FORT WINGATE DEPOT ACTIVITY
MCKINLEY COUNTY, NEW MEXICO

FINAL- NMED REVISION

RCRA FACILITY INVESTIGATION WORK PLAN
PARCEL 23

06 April 2010

Prepared for

U.S. Army Corps of Engineers
Fort Worth District
819 Taylor Street
Room 3A12
Fort Worth, TX 76112

Contract No. GS-10F-0029M
Contract Task Order No. W9126G-08-F-0070

Prepared by

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This RCRA Facility Investigation Work Plan summarizes previous investigations and describes field activities that will be conducted at Solid Waste Management Unit 21 and Area of Concern 73, within Parcel 23 at Fort Wingate Depot Activity, New Mexico. This document has been prepared for submission to the New Mexico Environment Department (NMED), Hazardous Waste Bureau (HWB) as required by Section VII.F.1 of the Resource Conservation and Recovery Act (RCRA) Permit, No. NM 6213820974.

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PREFACE

This Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) Work Plan summarizes previous investigations and describes the field activities that will be conducted at Solid Waste Management Unit (SWMU) 21 and Area of Concern (AOC) 73, within Parcel 23 at Fort Wingate Depot Activity (FWDA), New Mexico. The work plan addresses the requirements of the U.S. Army Corps of Engineers (USACE) Statement of Work (SOW) dated July 12, 2008, and revised on August 5, 2008.

This RFI Work Plan was prepared by CH2M HILL in April 2010. Mr. Mark Patterson served as the FWDA Defense Base Realignment and Closure (BRAC) Environmental Director and Mr. Steve Smith served as the USACE Project Manager.

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Acronyms and Abbreviations

AOC	Area of Concern
ACM	asbestos-containing material
BRAC	Defense Base Realignment and Closure Plan of 1990
bgs	below ground surface
C	composite (type of sample)
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COPC	contaminant of potential concern
CRP	Community Relations Plan
D	discrete (type of sample)
DDD	dichlorodiphenyldichloroethane
DDT	dichlorodiphenyltrichloroethane
DOI	U.S. Department of the Interior
DQO	data quality objective
DRO	diesel range organics
EB	equipment blank
EPA	U.S. Environmental Protection Agency
°F	degrees Fahrenheit
FWDA	Fort Wingate Depot Activity
GRO	gasoline range organics
HHRB	Human Health Risk Assessment Branch
HMX	cyclotetramethylenetetranitramine
HSP	Health and Safety Plan
ICP	inductively coupled plasma
IDW	investigation-derived waste
IDWMP	Investigation-Derived Waste Management Plan
J	estimated value, analyte positively detected below the analytical reporting limit
lbs	pounds
M	multi-incremental (type of sample)
MI	multi-incremental
mg/kg	milligram(s) per kilogram
mm	millimeter
MDL	method detection limit
MSL	mean sea level

MS/MSD	matrix spike/matrix spike duplicate
NMED	New Mexico Environment Department
NMED-HWB	New Mexico Environment Department – Hazardous Waste Bureau
NRCS	Natural Resources Conservation Service
OB/OD	Open Burn/Open Detonation
PA	Programmatic Agreement
PARCC	precision, accuracy, representativeness, comparability, and completeness
PCB	polychlorinated biphenyl
PID	photoionization detector
PPE	personal protective equipment
ppmv	parts per million by volume
QAPP	Quality Assurance Project Plan
QA/QC	quality assurance/quality control
QC	quality control
RCRA	Resource Conservation and Recovery Act of 1976
RDX	cyclotrimethylenetrinitramine
RFI	RCRA Facility Investigation
RSL	Regional Screening Level
SB	soil boring
SOW	Statement of Work
SS	surface soil
SSL	Soil Screening Levels
SVOC	semi-volatile organic compound
SWMU	Solid Waste Management Unit
TAL	target analyte list
TB	trip blank
TCL	target compound list
TCP	traditional cultural property
TEAD	Tooele Army Depot
TNT	trinitrotoluene
TPH	total petroleum hydrocarbons
TRPH	total recoverable petroleum hydrocarbons

USACE	U.S. Army Corp of Engineers
USGS	U.S. Geological Survey
UTM	Universal Transverse Mercator
UXO	unexploded ordnance
VOC	volatile organic compound
WSMR	White Sands Missile Range
WWI	World War I

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ES.0 Executive Summary

ES.1 Executive Summary

This Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) Work Plan summarizes previous investigations at Solid Waste Management Unit (SWMU) 21 and Area of Concern (AOC) 73 within Parcel 23 at Fort Wingate Depot Activity (FWDA), New Mexico. This plan also describes additional investigation activities to be completed at SWMU 21 and AOC 73.

A companion to this document, the Historical Information Report for Parcel 23, has been prepared to compile and summarize historical documents available for SWMU 21 and AOC 73, which are the only SWMU or AOC sites located within Parcel 23. The Historical Information Report provides further detail regarding the operational history, site or facility drawings, and environmental information contained in previously completed reports for SWMU 21 and AOC 73.

ES.2 Purpose

This RFI Work Plan has been prepared for submission to the New Mexico Environment Department – Hazardous Waste Bureau (NMED-HWB), as required by Section VII.H.1.a of the RCRA Permit (NM 6213820974) for the FWDA, which became effective December 31, 2005.

This RFI Work Plan contains information for SWMU 21 and AOC 73, which are the only SWMU or AOC sites located within Parcel 23.

ES.2 Proposed Investigations

Existing data have been evaluated to determine whether additional field activities are required to characterize the nature and extent of potential environmental impacts at SWMU 21 and AOC 73. Sections 5 and 6 of this RFI Work Plan evaluate the existing data for the individual sites and propose additional investigation activities. Brief summaries of the recommended actions for SWMU 21 and AOC 73 are provided as follows:

- SWMU 21: Central Landfill

  Installation and sampling of ten additional soil borings is proposed to evaluate the vertical extent of contamination. Seven of 10 soil borings will be advanced in the SWMU 21 area that was excavated in 1999. These seven borings will be advanced to approximately 40 feet below the bottom of the former landfill with four advanced to the water table or to drilling refusal if the water table is not encountered. Soil samples will be collected at 0-to 1-feet below the bottom of the former landfill and then at 5-foot intervals to total depth. The remaining three soil borings will be installed immediately south of SWMU 21. Soil samples in these borings will be collected at 1- to 2-feet bgs and then at 5-foot intervals to 20 feet bgs. Soil samples will be analyzed for: RCRA metals, volatile organic compounds (VOCs), total petroleum hydrocarbons (TPH) as gasoline range organics (GRO) and diesel range organics (DRO), perchlorate, semi-volatile organic compounds (SVOCs), pesticides, and explosives.

- AOC 73: Buildings or Structures along Road C-3

  The 2008 Release Assessment investigation indicated that no COPCs were positively detected in soil at the site. Multi-incremental soil sampling will be performed at the two former building locations to confirm the results of the Release Assessment. Fifty subsamples will be collected from 0- to 6-inches bgs and 50 subsamples from 6- to 12-inches bgs within each decision unit at the former building locations. Each of the multi-incremental samples will be analyzed for RCRA metals and explosives.

All RFI activities will be conducted in accordance with proposed actions and procedures specified in the NMED-approved work plan. Other associated project-specific planning documents are discussed in this work plan and provided as appendices.

1.0 Introduction

This Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) Work Plan summarizes previous investigations and describes additional investigation activities to be completed at Solid Waste Management Unit (SWMU) 21 and Area of Concern (AOC) 73 within Parcel 23 at Fort Wingate Depot Activity (FWDA), New Mexico. The location of FWDA is shown on Figure 1-1. The location of the major land use areas and parcels within FWDA are shown on Figure 1-2. Parcel 23 contains one SWMU and one AOC, SWMU 21 and AOC 73, as shown on Figure 1-3.

A companion to this document, the Historical Information Report for Parcel 23, has been prepared to compile and summarize historical documents available for SWMU 21 and AOC 73 (USACE, 2009). The Historical Information Report provides further detail regarding the operational history, site or facility drawings, and environmental information contained in previously completed reports for SWMU 21 and AOC 73.

1.1 Purpose and Scope

This RFI Work Plan has been prepared for submission to the New Mexico Environment Department – Hazardous Waste Bureau (NMED-HWB), as required by Section VII.H.1.a of the RCRA Permit (NM 6213820974) for FWDA, which became effective December 31, 2005.

This work was completed in partial fulfillment of the requirements of Contract Task Order Number W9126G-08-F-0070 under Contract Number GS-10F-0029M as outlined in the Statement of Work (SOW) dated July 12, 2008, and revised on August 5, 2008. Technical oversight of this work was provided by the U.S. Army Corps of Engineers (USACE), Fort Worth District.

1.2 Document Organization

The remainder of this RFI Work Plan is organized into the following sections:

- Section 2 – Describes the cultural resources within Parcel 23.
- Section 3 – Presents background information for the FWDA and Parcel 23 including operational histories and site conditions.
- Section 4 – Describes the proposed investigation methods.
- Section 5 – Presents information for SWMU 21 including the site background, previous investigations, investigation methods, and field activities.
- Section 6 – Presents information for AOC 73 including the site background, previous investigations, investigation methods, and the release assessment.
- Section 7 – Provides project management information including project scheduling and reporting requirements, and other plans that will followed during completion of the proposed field activities.
- References – Presents works cited within this report.

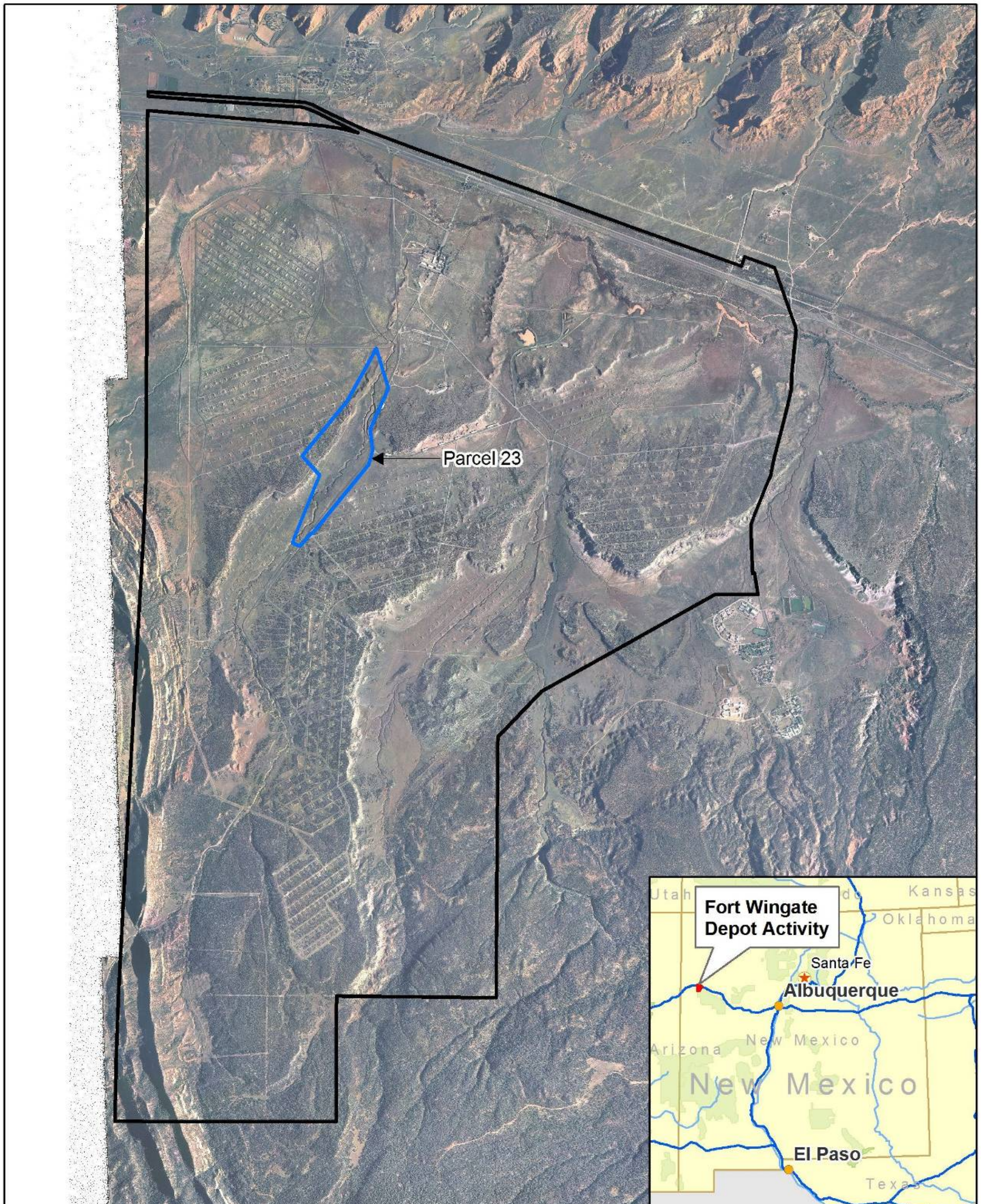

Figure 1-1

Site Location Map for Parcel 23
Fort Wingate Depot Activity, New Mexico

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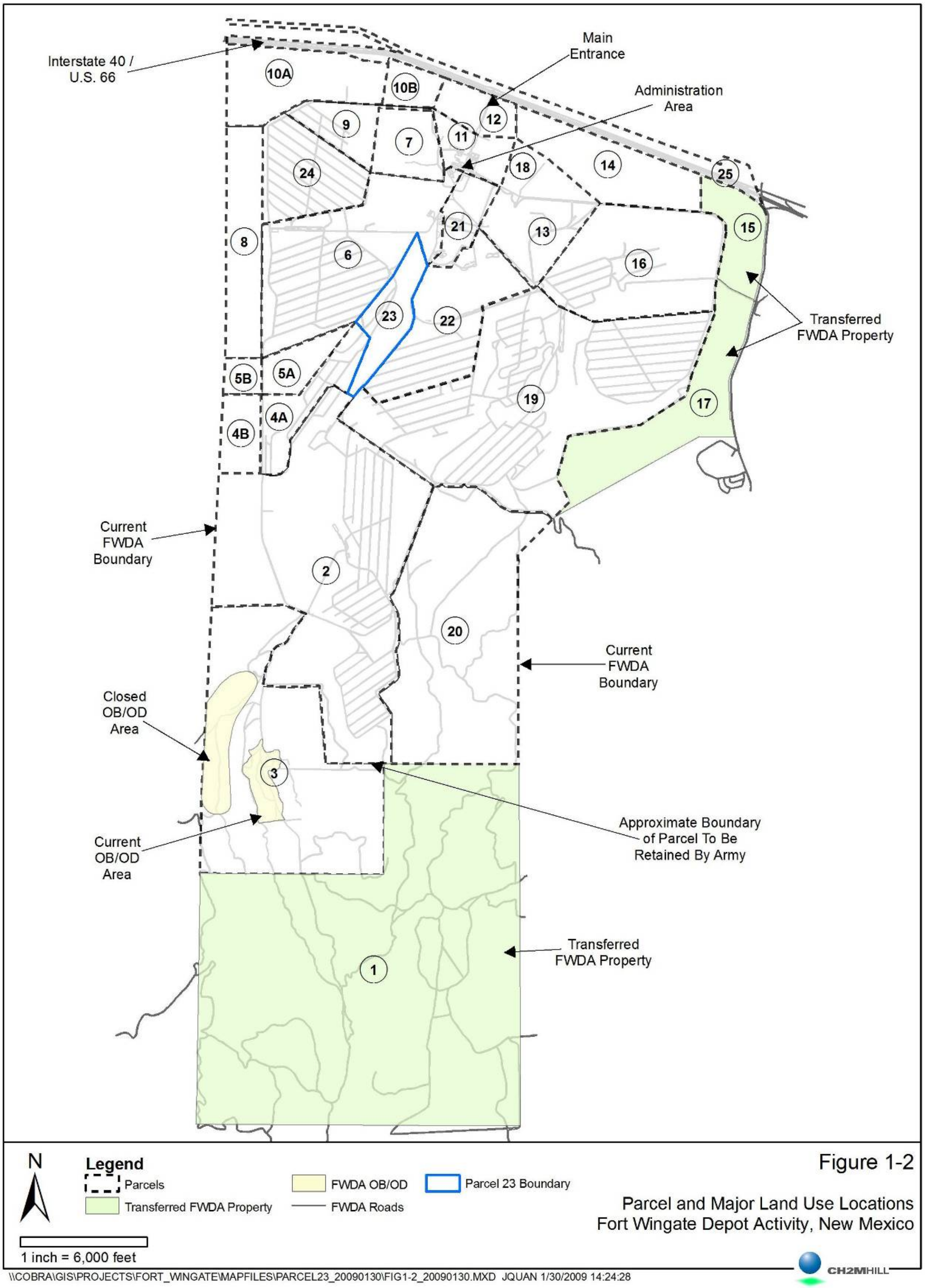

Figure 1-2
Parcel and Major Land Use Locations
Fort Wingate Depot Activity, New Mexico

Figure 1-3

Parcel 23 AOC and SWMU Locations
Fort Wingate Depot Activity, New Mexico

2.0 Cultural Resources

Traditional cultural properties (TCPs) and other cultural resources have been documented within the FWDA boundaries. Based on a review of available mapping (UNM OCA, 1994), it appears that there are a limited number of identified sites within Parcel 23.

The USACE, Fort Worth District has developed a Programmatic Agreement (PA) to specify procedures to be employed during environmental characterization and remediation activities. The PA is provided as Appendix A.

Maps showing the locations of TCPs relative to proposed investigation locations will not be included in this Work Plan, which will be a public document when final. Instead, the consultation process will include review by tribal cultural resource personnel to confirm the presence or absence of identified cultural resources within the proposed investigation locations. If needed, tribal cultural resource personnel will walk each proposed investigation location prior to the initiation of intrusive activities. Tribal cultural resource and archaeological personnel will be onsite during intrusive activities, as described in the PA.

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3.0 Background

3.1 Site Description and Operational History

The FWDA installation is located approximately 8 miles east of Gallup, New Mexico, and currently occupies approximately 15,277 acres of land in McKinley County, New Mexico (Figure 3-1). The installation is almost entirely surrounded by federally owned or administered lands, including both national forest and tribal lands. The installation can be divided into several sub-areas based on their location and historical land use (Figure 3-2). The major land use areas include:

- Administration Area – encompassing approximately 800 acres in the northern portion of the installation, which contains former office facilities, housing, equipment maintenance facilities, warehouse buildings, and utility support facilities.
- Workshop Area – encompassing approximately 700 acres to the south of the Administration Area, which consists of an industrial area containing former ammunition maintenance and renovation facilities, the former trinitrotoluene (TNT) washout facility, and the TNT leach beds area.
- Ten Munitions Storage Areas (Igloo Blocks A through H, J, and K) – encompassing approximately 7,400 acres in the central portion of the installation, which consists of 732 earth-covered igloos and 241 earthen revetments previously used for the storage of munitions.
- Open Burning/Open Detonation (OB/OD) Area – encompassing approximately 1,800 acres in the west-central portion of the installation, which is separated into two sub-areas based on the period of operation, the Closed OB/OD Area and the Current OB/OD Area.
- Protection and Buffer Areas – encompassing approximately 4,050 acres located adjacent to the eastern, western, and northern installation boundaries, which consists of buffer zones surrounding the former magazine and demolition areas.

The FWDA installation was originally established by the U.S. Army in 1862 at the southern edge of the Navajo territory. In 1918, the mission of the FWDA changed from tribal issues to World War I (WWI)-related activities. Beginning in 1940, the FWDA's mission was primarily to receive, store, maintain, and ship explosives and military munitions, as well as to disassemble and dispose of unserviceable or obsolete explosives and military munitions. In 1975, the installation came under the administrative command of Tooele Army Depot (TEAD), located near Salt Lake City, Utah.

In January 1993, the active mission of the FWDA was ceased and the installation closed as a result of the Defense Base Realignment and Closure Act of 1990 (BRAC). Beginning in 2002, the U.S. Army reassigned many FWDA functions to the BRAC Division, including caretaker duties, property transfer, and performance of environmental compliance and restoration activities. Command and control responsibilities were retained by TEAD until January 31, 2008, when these responsibilities were transferred to White Sands Missile Range (WSMR).

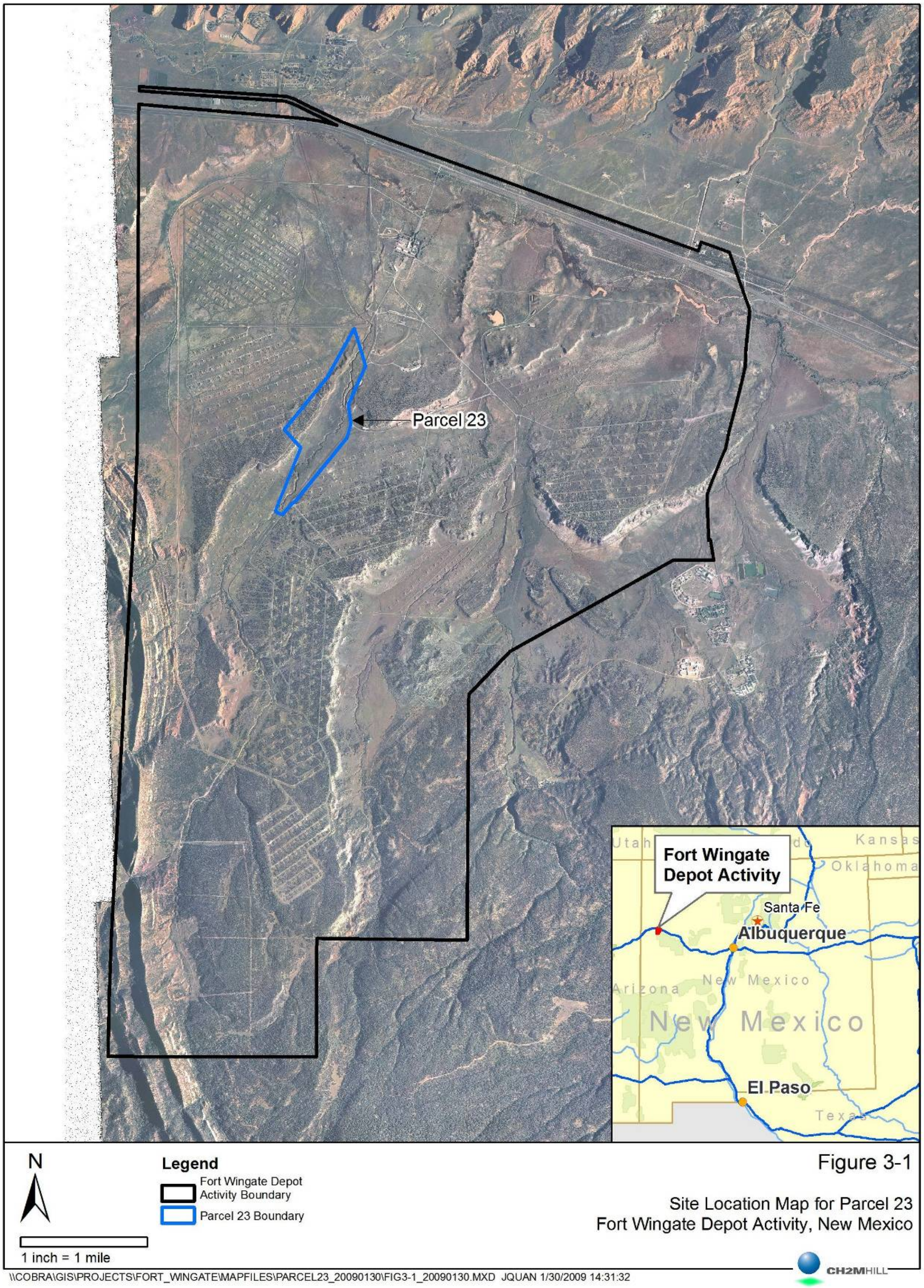

Figure 3-1

Site Location Map for Parcel 23
Fort Wingate Depot Activity, New Mexico

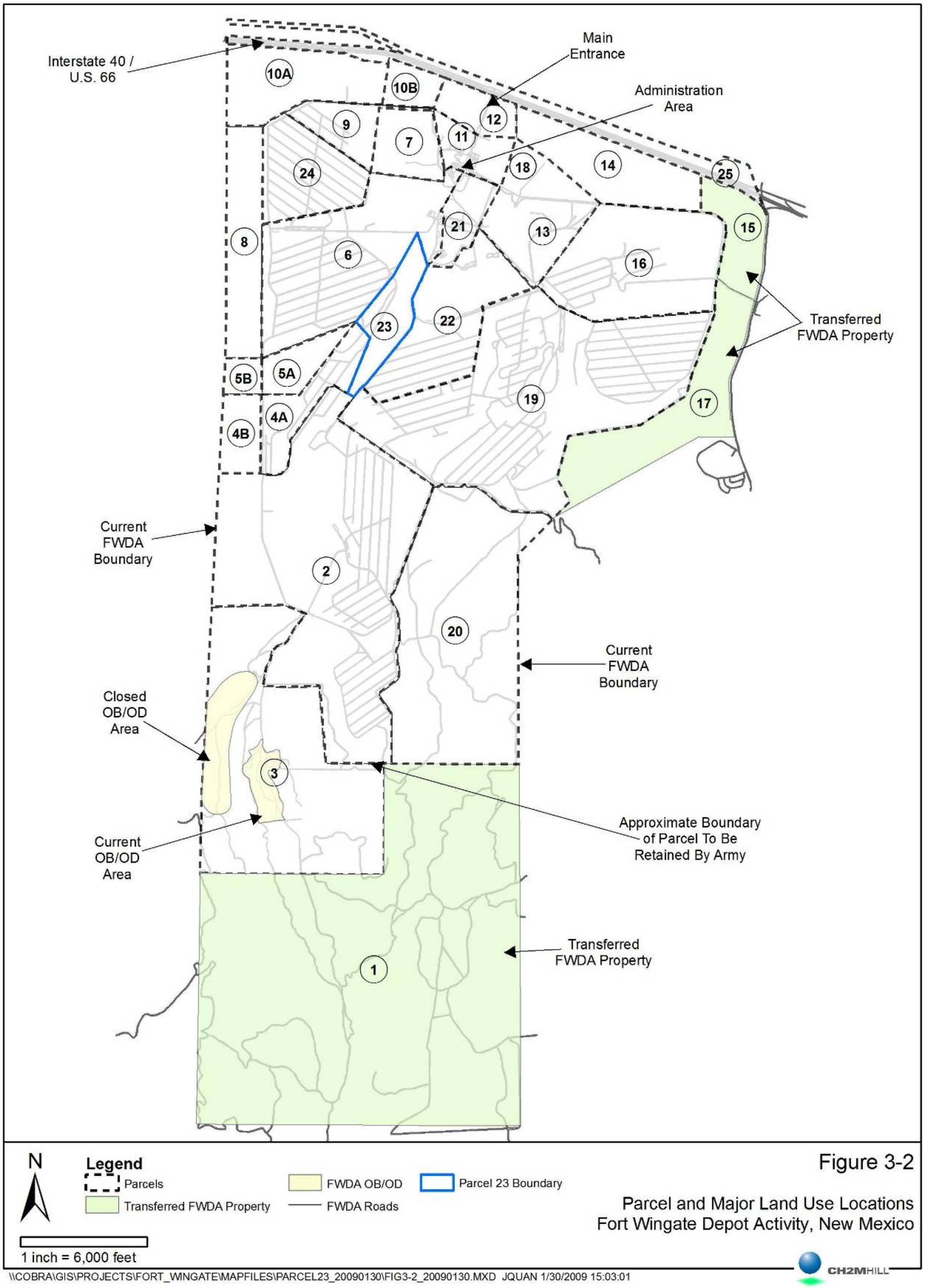

Figure 3-2

Parcel and Major Land Use Locations
Fort Wingate Depot Activity, New Mexico

The FWDA installation is currently undergoing final environmental characterization and restoration activities prior to final property transfer and reuse. The installation has been divided into reuse parcels as part of the planned property transfer to the U.S. Department of the Interior (DOI). This RFI Work Plan only includes information related to the SWMUs and AOCs located within Parcel 23. The RCRA Permit lists a total of one SWMU and one AOC located within the boundary of Parcel 23, as shown in Figure 3-3. The sites included in this RFI Work Plan are:

- SWMU 21: Central Landfill
- AOC 73: Former buildings or structures along Road C-3

3.2 Site Conditions

3.2.1 Climate

Northwestern New Mexico is characterized by a semiarid continental climate. Most precipitation occurs from May through October as rain or hail in summer thunderstorms, and the remainder from light winter snow accumulations (M&E, 1992). Spring and fall droughts characterize the area. Mean annual rainfall for the area ranges between 10 and 16 inches, while the recorded average annual precipitation for the FWDA is 11 inches. Depending on local elevations, mean annual rainfall fluctuates between 8 and 20 inches.

