344.68	4342.68	MW	2.00	141.56	161.56	161.89	20.00	0.33	4.0	PVC	DBP	158.89	Chinle
	MAO1MW002	702321.76	1205536.48	4343.58	4341.28	MW	2.30	145.31	155.31	155.64	10.00	0.33	4.0	PVC	DBP	152.64	Chinle
	MAO1MW003	702047.46	1205516.57	4345.33	4342.58	MW	2.75	139.36	159.36	159.69	20.00	0.33	4.0	PVC	DBP	156.69	Chinle
	MAO1MW004	702257.89	1205963.87	4342.91	4340.31	MW	2.60	140.08	160.08	160.41	20.00	0.33	4.0	PVC	DBP	157.41	Chinle
	MAO2MW001D	706656.33	1199306.69	4355.90	4353.19	MW	2.71	161.95	181.95	182.28	20.00	0.33	4.0	PVC	DBP	179.28	Chinle
	MWQ-24	689675.49	1180704.95	4644.95	4643.32	MW	1.63	42.80	62.80	63.12	20.00	0.32	4.0	PVC	DBP	60.12	Ogallala
Annual GW Quality Well Network	MWQ-2	720370.93	1196505.43	4293.72	4290.43	MW	3.29	220.64	230.64	235.54	10.00	4.90	2.0	PVC	DBP	225.71	Chinle
	MWQ-14	706871.58	1193064.56	4382.11	4380.77	MW	1.34	90.70	110.70	119.93	20.00	9.23	2.0	PVC	DBP	100.66	Chinle
	MWQ-18	694417.52	1215441.23	4290.17	4288.32	MW	1.85	119.00	139.00	152.00	20.00	13.00	2.0	PVC	DBP	128.15	Ogallala
	MWQ-19	694417.52	1215441.00	4290.13	4288.32	MW	1.81	200.70	221.07	226.00	20.00	4.30	2.0	PVC	DBP	210.19	Chinle
	MWQ-20	694399.63	1215417.04	4290.26	4288.01	MW	2.25	256.00	296.00	297.82	40.00	1.82	2.0	PVC	DBP	275.75	Chinle
	MWQ-21	720195.67	1217791.91	4209.26	4207.40	MW	1.86	40.70	60.70	64.40	20.00	3.70	2.0	PVC	DBP	54.14	Ogallala
	MWQ-22	720195.85	1217791.78	4209.12	4207.42	MW	1.70	90.70	150.70	153.65	60.00	2.95	2.0	PVC	DBP	120.30	Ogallala/Chinle
Water Level Only	MWQ-1	720367.74	1196501.97	4293.60	4290.53	MW	2.77	UNK	UNK	136.50	UNK	UNK	2.00	PVC	none	NA	UNK
	MWQ-8	692464.50	1197219.55	4469.71	4468.60	Supply	1.10	UNK	UNK	117.00	UNK	UNK	4.00	Steel	none	NA	UNK
	MWQ-12	712235.10	1172236.04	4405.77	4405.44	Supply	UNK	UNK	UNK	UNK	UNK	UNK	6.00	UNK	UNK	NA	UNK
	MWQ-13	736665.25	1180908.47	4280.51	4279.17	Supply	UNK	UNK	UNK	UNK	UNK	UNK	6.00	UNK	UNK	NA	UNK
	MWL-4	715033.16	1218237.91	4220.77	4217.47	Supply	3.20	UNK	UNK	59.80	UNK	UNK	4.00	Steel	none	NA	UNK
	MWL-5	714597.21	1224854.49	4196.32	4194.28	Supply	1.72	UNK	UNK	35.00	UNK	UNK	6.00	PVC	none	NA	UNK
	MWL-6	697695.65	1212918.66	4304.80	4303.52	Supply	1.22	UNK	UNK	136.00	UNK	UNK	6.00	Steel	none	NA	UNK
	MWL-7	702121.36	1216423.71	4258.43	4256.28	Supply	2.15	UNK	UNK	108.90	UNK	UNK	6.00	Steel	none	NA	UNK
	MWL-8	697907.88	1218188.04	4262.06	4259.52	Supply	2.28	UNK	UNK	114.00	UNK	UNK	6.00	Steel	DSP	UNK	UNK
	MWL-9	701865.19	1225896.35	4241.74	4239.60	Supply	UNK	UNK	UNK	49.60	UNK	UNK	6.00	Steel	none	NA	UNK
	MWL-10	689066.62	1187189.66	4573.45	4572.87	Supply	UNK	UNK	UNK	UNK	UNK	UNK	6.00	Steel	UNK	NA	UNK
	MWL-11	684248.92	1169768.42	4579.80	4578.04	Supply	0.83	UNK	UNK	UNK	UNK	UNK	6.00	Steel	UNK	NA	UNK
	MWL-12	707038.74	1169558.06	4446.85	4445.95	Supply	UNK	UNK	UNK	UNK	UNK	UNK	6.00	Steel	UNK	NA	UNK