The average seasonal temperatures for the area vary with elevation and topographic features. During winter, daily temperatures fluctuate as much as 50 to 70 degrees Fahrenheit (°F) in a 24-hour period. In summer, daily high temperatures are between 85°F and 95°F (M&E, 1992). Average temperatures in winter are about 27°F and in summer 70°F, while extreme temperatures are as low as -30°F in winter and as high as 100°F in summer. There are 100 to 150 frost-free days during the year from the middle of May to the middle of October (M&E, 1992).

3.2.2 Topography

The elevation of the FWDA ranges from approximately 8,200 feet above mean sea level (MSL) in the south to 6,660 feet above MSL in the north, as shown in Figure 3-4. Topographically, the FWDA may be divided into three general areas: 1) the rugged north-to south trending Hogback along the western and the southwestern boundaries; 2) the northern hill slopes of the Zuni Mountains in the southern portion; and 3) the alluvial plains marked by bedrock remnants in the northern portion of the installation.

Main drainages, following the topography, generally flow from south to north and discharge to the south fork of the Puerco River near the northern boundary of the FWDA. However, many tributaries follow the regional trend, flowing from southwest to northeast. During rainfall and snowmelt events, streams transport sediment to low-lying areas in the northern part of the installation, creating an extensive alluvial deposit among remnants of bedrock.

The topographic contours for the land within Parcel 23 are shown in Figure 3-4 (at the end of this section) and illustrate that this parcel is relatively flat with the exception of the incised arroyo channel. Surface runoff during rainfall /snowmelt events collects in the arroyo channel, which only flows intermittently during precipitation events or pools locally in low areas where it evaporates or infiltrates. No other perennial or intermittent surface water bodies exist within Parcel 23.

Figure 3-3

Parcel 23 AOC and SWMU Locations
Fort Wingate Depot Activity, New Mexico

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3.2.3 Vegetation/Habitat

The vegetation cover for Parcel 23 includes moderate grasslands and sagebrush. Parcel 23 provides habitat for antelope, coyotes, prairie dogs, rattlesnakes, field mice, various other insects and animals, and occasionally mountain lions and bear.

3.2.4 Soils

The soils found on the installation are similar to those occurring in cool plateau and mountain regions of New Mexico. The major soil types at the FWDA are variants/complexes of sands, loams, clays, and rocks. These soils are relatively thin, and the parent bedrock is either at or near the surface in more than a quarter of the installation.

Natural Resources Conservation Service (NRCS) soils mapping for Parcel 23 is shown in Figure 3-5 at the end of this section. NRCS soils descriptions are included in Appendix B. As presented in Figure 3-5 and Appendix B, there are three types of soil for Parcel 23. Soils are generally as follows from west to east: Evpark-Arabrab Complex, Aquima-Hawaikuh Silt Loam, and Rehobeth Silty Clay Loam. A rock outcrop of the Rizno-Tekapo Complex is present in the central portion of Parcel 23 (Figure 3-5).

3.2.5 Geology

In 1997, geologic mapping of portions of the FWDA and a fracture trace analysis were conducted by the U.S. Geological Survey (USGS) located in Flagstaff, Arizona. Geologic units exposed at the ground surface throughout much of the FWDA were identified. Results of this identification, combined with information from geologic literature, are presented below to provide a description of the geologic and stratigraphic setting of the portion of the FWDA in which Parcel 23 is located.

3.2.5.1 Stratigraphy

Quaternary alluvial sediments cover the eastern portion of Parcel 23 (Figure 3-6, at the end of this section). The Quaternary alluvial sediments at FWDA consist predominately of silts and clays, with discontinuous bodies of sand and some areas of gravel. Wind and water cause extensive soil erosion, especially where vegetative cover is absent.

The alluvial deposits in Parcel 23 are underlain by the Triassic-age Petrified Forest Formation, which is exposed in the western portion of Parcel 23. FWDA is primarily underlain by Triassic mudstone and sandstone layers that are tilted gently to the northwest. However, in the western and southern portions of the installation, Jurassic and Cretaceous sandstone and claystone layers are exposed along the Nutria Monocline (the Hogback), which is a steeply west-dipping, north-trending monoclinal fold.

The Petrified Forest Formation comprises greater than 75 percent of the bedrock exposed at the surface throughout the FWDA. The Petrified Forest Formation is divided into three members with the upper and lower members divided by a middle member consisting of a relatively thick, continuous sandstone layer (Sonsela Sandstone Member). A stratigraphic column and description of the various lithologic units in the FDWA area is presented in Figure 3-7 at the end of this section. The upper Painted Desert Member and the lower Blue Mesa Member each consist of mudstone, siltstone, sandy-mudstone, and lenticular sandstone layers. Sandstone lenses within the Painted Desert and Blue Mesa Members are thin (generally less than 20 feet thick), laterally discontinuous, and contain high quantities of very fine, muddy matrix. As a result, the apparent permeability of these lenses, and the Painted Desert and Blue Mesa Members as a whole, is very low. The Sonsela Sandstone Member (the middle member of the Petrified Forest Formation) is of variable thickness (20 to 80 feet thick) and is laterally continuous. This unit is a clean, well-sorted, quartzose sandstone that contains very small amounts of matrix and therefore has a high apparent permeability.

The Moenkopi Formation, the San Andres Limestone, and the Glorieta Sandstone underlie the Blue Mesa Member. The lower Petrified Forest Formation and the Moenkopi Formation comprise 250 to 300 feet of mudstones and sandstones with a relatively low apparent permeability. These units are underlain by approximately 100 feet of the San Andres Limestone which is underlain by approximately 120 feet of the Glorieta Sandstone.

3.2.5.2 Structural Geology

Bedrock underlying the majority of the FWDA installation dips gently to the northwest at an angle of approximately 5 degrees. The structural orientation of the bedrock substantially influences the movement of groundwater. The groundwater flow gradient across the installation is primarily to the north-northwest, generally following the structural dip of the geologic units.

3.2.6 Hydrogeologic Conceptual Model

The hydrogeologic conceptual model that has been developed for the northern portion of FWDA is based on previous investigations conducted in the areas of the installation described as the TNT Leaching Beds and the Administration Area. This conceptual model has been developed based on data collected during various investigations performed over a 25-year period prior to issuance of the RCRA Permit. Generally, the objective of the prior investigations was the characterization of impacts to groundwater on a larger scale. Specifically, these investigations included a primary focus on impacts associated with discharges at the TNT Leaching Beds (part of SWMU 1), and a secondary focus on impacts associated with releases from various locations within the Administration Area. At the time the data were collected and the conceptual model was developed, the current system of dividing the FDWA into parcels, SWMUs, and AOCs was not in place. Therefore, the conceptual model uses broader terminology, such as TNT Leaching Beds and Administration Area, to describe areas of the FDWA installation and the associated hydrogeologic properties. SWMU 21 and AOC 73 are generally located immediately to the south of the TNT Leaching Beds and the Administration Area. However, the Parcel 23 sites have similar Quaternary alluvial material as the overlying unconsolidated sediments and are underlain by the same Triassic-age geologic units.

A summary of the basic hydrogeologic model for the FDWA installation is presented in the following subsections.

Water-Bearing Zones with the Shallow, Unconsolidated Alluvium

The unconsolidated alluvium consists of a series of interbedded silt, clay, and sand Quaternary sediments ranging from near 0 feet to almost 100 feet in thickness. These sediments form a wedge that increases in thickness from south to north through the TNT Leaching Beds and Administration Area study area. The thickest sediments are found near the Rio Puerco. The low-permeability mudstone and siltstones of the Petrified Forest Formation are the bedrock that generally underlies the unconsolidated materials.

Two water-bearing zones have been identified within the unconsolidated alluvium in the TNT Leaching Beds area, to north of Parcel 23. These zones are referred to as the first unconsolidated water-bearing zone and the second unconsolidated water-bearing zone. Where present, the first and second water-bearing zones are separated by a clay layer which is present between two thin, poorly graded sand deposits. Groundwater is typically encountered in each of these sand deposits, thus comprising the first and second water-bearing zones. However, the sand deposits and clay layer are not laterally extensive. In areas where the clay layer is absent a single water-bearing zone is present, which is then defined as the first unconsolidated water-bearing zone. In locations where the permeable sand intervals are absent, sustainable water-bearing zones are typically not present within the unconsolidated alluvium. The unconsolidated alluvial sediments tend to pinch out near outcrops and in areas of near-surface bedrock surfaces, acting to limit the areal extent of the shallow unconsolidated water-bearing units in these areas.

Groundwater in the unconsolidated sediments is derived from the infiltration and percolation of rain and snow-melt that moves downward through these sediments until it reaches the relatively low-permeability Triassic bedrock surface or one of the permeable sand units that define the first and second water-bearing zones. Groundwater flow in Parcel 23 is expected to generally be to the northeast, mimicking topography in this area and parallel to the arroyo.

Water-Bearing Zones with Bedrock Units

The TNT Leaching Beds and adjacent Parcel 23 area is largely underlain by low-permeability claystone bedrock with little water bearing capacity. However, discrete intervals of interbedded sandstone do provide a series of geologic materials that can be potential water-bearing zones. Previous investigations have indicated that the first encountered thin sandstone unit within the massive Painted Desert claystone interval may occur at approximately 80 to 110 feet below ground surface (bgs) but tends to be thin and discontinuous. This unit typically does not yield sufficient groundwater to be regularly monitored with a groundwater monitoring well. Additionally, the claystone above and below the sandstone interval is largely dry, indicating little vertical movement of groundwater between intervals within this largely claystone sequence of rock. Despite being laterally discontinuous and not yielding sustainable water production, this interval is referred to as the "first sandstone water-bearing zone."

At depths of slightly over 100 feet bgs and ranging to nearly 200 feet bgs, another, stratigraphically lower sandstone interval is present within the massive claystone. This layer yields more appreciable and sustainable amounts of groundwater. This interval is referred to as the "second sandstone water-bearing zone." However, the claystone intervals above and below the second sandstone water-bearing zone are also largely dry, again suggesting little vertical movement of water occurs within the geologic unit.

A series of groundwater monitoring wells have been installed in association with investigations of the TNT Leaching Beds and from possible releases from Buildings 542 and 600. However, there are no wells directly located within Parcel 23. Findings from the existing monitoring wells have generally verified that the extent of unconsolidated water-bearing zones near the Parcel 23 area that are capable of yielding sustainable groundwater is limited.

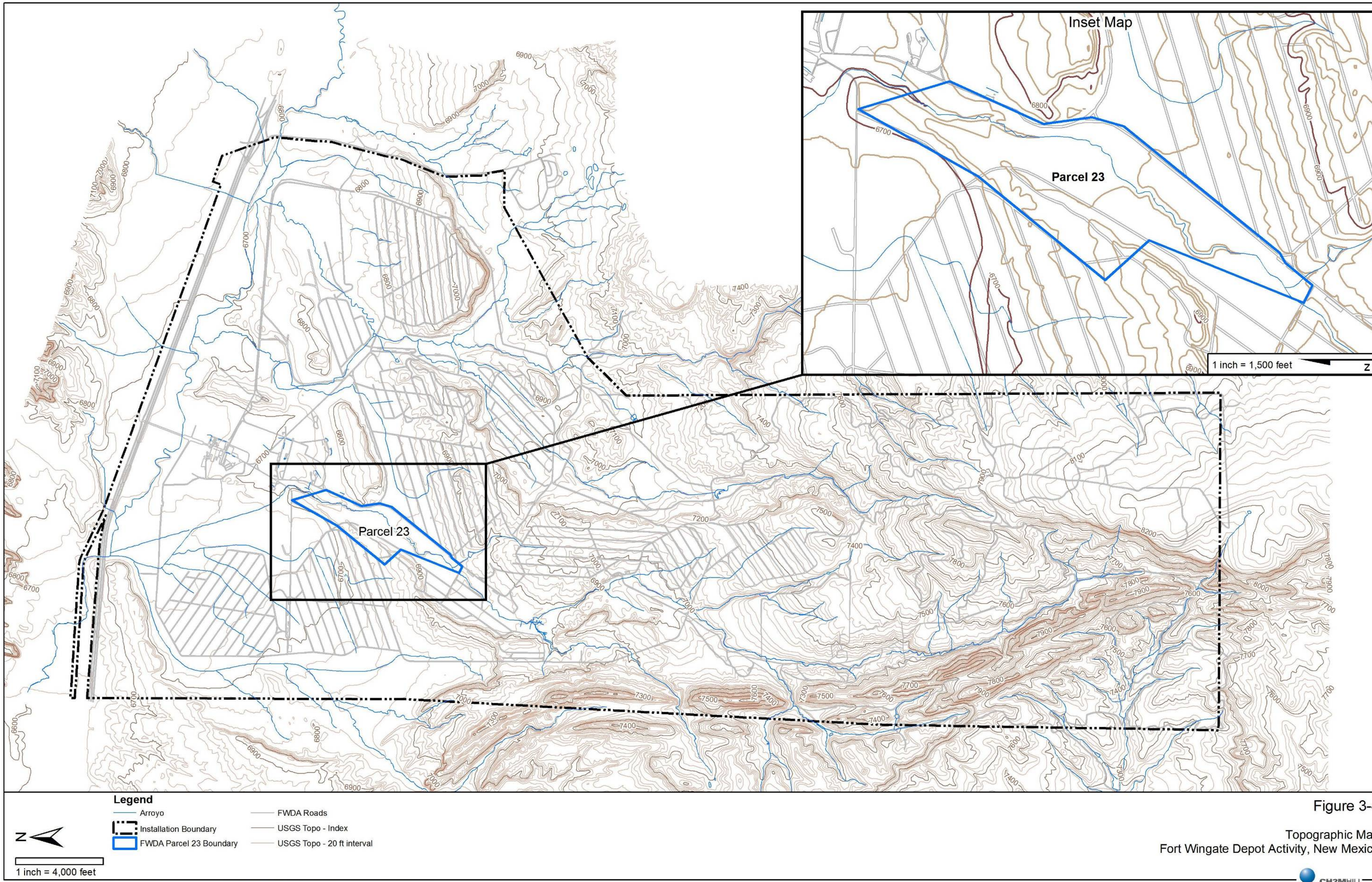

Figure 3-4

Topographic Map
Fort Wingate Depot Activity, New Mexico

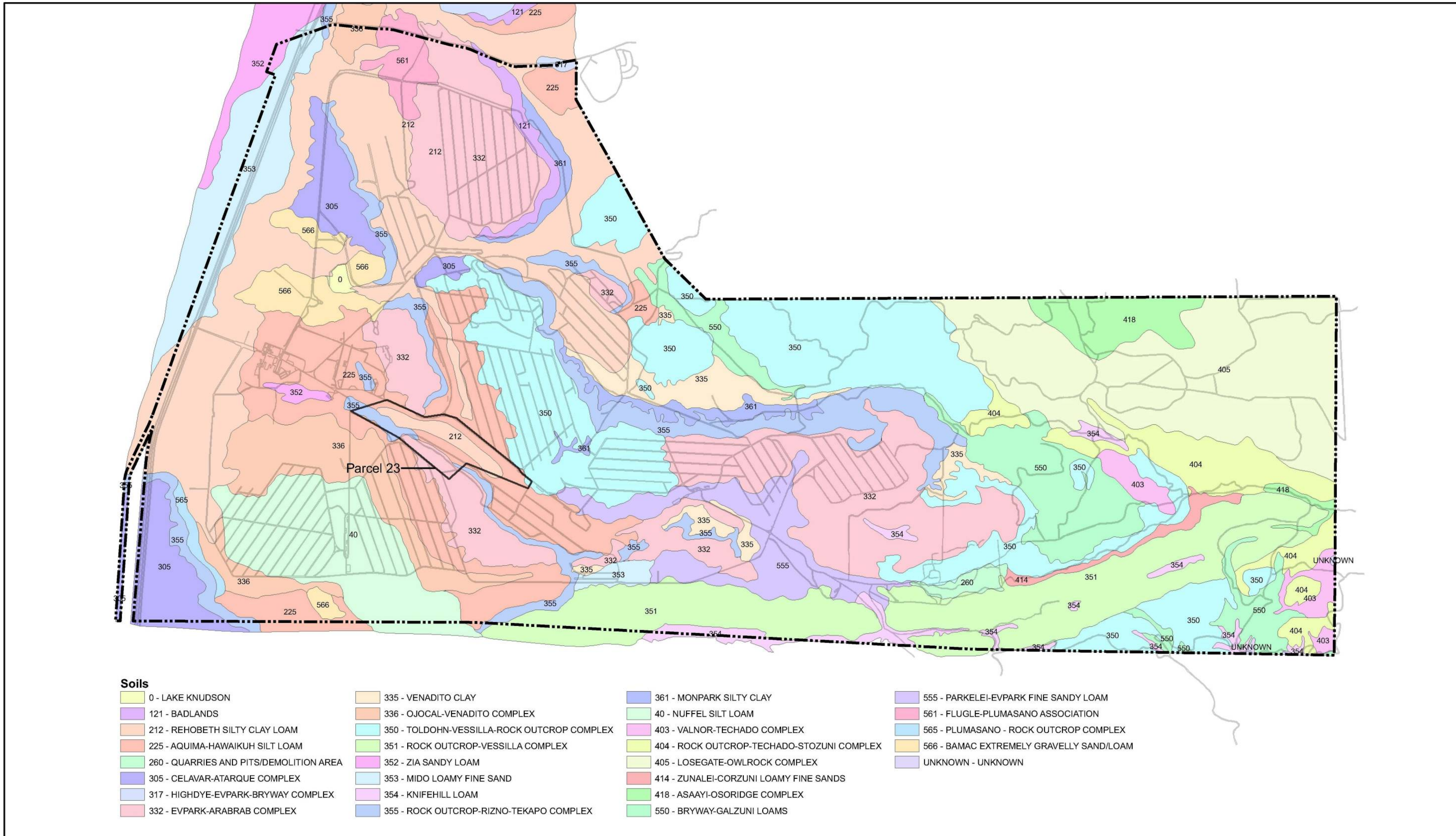

Figure 3-5

Soils Map

Fort Wingate Depot Activity, New Mexico

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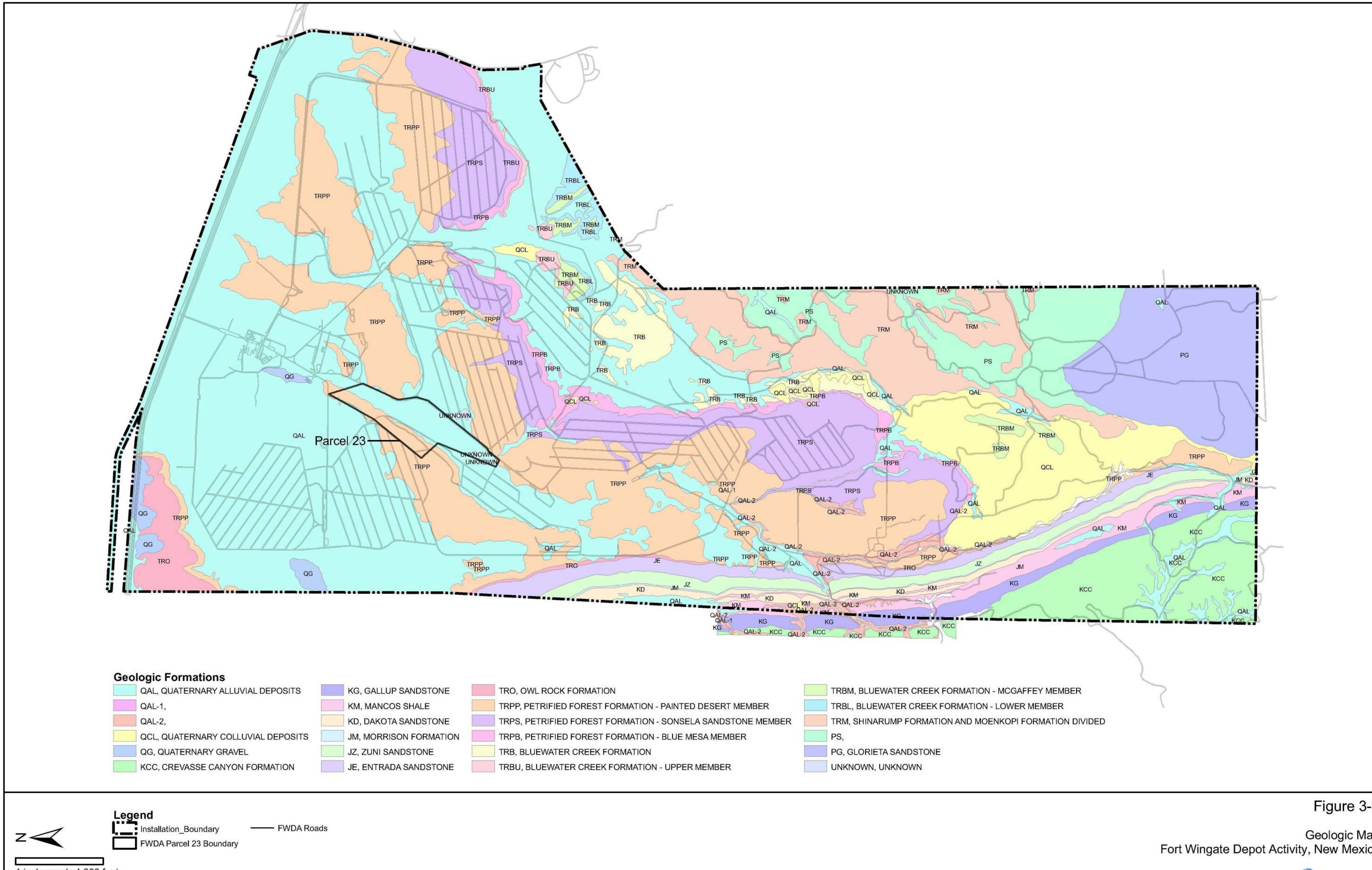

Figure 3-6

Geologic Map
Fort Wingate Depot Activity, New Mexico

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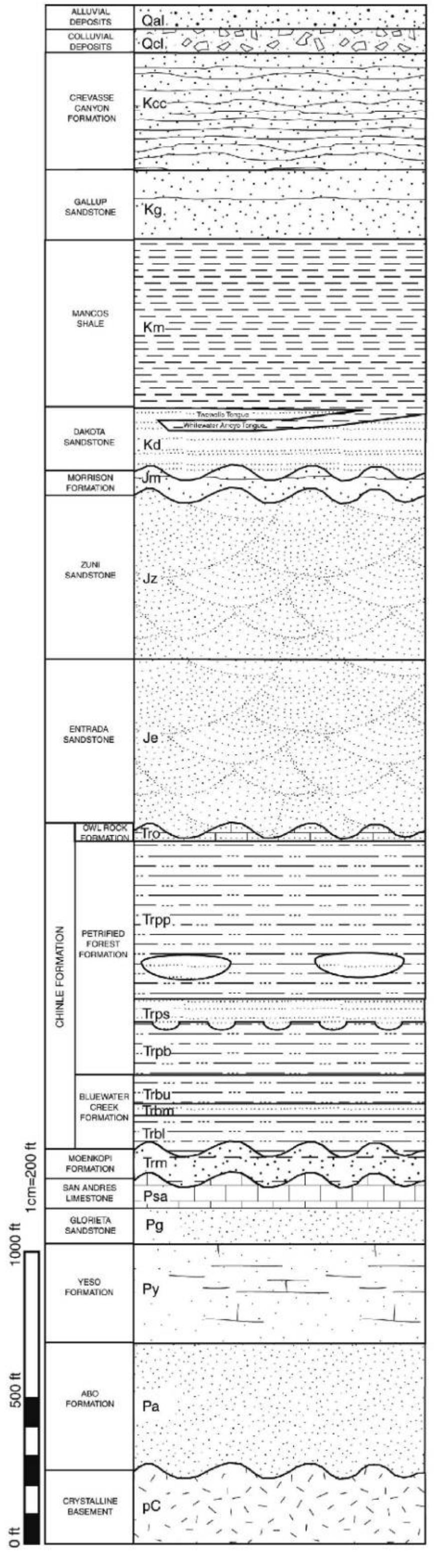

Description of Units

Qal - Alluvial deposits (Quaternary); sand, gravel, and clay in young valleys and drainages

Qcl - Colluvial deposits (Quaternary); land-slides, and cobble deposits in young valleys and on steep slopes

Kcc - Crevasse Canyon Formation (Upper Cretaceus, 88 Ma); mudstone, shale, very fine- to medium-grained sandstone, carbonaceous shale, and thin lenticular coal beds; outcrops in southwest corner only; <400 feet thick

Kg - Gallup Sandstone (Upper Cretaceus, 90 Ma); tan to pale-orange, medium-grained, well-sorted calcareous-sandstone, silty-sandstone, and coaly-carbonaceous layers; three prominent ridge forming sandstone layers (<20') are separated by silty, and carbonaceous intervals (<80'); sandstone layers have only minor amounts of cement and minimal matrix material resulting in high apparent permeability; <220 feet thick

Km - Mancos Shale (Upper Middle Cretaceus, 97-90 Ma); light- to dark-gray and mudstone, silty-mudstone, and shale; minor amounts of lenticular sandy-siltstone, limestone, and calcerous-sandstone present in upper portions; sandy layers have abundant cement and ultrafine matrix resulting in very low apparent-permeability; the Whitewater Arroyo Tongue of the Mancos Shale is intertounged with and underlies the Twowells Tongue of the Dakota Sandstone, abundant fossil corrals and cephalopods in Whitewater Arroyo Tongue; <600 feet thick excluding the Whitewater Arroyo Tongue which varies in thickness from 0-80 feet thick

Kd - Dakota Sandstone (Upper Middle Cretaceus, 97-90 Ma); tan to pale-yellow, fine- to medium-grained, sub-angular to well-rounded, grain-supported sandstone; small amounts of matrix and grain-support result in a very high apparent-permeability; Twowells Tongue of Dakota Sandstone is intertongued with and overlies the Whitewater Arroyo Tongue of the Mancos Shale; basal contact of Dakota Sandstone unconformably overlies an irregular erosional surface developed in the Morrison Formation; <230-310 feet thick including the Whitewater Arroyo Tongue

Jm - Morrison Formation (Upper Jurassic, 160-145 Ma); grayish-white to pale-orange, subangular to well rounded, fine- to coarse-grained sandstone and conglomeratic-sandstone; trough cross stratification locally; clay-rich fine-grained intervals present near upper contact; highly variable apparent-permeability; variable thickness possibly due to bedding-plane slip along monoclinal fold axis; <65 feet thick in northern part of base, thinning to <20 feet to the south

Jz - Zuni Sandstone (Middle Jurassic, 170-165 Ma); white, pink, and reddish-orange, well-rounded, clast-supported, fine- to very-fine-grained sandstone and silty-sandstone; horizontal color banding common; crossbedding in relatively thin sets (compared to Entrada Sandstone); siltier intervals correlate to shallow slopes and cleaner interval correlate to steep slopes; very-high apparent-permeability; <620 feet thick

Je - Entrada Sandstone (Middle Jurassic, 170-165 Ma); red, and pinkish-gray, moderately rounded, matrix supported, fine- to medium-grained sandstone; large-scale crossbedding; less competent than Zuni Sandstone; calcareous cement; very-high apparent-permeability; <650 feet thick

Tro - Owl Rock Formation (Upper Triassic, 225-210 Ma); white, grayish-pink, and orange, crystalline-limestone, sandy-limestone, and calcerous-sandstone; variable thickness possibly due to bedding-plane slip along monoclinal fold axis; <30 feet thick

Trpp - Petrified Forest Formation, Painted Desert Member (Middle Triassic, 225-210 Ma); purplish-red, orangish-red and rust colored, mudstone, siltstone, sandstone, and sandstone-conglomerate; sandstone intervals (<20') have tabular and trough cross beds, abundant ultrafine matrix, and are generally dirty resulting in low apparent-permeability; abundant 1-2cm greenish gray calcrete nodules present forming a distinctive mottled or speckled surface; shallow (<6') channel deposits with intraformational conglomerates containing mudstone and carbonate clasts; lenticular bodies of sandstone with similar lithology to the Sonsela Sandstone are laterally discontinuous; <600 feet thick

Trps - Petrified Forest Formation, Sonsela Sandstone Member (Middle Triassic, 225-210 Ma); yellow, tan, and olive-colored, well rounded, clast-supported, medium- to coarse-grained sandstone and conglomeratic sandstone; conglomeratic intervals containing intraformational (mudstone, carbonate) and extraformational (chert, quartzite) clasts; thin crossbedding common; minimal matrix and grain-support result in very-high apparent-permeability; <100 feet thick, highly variable thickness typical of large-scale channel deposits

Trpb - Petrified Forest Formation, Blue Mesa Member (Middle Triassic, 230-225 Ma); purple, and purplish-red, mudstone, and muddy-sandstone; mudstones are smectitic; light-gray sandy-smectitic-siltstone interval (<8') serves as marker bed for the base of the Petrified Forest Formation; high quantity of ultrafine matrix results in a very-low apparent-permeability; petrified wood very common in upper portions; <280 feet thick

Trbu - Bluewater Creek Formation, Upper Member (Upper Triassic, 230-225 Ma); pinkish-gray to reddish-brown siltstone and mudstone; calcrete nodules present locally; high silt and ultrafine matrix result in low apparent-permeability; <100 feet thick

Trbm - Bluewater Creek Formation, McGaffey Member (Upper Triassic, 230-225 Ma); white, pale-red and gray, medium-grained, ripple-laminated sandstone; color banding common; basal interval has carbonate-clast-conglomerate; calcareous cement; high apparent-permeability; <80 feet thick, highly variable thickness typical of large-scale channel deposits, locally not recognized

Trbl - Bluewater Creek Formation, Lower Member (Middle to Upper Triassic, 240-225 Ma); yellowish-gray, and reddish-brown mudstone and siltstone; calcrete nodules are present locally; low apparent-permeability; <115 feet thick

Trm - Shinarump Formation and Moenkopi Formation Undivided (Middle Triassic, 240-225 Ma); Shinarump Formation is purple and reddish-gray, motled chert- and quartzite-pebble-conglomerate and congloeratic-sandstone with reddish-brown matrix; Moenkopi is red, tan, and black calcareous-mottled-sandstone and calcareous-mudstone; massive to thinly-laminated and ripple-laminated siltstone and very fine-grained sandstones; 30-200 feet thick combined

Psa - San Andres Limestone (Middle Permian, 275-250 Ma); gray and white, fossiliferous, crystalline-limestone and dolomitic-limestone; locally absent due to karsting; <165 feet thick

Pg - Glorieta Sandstone (280-275 Ma); grayish-orange to orange, well-sorted, moderate- to well-rounded, fine- to medium-grained quartzose-sandstone; horizontal and low-angle crossbedding locally; <130 feet thick

Py - Yeso Formation (280-275 Ma); dark-orange to reddish-orange, very fine-grained gypsiferous-sandstone and silty-sandstone; three light-gray, dolomitic, carbonate beds (7') present in formation; <375 feet thick

Pa - Abo Formation (280-275 Ma); grayish-red, very fine-grained silty-sandstone; non-calcerous; flat-bedded; basal 3-12' are arkosic; <450 feet thick

pC - Precambrian Basement; typically granitic- to dioritic- igneous and metamorphic rocks

Reference: Thorstenson, D.J., and Beard, L.S., U.S. Geological Survey, 2000

Figure 3-7

Stratigraphic Column
Fort Wingate Depot Activity, New Mexico

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4.0 Investigation Methods

4.1 Previous Investigations

The environmental restoration process has been underway for more than 30 years at the FWDA. In 1980, the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) guidelines began to guide the environmental restoration activities other than those in the OB/OD Area, with the U.S. Environmental Protection Agency (EPA) Region 6 as the lead regulatory agency. In 1996 the NMED was granted regulatory authority under RCRA and they became the lead regulatory agency at the site. Activities are currently performed under the RCRA Permit issued in 2005.

SWMU 21 and AOC 73 constitute the relevant sites listed in the RCRA Permit for Parcel 23. Available historical information from prior investigations at these sites have been compiled and summarized in a Historical Information Report, which serves as a companion to this RFI Work Plan. The Historical Information Report provides a listing of site surveys; data compilation efforts; operational history; site or facility drawings; and environmental investigations contained in previously completed reports which are pertinent to the Parcel 23 sites. The Historical Information Report also provides a brief summary of findings and conclusions from the relevant historical investigation efforts. Additionally, summaries of prior environmental investigations pertinent to the Parcel 23 sites are provided in the individual sections of this RFI Work Plan.

4.2 Evaluation of Existing Data

Existing data have been evaluated to determine whether additional field activities are required to characterize the nature and extent of potential environmental impacts at the Parcel 23 AOCs and SWMUs. The following sections present a brief discussion of the general types of existing data available for Parcel 23. Existing data for the individual SWMU and AOC sites within Parcel 23 are evaluated further as part of site-specific sections of this document.

4.2.1 Nonsampling Data

Nonsampling data available for Parcel 23 include facility drawings, maps, photographs, aerial imagery, historical documents, and interviews. Specific nonsampling data available for the individual SWMU and AOC sites will be discussed further in the site-specific sections of this document.

4.2.2 Sampling Data

Sampling data available for Parcel 23 include soil and sediment samples collected and analyzed during prior investigations. Specific sampling data available for SWMU 21 and AOC 73 are evaluated in the site-specific sections of this document. As part of this RFI Work Plan, available soil analytical data have been compared to the most recent version of the NMED Residential Soil Screening Levels (SSL) (NMED, 2006). If a NMED Residential SSL was not available for a specific compound then the compound was compared to the EPA Regional Screening Levels (RSLs) (EPA, 2009). Previous analytical data are presumed to be of suitable quality to be used in the human-health risk screening assessment process.

A soil background investigation was completed in 2000, as documented in a report entitled *Soil Background Concentration Report of Fort Wingate Depot Activity* (Malcolm Pirnie, 2000). The background investigation has not been approved by the NMED-HWB to date. The Army plans to conduct additional sampling and analysis as part of a separate investigation to generate NMED-approved background concentrations of naturally occurring inorganic constituents in soil and groundwater at the FWDA. For this RFI Work Plan all positively detected inorganic constituents were included in the screening assessments.

4.3 Data Quality Objectives

The process used for development of the data quality objectives (DQOs) for additional characterization and/or remediation activities at Parcel 23 is as follows:

1. **Statement of Problem**
   Determine the presence or absence of metals, semi-volatile organic compounds (SVOCs), pesticides and explosives at SWMU 21 as these are the contaminants of potential concern (COPCs) identified for this site. If present, delineate the horizontal and/or vertical extent and magnitude of the contaminants.

2. **Identification of a Decision that Addresses the Problem**
   The presence or absence and horizontal and vertical extent of contamination in the soils at SWMU 21 can be determined by collecting and analyzing surface and subsurface soil samples and evaluating whether or not the sample results are indicative of the presence of contamination. Groundwater will not be investigated unless the vertical extent of soil contamination at an individual site is sufficient to suspect migration of contaminants to groundwater by transport through the vadose zone.

3. **Identification of Inputs that Affect the Decision**
   Inputs that will affect the decision of whether or not soil samples from the site are uncontaminated include the validated analytical results for collected soil samples NMED Residential SSL and EPA RSL.

4. **Specification of the Domain of the Decision**
   The domain of the decision of whether or not soils at the site have been negatively impacted is restricted to evaluation of only those parameters for which samples are analyzed and for which a screening level (that is, NMED or EPA RSL) or other regulatory level exists.

5. **Development of a Logic Statement**
   If the validated analytical data for samples collected during this RFI exceed site-specific background levels, NMED Residential SSL, and/or EPA RSL, the area from which the sample was collected will be considered contaminated. Additional horizontal and/or vertical delineation may then be required until uncontaminated samples are collected. Groundwater will only be investigated at a site if the vertical extent of soil contamination is to a sufficient depth to suspect that groundwater may have become contaminated by transport of the contaminant through the vadose zone.

6. **Establishment of Constraints on Uncertainty**
   Uncertainty in the data used to evaluate the logic statement will be constrained by following the quality assurance and quality control (QA/QC) guidelines specified in the Quality Assurance Project Plan (QAPP) (provided in Appendix C); selecting the appropriate analytical support level for the soil sample data; and by adhering to both the field and laboratory data quality indicator objectives (precision, accuracy, representativeness, comparability, and completeness [PARCC]).

7. **Optimization of Design for Obtaining Data**
   To optimize the quality of data collected for evaluation, this RFI Work Plan has been developed to be used as guidance during field activities.

Quality assurance and quality control procedures associated with the field activities described in this document are presented in the QAPP, which is presented in Appendix C.

4.4 Planned Investigations

This RFI Work Plan describes additional field activities to be conducted at SWMU 21 to further delineate the nature and extent of environmental releases at that site. Cultural resources oversight, specific sampling methods and procedures, management of investigation-derived waste (IDW), decontamination of equipment, and health and safety procedures are presented in the following sections and in specified appendices to this document.

4.4.1 Cultural Resources Oversight

Traditional cultural properties and other cultural resources have been documented within the FWDA boundaries. The USACE, Fort Worth District has developed a PA to specify procedures to be employed during environmental characterization and remediation activities. A copy of the PA is provided in Appendix A.

Maps showing the locations of TCPs relative to proposed investigation locations are not included in this Work Plan, which will be a public document when final. Instead, the consultation process will include review by tribal cultural resource personnel to confirm the presence or absence of identified cultural resources within the proposed investigation locations. If needed, tribal cultural resource personnel will walk each proposed investigation location prior to the initiation of intrusive activities. Tribal cultural resource personnel will be onsite during intrusive activities, as described in the PA.

4.4.2 Health and Safety

The project-specific Health and Safety Plan (HSP) has been prepared for Parcel 23 and will be included with the field sampling plan.

4.4.3 Soil Investigations

Soil sampling is proposed at SWMU 21 and AOC 73 as described in Sections 5 and 6. Basic soil sampling procedures are described in Section 4.4.4. A specific discussion of the proposed field and soil sampling activities is presented in Sections 5 and 6. Sample locations will be surveyed as described in Section 4.4.7. Sample identification, management, and field documentation will be conducted as described in the Sections 4.4.8 and 4.4.9. Decontamination of non-disposable sampling equipment and drilling equipment will be conducted as described in Section 4.4.10. Any IDW generated during the investigation will be managed as described in Section 4.4.11.

4.4.4 Discrete Soil Sampling

Discrete soil sampling will be conducted to delineate the nature and extent of COPCs at SWMU 21. Specific sampling activities are described in Section 5. Sample collection volumes, bottle requirements, preservation, and holding times are described in the project QAPP included as Appendix C.

4.4.5 Multi-Incremental Soil Sampling

Multi-incremental soil sampling will be conducted to delineate the nature and extent of COPCs at AOC 73. Specific sampling activities are described in Section 6. Sample collection volumes, bottle requirements, preservation, and holding times are described in the project QAPP included as Appendix C.

4.4.6 Well Installation and Sampling

If the water table is encountered during the soil boring investigation at SWMU 21, then one groundwater monitoring well will be installed. The location of the well will be determined based on results of the borehole investigation. The well will be located immediately downgradient of SWMU 21.

As appropriate, one 4-inch diameter schedule 40 PVC groundwater monitoring well will be installed. The well will be installed with 20 feet of 4-inch schedule 40 PVC 0.010-inch machine slotted screen with a 5-foot blank casing sump. Approximately 5-feet of the screened interval will be placed above the water table to allow for seasonal water level fluctuations. The well shall have centralizers placed at the top and bottom of the screen. The filter pack shall be 10-20 Colorado Silica Sand or equivalent and will extend from the bottom of the borehole to a depth of 2 feet above the screened interval. Above the filter pack, a bentonite chip seal will be installed with a thickness of approximately 10 feet and hydrated with potable water every 1-foot to provide a competent seal. The thickness of the seal will be dependent on the lithology of the aquifer formation such that the bentonite seal extends from the top of the filter pack to within 5 feet of the most consolidated unit above the water table. To the ground surface, a cement/bentonite grout mixture shall be installed using a tremie pipe. The mixture will consist of 94 pounds of Portland cement to 7 gallons of approved water and 3 percent by weight of sodium bentonite powder.

The well will have an 8-inch diameter by 5-foot tall round protective steel casing and a 4-foot by 4-foot wide by 4-inch thick concrete pad, which shall be installed in such a way as to direct surface runoff away from the casing. Four 4-inch diameter by 5-feet tall steel bollards will be installed around the well on the outside of the concrete pad. An approximate well casing stick-up height of 3 feet is required to accommodate a potential dedicated pump system. The well shall be equipped with a security lock and the well will be tagged with corrosion-resistant identification. The casing will be coated with protective yellow paint as required by the depot.

Wells will be developed by swabbing, bailing, and pumping until the recorded temperature, pH, turbidity, and specific conductivity values are within 10-percent of one another and once the turbidity is below 100 nephelometric turbidity units (NTU). Following well development, groundwater samples will be collected and analyzed for RCRA metals (EPA Methods 6010B and 7471A), VOCs (EPA Method 8260B), SVOCs (EPA Method 8270C), TPH-GRO and TPH-DRO (EPA Method 8015M), pesticides (EPA Method 8081A), explosives (EPA Method 8330B), and perchlorate (EPA Method 314). All samples will be analyzed in accordance with the project QAPP (Appendix C).

4.4.7 Survey of Points

All sample locations will be marked with a survey stake and flagged when sampling is complete. Following the field sampling program all sample locations will be surveyed by a New Mexico licensed professional surveyor. Horizontal coordinates for all sample locations will be referenced to the New Mexico State Planar grid and Universal Transverse Mercator (UTM) coordinates.

4.4.8 Sample Identification, Chain-of-Custody, Packaging, and Shipping Procedures

4.4.8.1 Sample Identification

The sample identification will consist of a combination of the Parcel number, SWMU number, source of sample, increment or boring number, type of sample, and depth of sample collection, in accordance with the latest version of the FWDA Environmental Information Management Plan (USACE, 2007b). Additional description of the proposed sample nomenclature system is as follows:

Parcel:	23
SWMU or AOC:	21
	Source of sample: SS (surface soil), SB (soil boring), TB (trip blank), EB (equipment blank)
Boring or Increment Number:	XX or XXX, sequence number as appropriate
Type of Sample:	M (multi-incremental), C (composite), D (discrete)
Sample Depth:	0001 (0 to 1 foot), 1011 (10 to 11 feet), etc., as appropriate depending on the COPCs at an individual site

QA/QC samples (as described in the QAPP) will carry the same sample nomenclature as the parent sample with a unique suffix and numeral (if required) to distinguish individual samples. Equipment rinsate blanks and trip blanks, and field blanks will carry the sample location identifier with an additional designation of TBXX or EBXX (where the XX representing the sequence number of the sample). Each blank will have a unique tracking number.

4.4.8.2 Chain-of-Custody

Chain-of-custody forms will be completed and will accompany each sample at all times. Data on the forms will include the sample number, date sampled, time sampled, project name, project number, and signatures of those in possession of the sample. Forms will accompany those samples shipped to the designated laboratory so that sample possession information can be maintained. The field team will retain a separate copy of the chain-of-custody reports at the field office. Additionally, the sample numbers; date and time collected; collection location; tracking number; and analysis will be documented in the field log book.

4.4.8.3 Packaging and Shipping Procedures

All samples will be shipped by overnight air freight to the laboratory. Unless otherwise indicated, samples will be treated as environmental samples, shipped in heavy-duty coolers, packed in materials to prevent breakage, and preserved with ice in sealed plastic bags. Each shipment will include the appropriate field quality control (QC) samples (such as, trip blanks, duplicates, field blanks, and rinsate blanks). Corresponding chain-of-custody forms will be placed in waterproof bags and taped to the inside of the coolers lids. Each cooler shipped to the laboratory containing aqueous sample bottles for volatile organic compound (VOC) analyses will contain a trip blank. The trip blank will stay with the cooler until the cooler is returned to the analytical laboratory.

4.4.9 Field Documentation

Appropriate field documentation for all activities will be maintained as part of the formal project documentation. Field sampling documentation and data reporting will adhere to those procedures specified in the QAPP, which is provided as Appendix C.

4.4.10 Decontamination Procedures

Decontamination of reusable sampling equipment and personnel will be performed to ensure chemical analyses reflect actual concentrations at sampling locations by maintaining the quality of samples and preventing cross-contamination. The standard equipment decontamination procedures to be used during completion of soil sampling activities are as follows:

- All direct-push sampling cores will be collected in non-reusable acetate sleeves. The reusable direct push samplers and drill rods are not expected to come into direct contact with soil samples recovered for laboratory analysis. However, the samplers and drill rods will be decontaminated between boreholes.
- A simple decontamination wash pad shall be constructed using plastic sheeting which is rolled up at the ends (typically with lumber) to contain water. The pad shall be large enough to hold multiple 5-gallon buckets and sampling rods that require decontamination and to provide ample working area within the pad (roughly 8 feet by 8 feet).
- Direct push samplers and drill rods will be washed using a bristle brush in potable water to which alconox or liquinox laboratory detergent has been added. All items will then be thoroughly rinsed with potable water and allowed to air dry.
- Decontamination should be performed on the plastic sheeting of the temporary decontamination pad. Accumulated wash and rinse water will be left within the decontamination pad and allowed to evaporate.
- Once all decontamination water is evaporated, the plastic sheeting and associated pad materials shall be disposed of at an approved on-facility dumpster.
- After field cleaning, equipment will be handled only by personnel wearing clean gloves to prevent recontamination. The equipment will be moved away from the cleaning area to prevent recontamination. If the equipment is not to be immediately reused it will be covered with plastic sheeting or wrapped in aluminum foil to prevent recontamination. The area where the equipment is stored prior to reuse must be free of contaminants.

4.4.11 Investigation-Derived Waste Disposal

Investigation derived waste will be managed in accordance with the IDW Management Plan, which is presented in Appendix D.

Three types of IDW may be generated during the sampling of environmental media during the Parcel 23 RFI activities: residual soil volume, decontamination fluids, and disposable sampling equipment and personal protective equipment (PPE). These IDW categories will be managed as follows:

- Soil that remains after required sample volumes have been collected from recovered direct-push cores will be emptied from the sampling sleeves and contained in drums for appropriate disposal.
- Volumes of decontamination fluids are anticipated to be small. Decontamination fluids will be contained within the temporary decontamination pad areas during active sampling and decontamination activities at a site. Accumulated wash and rinse water will be left within the decontamination pad and allowed to evaporate.
- Used, non-decontaminated disposable sampling equipment or PPE will be placed in polyethylene trash bags and treated as general refuse which will be placed in suitable facility trash receptacles on a daily basis.

5.0 SWMU 21: Central Landfill

5.1 Background

5.1.1 Location, Description, and Operational History

The former Central Landfill was a burial site located approximately 1 mile south of the Administration Area, on the western side of Arterial Road No. 2, as shown in Figure 5-1. This site was also historically called the Current Landfill and the Sanitary Landfill. Photographs 5-1 through 5-4, which are provided at the end of this section, show various views of the Central Landfill.