[1] With the exception of MWQ-24 which was surveyed on September 16, 2013 all wells were surveyed or resurveyed by Lydick, Inc. between December 4, 2012 and January 2, 2013. Land surveying was completed using the New Mexico East State Plane North American Datum (NAD) 83 and North American Vertical Datum (NAVD) 88 (adjusted) in decimal feet. All horizontal coordinates were measured to the nearest fiftieth of a foot. All vertical coordinates were measured to the nearest tenth of a foot. bls = below land surface; DBP = dedicated bladder pump; DSP = dedicated submersible pump; ft = feet or foot; GW = groundwater; ID = inner diameter; MW = monitoring well; NA = not applicable; No.= number; PVC= polyvinyle chloride; UNK= unknown; ~=approximate

TABLE 1-3
INACTIVE WELLS
MELROSE AIR FORCE RANGE
ROOSEVELT AND CURRY COUNTIES, NEW MEXICO

Well No.	Location (State Plane)[1]		Top of Casing[1]	Well Type	Top of Screen	Bottom of Screen	Total Well Depth	Well I.D.	Well Material	Pump	Formation Monitored	Reason for Inactive Status
	Easting (ft)	Northing (ft)	ft NAVD		ft bls	ft bls	ft bls	inches				
MWQ-23	689359.37	1196710.78	4498.43	Supply	UNK	UNK	UNK	6.0	Steel	DSP	Ogallala	NMED Guidance[2]. MWQ-24 was installed August 2013 as a replacement.
MWQ-3	720584.37	1202483.91	4270.78	Supply	90.70	110.70	119.93	2.0	Steel	DSP	Ogallala	Unable to collect water levels due to electrical wires. NMED Guidance[2]
MWQ-4	718665.24	1224301.96	4202.69	Supply	119.00	139.00	152.00	2.0	Steel	DSP	Ogallala	Solar powered stock pond well. Unable to collect representative static water levels due to the DSP running. NMED Guidance[2]
MWQ-5	707559.27	1216915.19	4234.22	Supply	201.00	221.00	230.00	2.0	Steel	DSP	Ogallala	Old center pivot well. Unable to collect water levels. NMED Guidance[2]
MWQ-6	694796.10	1217958.83	4273.00	Supply	256.00	296.00	297.82	2.0	Steel	DSP	Ogallala	Unable to collect water levels due to electrical wires. NMED Guidance[2]
MWQ-7	688613.19	1218117.07	4262.68	Supply	41.00	61.00	66.30	2.0	Steel	DSP	Ogallala	Old center Pivot well. Plug rusted in-place. NMED Guidance[2]
MWQ-9	696653.62	1186440.97	4490.64	Supply	UNK	UNK	UNK	~4 ft	none	none	UNK	Hand dug well. This well is dry.
MWQ-10	689875.24	1180475.78	4642.32	Supply	90.70	150.70	153.65	2.0	Steel	DSP	Ogallala	USGS previously lost water level tape in this well. NMED Guidance[2]
MWQ-11	693783.78	1175090.62	4666.10	Supply	UNK	UNK	UNK	6.0	Steel	DSP	Ogallala	Unable to collect water levels due to electrical wires.
MWL-1	738425.62	1196901.96	4226.02	Supply	UNK	UNK	NA	6.0	Steel	DSP	Ogallala	Unable to collect water levels due to electrical wires.
MWL-2	715905.50	1201457.72	4291.95	Supply	UNK	UNK	NA	UNK	UNK	UNK	Ogallala	Located in Impact Area. No access.
MWL-3	714515.51	1213337.34	4226.98	Supply	UNK	UNK	NA	UNK	UNK	UNK	Ogallala	Located in Impact Area. No access.
M117MW001	707165.34	1197940.69	4359.75	MW	UNK	UNK	~50	4.0	PVC	none	Ogallala	Abandoned 10-5-2011
M117MW002	707316.92	1197989.26	4357.67	MW	UNK	UNK	~50	4.0	PVC	none	Ogallala	Abandoned 10-5-2011
M117MW003	707217.53	1198339.13	4355.55	MW	UNK	UNK	~50	4.0	PVC	none	Ogallala	Abandoned 10-5-2011
M117MW004	707317.84	1198489.29	4353.88	MW	UNK	UNK	~50	4.0	PVC	none	Ogallala	Abandoned 10-5-2011
MAO2MW001S	706662.83	1199311.35	4355.78	MW	UNK	UNK	49.55	4.0	PVC	none	Ogallala	Abandoned 10-5-2011
MAO3MW001	707170.57	1199036.28	4350.11	MW	UNK	UNK	~50	4.0	PVC	none	Ogallala	Abandoned 10-5-2011

[1] With the exception of the abandoned wells, all wells were surveyed or resurveyed by Lydick, Inc. between December 4, 2012 and January 2, 2013. Land surveying was completed using the New Mexico East State Plane North American Datum (NAD) 83 and North American Vertical Datum (NAVD) 88 (adjusted) in decimal feet. All horizontal coordinates were measured to the nearest fiftieth of a foot. All vertical coordinates were measured to the nearest tenth of a foot. [2] When NMED provided a review of the *Final Report Initial Baseline Groundater Monitoring, Melrose Air Force Range, New Mexico, June 2009 (URS, 2009),* NMED stated *"NMED discourages including stock wells with steel casings in the Groundwater Quality Well Network, e.g., MWL-6, MWQ-4, MWQ-5, MWQ-6, MWQ-7, and MWQ-8..."* bls = below land surface; DSP = dedicated submersible pump; ft = feet or foot; MW = monitoring well; NA = not applicable; No. = number; NMED = New Mexico Environment Department; PVC = polyvinyl chloride; UNK = unknown; USGS = United States Geological Survey

APPENDIX A

Field Forms

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GROUNDWATER SAMPLING LOG

☐ SYSTEM ON ☐ SYSTEM OFF ☐ NOT APPLICABLE (NO SYSTEM)

SITE NAME:	SITE LOCATION:	DATE:

WELL NO:	SAMPLE ID:	FREE PRODUCT: Y N DEPTH TO PRODUCT (ft BTOC):	FIELD DUPLICATE: Y N DUPLICATE ID:

PURGING DATA

WELL DIAMETER (inches):	TUBING DIAMETER (inches):	WELL SCREEN INTERVAL DEPTH: feet to feet	STATIC DEPTH TO WATER (feet):	PURGE PUMP TYPE OR BAILER:

WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH – STATIC DEPTH TO WATER) x WELL CAPACITY
(only fill out if applicable)
= (feet – feet) x gallons/foot = gallons

EQUIPMENT VOLUME PURGE: 1 EQUIPMENT VOL. = PUMP VOLUME + (TUBING CAPACITY x TUBING LENGTH) + FLOW CELL VOLUME
(only fill out if applicable)
= gallons + (gallons/foot x feet) + gallons = gallons

INITIAL PUMP OR TUBING DEPTH IN WELL (feet):	FINAL PUMP OR TUBING DEPTH IN WELL (feet):	PURGING INITIATED AT:	PURGING ENDED AT:	TOTAL VOLUME PURGED (gallons):

Time	Volume Purged (gallons)	Cum. Volume Purged (gallons)	Purge Rate (gpm)	Depth to Water (ft BTOC)	pH (SU)	Temp. (°C)	Spec. Cond. (mS/cm)	Dissolved Oxygen (mg/L)	Salinity (‰)	ORP (mV)	Color/ Odor (describe)	Turbidity (NTUs)

WELL CAPACITY (gal/ft): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06; **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6"** = 1.47; **12"** = 5.88
TUBING INSIDE DIA. CAPACITY (gal/ft): **1/8"** = 0.0006; **3/16"** = 0.0014; **1/4"** = 0.0026; **5/16"** = 0.004; **3/8"** = 0.006; **1/2"** = 0.010; **5/8"** = 0.016