The former landfill was located in an abandoned portion of a former arroyo channel that was cut off from the main arroyo sometime between 1952 and 1958. A bedrock structure, which likely controlled the configuration of the active arroyo channel outcrops to the east of the former Central landfill and to the west within the active arroyo channel. The former landfill site was approximately 1,100 feet long and 50 feet wide. The landfill was confined by vertical walls that likely represent the walls of the former arroyo channel and the total depth of the landfill was 3 to 18 feet deep. Prior to removal of the landfill contents in 1999, there was silty to clayey sand cover of approximately 1 to 3 feet.

Based on available historical information, the former Central Landfill received waste materials from 1969 to 1993. The landfill historically received construction and demolition rubble, land debris, paper wastes, pesticide containers, paint cans, land-dried sewage sludge, and suspected asbestos-containing materials (USATHMA, 1980). In 1997, nine trenches were excavated to determine the contents of the landfill. The waste encountered generally consisted of solid waste of the sort typically generated during warehousing and packaging of munitions, construction debris, and household waste (ERM Program Management Company, 1997). In 1999, all landfill waste and visibly impacted soil below the former landfill was removed and disposed of at an offsite disposal facility (SCIENTECH, Inc., 1999a).

5.1.2 Surface Conditions

The SWMU 21 area is a former arroyo channel that was incised into the Quaternary alluvial sediments and the Triassic-age Petrified Forest Formation – Painted Desert Member. The site is a low-lying area that has been re-graded and re-vegetated following removal of the former landfill materials. The vegetation cover consists mostly of grass and sagebrush.

5.1.3 Subsurface Conditions

Previous sampling and excavation activities confirm that the site is underlain by unconsolidated alluvium to depths of at least 5 feet below the current ground surface, which is near the bottom of the former landfill following the 1999 excavation activities. It is anticipated that the Painted Desert Member of the Petrified Forest Formation underlies the site at an unknown depth. The Painted Desert Member consists of mudstone, siltstone, sandy-mudstone, and lenticular sandstone layers. Depth to the first water-bearing zone water table is unknown for this area, but is expected to be between approximately 50 and 60 feet bgs, based on installed groundwater monitoring wells to the north of SWMU 21. Depth to the second water-bearing zone is unknown for SWMU 21, but is expected to be between 70 and 120 feet bgs, based on installed groundwater wells to the north of SWMU 21.

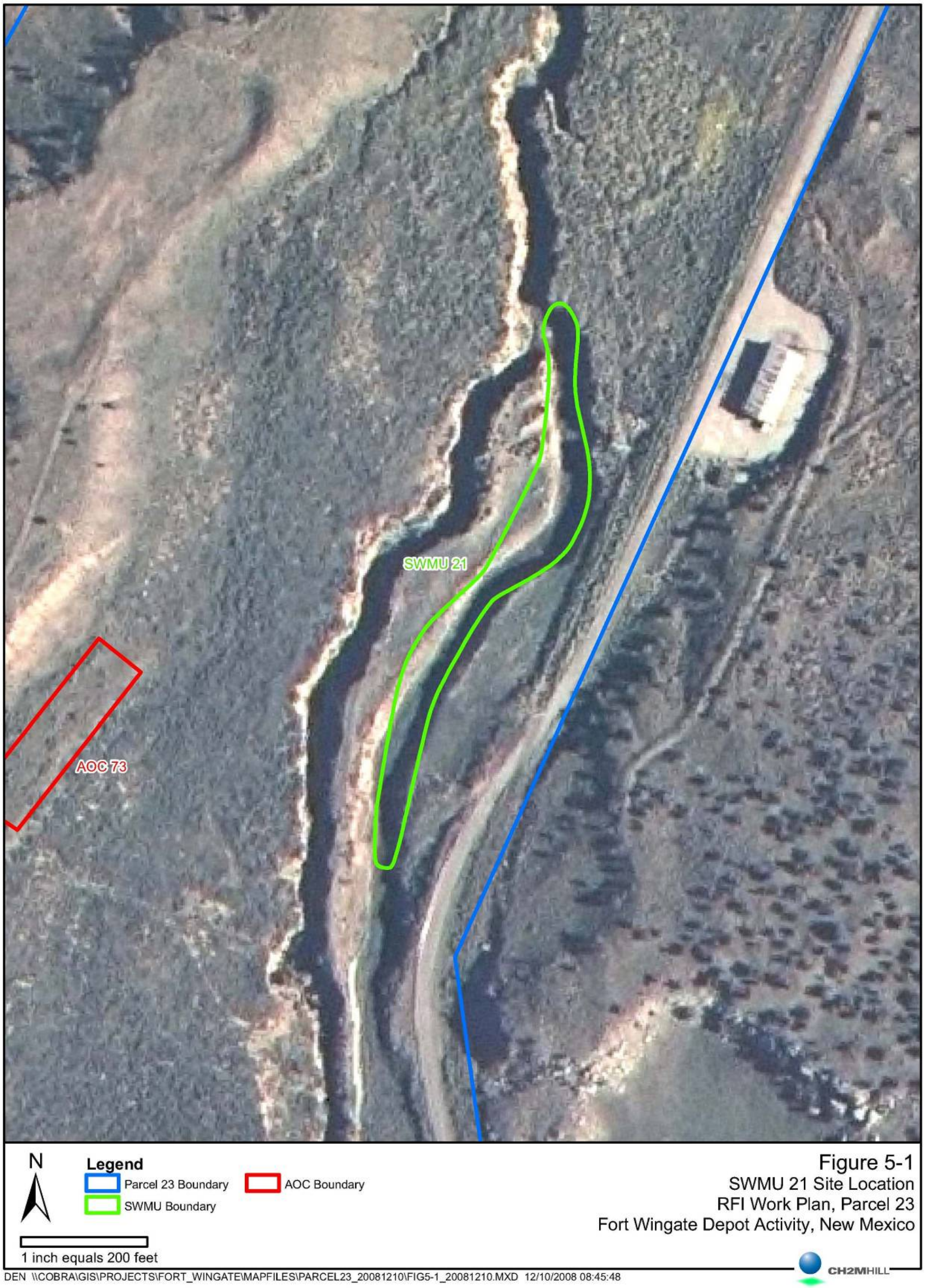

Figure 5-1
SWMU 21 Site Location
RFI Work Plan, Parcel 23
Fort Wingate Depot Activity, New Mexico

5.1.4 Waste Characteristics and Contaminants of Potential Concern

It is reported that the landfill historically received construction and demolition rubble, land debris, paper wastes, pesticide containers, paint cans, land-dried sewage sludge, and suspected asbestos-containing materials (USATHMA, 1980). In 1997, nine trenches were excavated to determine the contents of the landfill. The waste encountered generally consisted of solid waste of the sort typically generated during warehousing and packaging of munitions, construction debris, and household waste (ERM Program Management Company, 1997). In 1999, all landfill waste and visibly impacted soil below the former landfill was removed and disposed of at an offsite disposal facility (SCIENTECH, Inc., 1999a). However, additional soil sampling completed in 2000 indicated that arsenic, as well as several SVOCs, pesticides, and explosives were present at concentrations above their respective NMED Residential SSLs in soil below the former landfill (TetraTech NUS, 2000). Therefore, based on the operational history and previous soil sampling, the COPCs for SWMU 21 are metals, SVOCs, pesticides, and explosives.

5.2 Previous Investigations

5.2.1 Nonsampling Data

Nonsampling data available for SWMU 21 are summarized below.

Final Report Installation Assessment of Fort Wingate Depot Activity; USATHMA, 1980

This report includes a description of solid waste treatment at the FWDA. The Central Landfill at this time was referred to as the Sanitary Landfill. At the time of this report, garbage was collected by the City of Gallup and hauled to a city-owned landfill for disposal. Trash from other activities on the installation was buried within the Central Landfill. Waste material was covered with soil once a month. No burial sites for contaminated waste were reported at the FWDA at the time of this report.

Master Environmental Plan; ANL, 1990

This report includes the general description of historical operations at the Central Landfill, including that the landfill had been in operation since 1969 and covered approximately 6 acres. The waste was anticipated to be as much as 20 feet deep. The report indicates that pesticide containers and sludge from the drying beds at the sewage treatment plant were identified among other waste material historically disposed of in the landfill. Additionally, an inspection in 1989 revealed paint cans and asbestos-containing materials (ACMs) were present in the active portion of the landfill. In 1990, the landfill was supposed to receive mostly construction and demolition rubble, land debris, paper wastes, and other similar waste.

Aerial Report; Environmental Research, Inc. (ERI), 2006

An aerial photography analysis was completed in 2006 based on aerial imagery obtained during a search of government and commercial records (ERI, 2006). The photographs were analyzed utilizing a stereoscope to locate potential sources of contamination and to record any findings inside the boundaries of the known AOCs and SWMUs. Aerial images dated from 1935 to 1997 were analyzed as part of this report.

Activities at the Central Landfill are first observed in the 1973 aerial photograph when multi-toned materials were present in the landfill area. However, activities near the Central Landfill location are first observed in the 1958 photograph when a diversion ditch had been installed to the west of the native arroyo. This ditch by-passed the portion of the arroyo that ultimately became the Central Landfill. It is unknown why this ditch was originally installed. The 1978 photograph shows a fill area with probable debris. The 1985 photograph shows an access road which leads to an area of rubble and debris in the southern portion of the site. Rubble and debris also remain at an area to the south of the Central Landfill. The 1991 photograph shows a fill area with debris present. More rubble and debris are also visible in the ditch south of the site. The 1993 photograph shows light-toned material near the center of the site. The 1997 photograph shows three areas of mounded material in the northern portion of the site. A 2005 photograph prepared by CH2M HILL, which is included in Appendix B2 of the Historical Information Report for Parcel 23 (USACE, 2009), shows that the site had been excavated.

Interpretation of the aerial photographs available from 1958 to 2005 indicate various debris and fill areas were historically present within the SWMU 21 boundary and in an area extending immediately to the south of SWMU 21, within the arroyo channel. Based on interpretation of the available photographs, the Central Landfill disposal activities appear to have only occurred within the abandoned arroyo channel within the SWMU 21 boundary and in a possible release area extending to a distance of approximately 600 feet to the south of SWMU 21.

5.2.2 Sampling Data

Previous investigation phases have been completed at SWMU 21 and are summarized below. Available analytical data from previous investigations are summarized in Tables 5-1A through 5-1H (provided at the end of this section). Figure 5-2 presents the locations of previous soil sampling investigations from 1981, 1992, and 2000. Figure 5-3 presents the locations of trench and soil sampling that was completed in 1997. Figure 5-4 presents the locations of landfill cell removal activities and soil sampling completed in 1999.

Final Report Environmental Survey of Ft. Wingate Depot Activity; ESE, 1981

This report presents results from soil sampling conducted at the Central Landfill. Soil sample FW01 was collected down-gradient (north) of the Central Landfill at a depth of 2 feet bgs to evaluate potential contamination from the landfill. The sample was analyzed for explosives, VOCs, SVOCs, polychlorinated biphenols (PCBs), pesticides, herbicides, nitrate, nitrite, phosphorous, and sulfate. As presented in Table 5-1A, dichlorodiphenyldichloroethane (DDD) was detected at 0.007 mg/kg, endosulfan sulfate at 0.004 mg/kg, endrin at 0.002 mg/kg, Aroclor 1016 at 0.02 mg/kg, and total phosphorous at 308 mg/kg.

Final Remedial Investigation/Feasibility Study & RCRA Corrective Action Program Document; ERM Program Management Company, 1997

In 1993, soil gas samples were analyzed for methane and hydrogen sulfide at 10 locations on the landfill at 25-foot centers. Additionally, 30 soil gas samples were collected directly north of the landfill on 50-foot centers in a 250-foot-by-300-foot grid. A summary of results from this investigation is presented in Table 5-1B. To assess the potential for leachate migration east and north of the landfill, six soil borings were advanced in 1992 and 1993 around the parameter of the landfill. Each soil boring was advanced to a total depth of 20 feet with samples collected at depth intervals of 0.5 to 2.5 feet, 8 to 10 feet, and 18 to 20 feet bgs. Samples were analyzed for target compound list (TCL) organics, target analyte list (TAL) inorganics, pesticides, and PCBs. A summary of positive detections is presented in Table 5-1C.

Figure 5-2
Previous Soil Sampling Locations at SWMU 21
RFI Work Plan, Parcel 23
Fort Wingate Depot Activity, New Mexico

\\COBRA\GIS\PROJECTS\FORT_WINGATE\MAPFILES\PARCEL23_20090130\FIG5-2_20090130.MXD JQUAN 2/4/2009 08:57:58

Figure 5-3
1997 Trench and Soil Sample Locations at SWMU 21
RFI Work Plan, Parcel 23
Fort Wingate Depot Activity, New Mexico

\\COBRA\GIS\PROJECTS\FORT_WINGATE\MAPFILES\PARCEL23_20090130\FIG5-3_20090130.MXD JQUAN 2/4/2009 09:00:45

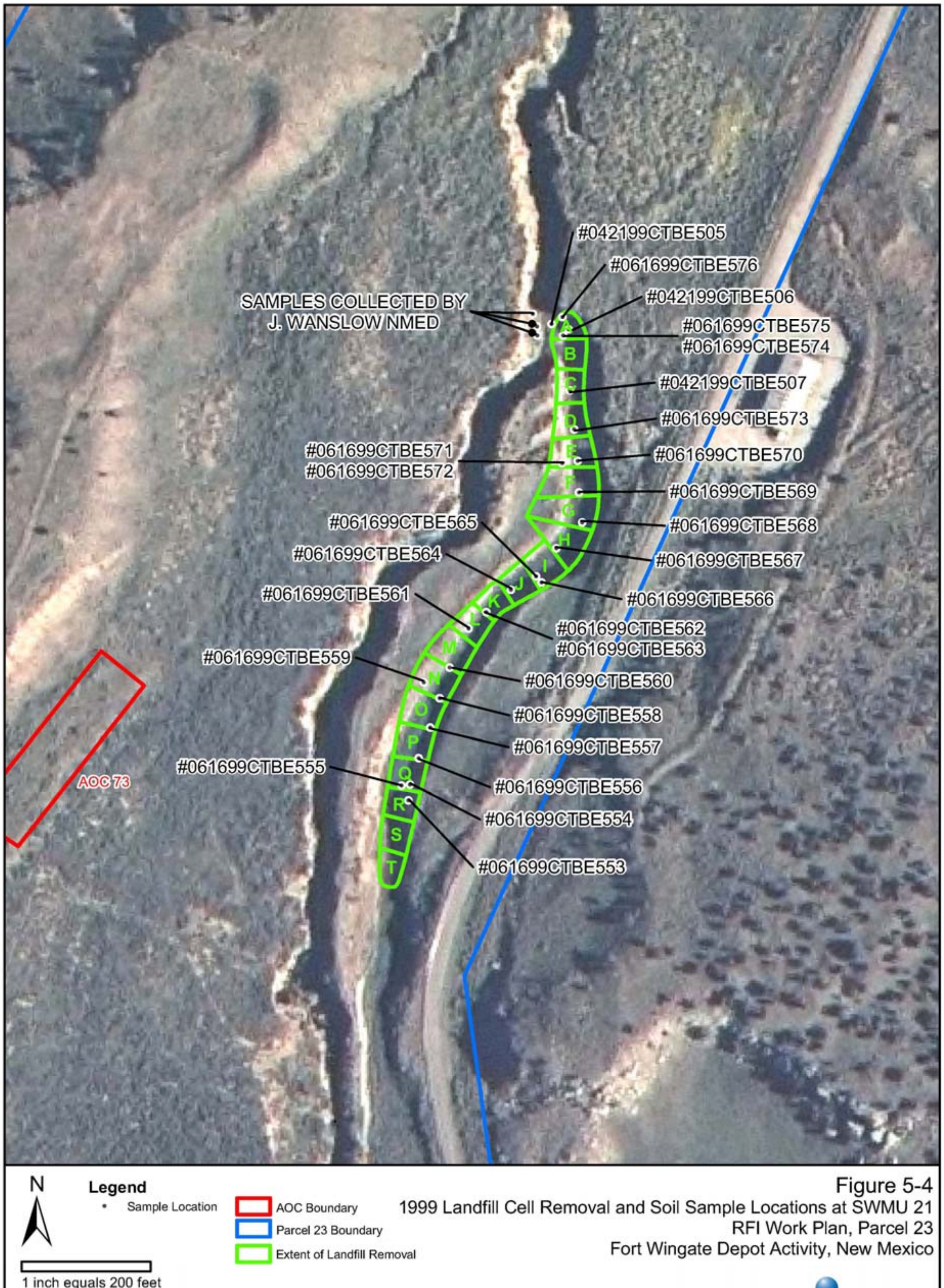

Figure 5-4
1999 Landfill Cell Removal and Soil Sample Locations at SWMU 21
RFI Work Plan, Parcel 23
Fort Wingate Depot Activity, New Mexico

DEN \\COBRA\GIS\PROJECTS\FORT_WINGATE\MAPFILES\PARCEL23_20081210\FIG5-4_20081210.MXD 12/11/2008 12:36:40

Nine trenches were excavated throughout the length of the Central Landfill, generally from east to west through the width of the landfill. The trenches varied in length from 35 to 195 feet with maximum depths from 11 to 22 feet bgs. Waste was encountered in eight of the nine trenches. The depth of the waste varied across the site, but was generally encountered in an interval between 1 and 18 feet bgs. All trenches penetrated the full thickness of the wastes in both the horizontal and vertical planes.

A geophysical survey was completed on a 50-foot-by-50-foot grid. The electromagnetic conductivity data was generally consistent with the expected boundary of the landfill. Magnetic data were characterized as randomly spaced high and low anomalies that were inconsistent with topography and the location of landfill ferrous materials. Ground-penetrating radar data did not identify the base of the landfill

Twelve samples of soil from within the waste and 12 samples from the native soil below the waste intervals were collected for laboratory analysis. In addition, two samples each of the cover soil and the soil beneath the waste were collected for geotechnical analysis to aid in the evaluation of potential restoration or closure options. A summary of results is presented in Table 5-1D. Groundwater was not encountered during the investigation effort.

The types of waste encountered at the Central Landfill generally consisted of solid waste typically generated during warehousing and packaging of munitions, construction debris, and household wastes. Unusual material identified in the landfill included: two drums, one containing what appeared to be unused oil and the other contained a tar-like substance; a single demilitarized 155-millimeter (mm) shell was recovered in the northern portion of the landfill; several crushed 5-gallon containers which appeared to be empty; and a layer of treated lumber. Concentrations of SVOCs, pesticides, and metals exceeding background levels were detected in samples collected within the waste materials throughout the landfill. The SVOCs benzo(a)pyrene, benzo(k)fluoranthene, and dibenz(a,h)anthracene and the metal cadmium were detected at concentrations exceeding the NMED Residential SSL in selected waste samples.

A total of 27 soil gas samples were collected on the 50-foot-by-50-foot grid established for the geophysical survey. Methane concentrations ranged from below the detection limit to 7 parts per million by volume (ppmv). Hydrogen sulfide was not detected in any of the 27 soil gas sampling locations. The relatively low methane concentrations and absence of hydrogen sulfide suggest that landfill gas was not being generated at significant concentrations.

Chemical Quality Control Summary Report for the Landfill Closure: Removal and Disposal of Group "C" and Central Landfills, Fort Wingate, New Mexico; SCIENTECH, Inc., 1999a

This report includes a summary of the removal and disposal action completed at the Central Landfill. Excavation, transportation, and offsite disposal of landfill material were completed in 1999. There was a potential for unexploded ordnance (UXO) to be present; therefore, UXO Safety Specialists were present at all times to inspect all materials as they were removed from the landfill. All soil was screened through a ½-inch grid screen to locate any UXO items. The soil was then disposed of offsite after meeting testing requirements for chemical constituents. Materials other than soil were transported offsite for disposal after being certified as free of explosion hazards. NMED personnel provided regulatory guidance during the landfill removal project and made onsite inspections during various phases of the project.

After removal of landfill materials, confirmation soil samples were collected and analyzed for metals, VOCs, SVOCs, pesticides, herbicides, PCBs, and total petroleum hydrocarbons (TPH) to verify that there was no contamination remaining in the native soil below the landfill. It was reported that all compounds were detected below applicable federal, state, or local guidelines. However, further review of the data from this report indicates that several compounds detected in the native soil below the landfill exceed current NMED Residential SSLs. As presented in Table 5-1E and F, the SVOCs benzo(a)pyrene, dibenz(a,h)anthracene, dibenzofuran, and ideno(1,2,3-cd)pyrene and the metals arsenic and thallium were detected above their respective NMED Residential SSLs in either landfill section A, D, G, I, J, L, M, or P. Additionally, the reporting limits for arsenic and thallium from these samples were above the current NMED Residential SSLs. The excavation was backfilled with clean soil, graded, and re-seeded with native vegetation. The depth of the backfill was not reported.

Chemical Quality Control Summary Report for Confirmation Soil Sampling in Support of the Landfill Closure: Removal and Disposal of Group "C" and Central Landfills, Fort Wingate, New Mexico; SCIENTECH, Inc., 1999b

This report includes a summary of confirmation sampling completed following the removal and disposal activities completed at the Central Landfill. During excavation of the Central Landfill, an additional landfill cell was discovered immediately to the south. The cell measured 40 feet by 450 feet. A total of 18 soil samples were collected from this area at a frequency of one sample every 25 feet at a depth of 1 foot bgs, or approximately 20 feet below the original landfill grade. The samples were analyzed for VOCs, SVOCs, TPH, pesticides, herbicides, PCBs, RCRA metals, and explosives. As presented in Table 5-1G, sample results indicated elevated concentrations of SVOCs, TPH, metals, and explosives. It was reported that none of the compounds were detected above applicable federal, state, or local guidelines. However, arsenic and the SVOCs benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, and ideno(1,2,3-cd)pyrene and the metal arsenic were detected at concentrations above their current applicable NMED Residential SSLs.

Release Assessment Report; TetraTech NUS, 2000

As part of the release assessment, 25 soil boring locations were placed in the main cell of the Central Landfill at 40- to 50-foot intervals along the centerline of the former excavation. One sample was collected from each boring. Borings CMAIN-1, -4, -7, -10, -13, -16, -19, -22, and -25 were drilled to a depth of 1 foot bgs. Borings CMAIN-2, -5, -8, -11, -14, -17, -20, and -23 were drilled to a depth of 3 feet bgs. Borings CMAIN-3, -6, -9, -12, -15, -18, -21, and -24 were drilled to a depth of 5 feet bgs.

Eighteen soil boring locations were placed in the new cell of the Central Landfill at 25-foot intervals along the centerline of the former excavation. One sample was collected from each boring. Borings CNEW-1, -4, -7, -10, -13, and -16 were drilled to a depth of 1 foot bgs. Borings CNEW-2, -5, -8, -11, -14, and -17 were drilled to a depth of 3 feet bgs. Borings CNEW-3, -6, -9, -12, -15, and -18 were drilled to a depth of 5 feet bgs. Additionally, five QA/QC samples, two matrix spike/matrix spike duplicate (MS/MSD) samples, and one equipment rinsate sample were collected.

Table 5-1H presents the analytical data from the 2000 Release Assessment soil borings. These soil samples are representative of the soil that remained following the removal of the landfill materials. As presented in Table 5-1H, several compounds were detected in the CMAIN soil borings at concentrations above their respective NMED Residential SSLs. These included: arsenic; the SVOCs benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, ideno(1,2,3-cd)pyrene; and the explosive compound 2,4,6-TNT.

Base Realignment and Closure (BRAC) Plan; Terranear PMC, 2006

This BRAC Plan briefly summarizes the 1999 landfill removal activities at the Group C and Central Landfills. The report states that 24,140 tons of waste, debris, and soil were excavated from the two landfills and disposed of offsite.

5.2.3 Conceptual Model

5.2.3.1 Nature and Extent of Contamination

Based on review of the operational history of SWMU 21 and evaluation of available analytical data, it appears that the horizontal extent of the release of COPCs to the environment is limited to the area within the abandoned arroyo channel that made up the extent of the former landfill, which includes the SWMU 21 boundary and a release area extending up to 600 feet to the south of SWMU 21. However, the nature and extent of potential soil contamination extending below the bottom of the former landfill has not been fully evaluated.

The Release Assessment conducted in 2000 indicated that several compounds were detected at depths below the bottom of the former landfill at concentrations above their respective NMED Residential SSL. These included: arsenic; the SVOCs benzo(a)pyrene, benzo(b)fluoranthene, chrysene, dibenzo(a,h)anthracene, dibenzofuran, flouranthene, fluorine, ideno(1,2,3-cd)pyrene, naphthalene, phenanthrene, and pyrene; the pesticides DDD, DDT, dieldrin, and chlordane; and the explosive compounds RDX and TNT.

5.2.3.2 Fate and Transport

If contamination is present at SWMU 21, it could pose a threat to human health and the environment through exposure to contaminated surface or subsurface soils.

5.2.3.3 Data Gaps

As previously discussed, analytical results from the 2000 Release Assessment indicated that elevated concentrations of metals, SVOCs, pesticides, and explosives were detected in soil below the bottom of the former landfill at various locations within the SWMU 21 boundary and in the abandoned arroyo channel up to 600 feet to the south of SWMU 21. Data gaps include assessing the vertical extent of COPCs below the former landfill. The horizontal extent of COPCs has been largely determined, with contamination limited to the area within the abandoned arroyo channel. However, the horizontal extent of COPCs will be further assessed and verified through the installation of multiple borings throughout the area.

5.3 Investigation Methods

5.3.1 Contaminant Source

The potential contaminant source associated with SWMU 21 is the former waste that was located in the landfill that may have leached into the soil below. The landfill waste materials were removed in 1999.

5.3.2 Media Characterization

The presence of soil contamination at SWMU 21 will be evaluated by collecting soil samples from direct-push boreholes to delineate the vertical extent of COPCs and to confirm the previously evaluated horizontal extent of COPCs.

5.3.3 Quality Assurance/Quality Control

The QA/QC practices specified in the project QAPP (Appendix C) will be followed during all sampling activities.

5.4 Scope of Activities

The following field activities will be conducted during the RFI at SWMU 21:

- Installation of ten soil borings using direct-push drilling methods.
- Collection and analysis of surface and subsurface soil samples

5.4.1 Borehole Installation and Soil Sampling

Soil sampling will be conducted to evaluate the presence of environmental impacts from historical landfill operations near SWMU 21. Based on the operational history and previous soil sampling, the expected COPCs for SWMU 21 are metals, SVOCs, pesticides, and explosives. However, based on direction from NMED soil samples will be analyzed for RCRA metals, VOCs, SVOCs, TPH-GRO, TPH-DRO, pesticides, explosives, and perchlorate.

Field activities will include the advancement of 10 soil borings at the site, as shown in Figure 5-5. Sample locations, depths, and analytical parameters are summarized in Table 5-2. The rationale for each boring location and sampling is described as follows:

- Seven soil borings will be advanced near the SWMU 21 area that was excavated in 1999. These soil borings will be advanced near the 2000 Release Assessment boring locations CMAIN-01, CMAIN-02, CMAIN-05, CMAIN-08, CMAIN-12, CMAIN-17, and CMAIN-21, which had positive detections of COPCs at the greatest depths. The soil borings will assess the vertical extent of soil contamination present below the bottom of the former landfill and verify the horizontal extent of contamination determined during the 2000 Release Assessment. The seven soil borings will be labeled as 2321-SB01 to 2321-SB07. An evaluation will be conducted to determine the depth that the excavation was backfilled and all borings will be advanced to approximately 40 feet below the bottom of the former landfill. Additionally, four of the borings (SB01, SB03, SB05, and SB07) will be advanced to the water table or to drilling refusal if the water table is not encountered. Analytical samples will be collected at 0- to 1-feet below the bottom of the former landfill and then at 5-foot intervals to 40 feet below the bottom of the former landfill for borings SB02, SB04, and SB06, or until groundwater or the Painted Desert member is encountered for borings SB01, SB03, SB05, and SB07.

- Three soil borings will be advanced immediately to the south of SWMU 21 in the area identified during the 2000 Release Assessment to be impacted by previous environmental releases. These borings will be located near the 2000 Release Assessment borings that had positive detections of COPCs at the greatest depths, which were generally boring locations CNEW-05, CNEW-08, and CNEW-12. These borings will assess the vertical extent of soil contamination below the bottom of this former release area and verify the horizontal extent of contamination determined during the 2000 Release Assessment. The three soil borings will be labeled as 2321-SB08 to 2321-SB10. Borings SB08, SB09 and SB10 will be advanced to approximately 20 feet bgs. Analytical samples will be collected at 1- to 2-feet bgs, and then at 5-foot intervals to 20 feet bgs.

Figure 5-5
Proposed Soil Sampling Locations for SWMU 21
RFI Work Plan, Parcel 23
Fort Wingate Depot Activity, New Mexico

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The 10 subsurface soil borings will be advanced using a direct-push drilling method. This method will allow for sample collection, as well as observation and description of the soil column at each location to allow visual identification of soil staining, lithology changes, etc., and collection of field measurements with a photoionization detector (PID).

The sampling process will be completed for each boring as follows and as indicated in Section 4 and the project QAPP (Appendix C):

1. The drilling rods and sampling sleeve will be advanced to each depth interval to recover specified samples.
2. The recovered soil cores will be geologically logged and field-screened using a PID. Soils will be described on the soil boring logs using the Unified Soil Classification System (ASTM D2487 and D2488).
3. Discrete grab soil samples will be extracted from the appropriate depth intervals and placed into appropriate sample bottles as specified in the project QAPP (Appendix C).
4. Remaining soil shall be emptied from the sampling sleeves and contained in drums for appropriate sampling and disposal.
5. At the conclusion of drilling the borehole will be abandoned by backfilling with hydrated bentonite chips.
6. Each borehole location will be identified with a survey spike that incorporates colored flagging.

Table 5-2 summarizes the proposed soil sampling at SWMU 21. All samples will be analyzed for RCRA metals (EPA Methods 6010B and 7471A), VOCs (EPA Method 8260B), SVOCs (EPA Method 8270C), TPH-GRO and TPH-DRO (EPA Method 8015M), pesticides (EPA Method 8081A), explosives (EPA Method 8330B), and perchlorate (EPA Method 314). All samples will be analyzed in accordance with the project QAPP (Appendix C).

5.4.2 Well Installation and Sampling

If the water table is encountered during the soil boring investigation at SWMU 21, then one downgradient groundwater monitoring well will be installed. The location of the well will be determined based on results of the borehole investigation. The well will be located immediately downgradient of SWMU 21.

As appropriate, one 2-inch diameter schedule 40 PVC groundwater monitoring well will be installed. The well will be installed with 20 feet of 2-inch schedule 40 PVC 0.010-inch machine slotted screen with a 5-foot blank casing sump. Approximately 5-feet of the screened interval will be placed above the water table to allow for seasonal water level fluctuations. The well shall have centralizers placed at the top and bottom of the screen. The filter pack shall be 10-20 Colorado Silica Sand or equivalent and will extend from the bottom of the borehole to a depth of 2 feet above the screened interval. Above the filter pack, a bentonite chip seal will be installed with a thickness of approximately 10 feet and hydrated with potable water every 1-foot to provide a competent seal. The thickness of the seal will be dependent on the lithology of the aquifer formation such that the bentonite seal extends from the top of the filter pack to within 5 feet of the most consolidated unit above the water table. To the ground surface, a cement/bentonite grout mixture shall be installed using a tremie pipe. The mixture will consist of 94 pounds of Portland cement to 7 gallons of approved water and 3 percent by weight of sodium bentonite powder.

The well will have an 8-inch diameter by 5-foot tall round protective steel casing and a 4-foot by 4-foot wide by 4-inch thick concrete pad, which shall be installed in such a way as to direct surface runoff away from the casing. Four 4-inch diameter by 5-feet tall steel bollards will be installed around the well on the outside of the concrete pad. An approximate well casing stick-up height of 3 feet is required to accommodate a potential dedicated pump system. The well shall be equipped with a security lock and the well will be tagged with corrosion-resistant identification. The casing will be coated with protective yellow paint as required by the depot.

Wells will be developed by swabbing, bailing, and pumping until the recorded temperature, pH, turbidity, and specific conductivity values are within 10-percent of one another and once the turbidity is below 100 nephelometric turbidity units (NTU). Following well development, groundwater samples will be collected and analyzed for RCRA metals (EPA Methods 6010B and 7471A), VOCs (EPA Method 8260B), SVOCs (EPA Method 8270C), TPH-GRO and TPH-DRO (EPA Method 8015M), pesticides (EPA Method 8081A), explosives (EPA Method 8330B), and perchlorate (EPA Method 314). All samples will be analyzed in accordance with the project QAPP (Appendix C).

Table 5-1A. Soil Analytical Results from ESE, 1981 for SWMU 21, Central Landfill, Fort Wingate Depot Activity

Chemical Class and Laboratory Method	Analyte	RL[a]	NMED Residential SSL[b]	Current Landfill FW01 Depth: 2 feet 01/25/1981
Pesticides - Unknown[c] (mg/Kg)	4,4-DDD	NR	16.3 C	0.007
	Endosulfan sulfate	NR	N/A	0.004
	Endrin	NR	18.3	0.002
PCBs Unknown[c] (mg/Kg)	Aroclor 1016	NR	3.93	0.02
Anions Unknown[c] (mg/Kg)	Total Phosphate as K	NR	N/A	308

Notes:

[a] Column provides the Reporting Limit (RL), which was the Practical Quantitation Limit (PQL) for this project.
[b] NMED Residential Direct Exposure to Soil Screening Level (SSL), August 2009.
[c] Analytical methods not presented in available documents
Highlighted value - positive detection
C - carcinogen
N/A - not applicable
mg/Kg - milligrams per kilogram
NMED - New Mexico Environment Department
NR - not reported
PCBs - polychlorinated biphenyl

Table 5-1B. 1993 Soil Gas Analytical Results from ERM, 1997 for SWMU 21, Central Landfill, Fort Wingate Depot Activity

Location ID[a]		Methane[b] (ppmv)	Hydrogen Sulfide[b] (ppmv)
175N	275E	2.0	ND
175N	375E	1.0	ND
225N	400E	2.0	ND
275N	350E	1.0	ND
325N	450E	6.0	ND
325N	400E	6.0	ND
375N	425E	5.0	ND
375N	525E	2.0	ND
375N	575E	7.0	ND
425N	600E	5.0	ND
425N	500E	2.0	ND
475N	500E	1.0	ND
475N	650E	6.0	ND
525N	700E	2.0	ND
525N	600E	4.0	ND
525N	550E	2.0	ND

Notes:

[a] Sample dates not presented in available reports

[b] Analytical methods not presented in available reports

Highlighted Value - positive detection

ND – not detected, reporting limit not provided in the report

ppmv – parts per million by volume

Table 5-1C. Soil Analytical Results from ERM, 1997 for SWMU 21, Central Landfill, Fort Wingate Depot Activity

Chemical Class - Laboratory Method (Units)	**Analyte**	**NMED Residential SSL[a]**	**RL[b]**	CLF01-1	CLF01-10	CLF01-20	CLF02-1
				1-foot	10-feet	20-feet	1-foot
				12/03/1992	12/03/1992	12/03/1992	5/5/1993
TAL Metals - EPA Method 6010B (mg/Kg)	Arsenic	3.59 C	2.50	<2.5	3.06	<2.5	3.28
	Barium	15,600	3.29	696	ND	553	ND
	Manganese	10,700	9.87	2,000	<9.87	<9.87	<9.87
	Zinc	23,500	2.34	<2.34	<2.34	<2.34	59.5

Chemical Class - Laboratory Method (Units)	**Analyte**	**NMED Residential SSL[a]**	**RL[b]**	CLF02-10	CLF03-1	CLF03-10	CLF03-20
				10-feet	1-foot	10-feet	20-feet
				5/5/1993	5/5/1993	5/5/1993	5/5/1993
TAL Metals - EPA Method 6010B (mg/Kg)	Arsenic	3.59 C	2.50	2.8	2.94	3.01	2.66
	Zinc	23,500	2.34	47.1	52.8	<2.34	<2.34

Chemical Class - Laboratory Method (Units)	**Analyte**	**NMED Residential SSL[a]**	**RL[b]**	CLF04-1	CLF04-10	CLF04-20	CLF05-10	CLF05-20
				1-foot	10-feet	20-feet	10-feet	20-feet
				5/5/1993	5/5/1993	5/5/1993	5/5/1993	5/5/1993
TAL Metals - EPA Method 6010B (mg/Kg)	Aluminum	78,100	11.20	49,300	<11.2	<11.2	<11.2	<11.2
	Sodium	N/A	38.7	8,020	<38.7	<38.7	<38.7	<38.7
	Zinc	23,500	2.34	55.8	<2.34	<2.34	<2.34	<2.34
	Potassium	N/A	131	11,700	<131	<131	<131	<131

Notes:

[a] NMED Residential Direct Exposure to Soil Screening Level (SSL), August 2009.

[b] Column provides the Reporting Limit (RL), which was the Practical Quantitation Limit (PQL) for this project.

Highlighted value - positive detection

mg/kg - milligram per kilogram

N/A – not applicable

ND – not detected, reporting limit not provided in the report

TAL - target analyte list

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Table 5-1D. Soil Analytical Results from ERM, 1997 for SWMU 21, Central Landfill, Fort Wingate Depot Activity (Continued, Page 1 of 2)

Chemical Class - Laboratory Method (Units)	Analyte	NMED Residential SSL[a]	RL[b]	CLF010103 1- to 3-feet 02/02/1996	CLF010306 3- to 6-feet 02/02/1996	CLF010409 4- to 9-feet 02/02/1996	CLF010505 5-feet 02/05/1996	CLF020106 1- to 6-feet 02/05/1996	CLF020303 3-feet 02/06/1996	CLF020413 4- to 13-feet 02/06/1996	CLF020506 5- to 6-feet 02/06/1996	CLF020616 6- to 16-feet 02/06/1996
SVOCs - EPA Method 8270C (mg/Kg)	2-Methylnaphthalene	310[c]	NR	ND	ND	ND	ND	0.59	0.055	ND	0.12	ND
	Acenaphthene	3,440	NR	ND	ND	ND	ND	0.16	ND	ND	1.2	ND
	Benzo(a)anthracene	4.81 C	NR	ND	0.19	ND	0.12	0.5	0.11	ND	4.3	ND
	Benzo(a)pyrene	0.481 C	NR	ND	ND	ND	ND	ND	ND	ND	**3.1**	ND
	Benzo(b)fluoranthene	4.81 C	NR	ND	ND	ND	ND	1.1	ND	ND	**6.0**	ND
	Benzo(k)fluoranthene	48.1 C	NR	ND	ND	ND	ND	0.38	ND	ND	2.4	ND
	Benzo(ghi)perylene	N/A	NR	ND	ND	ND	ND	0.55	ND	ND	2.5	ND
	Bis(2-ethylhexyl)phthalate	280 C	NR	ND	ND	ND	ND	1.1	ND	ND	ND	ND
	Chrysene	481 C	NR	0.060	0.18	ND	0.17	0.65	0.12	ND	4.3	ND
	Di-n-butylphthalate	6,110	NR	ND	ND	ND	ND	2.4	ND	ND	ND	ND
	Dibenz(a,h)anthracene	0.481 C	NR	ND	ND	ND	ND	ND	ND	ND	**0.58**	ND
	Fluoranthene	2,290	NR	0.087	0.29	ND	0.12	0.77	0.08	ND	6.4	ND
	Fluorene	2,290	NR	ND	ND	ND	ND	0.19	ND	ND	1.5	ND
	Pentachlorophenol	20.7 C	NR	ND	ND	ND	ND	2.3	ND	ND	ND	ND
	Phenanthrene	1,830	NR	0.079	0.35	ND	0.19	0.74	0.12	ND	9.7	ND
	Phenol	18,300	NR	ND	0.12	ND	ND	ND	ND	ND	ND	ND
	Pyrene	1,720	NR	ND	0.4	ND	0.21	1.8	0.14	ND	9.8	ND
TAL Metals - EPA Method 6010B (mg/Kg)	Arsenic	3.59 C	NR	ND	ND	2.65	ND	ND	ND	ND	ND	ND
	Cadmium	7.79	NR	ND	**8.21**	ND	ND	ND	ND	ND	ND	ND
	Chromium (total)	219	NR	ND	40.2	ND	ND	ND	ND	ND	ND	ND
	Copper	3,130	NR	19.2	83.5	ND	ND	21.2	ND	ND	ND	ND
	Lead	400	NR	ND	46	ND	ND	ND	26	ND	ND	ND
	Magnesium	N/A	NR	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Nickel	1,560	NR	ND	28.9	ND	ND	ND	ND	ND	ND	ND
	Silver	391	NR	ND	1.38	ND	1.05	ND	ND	ND	ND	ND
	Zinc	23,500	NR	83.0	263	ND	ND	97.4	194	50.2	ND	48.9
TCL Pesticides - EPA Method 8081 (mg/Kg)	Endrin ketone	N/A	NR	ND	0.00262	ND	ND	ND	ND	ND	ND	ND
	4,4-DDD	16.3 C	NR	ND	ND	ND	ND	ND	ND	ND	ND	ND
	4,4-DDE	11.5 C	NR	ND	ND	ND	ND	ND	ND	ND	ND	ND
	4,4-DDT	15.8 C	NR	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Endosulfan-I / Endosulfan-II	367	NR	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Endrin aldehyde	N/A	NR	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Endrin ketone	N/A	NR	ND	ND	ND	ND	ND	ND	ND	ND	ND

Table 5-1D. Soil Analytical Results from ERM, 1997 for SWMU 21, Central Landfill, Fort Wingate Depot Activity (Concluded, Page 2 of 2)

Chemical Class - Laboratory Method (Units)	Analyte	NMED Residential SSL[a]	RL[b]	CLF030103	CLF030303	CLF030405	CLF030513	CLF030617	CLF040109	CLF040109-Dup	CLF040218	CLF060104
				1- to 3-feet	3-feet	4- to 5-feet	5- to 13-feet	6- to 17-feet	1 to 9-feet	1 to 9-feet	2- to 18-feet	1- to 4-feet
				02/07/1996	02/07/1996	02/07/1996	02/07/1996	02/07/1996	02/08/1996	02/08/1996	02/08/1996	02/08/1996
SVOCs - EPA Method 8270C (mg/Kg)	2-Methylnaphthalene	310[c]	NR	ND	ND	ND	0.14	ND	ND	ND	ND	ND
	Acenaphthene	3,440	NR	ND	ND	0.44	0.44	ND	ND	ND	ND	ND
	Benzo(a)anthracene	4.81 C	NR	0.25	ND	1.4	0.81	ND	0.19	0.12	ND	ND
	Benzo(a)pyrene	0.481 C	NR	ND	ND	**1.6**	ND	ND	ND	ND	ND	ND
	Benzo(b)fluoranthene	4.81 C	NR	ND	ND	ND	1.1	ND	ND	ND	ND	ND
	Benzo(k)fluoranthene	48.1 C	NR	ND	ND	0.60	0.47	ND	ND	ND	ND	ND
	Benzo(ghi)perylene	N/A	NR	ND	ND	0.58	0.38	ND	ND	ND	ND	ND
	Bis(2-ethylhexyl)phthalate	280 C	NR	0.85	ND	ND	ND	ND	ND	ND	ND	ND
	Chrysene	481 C	NR	0.24	ND	1.1	0.63	ND	0.18	0.11	ND	0.059
	Dimethylphthalate	611,000	NR	ND	ND	ND	ND	ND	ND	ND	ND	0.23
	Fluoranthene	2,290	NR	0.47	ND	1.8	1.1	ND	0.37	0.22	ND	0.077
	Fluorene	2,290	NR	ND	ND	ND	0.47	ND	ND	ND	ND	ND
	Phenanthrene	1,830	NR	1.1	ND	0.69	1.8	ND	0.21	0.25	ND	0.097
	Phenol	18,300	NR	ND	ND	ND	ND	ND	0.18	0.15	0.13	ND
	Pyrene	1,720	NR	0.51	ND	1.8	1.7	ND	0.35	0.24	ND	ND
TAL Metals - EPA Method 6010B (mg/Kg)	Calcium	N/A	NR	ND	ND	150,000	ND	ND	ND	ND	ND	ND
	Copper	3,130	NR	ND	ND	ND	ND	ND	16.3	18.7	ND	18.7
	Lead	400	NR	ND	ND	ND	57	ND	42	64	ND	ND
	Manganese	10,700	NR	ND	ND	2,200	ND	ND	ND	ND	ND	ND
	Mercury	7.71	NR	ND	ND	ND	ND	ND	0.120	0.100	ND	ND
	Zinc	23,500	NR	150	104	ND	54.8	47.4	387	282	ND	584
TCL Pesticides - EPA Method 8081 (mg/Kg)	4,4-DDD	16.3 C	NR	ND	ND	ND	0.0130	ND	ND	ND	ND	ND
	4,4-DDE	11.5 C	NR	ND	ND	ND	0.0104	ND	ND	ND	ND	ND
	Heptachlor	0.871 C	NR	ND	ND	ND	ND	ND	0.00292	ND	ND	ND
	Heptachlor epoxide	0.053[c] C	NR	ND	ND	ND	ND	ND	0.00255	0.00208	ND	0.00165

Notes:

[a] NMED Residential Direct Exposure to Soil Screening Level (SSL), August 2009.
[b] The reporting limit was not presented in the report
[c] EPA Region 6 Regional Screening Levels, December 2009. Provided if no NMED SSL available for analyte.
Highlighted Value - positive detection for organic compounds and metals detected above background values
Bold Value - detected concentration above NMED Residential SSL
C - carcinogen
mg/Kg - milligram per kilogram
NR – not reported
ND – not detected, reporting limit not provided in the report
SVOC - semi-volatile organic compound
TAL - target analyte list
TCL - target compound list
VOC - volatile organic compound

Table 5-1E. Soil Analytical Results from SCIENTECH, 1999a from April 21, 1999 for SWMU 21, Central Landfill, Fort Wingate Depot Activity

Chemical Class - Laboratory Method (Units)	**Analyte**	**RL[a]**	**Background**	**NMED Residential SSL[b]**	42199CB E505 Outside Berm	42199CB E506 Group A	42199CB E507 Group C
TAL Metals - EPA Method 6010B (mg/Kg)	Arsenic	5.95	<0.449	3.59 C	**<5.95**	**<5.95**	**16 B**
	Chromium (total)	0.1	6.8	219	9.7	12	16
	Copper	0.11	8.28	3,130	4.3	5.8	12
	Lead	0.1	10.7	400	9.5B	8.5B	17
	Magnesium	1.0	7,588	N/A	3,100	7,100	10,000
	Nickel	3.3	12.4	1,560	8.4	8.6	13
	Vanadium	0.02	21	391	16	18	28
	Zinc	0.2	25.2	23,500	89	130	150
TCL VOCs - EPA Method 8260B (mg/Kg)	Acetone	0.00262	N/A	67,500	<0.00262	0.0048 J	0.0059 J
TCL SVOCs - EPA Method 8270C (mg/Kg)	Acenaphthene	0.011	N/A	3,440	<0.011	<0.011	0.11 J
	Acenaphthylene	0.0091	N/A	N/A	<0.0091	<0.0091	ND
	Anthracene	0.037	N/A	17,200	<0.037	<0.037	0.076 J
	Benzo(a)anthracene	0.021	N/A	4.81 C	<0.021	<0.021	0.160 J
	Benzo(a)pyrene	0.014	N/A	0.481 C	<0.014	<0.014	0.082 J
	Benzo(b)fluoranthene	0.016	N/A	4.81 C	<0.016	<0.016	0.11 J
	Benzo(k)fluoranthene	0.014	N/A	48.1 C	<0.014	<0.014	0.044 J
	Chrysene	0.015	N/A	481 C	<0.015	<0.015	0.11 J
	Dibenzofuran	0.0093	N/A	78[c]	<0.0093	<0.0093	0.063 J
	Fluoranthene	0.021	N/A	2,290	<0.021	<0.021	0.620 J
	Fluorene	0.01	N/A	2,290	<0.01	<0.01	0.130 J
	2-Methylnaphthalene	0.0089	N/A	N/A	<0.0089	<0.0089	0.077 J
	Naphthalene	0.022	N/A	45 C	<0.022	<0.022	0.18 J
	Pentachlorophenol	0.041	N/A	20.7 C	<0.041	<0.041	0.40 J
	Phenanthrene	0.010	N/A	1,830	<0.0095	<0.0095	0.56 J
	Pyrene	0.045	N/A	1,720	<0.045	<0.045	0.49 J
TCL Pesticides - EPA Method 8081 (mg/Kg)	Endrin ketone	NR	N/A	N/A	<0.00067	0.0024 J	<0.00079
TCL Herbicides - EPA Method 8150 (mg/Kg)	DCAA	NR	N/A	9.7[c]	0.104	0.098	0.104
TCL TRPH - EPA Method 8015 (mg/Kg)	Oil and Grease	4.0	N/A	N/A	29	96	230

Notes:
[a] Column provides the Reporting Limit (RL), which was the Practical Quantitation Limit (PQL) for this project.
[b] NMED Residential Direct Exposure to Soil Screening Level (SSL), August 2009.
[c] EPA Region 6 Regional Screening Levels, December 2009. Provided if no NMED SSL available for analyte.
Highlighted Value - positive detection for organic compounds and metals detected above background values
Bold Value - detected concentration above NMED Residential SSL
Sample depths were not presented in the report
C - Carcinogen
mg/Kg - milligram per kilogram
NR – Not Reported
ND – Not Detected, reporting limit not provided in the report
SVOC - semi-volatile organic compound
TAL - target analyte list
TCL - target compound list
TRPH - total recoverable petroleum hydrocarbons
VOC - volatile organic compound

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Table 5-1F. Soil Analytical Results from SCIENTECH, 1999a from June 16, 1999 for SWMU 21, Central Landfill, Fort Wingate Depot Activity (Page 1 of 6)