PURGING EQUIPMENT CODES: **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **PP =** Peristaltic Pump; **O** = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION:	SAMPLER(S) SIGNATURE(S):	SAMPLE TIME:

PUMP OR TUBING DEPTH IN WELL (feet):	TUBING MATERIAL CODE:	FIELD-FILTERED: Y N Filtration Equipment Type:	FILTER SIZE: _____ µm

FIELD DECONTAMINATION: PUMP Y N TUBING Y N (replaced)

SAMPLE CONTAINER SPECIFICATION				INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
# CONTAINERS	MATERIAL CODE	VOLUME	PRESERVATIVE USED			

FIELD EQUIPMENT IDENTIFICATION

H20 QUALITY PARAMETER	
Model:	SN#:
TURBIDIMETER	
Model:	SN#:
OTHER	

REMARKS:

MATERIAL CODES: **AG** = Amber Glass; **CG** = Clear Glass; **PE** = Polyethylene; **PP** = Polypropylene; **S** = Silicone; **T** = Teflon; **O** = Other (Specify)

SAMPLING EQUIPMENT CODES: **APP** = After Peristaltic Pump; **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **RFPP** = Reverse Flow Peristaltic Pump; **SM** = Straw Method (Tubing Gravity Drain); **O** = Other (Specify)

NOTES:

☐ well needs repair_____ ☐ needs well tag _____ ☐ locking cap: _____ ☐ other comment: _____

☐ DI Water Lot # _____ ☐ MS / MSD _____ ☐ Equip blk _____ ☐ Ambient blk _____ ☐ Trip blk _____

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Page _____ of _____

Project Number: _____

Chain of Custody Number (1): _____

Chain of Custody and Analytical Request

Project Name / Site Name:

Facility:

Client Name:

Project Manager:

Collected by:

Turn Around Time

- 24 Hour ☐
- 7 Day ☐
- Standard ☐
- Other ☐

Field Sample ID (30 Characters Max)	ERPIMS LOCID (15 Characters Max)	Date Collected (dd-mm-yyyy)	Time Collected (Military) (hhmm)	Sample Depth (beginning - ending)	Sample Code (2)	Sample Number (3)	Sample Matrix (4)	Sample Method (5)	Number of Containers									Sampler's Initals	Ambient Blank Lot Control Number	Equipment Blank Lot Control Number	Trip Blank Lot Control Number	Cooler ID (Alphabetical Notation)
				-																		
				-																		
				-																		
				-																		
				-																		
				-																		
				-																		
				-																		
				-																		
				-																		
				-																		

Comments:

Custody Transfers Prior to Receipt by Laboratory

Relinquished By (Signed)	Date	Time	Received by (Signed)	Date	Time
1.			1.		
2.			2.		
3.			3.		

Sample Delivery Details / Laboratory Receipt

Delivered Directly to Lab: _____ Shipped: No.: _____

Method of Shipment: _____ Airbill Number: _____

Analytical Lab: _____ Delivery Location: _____

Lab Recipient: _____ Delivery Date/Time: _____

1.) Chain of Custody Number = site name (e.g., SS-125) and then date (yymmdd) collected + custody number (e.g. **SS1251207201**)…July 20, 2012. (12 Characters Max; No Dashes)

2.) Sample Type Codes: **N** = Normal Sample, **TB** = Trip Blank (-c) Sample, **FD** = Field Duplicate (-a) Samples, **FR** = Field Replicate (-b) Samples, **EB** = Equipment Blank (-d) Samples, **MS** = Matrix Spike (-ms), **SD** = Matrix Spike Duplicate (-sd), **AB** = Ambient Blank (-e)

3.) Sample Number: Unique sample number collected from a particular location per day. (e.g. Groundwater sample collected from MW-01 on 07/20/12 = 1, if sampled again on 07/20/12 = 2, etc.)

4.) Matrix Codes: **GS** = Soil Gas, **WG** = Ground Water , **WS** = Surface Water **SO** = Soil, **SE** = Sediment, **SL** = Sludge, **SS**= Suface Soil Samples, **WQ** = Aqueous Blank Samples (trip, equipment, ambient, etc.), **SQ**= Soil Blanks

5.) Sample Method Codes: **CS** = Compsite Sample, **E2** = Elec. Submersible Pump (1982 +), **G** = Grab, **H** = Hollow Stem Auger, **PP** = Peristaltic Pump, **W** = Swab or Wipe. (See handout for more methods)

6.) Sample Analysis Requested: Analytical method requested and number of containers provided for each.