Chemical Class - Laboratory Method (Units)	Analyte	RL[a]	Background			NMED Residential SSL[b]	61699CTB E553	61699CTB E554	61699CTB E555	61699CTB E556	61699CTB E557	61699CTB E558
							Section R	Section Q	Section Q	Section P	Section O	Section N
TAL Metals - EPA Method 6010B (mg/Kg)	Aluminum	NR	21,776			78,100	26,000	16,000	13,000	20,000	22,000	12,000
	Barium	NR	322			15,600	310	230	200	310	300	230
	Beryllium	NR	1.17			156	0.81	0.62	0.52 B	0.73	0.71	0.49 B
	Cadmium	0.24	0.0762			77.9	<0.24	0.24 B	<0.24	0.26 B	<0.24	<0.24
	Calcium	NR	34,355			N/A	19,000	23,000	16,000	26,000	21,000	16,000
	Chromium (total)	NR	6.8			219	19	13	9.2	16	17	8.8
	Cobalt	NR	5.99			370[c] C	5.8	4.0 B	3.9 B	5.6	7.1	4.0 B
	Copper	NR	8.28			3,130	7.9	5.9	4.2	7.6	7.4	3.0
	Iron	NR	13,885			54,800	16,000	11,000	10,000	14,000	14,000	9,300
	Lead	NR	10.7			400	8.8 B	15	7.8 B	16	25	5.5 B
	Magnesium	NR	7,588			N/A	7,200	5,100	4,100	6,700	7,100	3,800
	Manganese	NR	552			10,700	350	330	290	430	400	280
	Mercury	0.04	0.18			7.71	0.039 B	0.040 B	<0.038	<0.039	<0.038	<0.039
	Nickel	NR	12.4			1,560	12	9.7	6.2	9.6	11	7.8
	Potassium	NR	4,251			N/A	4,600	3,500	2,500	3,200	4,200	2,400
	Selenium	15	1.48			391	15	15	15	15	15	15
	Sodium	8.9	1,758			N/A	380	340	390	560	460	210
	Thallium	NR	<0.0825			5.16	**10 B**	**<8.9**	**<8.9**	**<8.9**	**<8.9**	**<8.9**
	Vanadium	NR	21			391	41	29	19	32	37	20
	Zinc	NR	25.2			23,500	37	49	26	53	57	21

Chemical Class - Laboratory Method (Units)	Analyte	RL[a]	Background			NMED Residential SSL[b]	61699CTB E559	61699CTB E560	61699CTB E561	61699CTB E562	61699CTB E563	61699CTB E564
							Section N	Section M	Section L	Section K	Section K Duplicate	Section J
TAL Metals - EPA Method 6010B (mg/Kg)	Arsenic	5.9	<0.449			3.59 C	**<5.9**	**<5.9**	**<5.9**	**<5.9**	**<5.9**	**<5.9**
	Barium	NR	322			15,600	210	250	180	340	310	270
	Beryllium	NR	1.17			156	0.45B	0.64	0.79	1.1	1.2	0.67
	Cadmium	0.24	0.0762			77.9	<0.24	0.27 B	<0.24	0.54 B	0.31 B	0.56
	Calcium	NR	34,355			N/A	16,000	22,000	51,000	32,000	21,000	27,000
	Chromium (total)	NR	6.8			219	9.9	12	18	26	26	15
	Cobalt	NR	5.99			370[c] C	3.9 B	4.8 B	7	9.8	9.4	4.8 B
	Copper	NR	8.28			3,130	2.9	4.8	11	9.5	9	8.5
	Iron	NR	13,885			54,800	9,500	12,000	12,000	21,000	21,000	15,000
	Lead	NR	10.7			400	6.7 B	9.5 B	14	9.3 B	15	13
	Magnesium	NR	7,588			N/A	3,900	5,200	9,300	13,000	13,000	5,800
	Manganese	NR	552			10,700	280	400	810	510	450	610
	Mercury	0.04	0.18			7.71	<0.039	<0.039	0.059	<0.041	<0.041	<0.04
	Nickel	NR	12.4			1,560	5.8	6.5	12	16	20	7.6
	Potassium	NR	4,251			N/A	2,800	3,400	2,900	3,400	3,200	3,600
	Sodium	NR	1,758			N/A	190	510	410	550	540	460
	Thallium	8.9	<0.0825			5.16	**<8.9**	**<8.9**	**<8.9**	**11 B**	**<8.9**	**<8.9**
	Vanadium	NR	21			391	23	28	30	62	58	30
	Zinc	NR	25.2			23,500	18	29	39	41	42	71

Table 5-1F. Soil Analytical Results from SCIENTECH, 1999a from June 16, 1999 for SWMU 21, Central Landfill, Fort Wingate Depot Activity (Continued, Page 2 of 6)

Chemical Class - Laboratory Method (Units)	**Analyte**	**RL**[a]	**Background**			**NMED Residential SSL**[b]	61699CTB E565	61699CTB E566	61699CTB E567	61699CTB E568	61699CTB E569	61699CTB E570
							Section I	Section I	Section H	Section G	Section F	Section E
TAL Metals - EPA Method 6010B (mg/Kg)	Aluminum	NR	21,776			77,800	20,000	33,000	14,000	24,000	16,000	20,000
	Barium	NR	322			15,600	640	130	480	260	340	230
	Beryllium	NR	1.17			156	0.7	0.94	0.49 B	0.78	0.64	0.64
	Cadmium	0.24	0.0762			77.9	0.4 B	<0.24	<0.24	0.4 B	0.68	0.49 B
	Calcium	NR	34,355			N/A	20,000	9,200	24,000	31,000	30,000	21,000
	Chromium (total)	NR	6.8			219	15	29	14	20	11	15
	Cobalt	NR	5.99			370[c] C	6.4	7.0	6.1	5.7	5.2 B	5.3
	Copper	NR	8.28			3,130	6.7	3.9	7.3	9.6	5.4	8.2
	Iron	NR	13,885			54,800	15,000	22,000	17,000	17,000	13,000	13,000
	Lead	NR	10.7			400	11	12	9.4 B	19	11	19
	Magnesium	NR	7,588			N/A	5,500	14,000	4,300	7,000	4,800	5,300
	Manganese	NR	552			10,700	470	380	490	410	450	520
	Mercury	0.04	0.18			7.71	0.082	<0.04	0.11	<0.04	0.048	0.044
	Nickel	NR	12.4			1,560	11	17	18	10	6.6	8.0
	Potassium	NR	4,251			N/A	3,900	1,400	2,600	6,000	3,200	4,300
	Selenium	15	1.48			391	<15	<15	<15	<15	<15	<15
	Sodium	NR	1,758			N/A	450	1,100	290	440	310	500
	Thallium	8.9	<0.0825			5.16	**<8.9**	**<8.9**	**<8.9**	**9.2 B**	**<8.9**	**<8.9**
	Vanadium	NR	21			391	33	43	25	37	27	31
	Zinc	NR	25.2			23,500	56	34	33	250	37	70

Chemical Class - Laboratory Method (Units)	**Analyte**	**RL**[a]	**Background**			**NMED Residential SSL**[b]	61699CTB E571	61699CTB E572	61699CTB E573	61699CTB E574	61699CTB E575	61699CTB E576
							Section E	Section E	Section D	Section A	Section A Duplicate	Section A
TAL Metals - EPA Method 6010B (mg/Kg)	Aluminum	NR	21,776			77,800	8,500	7,200	20,000	16,000	18,000	18,000
	Arsenic	5.9	<0.449			3.59 C	**<5.9**	**7.3B**	**<5.9**	**<5.9**	**<5.9**	**<5.9**
	Barium	NR	322			15,600	370	200	250	200	240	240
	Beryllium	NR	1.17			156	0.34 B	0.26 B	0.7	0.62	0.65	0.64
	Cadmium	0.24	0.0762			77.9	<0.24	<0.24	0.29 B	0.28 B	0.33 B	0.48 B
	Calcium	NR	34,355			N/A	12,000	16,000	17,000	19,000	19,000	24,000
	Chromium (total)	NR	6.8			219	6.9	5.3	14	12	13	10
	Cobalt	NR	5.99			370[c] C	4.9 B	4.2 B	4.7 B	4.1 B	4.8 B	5.4
	Copper	NR	8.28			3,130	1.8 B	2.1 B	8.2	7.9	7.0	6.2
	Iron	NR	13,885			54,800	8,400	7,700	14,000	13,000	13,000	13,000
	Lead	NR	10.7			400	7.9 B	6.1 B	21	11	12	11
	Magnesium	NR	7,588			N/A	2,700	2,400	5,400	4,800	5,200	5,000
	Manganese	NR	552			10,700	300	280	370	350	330	310
	Mercury	0.04	0.18			7.71	<0.04	0.047	0.08	0.069	0.059	<0.04
	Nickel	NR	12.4			1,560	<3.3	5.0	9.5	9.4	8.5	11
	Potassium	NR	4,251			N/A	1,600	1,300	4,200	3,200	3,800	3,700
	Sodium	NR	1,758			N/A	450	360	380	490	500	930
	Vanadium	NR	21			391	19	21	32	27	30	27
	Zinc	NR	25.2			23,500	17	15	180	61	46	40

Table 5-1F. Soil Analytical Results from SCIENTECH, 1999a from June 16, 1999 for SWMU 21, Central Landfill, Fort Wingate Depot Activity (Page 1 of 6)

Chemical Class - Laboratory Method (Units)	Analyte	RL[a]	Background			NMED Residential SSL[b]	61699CTB E553 Section R	61699CTB E554 Section Q	61699CTB E555 Section Q	61699CTB E556 Section P	61699CTB E557 Section O	61699CTB E558 Section N
TAL Metals - EPA Method 6010B (mg/Kg)	Aluminum	NR	21,776			78,100	26,000	16,000	13,000	20,000	22,000	12,000
	Barium	NR	322			15,600	310	230	200	310	300	230
	Beryllium	NR	1.17			156	0.81	0.62	0.52 B	0.73	0.71	0.49 B
	Cadmium	0.24	0.0762			77.9	<0.24	0.24 B	<0.24	0.26 B	<0.24	<0.24
	Calcium	NR	34,355			N/A	19,000	23,000	16,000	26,000	21,000	16,000
	Chromium (total)	NR	6.8			219	19	13	9.2	16	17	8.8
	Cobalt	NR	5.99			370[c] C	5.8	4.0 B	3.9 B	5.6	7.1	4.0 B
	Copper	NR	8.28			3,130	7.9	5.9	4.2	7.6	7.4	3.0
	Iron	NR	13,885			54,800	16,000	11,000	10,000	14,000	14,000	9,300
	Lead	NR	10.7			400	8.8 B	15	7.8 B	16	25	5.5 B
	Magnesium	NR	7,588			N/A	7,200	5,100	4,100	6,700	7,100	3,800
	Manganese	NR	552			10,700	350	330	290	430	400	280
	Mercury	0.04	0.18			7.71	0.039 B	0.040 B	<0.038	<0.039	<0.038	<0.039
	Nickel	NR	12.4			1,560	12	9.7	6.2	9.6	11	7.8
	Potassium	NR	4,251			N/A	4,600	3,500	2,500	3,200	4,200	2,400
	Selenium	15	1.48			391	15	15	15	15	15	15
	Sodium	8.9	1,758			N/A	380	340	390	560	460	210
	Thallium	NR	<0.0825			5.16	**10 B**	**<8.9**	**<8.9**	**<8.9**	**<8.9**	**<8.9**
	Vanadium	NR	21			391	41	29	19	32	37	20
	Zinc	NR	25.2			23,500	37	49	26	53	57	21

Chemical Class - Laboratory Method (Units)	Analyte	RL[a]	Background			NMED Residential SSL[b]	61699CTB E559 Section N	61699CTB E560 Section M	61699CTB E561 Section L	61699CTB E562 Section K	61699CTB E563 Section K Duplicate	61699CTB E564 Section J
TAL Metals - EPA Method 6010B (mg/Kg)	Arsenic	5.9	<0.449			3.59 C	**<5.9**	**<5.9**	**<5.9**	**<5.9**	**<5.9**	**<5.9**
	Barium	NR	322			15,600	210	250	180	340	310	270
	Beryllium	NR	1.17			156	0.45B	0.64	0.79	1.1	1.2	0.67
	Cadmium	0.24	0.0762			77.9	<0.24	0.27 B	<0.24	0.54 B	0.31 B	0.56
	Calcium	NR	34,355			N/A	16,000	22,000	51,000	32,000	21,000	27,000
	Chromium (total)	NR	6.8			219	9.9	12	18	26	26	15
	Cobalt	NR	5.99			370[c] C	3.9 B	4.8 B	7	9.8	9.4	4.8 B
	Copper	NR	8.28			3,130	2.9	4.8	11	9.5	9	8.5
	Iron	NR	13,885			54,800	9,500	12,000	12,000	21,000	21,000	15,000
	Lead	NR	10.7			400	6.7 B	9.5 B	14	9.3 B	15	13
	Magnesium	NR	7,588			N/A	3,900	5,200	9,300	13,000	13,000	5,800
	Manganese	NR	552			10,700	280	400	810	510	450	610
	Mercury	0.04	0.18			7.71	<0.039	<0.039	0.059	<0.041	<0.041	<0.04
	Nickel	NR	12.4			1,560	5.8	6.5	12	16	20	7.6
	Potassium	NR	4,251			N/A	2,800	3,400	2,900	3,400	3,200	3,600
	Sodium	NR	1,758			N/A	190	510	410	550	540	460
	Thallium	8.9	<0.0825			5.16	**<8.9**	**<8.9**	**<8.9**	**11 B**	**<8.9**	**<8.9**
	Vanadium	NR	21			391	23	28	30	62	58	30
	Zinc	NR	25.2			23,500	18	29	39	41	42	71

Table 5-1F. Soil Analytical Results from SCIENTECH, 1999a from June 16, 1999 for SWMU 21, Central Landfill, Fort Wingate Depot Activity (Continued, Page 3 of 6)

Chemical Class - Laboratory Method (Units)	Analyte	RL[a]	NMED Residential SSL[b]	NMED DAF-20 Values[e]	Toxicological End Point	61699CTB E553	61699CTB E554	61699CTB E555	61699CTB E556	61699CTB E557	61699CTB E558
						Section T-R	Section T-Q	Section T-Q	Section S-P	Section R-O	Section Q-N
TCL VOCs - EPA Method 8260B (mg/Kg)	Chloroform	0.00019	5.72 C	0.0184	NC	<0.00011	0.00026 J	<0.00012	<0.00013	<0.00011	<0.00013
	Toluene	0.00017	5,570	0.0336	C	0.00041 JB	0.00049 JB	0.0003 JB	0.00024 JB	0.00017 JB	0.00028 JB
	Xylenes (total)	0.00056	1,090			<0.00034	<0.00041	<0.00037	<0.00038	0.00034 J	<0.00038

Chemical Class - Laboratory Method (Units)	Analyte	RL[a]	NMED Residential SSL[b]	NMED DAF-20 Values[e]	Toxicological End Point	61699CTB E559	61699CTB E560	61699CTB E561	61699CTB E562	61699CTB E563	61699CTB E564
						Section Q-N	Section P-M	Section O-L	Section N-K	Section N-K	Section M-J
TCL VOCs - EPA Method 8260B (mg/Kg)	Acetone	0.0037	67,500	N/A	N/A	<0.0025	<0.0022	<0.0025	0.021	0.021	0.0051
	Carbon Disulfide	0.00018	1,940	N/A	N/A	<0.00018	<0.00018	<0.00018	0.0005 J	0.00019 J	0.00026 J
	Toluene	0.00017	5,570	0.0336	C	0.00029 JB	0.00033 JB	<0.00017	0.00037 JB	0.00019 JB	0.00026 JB

Chemical Class - Laboratory Method (Units)	Analyte	RL[a]	NMED Residential SSL[b]	NMED DAF-20 Values[e]	Toxicological End Point	61699CTB E565	61699CTB E566	61699CTB E567	61699CTB E568	61699CTB E569	61699CTB E570
						Section L-I	Section L-I	Section K-H	Section J-G	Section I-F	Section H-E
TCL VOCs - EPA Method 8260B (mg/Kg)	Acetone	0.0037	67,500	N/A	N/A	0.019	<0.0037	<0.0037	0.022	<0.0037	<0.0037
	2-Butanone	0.0032	39,600	N/A	N/A	<0.0032	<0.0032	<0.0032	0.005	<0.0032	<0.0032
	Chloroform	0.00019	5.72 C	0.0184	NC	0.00041 J	<0.00019	<0.00019	<0.00019	<0.00019	0.00022 J
	Carbon Disulfide	0.00018	1,940	N/A	N/A	<0.00018	<0.00018	<0.00018	0.00035 J	<0.00018	<0.00018
	trans-1,2-	0.00031	273	0.462	NC	<0.00031	<0.00031	<0.00031	<0.00031	<0.00031	0.22
	trans-1,3-	0.0002	23.5 C	N/A	NC	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
	Ethylbenzene	0.00024	69.6	N/A	N/A	0.00043 J	<0.00024	<0.00024	0.0004 J	<0.00024	<0.00024
	Toluene	0.00017	5,570	0.0336	C	0.00026 JB	0.00019 JB	<0.00017	<0.00017	<0.00017	<0.00017
	Xylenes (total)	0.00056	1,090			0.004 J	<0.00056	<0.00056	0.00051 J	<0.00056	<0.00056

Chemical Class - Laboratory Method (Units)	Analyte	RL[a]	NMED Residential SSL[b]	NMED DAF-20 Values[e]	Toxicological End Point	61699CTB E565	61699CTB E566	61699CTB E567	61699CTB E568	61699CTB E569	61699CTB E570
						Section H-E	Section H-E	Section G-D	Section A	Section A	Section A
TCL VOCs - EPA Method 8260B (mg/Kg)	Toluene	0.00017	5,570	0.0336	C	0.00042 JB	0.00049 JB	<0.00017	<0.00017	0.00024 JB	0.0002 JB

Chemical Class - Laboratory Method (Units)	Analyte	RL[a]	NMED Residential SSL[b]	NMED DAF-20 Values[e]	Toxicological End Point	61699CTB E553	61699CTB E554	61699CTB E555	61699CTB E556	61699CTB E557	61699CTB E558
						Section T-R	Section T-Q	Section T-Q	Section S-P	Section R-O	Section Q-N
TCL SVOCs - EPA Method 8270C (mg/Kg)	Acenaphthene	0.054	3,440	N/A	N/A	0.28 J	0.85 J	0.41 J	2.2	<0.054	<0.054
	Anthracene	0.052	17,200	1.07	NC	0.46 J	1.5	1.1	3.4	0.089 J	<0.052
	Benzo(a)anthracene	0.024	4.81 C	0.462	NC	0.69	2.1	1.6	3.7	0.17 J	0.027 J
	Benzo(a)pyrene	0.017	0.481 C	N/A	NC	**0.57**	**2.1**	**1.3**	**3.4**	**0.15 J**	<0.017
	Benzo(b)fluoranthene	0.019	4.81 C	N/A	N/A	0.68	2.6	1.7	3.8	0.18 J	<0.019
	Benzo(g,h,I)perylene	0.047	N/A	N/A	N/A	0.35 J	1.7	0.96	2.8	0.16 J	<0.047
	Benzo(k)fluoranthene	0.017	48.1 C	108	NC	0.26 J	0.71 J	0.63 J	1.3	0.062 J	<0.017
	Chrysene	0.074	481 C	N/A	NC	0.69	1.9	1.4	3.4	0.19 J	<0.074
	Dibenzo(a,h)anthracene	0.054	0.481 C	N/A	N/A	0.11 J	0.43 J	0.22 J	**0.60 J**	<0.054	<0.054
	Dibenzofuran	0.047	78[c]	N/A	N/A	0.16 J	0.47 J	0.27 J	1.3	<0.047	<0.047
	Bis(2-ethylhexyl)phthalate	0.052	280 C	N/A	N/A	<0.052	<0.052	<0.052	0.45 J	<0.052	<0.052
	Fluoranthene	0.025	2,290	108	NC	1.8	5.3	4.0	8.8	0.41	0.060 J
	Fluorene	0.051	2,290	0.0184	NC	0.30 J	0.96	0.53 J	2.5	0.058 J	<0.051
	Ideno(1,2,3-cd)pyrene	0.031	4.81 C	0.659	Sat	0.44 J	1.7	1.0	3.0	0.11 J	<0.031
	Isophorone	0.031	4,130 C			<0.031	<0.031	<0.031	<0.031	<0.031	<0.031
	2-Methylnaphthalene	0.044	310[c]	0.0353	C	0.058 J	0.230 J	0.066 J	0.760 J	<0.044	<0.044
	Naphthalene	0.045	45 C	1.07	NC	0.170 J	0.610 J	0.200 J	2.2	<0.045	<0.045
	Phenanthrene	0.011	1,830	108	NC	1.9	5.2	4.1	11	0.37	0.041 J
	Pyrene	0.055	1,720	0.0336	C	1.5	4.2	3.4	8.5	0.43	<0.055

Table 5-1F. Soil Analytical Results from SCIENTECH, 1999a from June 16, 1999 for SWMU 21, Central Landfill, Fort Wingate Depot Activity (Continued, Page 3 of 6)

Chemical Class - Laboratory Method (Units)	**Analyte**	**RL[a]**	**NMED Residential SSL[b]**	**NMED DAF-20 Values[e]**	**Toxicological End Point**	61699CTB E553	61699CTB E554	61699CTB E555	61699CTB E556	61699CTB E557	61699CTB E558
						Section T-R	Section T-Q	Section T-Q	Section S-P	Section R-O	Section Q-N
TCL VOCs - EPA Method 8260B (mg/Kg)	Chloroform	0.00019	5.72 C	0.0184	NC	<0.00011	0.00026 J	<0.00012	<0.00013	<0.00011	<0.00013
	Toluene	0.00017	5,570	0.0336	C	0.00041 JB	0.00049 JB	0.0003 JB	0.00024 JB	0.00017 JB	0.00028 JB
	Xylenes (total)	0.00056	1,090			<0.00034	<0.00041	<0.00037	<0.00038	0.00034 J	<0.00038

Chemical Class - Laboratory Method (Units)	**Analyte**	**RL[a]**	**NMED Residential SSL[b]**	**NMED DAF-20 Values[e]**	**Toxicological End Point**	61699CTB E559	61699CTB E560	61699CTB E561	61699CTB E562	61699CTB E563	61699CTB E564
						Section Q-N	Section P-M	Section O-L	Section N-K	Section N-K	Section M-J
TCL VOCs - EPA Method 8260B (mg/Kg)	Acetone	0.0037	67,500	N/A	N/A	<0.0025	<0.0022	<0.0025	0.021	0.021	0.0051
	Carbon Disulfide	0.00018	1,940	N/A	N/A	<0.00018	<0.00018	<0.00018	0.0005 J	0.00019 J	0.00026 J
	Toluene	0.00017	5,570	0.0336	C	0.00029 JB	0.00033 JB	<0.00017	0.00037 JB	0.00019 JB	0.00026 JB

Chemical Class - Laboratory Method (Units)	**Analyte**	**RL[a]**	**NMED Residential SSL[b]**	**NMED DAF-20 Values[e]**	**Toxicological End Point**	61699CTB E565	61699CTB E566	61699CTB E567	61699CTB E568	61699CTB E569	61699CTB E570
						Section L-I	Section L-I	Section K-H	Section J-G	Section I-F	Section H-E
TCL VOCs - EPA Method 8260B (mg/Kg)	Acetone	0.0037	67,500	N/A	N/A	0.019	<0.0037	<0.0037	0.022	<0.0037	<0.0037
	2-Butanone	0.0032	39,600	N/A	N/A	<0.0032	<0.0032	<0.0032	0.005	<0.0032	<0.0032
	Chloroform	0.00019	5.72 C	0.0184	NC	0.00041 J	<0.00019	<0.00019	<0.00019	<0.00019	0.00022 J
	Carbon Disulfide	0.00018	1,940	N/A	N/A	<0.00018	<0.00018	<0.00018	0.00035 J	<0.00018	<0.00018
	trans-1,2-	0.00031	273	0.462	NC	<0.00031	<0.00031	<0.00031	<0.00031	<0.00031	0.22
	trans-1,3-	0.0002	23.5 C	N/A	NC	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
	Ethylbenzene	0.00024	69.6	N/A	N/A	0.00043 J	<0.00024	<0.00024	0.0004 J	<0.00024	<0.00024
	Toluene	0.00017	5,570	0.0336	C	0.00026 JB	0.00019 JB	<0.00017	<0.00017	<0.00017	<0.00017
	Xylenes (total)	0.00056	1,090			0.004 J	<0.00056	<0.00056	0.00051 J	<0.00056	<0.00056

Chemical Class - Laboratory Method (Units)	**Analyte**	**RL[a]**	**NMED Residential SSL[b]**	**NMED DAF-20 Values[e]**	**Toxicological End Point**	61699CTB E565	61699CTB E566	61699CTB E567	61699CTB E568	61699CTB E569	61699CTB E570
						Section H-E	Section H-E	Section G-D	Section A	Section A	Section A
TCL VOCs - EPA Method 8260B (mg/Kg)	Toluene	0.00017	5,570	0.0336	C	0.00042 JB	0.00049 JB	<0.00017	<0.00017	0.00024 JB	0.0002 JB

Chemical Class - Laboratory Method (Units)	**Analyte**	**RL[a]**	**NMED Residential SSL[b]**	**NMED DAF-20 Values[e]**	**Toxicological End Point**	61699CTB E553	61699CTB E554	61699CTB E555	61699CTB E556	61699CTB E557	61699CTB E558
						Section T-R	Section T-Q	Section T-Q	Section S-P	Section R-O	Section Q-N
TCL SVOCs - EPA Method 8270C (mg/Kg)	Acenaphthene	0.054	3,440	N/A	N/A	0.28 J	0.85 J	0.41 J	2.2	<0.054	<0.054
	Anthracene	0.052	17,200	1.07	NC	0.46 J	1.5	1.1	3.4	0.089 J	<0.052
	Benzo(a)anthracene	0.024	4.81 C	0.462	NC	0.69	2.1	1.6	3.7	0.17 J	0.027 J
	Benzo(a)pyrene	0.017	0.481 C	N/A	NC	**0.57**	**2.1**	**1.3**	**3.4**	**0.15 J**	<0.017
	Benzo(b)fluoranthene	0.019	4.81 C	N/A	N/A	0.68	2.6	1.7	3.8	0.18 J	<0.019
	Benzo(g,h,I)perylene	0.047	N/A	N/A	N/A	0.35 J	1.7	0.96	2.8	0.16 J	<0.047
	Benzo(k)fluoranthene	0.017	48.1 C	108	NC	0.26 J	0.71 J	0.63 J	1.3	0.062 J	<0.017
	Chrysene	0.074	481 C	N/A	NC	0.69	1.9	1.4	3.4	0.19 J	<0.074
	Dibenzo(a,h)anthracene	0.054	0.481 C	N/A	N/A	0.11 J	0.43 J	0.22 J	**0.60 J**	<0.054	<0.054
	Dibenzofuran	0.047	78[c]	N/A	N/A	0.16 J	0.47 J	0.27 J	1.3	<0.047	<0.047
	Bis(2-ethylhexyl)phthalate	0.052	280 C	N/A	N/A	<0.052	<0.052	<0.052	0.45 J	<0.052	<0.052
	Fluoranthene	0.025	2,290	108	NC	1.8	5.3	4.0	8.8	0.41	0.060 J
	Fluorene	0.051	2,290	0.0184	NC	0.30 J	0.96	0.53 J	2.5	0.058 J	<0.051
	Ideno(1,2,3-cd)pyrene	0.031	4.81 C	0.659	Sat	0.44 J	1.7	1.0	3.0	0.11 J	<0.031
	Isophorone	0.031	4,130 C			<0.031	<0.031	<0.031	<0.031	<0.031	<0.031
	2-Methylnaphthalene	0.044	310[c]	0.0353	C	0.058 J	0.230 J	0.066 J	0.760 J	<0.044	<0.044
	Naphthalene	0.045	45 C	1.07	NC	0.170 J	0.610 J	0.200 J	2.2	<0.045	<0.045
	Phenanthrene	0.011	1,830	108	NC	1.9	5.2	4.1	11	0.37	0.041 J
	Pyrene	0.055	1,720	0.0336	C	1.5	4.2	3.4	8.5	0.43	<0.055

Table 5-1F. Soil Analytical Results from SCIENTECH, 1999a from June 16, 1999 for SWMU 21, Central Landfill, Fort Wingate Depot Activity (Continued, Page 4 of 6)

Chemical Class - Laboratory Method (Units)	**Analyte**	**RL[a]**	**NMED Residential SSL[b]**	**NMED DAF-20 Values[e]**	**Toxicological End Point**	61699CTB E559 Section Q-N	61699CTB E560 Section P-M	61699CTB E561 Section O-L	61699CTB E562 Section N-K	61699CTB E563 Section N-K	61699CTB E564 Section M-J
TCL SVOCs - EPA Method 8270C (mg/Kg)	Acenaphthene	0.054	3,440	N/A	N/A	0.086 J	1.2	0.072 J	<0.054	<0.054	0.033 J
	Anthracene	0.052	17,200	1.07	NC	0.11 J	1.7	0.12 J	<0.052	<0.052	0.052 J
	Benzo(a)anthracene	0.024	4.81 C	0.462	NC	0.17 J	2.1	0.17 J	<0.024	<0.024	0.085 J
	Benzo(a)pyrene	0.017	0.481 C	N/A	NC	0.18 J	**1.9**	0.15 J	<0.017	<0.017	0.088 J
	Benzo(b)fluoranthene	0.019	4.81 C	N/A	N/A	0.21 J	2.1	0.17 J	<0.019	<0.019	0.079 J
	Benzo(g,h,I)perylene	0.047	N/A	N/A	N/A	0.22 J	1.4	0.17 J	<0.047	<0.047	0.10 J
	Benzo(k)fluoranthene	0.017	48.1 C	108	NC	0.087 J	0.64 J	0.058 J	<0.017	<0.017	0.040 J
	Carbazole	0.032	N/A	0.00261	C	0.052 J	0.780 J	0.056 J	<0.032	<0.032	<0.032
	Chrysene	0.074	481 C	N/A	NC	0.15 J	1.8	0.16 J	<0.074	<0.074	0.085 J
	Dibenzo(a,h)anthracene	0.054	0.481 C	N/A	N/A	0.075 J	0.370 J	<0.054	<0.054	<0.054	<0.054
	Dibenzofuran	0.047	78[c]	N/A	N/A	<0.047	**670 J**	<0.047	<0.047	<0.047	<0.047
	Fluoranthene	0.025	2,290	108	NC	0.38	4.9	0.37	<0.025	<0.025	0.18 J
	Fluorene	0.051	2,290	0.0184	NC	0.079 J	1.3	0.072 J	<0.051	<0.051	0.038 J
	Ideno(1,2,3-cd)pyrene	0.031	4.81 C	0.659	Sat	0.20 J	1.5	0.14 J	<0.031	<0.031	**81 J**
	2-Methylnaphthalene	0.044	310[c]	0.0353	C	<0.044	0.42 J	<0.044	<0.044	<0.044	<0.044
	Naphthalene	0.045	45 C	1.07	NC	<0.045	1.3	<0.045	<0.045	<0.045	<0.045
	Phenanthrene	0.011	1,830	108	NC	0.48	5.7	0.42	<0.011	<0.011	0.24 J
	Phenol	0.059	18,300	0.0184	NC	<0.059	<0.059	<0.059	<0.059	<0.059	<0.059
	Pyrene	0.055	1,720	0.0336	C	0.51	4.2	0.39	<0.055	<0.055	0.19 J

Chemical Class - Laboratory Method (Units)	**Analyte**	**RL[a]**	**NMED Residential SSL[b]**	**NMED DAF-20 Values[e]**	**Toxicological End Point**	61699CTB E565 Section L-I	61699CTB E566 Section L-I	61699CTB E567 Section K-H	61699CTB E568 Section J-G	61699CTB E569 Section I-F	61699CTB E570 Section H-E
TCL SVOCs - EPA Method 8270C (mg/Kg)	Acenaphthene	0.054	3,440	N/A	N/A	0.067 J	1.2	<0.054	0.26 J	0.061 J	<0.054
	Anthracene	0.052	17,200	1.07	NC	0.10 J	1.7	<0.054	0.39 J	0.20J	<0.19
	Benzo(a)anthracene	0.024	4.81 C	0.462	NC	0.18 J	1.9	<0.024	0.68	0.5	<0.10
	Benzo(a)pyrene	0.017	0.481 C	N/A	NC	0.17 J	**1.7**	<0.017	**0.56 J**	0.47	<0.071
	Benzo(b)fluoranthene	0.019	4.81 C	N/A	N/A	0.19 J	1.9	<0.019	0.55 J	0.44	<0.082
	Benzo(g,h,I)perylene	0.047	N/A	N/A	N/A	0.16 J	1.2	<0.047	0.63	0.34 J	<0.20
	Benzo(k)fluoranthene	0.017	48.1 C	108	NC	0.058 J	0.68 J	<0.017	0.20 J	0.25 J	<0.069
	Carbazole	0.032	N/A	0.00261	C	0.051 J	0.76 J	<0.032	0.20 J	<0.032	<0.032
	Chrysene	0.074	481 C	N/A	NC	0.17 J	1.7	<0.074	0.55 J	0.43	<0.074
	Dibenzo(a,h)anthracene	0.054	0.481 C	N/A	N/A	<0.054	0.27 J	<0.054	0.17 J	0.095 J	<0.13
	Dibenzofuran	0.047	78[c]	N/A	N/A	<0.047	0.64 J	<0.047	0.13 J	<0.047	<0.047
	Fluoranthene	0.025	2,290	108	NC	0.33 J	4.1	0.043 J	<1.20	1.2	0.35 J
	Fluorene	0.051	2,290	0.0184	NC	0.070 J	1.2	<0.051	<.26 J	0.079 J	<0.051
	Ideno(1,2,3-cd)pyrene	0.031	4.81 C	0.659	Sat	0.15 J	1.3	<0.031	0.54 J	0.34 J	<0.031
	Isophorone	0.031	4130 C			<0.031	<0.031	<0.031	<0.031	<0.031	<0.031
	2-Methylnaphthalene	0.044	310[c]	0.0353	C	<0.044	0.46 J	<0.044	0.087 J	<0.044	<0.044
	2-Methylphenol	0.046	3,100[c]			<0.046	<0.046	<0.046	<0.046	<0.046	<0.046
	Naphthalene	0.045	45 C	1.07	NC	0.057 J	1.7	<0.045	0.22 J	<0.045	<0.045
	Phenanthrene	0.011	1,830	108	NC	0.42	5.6	<0.011	1.4	0.71	0.34 J
	Pyrene	0.055	1,720	0.0336	C	0.39	4.6	<0.055	0.95	1.0	0.41 J

Table 5-1F. Soil Analytical Results from SCIENTECH, 1999a from June 16, 1999 for SWMU 21, Central Landfill, Fort Wingate Depot Activity (Continued, Page 5 of 6)

Chemical Class - Laboratory Method (Units)	Analyte	RL[a]	NMED Residential SSL[b]	NMED DAF-20 Values[e]	Toxicological End Point	61699CTB E565	61699CTB E566	61699CTB E567	61699CTB E568	61699CTB E569	61699CTB E570
						Section H-E	Section H-E	Section G-D	Section A	Section A	Section A
TCL SVOCs - EPA Method 8270C (mg/Kg)	Acenaphthene	0.054	3,440	N/A	N/A	<0.054	<0.054	0.16 J	<0.054	<0.054	<0.054
	Anthracene	0.052	17,200	1.07	NC	<0.052	<0.052	0.45 J	<0.052	<0.052	<0.052
	Benzo(a)anthracene	0.024	4.81 C	0.462	NC	<0.024	<0.024	1.10 J	<0.024	<0.024	<0.024
	Benzo(a)pyrene	0.017	0.481 C	N/A	NC	<0.017	<0.017	**0.88 J**	<0.017	<0.017	<0.017
	Benzo(b)fluoranthene	0.019	4.81 C	N/A	N/A	<0.019	<0.019	1.20 J	<0.019	<0.019	<0.019
	Benzo(g,h,I)perylene	0.047	N/A	N/A	N/A	<0.047	<0.047	0.77 J	<0.047	<0.047	<0.047
	Benzo(k)fluoranthene	0.017	48.1 C	108	NC	<0.017	<0.017	0.36 J	<0.017	<0.017	<0.017
	Carbazole	0.032	N/A	0.00261	C	<0.032	<0.032	0.25 J	<0.032	<0.032	<0.032
	4-Chloroaniline	0.052	2.4[c] C			<0.052	<0.052	0.092	<0.052	<0.052	<0.052
	Chrysene	0.074	481 C	N/A	NC	<0.074	<0.074	1.20 J	<0.074	<0.074	<0.074
	Dibenzofuran	0.047	78[c]	N/A	N/A	<0.047	<0.047	0.10 J	<0.047	<0.047	<0.047
	Fluoranthene	0.025	2,290	108	NC	<0.025	<0.025	2.6	<0.025	<0.025	<0.025
	Fluorene	0.051	2,290	0.0184	NC	<0.051	<0.051	0.19 J	<0.051	<0.051	<0.051
	Ideno(1,2,3-cd)pyrene	0.031	4.81 C	0.659	Sat	<0.031	<0.031	0.75 J	<0.031	<0.031	<0.031
	3-Nitroaniline	0.088	N/A	N/A	NC	<0.088	<0.088	0.18	0.1	0.1	<0.088

Chemical Class - Laboratory Method (Units)	Analyte	RL[a]	NMED Residential SSL[b]	NMED DAF-20 Values[e]	Toxicological End Point	61699CTB E553	61699CTB E554	61699CTB E555	61699CTB E556	61699CTB E557	61699CTB E558
						Section T-R	Section T-Q	Section T-Q	Section S-P	Section R-O	Section Q-N
TCL Pesticides - EPA Method 8081 (mg/Kg)	Dieldrin	0.000838	0.245 C	N/A	N/A	<0.000838	0.0294	<0.000838	0.047	0.00951	<0.000838
	4,4-DDD	0.0016	16.3 C	N/A	N/A	<0.0016	<0.0016	<0.0016	<0.0016	0.00425 J	<0.0016
	4,4-DDT	0.00145	15.8 C	0.0184	NC	<0.00145	<0.00145	<0.00145	0.00852	0.00595 J	<0.00145
	Endosulfan sulfate	0.000626	N/A	0.00261	C	<0.000626	0.00105 J	<0.000626	<0.000626	<0.000626	<0.000626
	Heptachlor	0.0008	0.871 C	0.0353	C	<0.0008	<0.0008	<0.0008	0.00364 J	<0.0008	<0.0008
	Methoxychlor	0.0404	310[c]	1.07	NC	<0.0404	<0.0404	<0.0404	0.0227 J	<0.0404	<0.0404

Chemical Class - Laboratory Method (Units)	Analyte	RL[a]	NMED Residential SSL[b]	NMED DAF-20 Values[e]	Toxicological End Point	61699CTB E559	61699CTB E560	61699CTB E561	61699CTB E562	61699CTB E563	61699CTB E564
						Section Q-N	Section P-M	Section O-L	Section N-K	Section N-K	Section M-J
TCL Pesticides - EPA Method 8081 (mg/Kg)	delta-BHC	0.000716	N/A	0.462	NC	<0.000716	0.00619 J	<0.000716	<0.000716	<0.000716	<0.000716
	4,4-DDD	0.0016	24.4 C	N/A	N/A	<0.0016	<0.0016	<0.0016	<0.0016	<0.0016	0.00187 J
	4,4-DDT	0.00145	17.2 C	0.0184	NC	<0.00145	0.00301 J	<0.00145	<0.00145	<0.00145	<0.00145
	Heptachlor	0.0008	1.08 C	0.0353	C	<0.0008	0.00125 J	<0.0008	<0.0008	<0.0008	<0.0008

Chemical Class - Laboratory Method (Units)	Analyte	RL[a]	NMED Residential SSL[b]	NMED DAF-20 Values[e]	Toxicological End Point	61699CTB E565	61699CTB E566	61699CTB E567	61699CTB E568	61699CTB E569	61699CTB E570
						Section L-I	Section L-I	Section K-H	Section J-G	Section I-F	Section H-E
TCL Pesticides - EPA Method 8081 (mg/Kg)	Dieldrin	0.000838	0.304 C	N/A	N/A	0.0337	0.0106	0.00928	0.0101	<0.000838	<0.000838
	4,4-DDD	0.0016	16.3 C	N/A	N/A	<0.0016	0.00832	<0.0016	0.0135	<0.0016	0.00183 J
	4,4-DDE	0.000721	11.5 C	108	NC	0.000816 J	<0.000721	<0.000721	<0.000721	<0.000721	<0.000721
	4,4-DDT	0.00145	15.8 C	0.0184	NC	0.0374	0.0236	0.00280 J	0.0263	<0.00145	0.00509 J
	Endosulfan sulfate	0.000626	N/A	0.00261	C	<0.000626	<0.000626	<0.000626	0.00487 J	<0.000626	0.00433 J
	Endrin ketone	0.000685	N/A			0.0011 J	<0.000685	<0.000685	0.00915	<0.000685	0.00113 J

Chemical Class - Laboratory Method (Units)	Analyte	RL[a]	NMED Residential SSL[b]	NMED DAF-20 Values[e]	Toxicological End Point	61699CTB E565	61699CTB E566	61699CTB E567	61699CTB E568	61699CTB E569	61699CTB E570
						Section H-E	Section H-E	Section G-D	Section A	Section A	Section A
TCL Pesticides - EPA Method 8081 (mg/Kg)	4,4-DDD	0.0016	16.3 C	N/A	N/A	<0.0016	<0.0016	0.0066 J	<0.0016	<0.0016	<0.0016
	4,4-DDT	0.00145	15.8 C	0.0184	NC	<0.00145	<0.00145	0.00547 J	0.00182 J	0.00199 J	0.00288 J
	Endrin ketone	0.000685	N/A			<0.000685	<0.000685	0.00231 J	0.00122 J	0.00433 J	0.00409 J

Table 5-1F. Soil Analytical Results from SCIENTECH, 1999a from June 16, 1999 for SWMU 21, Central Landfill, Fort Wingate Depot Activity (Concluded, Page 6 of 6)

Chemical Class - Laboratory Method (Units)	Analyte	RL[a]	NMED Residential SSL[b]	NMED DAF-20 Values[e]	Toxicological End Point	61699CTB E553	61699CTB E554	61699CTB E555	61699CTB E556	61699CTB E557	61699CTB E558
						Section T-R	Section T-Q	Section T-Q	Section S-P	Section R-O	Section Q-N
TCL TRPH - EPA Method 8015 (mg/Kg)	Total recoverable petroleum hydrocarbons	4.0	N/A	N/A	N/A	97	210	87	180	160	16 J
	Analyte	**RL[a]**	**NMED Residential SSL[b]**	**NMED DAF-20 Values[e]**	**Toxicological End Point**	61699CTB E559	61699CTB E560	61699CTB E561	61699CTB E562	61699CTB E563	61699CTB E564
						Section Q-N	Section P-M	Section O-L	Section N-K	Section N-K	Section M-J
	Total recoverable petroleum hydrocarbons	4.0	N/A	N/A	N/A	35	49	82	<4.0	5.6	310
	Analyte	**RL[a]**	**NMED Residential SSL[b]**	**NMED DAF-20 Values[e]**	**Toxicological End Point**	61699CTB E565	61699CTB E566	61699CTB E567	61699CTB E568	61699CTB E569	61699CTB E570
						Section L-I	Section L-I	Section K-H	Section J-G	Section I-F	Section H-E
	Total recoverable petroleum hydrocarbons	4.0	N/A	N/A	N/A	280	16 J	45	140	950	800
	Analyte	**RL[a]**	**NMED Residential SSL[b]**	**NMED DAF-20 Values[e]**	**Toxicological End Point**	61699CTB E565	61699CTB E566	61699CTB E567	61699CTB E568	61699CTB E569	61699CTB E570
						Section H-E	Section H-E	Section G-D	Section A	Section A	Section A
	Total recoverable petroleum hydrocarbons	4.0	N/A	N/A	N/A	7.8 J	<4.0	730	120	190	46

Notes:

[a] Column provides the Reporting Limit (RL), which was the Practical Quantitation Limit (PQL) for this project.
[b] NMED Residential Direct Exposure to Soil Screening Level (SSL), August 2009.
[c] EPA Region 6 Regional Screening Levels, December 2009. Provided if no NMED SSL available for analyte.
Highlighted Value - positive detection for organic compounds and metals detected above background values
Bold Value - detected concentration above NMED Residential SSL
Sample depths were not presented in the report
B - detected in blank
C - Carcinogen
J - value is between method detection limit (MDL) and PQL
mg/Kg - milligram per kilogram
N/A - not applicable
NR - not reported
PCBs - polychlorinated biphenyl
SVOC - semi-volatile organic compound
TAL - target analyte list
TCL - target compound list
TRPH - total recoverable petroleum hydrocarbons
VOC - volatile organic compound

Table 5-1G. Soil Analytical Results from SCIENTECH, 1999b from November 8, 1999
for SWMU 21, Central Landfill, Fort Wingate Depot Activity (Page 1 of 3)

Chemical Class - Laboratory Method (Units)	**Analyte**	**RL[a]**	**NMED Residential SSL[b]**	FTW-01	FTW-02	FTW-03	FTW-04	FTW-05	FTW-06	FTW-07	FTW-08	FTW-09
TCL VOCs - EPA Method 8260B (mg/Kg)	Toluene	0.00021	5,570	0.0007	0.00058	0.00032	<0.00021	0.00044	<0.00021	0.00034	<0.00021	<0.00021
SVOCs - EPA Method 8270C (mg/Kg)	2-Methylnaphthalene	0.0034	310[c]	0.19	0.11	0.031	0.13	0.012	0.039	<0.0034	0.054	0.24
	Acenaphthene	0.0042	3,440	0.69	0.29	0.07	0.059	0.031	0.076	<0.0042	0.13	0.99
	Anthracene	0.014	17,200	1.2	0.49	0.11	0.092	0.056	0.14	0.0084	0.31	2.1
	Benzo(a)anthracene	0.0079	4.81 C	1.9	**7.0**	0.22	0.15	0.13	0.28	0.025	0.62	2.1
	Benzo(a)pyrene	0.0055	0.481 C	**1.7**	**0.65**	0.18	0.13	0.094	0.19	0.016	0.45	**1.6**
	Benzo(b)fluoranthene	0.0064	4.81 C	2.0	0.8	0.35	0.23	0.13	0.32	0.022	0.61	2.3
	Benzo(ghi)perylene	0.015	N/A	1.1	0.44	0.16	0.12	0.1	0.15	<0.015	0.36	1.0
	Benzo(k)fluoranthene	0.0053	48.1 C	0.81	0.24	0.089	0.062	0.045	0.11	0.0075	0.21	0.72
	Bis(2-ethylhexyl)phthalate	0.02	280 C	0.14	0.13	0.13	0.057	<0.02	0.066	0.031	<0.02	<0.02
	Chrysene	0.0057	481 C	2.0	0.79	0.22	0.17	0.11	0.31	0.019	0.5	2.3
	Dibenz(a,h)anthracene	0.01	0.481 C	0.27	0.11	0.034	0.03	0.02	0.044	<0.01	0.087	0.3
	Dibenzofuran	0.0036	78[c]	0.44	0.17	0.045	0.049	0.018	0.047	<0.0036	0.093	0.65
	Fluoranthene	0.0081	2,290	3.7	1.6	0.51	0.46	0.29	0.68	<0.0081	1.3	6.3
	Fluorene	0.004	2,290	0.89	0.36	0.086	0.067	0.035	0.088	0.049	0.16	1.6
	Ideno (1,2,3-cd) pyrene	0.01	4.81 C	1.1	0.45	0.16	0.12	0.089	0.14	<0.01	0.38	1.1
	Naphthalene	0.008	45	0.47	0.24	0.06	0.15	0.022	0.052	<0.008	0.1	0.57
	Phenanthrene	0.0036	1,830	3.6	1.6	0.47	0.4	0.24	0.57	0.032	1.3	7.9
	Pyrene	0.018	1,720	3.9	1.5	0.5	0.32	0.28	0.66	0.041	1.3	5.9
	Carbazole	0.0025	N/A	0.6	0.21	0.04	0.038	0.02	0.05	<0.0025	0.13	0.73
TPH - EPA Method 418.1	Total petroleum hydrocarbons	NR	N/A	150	200	ND	49	22	420	89	150	770

Chemical Class - Laboratory Method (Units)	**Analyte**	**RL[a]**	**NMED Residential SSL[b]**	**Background**	FTW-01	FTW-02	FTW-03	FTW-04	FTW-05	FTW-06	FTW-07	FTW-08
ICP Metals - EPA Method 6010 (mg/Kg)	Aluminum	4.9	78,100	21,776	6,600	6,500	5,100	6,200	3,300	6,700	4,400	5,500
	Arsenic	5.9	3.59 C	<0.449	<5.9	<5.9	<5.9	<5.9	**8.7**	**16**	<5.9	**7.4**
	Barium	0.25	15,600	322	200	160	190	180	140	210	130	210
	Beryllium	0.046	156	1.17	0.59	0.55	0.41	0.49	0.25	0.55	0.3	0.47
	Cadmium	0.24	77.9	0.0762	0.41	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24
	Calcium	3.2	N/A	34,355	19,000	18,000	19,000	15,000	9,100	26,000	14,000	20,000
	Chromium (total)	0.85	219	6.8	3.9	4.6	2.7	4.5	2	8.2	2.7	3.5
	Cobalt	1.5	370[c]	5.99	4.2	4.2	3.5	3.5	2.8	3.7	2.2	3.2
	Copper	0.82	3,130	8.28	6.5	12	6.1	4.4	3.8	9.0	2.8	5.6
	Iron	1.5	54,800	13,885	7,500	5,700	4,800	7,700	4,700	12,000	4,200	4,600
	Lead	4.0	400	10.7	9.8	15	8.6	9.4	4.1	28	5.1	16
	Magnesium	3.3	N/A	7,588	2,600	2,600	2,000	2,300	1,400	3,700	1,800	2,100
	Manganese	0.18	10,700	552	310	330	440	230	180	340	200	290
	Mercury	0.037	77,100	0.18	<0.037	<0.037	<0.037	<0.037	<0.037	0.069	<0.037	<0.037
	Nickel	3.3	1,560	12.4	5.6	5.6	3.3	3.3	3.4	5.0	<3.3	3.3
	Potassium	130	N/A	4,251	1,100	660	790	1,000	500	1,200	840	870
	Sodium	8.7	N/A	1,758	640	1,000	130	120	200	650	390	1,000
	Vanadium	0.63	391	21	12	9.1	9.9	15	9	17	8.8	9.9
	Zinc	1.3	23,500	25.2	54	110	18	50	92	150	27	47
	alpha-BHC	0.0000197	0.077[c] C	N/A	0.000103	0.000147	0.000172	<0.0000197	0.00031	0.000554	0.00339	<0.0000197
	beta-BHC	0.0000498	0.27[c] C	N/A	<0.0000498	<0.0000498	<0.0000498	0.000956	0.000559	<0.0000498	0.000379	<0.0000498
	delta-BHC	0.0000672	N/A	N/A	<0.0000672	<0.0000672	<0.0000672	<0.0000672	0.000884	<0.0000672	0.00199	<0.0000672
	Dieldrin	0.0000786	0.245 C	N/A	<0.0000786	<0.0000786	0.0115	0.0126	0.00334	0.00597	0.00248	0.0121
	4,4-DDD	0.00015	16.3 C	N/A	0.00152	0.00306	0.00452	0.00136	0.00575	0.00884	0.00226	0.00479
	4,4-DDE	0.0000677	11.5 C	N/A	0.000734	0.0024	0.00407	0.00113	0.00234	0.00646	0.000586	0.00405
	4,4-DDT	0.000136	15.8 C	N/A	0.00535	0.00925	0.0123	0.00379	0.0187	0.0228	0.00538	0.0148
	Endosulfan-II	0.0000754	367	N/A	0.00212	0.00918	0.000429	<0.0000754	0.000257	0.0011	<0.0000754	0.0013
	Lindane	0.0000668	0.516[c] C	N/A	<0.0000668	<0.0000668	<0.0000668	<0.0000668	<0.0000668	0.00157	0.00275	<0.0000668