7.) Quality assurance samples are assigned by date and the number (ddmmyynn) of the associated QC sample (01, 02, etc). (E.g., The first equipment blank, trip blank, or ambient blank collected on July 20, 2012 in association with samples on the COC will be designated **20071201** in the Blank Lot Control Number field).

NOTES: Trip Blanks shall correspond to the first well sampled with VOCs, for example: ST069-MW-08S-c. ERPIMS LOCID for TB, EB and AB are designated as **FIELDQC** samples.

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WATER-LEVEL DATA SUMMARY

Project Name/Number	**Date**
	Field Personnel #1
Site Name	**Field Personnel #2**
Client	**Field Personnel #3**
Survey Datum (NGVD)	**Weather (previous 24 hours)**
Measuring Device	

Well Number	Time (hhmm)	Measuring Point		Depth to Water (ft, TOC)	Elevation of Water (ft, NGVD)
		Description	Elevation (ft, NGVD)		

Notes: NGVD = National Geodetic Vertical Datum
TOC = Top of Well Casing

Comments/Observations

APPENDIX B

Dedicated Bladder Pump Diagram

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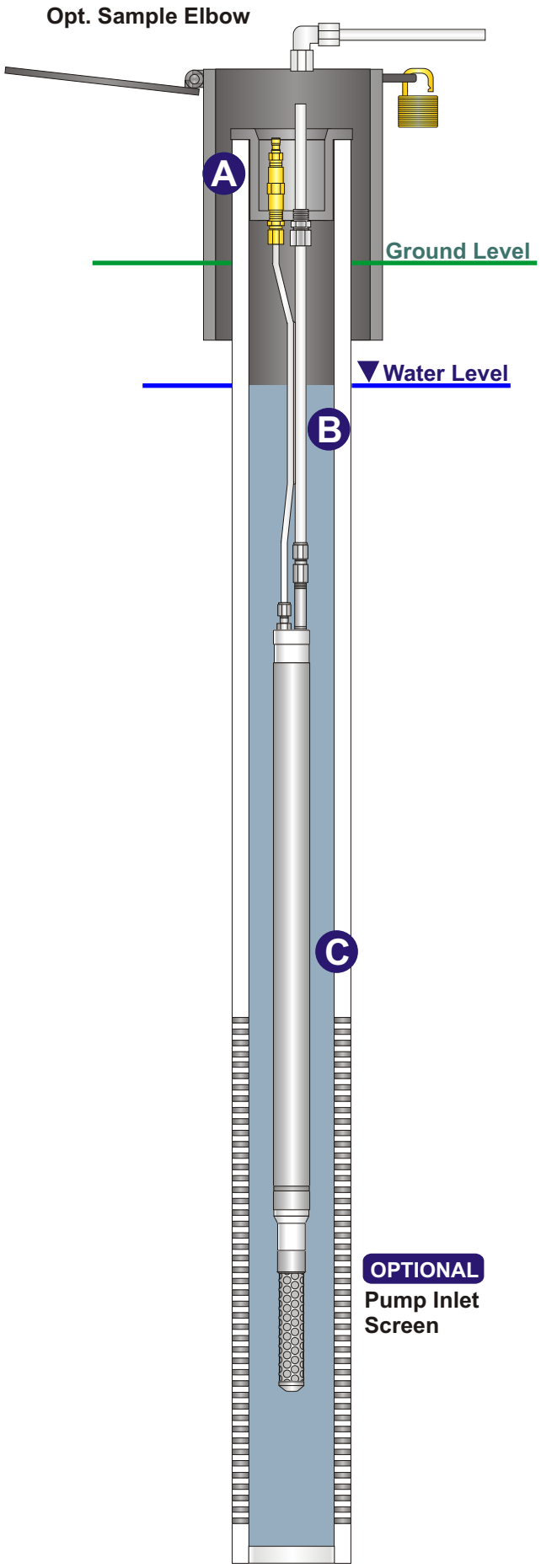
WELL WIZARD®
Dedicated Monitoring Systems

SYSTEM "A" Bladder Pump Only



System Components

- **A** Well Cap
- **B** Pump Tubing
- **C** Pump

Options:

Pump Inlet Screen

REV. 8-25-04