Table 5-1G. Soil Analytical Results from SCIENTECH, 1999b from November 8, 1999 for SWMU 21, Central Landfill, Fort Wingate Depot Activity (Continued, Page 2 of 3)

Chemical Class - Laboratory Method (Units)	Analyte	RL[a]	NMED Residential SSL[b]	FTW-10	FTW-11	FTW-12	FTW-13	FTW-14	FTW-15	FTW-16	FTW-17	FTW-18
TCL VOCs - EPA Method 8260B (mg/Kg)	Ethylbenzene	0.00025	69.6	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025	0.00024
	Toluene	0.00021	5,570	0.00055	<0.00021	0.00035	<0.00021	0.00045	0.00045	0.00023	0.00039	0.0005
SVOCs - EPA Method 8270C (mg/Kg)	2-Methylnaphthalene	0.0034	310[c]	0.18	1.1	0.064	0.078	<0.0034	0.03	0.22	0.088	0.16

Chemical Class - Laboratory Method (Units)	Analyte	RL[a]	NMED Residential SSL[b]	FTW-10	FTW-11	FTW-12	FTW-13	FTW-14	FTW-15	FTW-16	FTW-17	FTW-18
SVOCs - EPA Method 8270C (mg/Kg) Continued	Acenaphthene	0.0042	3,440	0.059	4.2	0.29	0.16	0.03	0.09	0.45	0.29	0.33
	Anthracene	0.014	17,200	0.15	7.6	0.39	0.28	<0.014	0.15	0.94	0.48	0.71
	Benzo(a)anthracene	0.0079	4.81 C	0.22	**11**	0.66	0.53	0.12	0.31	1.3	0.9	1.2
	Benzo(a)pyrene	0.0055	0.481 C	0.23	**9.6**	**0.57**	0.48	0.091	0.29	**1.0**	**0.78**	**0.83**
	Benzo(b)fluoranthene	0.0064	4.81 C	0.33	**11**	0.72	0.62	0.14	0.36	1.5	1.1	1.2
	Benzo(ghi)perylene	0.015	N/A	0.25	5.7	0.42	0.43	<0.015	0.23	0.75	0.51	0.61
	Benzo(k)fluoranthene	0.0053	48.1 C	0.083	4.6	0.33	0.25	0.062	0.12	0.55	0.33	0.37
	Bis(2-ethylhexyl)phthalate	0.02	280 C	<0.02	0.92	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
	Chrysene	0.0057	481 C	0.25	12	0.73	0.59	0.13	0.35	1.3	0.98	0.96
	Dibenz(a,h)anthracene	0.01	0.481 C	<0.01	**1.5**	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	Dibenzofuran	0.0036	78[c]	0.072	2.6	0.13	0.11	<0.0036	0.052	0.32	0.15	0.22
	Fluoranthene	0.0081	2,290	0.55	24	1.6	1.3	0.34	0.79	3.6	2.1	3.0
	Fluorene	0.004	2,290	0.076	5.4	0.28	0.19	0.04	0.097	0.63	0.32	0.43
	Ideno (1,2,3-cd) pyrene	0.01	4.81 C	0.21	**6.0**	0.45	0.38	<0.01	0.19	0.75	0.52	0.63
	Naphthalene	0.008	45	0.15	3.2	0.13	0.13	<0.008	0.062	0.28	0.19	0.21
	Phenanthrene	0.0036	1,830	0.53	24	1.5	1.2	0.24	0.67	3.6	1.9	2.8
	Phenol	0.019	18,300	<0.019	<0.019	<0.019	<0.019	<0.019	<0.019	<0.019	<0.019	<0.019
	Pyrene	0.018	1,720	0.51	23	1.4	1.2	0.28	0.71	3.3	2.1	2.3
	Carbazole	0.0025	N/A	<0.0025	3.8	0.19	0.11	<0.0025	0.058	0.31	0.19	0.22

Chemical Class - Laboratory Method (Units)	Analyte	RL[a]	NMED Residential SSL[b]	Background	FTW-10	FTW-11	FTW-12	FTW-13	FTW-14	FTW-15	FTW-16	FTW-17
ICP Metals - EPA Method 6010	Aluminum	4.9	78,100	21,776	6,500	7,100	6,100	6,600	4,800	7,900	9,300	8,500
	Arsenic	5.9	3.59 C	<0.449	**11**	<5.9	<5.9	<5.9	**8.3**	<5.9	**5.9**	<5.9
	Barium	0.25	15,600	322	390	190	180	220	140	280	250	210
	Beryllium	0.046	156	1.17	0.51	0.48	0.47	0.49	0.39	0.55	0.63	0.65
	Cadmium	0.24	77.9	0.0762	0.51	<0.24	<0.24	0.38	<0.24	0.55	<0.24	<0.24
	Calcium	3.2	N/A	34,355	27,000	19,000	18,000	21,000	15,000	23,000	25,000	18,000
	Chromium (total)	0.85	219	6.8	5.7	6.2	4.3	5.2	2.5	8.2	8.0	5.9
	Cobalt	1.5	370[c]	5.99	4.4	4.2	3.8	4.8	3.1	4.2	4.1	5.2
	Copper	0.82	3,130	8.28	11	5.1	4.6	7.1	3.1	13	13	6.9
	Iron	1.5	54,800	13,885	8,000	6,900	8,200	6,400	4,600	13,000	12,000	11,000
	Lead	4.0	400	10.7	41	19	9.4	18	4.8	29	26	14
	Magnesium	3.3	N/A	7,588	4,500	3,500	2,400	2,700	2,300	3,000	3,800	3,100
	Manganese	0.18	10,700	552	350	280	260	340	190	360	310	300
	Mercury	0.037	8	0.18	0.074	<0.037	<0.037	0.066	<0.037	0.079	0.071	0.037
	Nickel	3.3	1,560	12.4	6.8	5.0	4.1	6.6	<3.3	6.3	8.1	6.9
	Potassium	130	N/A	4,251	1,200	1,400	1,000	1,100	880	1,100	1,500	1,500
	Sodium	8.7	N/A	1,758	980	360	610	1,100	260	890	970	1,200
	Vanadium	0.63	391	21	13	12	15	11	9	17	19	17
	Zinc	1.3	23,500	25.2	59	68	41	59	19	170	170	31
TCL Pesticides - EPA Method 8081 (mg/Kg)	alpha-BHC	0.0000197	0.077[c] C	N/A	0.000397	<0.0000197	<0.0000197	0.000548	<0.0000197	0.000517	0.000262	0.00052
	Dieldrin	0.0000786	0.245 C	N/A	0.00459	<0.0000786	0.00721	<0.0000786	0.00671	<0.0000786	<0.0000786	0.0068
	4,4'-DDD	0.00015	16.3 C	N/A	0.0000162	0.0354	0.00309	0.0151	0.0601	0.0162	0.03	0.0333
	4,4'-DDE	0.0000677	11.5 C	N/A	0.0000138	0.00613	0.00167	0.00939	0.0476	0.0208	0.0151	0.0113
	4,4'-DDT	0.000136	15.8 C	N/A	0.0000541	0.0507	0.0034	0.0196	0.0241	0.00942	0.0312	0.021
	Endosulfan-I	0.0000721	367	N/A	0.0000031	<0.0000721	<0.0000721	<0.0000721	<0.0000721	0.00151	<0.0000721	<0.0000721
	Endosulfan-II	0.0000754	367	N/A	0.0000065	0.00267	0.000247	0.00139	0.00168	<0.0000754	0.00262	0.00173

Table 5-1G. Soil Analytical Results from SCIENTECH, 1999b from November 8, 1999 for SWMU 21, Central Landfill, Fort Wingate Depot Activity (Concluded, Page 3 of 3)

Chemical Class - Laboratory Method (Units)	**Analyte**	**RL**[a]	**NMED Residential SSL**[b]	FTW-10	FTW-11	FTW-12	FTW-13	FTW-14	FTW-15	FTW-16	FTW-17	FTW-18
TPH - EPA Method 418.1 (mg/Kg)	Total petroleum hydrocarbons	NR	N/A	280	350	130	720	46	800	770	31	770
Explosives - EPA Method 8330B (mg/Kg)	RDX	NR	35.6 C	ND	ND	ND	ND	ND	ND	ND	0.292	0.137

Notes:

[a] Column provides the Reporting Limit (RL), which was the Method Detection Limit (MDL) for this project.
[b] NMED Residential Direct Exposure to Soil Screening Level (SSL), August 2009.
[c] EPA Region 6 Regional Screening Levels, December 2009. Provided if no NMED SSL for analyte.

Highlighted Value - positive detection for organic compounds and metals detected above background values
Bold Value - detected concentration above NMED Residential SSL
Sample depths were not presented in the report

C - Carcinogen
ICP - inductively coupled plasma
mg/Kg - milligram per kilogram
N/A - not applicable
ND - not detected
NR - not reported
RDX - cyclotrimethylenetrinitramine
SVOC - semi-volatile organic compound
TAL - target analyte list
TCL - target compound list
TPH - total petroleum hydrocarbons
VOC - volatile organic compound

Table 5-1H. Soil Analytical Results from TetraTechNUS, 2000 for SWMU 21, Central Landfill, Fort Wingate Depot Activity (Page 1 of 4)

Chemical Class - Laboratory Method (Units)	Analyte	RL[a]	NMED Residential SSL[b]	CMAIN23-03	CMAIN24-05	CMAIN19-01	CMAIN22-01	CMAIN25-01	CMAIN01-01	CMAIN02-03	CMAIN03-05
				3-feet	5-feet	1-foot	1-foot	1-foot	1-foot	3-feet	5-feet
SVOCs - EPA Method 8270C (mg/Kg)	4-Nitrophenol	NR	N/A	ND	ND	2.03	1.89	ND	ND	ND	ND
	Anthracene	NR	17,200	ND	ND	3.44	5.57	ND	ND	ND	ND
	Benzo(a)anthracene	NR	4.81 C	ND	0.762	4.7	**6.26**	0.905	ND	0.0709	ND
	Benzo(a)pyrene	NR	0.481 C	ND	**0.726**	**4.77**	**5.35**	**0.906**	ND	0.0852	ND
	Benzo(b)fluoranthene	NR	4.81 C	ND	0.646	3.54	4.36	0.814	ND	0.0785	ND
	Benzo(ghi)perylene	NR	N/A	ND	ND	2.37	3.78	0.941	ND	ND	ND
	Benzo(k)fluoranthene	NR	48.1 C	ND	ND	3.02	3.56	ND	ND	ND	ND
	Chrysene	NR	481 C	2.48	0.82	4.75	6.12	1.01	ND	0.0831	ND
	Dibenz(a,h)anthracene	NR	0.481 C	ND	ND	**0.659**	**0.879**	ND	ND	ND	ND
	Dibenzofuran	NR	78[c]	ND	ND	1.15	1.61	ND	ND	ND	ND
	Fluoranthene	NR	2,290	ND	1.98	12.4	16.7	2.18	ND	0.16	ND
	Fluorene	NR	2,290	ND	ND	2.21	2.93	ND	ND	ND	ND
	Ideno(1,2,3-cd)pyrene	NR	4.81 C	ND	ND	3.12	4.65	0.808	ND	ND	ND
	Naphthalene	NR	45 C	ND	ND	2.06	0.67	ND	ND	ND	ND
	Phenanthrene	NR	1,830	ND	1.76	11.7	17.7	1.78	ND	0.144	ND
	Pyrene	NR	1,720	ND	1.23	7.54	11.3	1.68	ND	0.119	ND
	Carbazole	NR	N/A	ND	ND	1.5	2.16	ND	ND	ND	ND
TAL Metals - EPA Method 6010 (mg/Kg)	Aluminum	NR	78,100	12,300	21,300	N/A	N/A	N/A	1,150	16,800	N/A
	Antimony	0.1	31.3	<0.10	0.19	N/A	N/A	N/A	<0.10	<0.12	N/A
	Arsenic	NR	3.59 C	1.9	2.7	N/A	N/A	N/A	2.9	2.3	N/A
	Barium	NR	15,600	334	234	N/A	N/A	N/A	267 J	284 J	N/A
	Beryllium	NR	156	0.72	0.82	N/A	N/A	N/A	0.5	0.9	N/A
	Cadmium	0.02	77.9	0.31	0.53	N/A	N/A	N/A	<0.020	<0.020	N/A
	Calcium	NR	N/A	10,900	29,800	N/A	N/A	N/A	50,600	34,100	N/A
	Chromium (total)	NR	219	21.5	16	N/A	N/A	N/A	7.6 J	11.6 J	N/A
	Cobalt	NR	370[c]	6.4	4.8	N/A	N/A	N/A	3.2 J	4.9 J	N/A
	Copper	NR	3,130	10.6 J	10.9 J	N/A	N/A	N/A	2.9 J	7.5 J	N/A
	Iron	NR	54,800	10,400	20,700	N/A	N/A	N/A	13,100	14,300	N/A
	Lead	NR	400	15.6 J	24.3 J	N/A	N/A	N/A	5.6 J	7.6 J	N/A
	Magnesium	NR	N/A	4,660	7,730	N/A	N/A	N/A	3,650	5,060	N/A
	Manganese	NR	10,700	310	309	N/A	N/A	N/A	755	390	N/A
	Mercury	0.045	77,100	<0.042	0.047	N/A	N/A	N/A	<0.039	<0.045	N/A
	Nickel	NR	1,560	11.4 J	9.4 J	N/A	N/A	N/A	5.2	8.5	N/A
	Potassium	NR	N/A	2,710	3,050	N/A	N/A	N/A	1,580	2,590	N/A
	Silver	0.1	391	<0.10	0.22	N/A	N/A	N/A	<0.10	<0.12	N/A
	Sodium	NR	N/A	1,020 J	1,070 J	N/A	N/A	N/A	402	591	N/A
	Thallium	NR	5.16	0.67	0.38	N/A	N/A	N/A	<0.17	0.33	N/A
	Vanadium	NR	391	39.1 J	29.8 J	N/A	N/A	N/A	18.3 J	18.5 J	N/A
	Zinc	NR	23,500	127 J	156 J	N/A	N/A	N/A	26.6 J	29.7 J	N/A
TCL Pesticides - EPA Method 8081 (mg/Kg)	4,4-DDD	NR	16.3 C	0.0162	ND	ND	0.0283	0.0299	ND	ND	ND
	4,4-DDT	NR	15.8 C	0.0164	ND	ND	0.0217	0.0194	ND	ND	ND

Table 5-1H. Soil Analytical Results from TetraTechNUS, 2000
for SWMU 21, Central Landfill, Fort Wingate Depot Activity (Continued, Page 2 of 4)

Chemical Class - Laboratory Method (Units)	**Analyte**	**RL[a]**	**NMED Residential SSL[b]**	CMAIN05-03	CMAIN08-03	CMAIN09-05	CMAIN10-01	CMAIN06-05	CMAIN07-01	CMAIN11-03	CMAIN12-05
				3-feet	3-feet	5-feet	1-foot	5-feet	1-foot	3-feet	5-feet
SVOCs - EPA Method 8270C (mg/Kg)	2-Methylnaphthalene	NR	310[c]	ND	ND	ND	0.962	ND	ND	ND	ND
	Acenaphthene	NR	3,440	0.689	1.26	ND	3.46	ND	ND	ND	ND
	Anthracene	NR	17,200	1.11	2.12	ND	5.3	ND	0.629	0.348	ND
	Benzo(a)anthracene	NR	4.81 C	1.22	3.21	ND	**6.89**	ND	0.956	0.611	0.474
	Benzo(a)pyrene	NR	0.481 C	**1.26**	**3.3**	ND	**6.89**	ND	**0.991**	**0.603**	0.424
	Benzo(b)fluoranthene	NR	4.81 C	0.984	2.24	ND	4.76	ND	0.667	0.495	0.37
	Benzo(ghi)perylene	NR	N/A	1.08	2.84	ND	6.65	ND	0.751	0.394	0.276
	Benzo(k)fluoranthene	NR	48.1 C	0.874	2.25	ND	4.64	ND	0.657	ND	ND
	Bis(2-ethylhexyl)phthalate	NR	280 C	ND	ND	ND	1.67	ND	ND	ND	ND
	Chrysene	NR	481 C	1.26	3.24	ND	6.8	ND	1.0	0.637	0.5
	Dibenz(a,h)anthracene	NR	0.481 C	0.227	**0.579**	ND	**1.54**	ND	ND	ND	ND
	Dibenzofuran	NR	78[c]	0.407	0.619	ND	1.78	ND	ND	ND	ND
	Fluoranthene	NR	2,290	3.54	8.07	ND	19	ND	2.7	1.51	1.2
	Fluorene	NR	2,290	0.749	1,240	ND	3.42	ND	366	ND	ND
	Ideno(1,2,3-cd)pyrene	NR	4.81 C	1.12	3.23	ND	**7.41**	ND	0.888	0.44	ND
	Naphthalene	NR	45 C	0.861	0.753	ND	2.87	ND	ND	ND	ND
	Phenanthrene	NR	1,830	3.58	7.16	ND	18	ND	2.33	1.21	0.72
	Pyrene	NR	1,720	2.41	5.78	ND	15	ND	1.77	1.11	0.699
	Carbazole	NR	N/A	0.495	1.07	ND	2.59	ND	0.285	ND	ND
TAL Metals - EPA Method 6010 (mg/Kg)	Aluminum	NR	78,100	N/A	N/A	20,100	18,100	N/A	N/A	N/A	N/A
	Arsenic	NR	3.59 C	N/A	N/A	2.6	1.9	N/A	N/A	N/A	N/A
	Barium	NR	15,600	N/A	N/A	383 J	230 J	N/A	N/A	N/A	N/A
	Beryllium	NR	156	N/A	N/A	0.77	0.7	N/A	N/A	N/A	N/A
	Calcium	NR	N/A	N/A	N/A	25,700	31,000	N/A	N/A	N/A	N/A
	Chromium (total)	NR	219	N/A	N/A	13.8 J	12.7 J	N/A	N/A	N/A	N/A
	Cobalt	NR	370[c]	N/A	N/A	5.5 J	4.1 J	N/A	N/A	N/A	N/A
	Copper	NR	3,130	N/A	N/A	7.7 J	7.7 J	N/A	N/A	N/A	N/A
	Iron	NR	54,800	N/A	N/A	18,900	13,300	N/A	N/A	N/A	N/A
	Lead	NR	400	N/A	N/A	9.3 J	11.7 J	N/A	N/A	N/A	N/A
	Magnesium	NR	N/A	N/A	N/A	6,990	5,370	N/A	N/A	N/A	N/A
	Manganese	NR	10,700	N/A	N/A	687	412	N/A	N/A	N/A	N/A
	Mercury	0.045	77,100	N/A	N/A	<0.047	0.05	N/A	N/A	N/A	N/A
	Nickel	NR	1,560	N/A	N/A	9.8	8.4	N/A	N/A	N/A	N/A
	Potassium	NR	N/A	N/A	N/A	2,900	3,430	N/A	N/A	N/A	N/A
	Sodium	NR	N/A	N/A	N/A	650	856	N/A	N/A	N/A	N/A
	Thallium	NR	5.16	N/A	N/A	0.41	0.4	N/A	N/A	N/A	N/A
	Vanadium	NR	391	N/A	N/A	29.7 J	22.8 J	N/A	N/A	N/A	N/A
	Zinc	NR	23,500	N/A	N/A	51.8 J	70.8 J	N/A	N/A	N/A	N/A
TCL Pesticides - EPA Method 8081 (mg/Kg)	Chlordane	NR	16.2 C	ND	0.286	ND	ND	ND	0.0658	0.0296	0.0628
	Dieldrin	NR	0.304 C	0.057	0.07	ND	ND	ND	ND	ND	0.0502
	4,4-DDD	NR	16.3 C	0.0064	0.0226	ND	ND	ND	0.0042	0.0086	0.0127
	4,4-DDE	NR	11.5 C	ND	0.0079	ND	ND	ND	ND	ND	ND
	4,4-DDT	NR	15.8 C	0.0121	0.0103	ND	ND	ND	0.0133	0.0174	0.072

Table 5-1H. Soil Analytical Results from TetraTechNUS, 2000 for SWMU 21, Central Landfill, Fort Wingate Depot Activity (Continued, Page 3 of 4)

Chemical Class - Laboratory Method (Units)	Analyte	RL[a]	NMED Residential SSL[b]	CMAIN14-03	CMAIN15-05	CMAIN16-01	CMAIN17-03	CMAIN18-05	CMAIN20-03	CMAIN21-05	CNEW02-03
				3-feet	5-feet	1-foot	3-feet	5-feet	3-feet	5-feet	3-feet
SVOCs - EPA Method 8270C (mg/Kg)	2-Methylnaphthalene	NR	310[c]	3.34	ND	ND	ND	ND	ND	ND	N/A
	Acenaphthene	NR	3,440	6.44	ND	7.12	ND	ND	0.719	ND	N/A
	Anthracene	NR	17,200	9.55	ND	11.5	0.743	ND	1.24	0.599	N/A
	Benzo(a)anthracene	NR	4.81 C	**9.88**	ND	**14.6**	1.33	ND	1.71	0.997	N/A
	Benzo(a)pyrene	NR	0.481 C	**9.99**	ND	**14.6**	**1.36**	ND	**1.71**	**1.02**	N/A
	Benzo(b)fluoranthene	NR	4.81 C	**7.09**	ND	**11.1**	1.06	ND	1.28	0.815	N/A
	Benzo(ghi)perylene	NR	N/A	5.3	ND	13.8	1.12	ND	1.11	0.606	N/A
	Benzo(k)fluoranthene	NR	48.1 C	5.99	ND	9.56	0.889	ND	1.06	0.686	N/A
	Chrysene	NR	481 C	9.83	ND	14.5	1.4	ND	1.78	1.08	N/A
	Dibenz(a,h)anthracene	NR	0.481 C	**1.29**	ND	**2.92**	0.26	ND	0.281	ND	N/A
	Dibenzofuran	NR	78[c]	4.48	ND	3.85	ND	ND	0.354	ND	N/A
	Fluoranthene	NR	2,290	27.4	ND	39.2	3.36	ND	4.48	2.65	N/A
	Fluorene	NR	2,290	8.1	ND	7.5	0.388	ND	0.676	0.308	N/A
	Ideno(1,2,3-cd)pyrene	NR	4.81 C	**6.94**	ND	**15.2**	1.29	ND	1.36	0.788	N/A
	Naphthalene	NR	45 C	10.2	ND	ND	ND	ND	0.513	ND	N/A
	Phenanthrene	NR	1,830	32.8	ND	38	2.73	ND	4.15	2.22	N/A
	Pyrene	NR	1,720	19.4	ND	32.4	2.52	ND	3.32	1.77	N/A
	Carbazole	NR	N/A	4.46	ND	4.74	0.379	ND	0.57	0.298	N/A
TAL Metals - EPA Method 6010 (mg/Kg)	Aluminum	NR	78,100	23,800	N/A	N/A	N/A	N/A	21,200	21,700	N/A
	Arsenic	NR	3.59 C	1.8	N/A	N/A	N/A	N/A	2.8	**4.0**	2.3 J
	Barium	NR	15,600	339 J	N/A	N/A	N/A	N/A	263 J	323 J	N/A
	Calcium	NR	N/A	22,900	N/A	N/A	N/A	N/A	24,900	35,500	N/A
	Chromium (total)	NR	219	16.8 J	N/A	N/A	N/A	N/A	17.8 J	16.5 J	N/A
	Cobalt	NR	370[c]	4.7 J	N/A	N/A	N/A	N/A	5.3 J	6.6 J	N/A
	Copper	NR	3,130	11 J	N/A	N/A	N/A	N/A	12.2 J	13.8 J	N/A
	Iron	NR	54,800	14,900	N/A	N/A	N/A	N/A	19,900	21,500	N/A
	Lead	NR	400	23.6 J	N/A	N/A	N/A	N/A	27.3 J	26.5 J	N/A
	Magnesium	NR	N/A	6,560	N/A	N/A	N/A	N/A	6,510	12,600	N/A
	Manganese	NR	10,700	317	N/A	N/A	N/A	N/A	335	692	N/A
	Mercury	NR	77,100	0.14	N/A	N/A	N/A	N/A	0.11	0.066	N/A
	Nickel	NR	1,560	9.4	N/A	N/A	N/A	N/A	11.4 J	31.3 J	N/A
	Potassium	NR	N/A	4,370	N/A	N/A	N/A	N/A	3,780	4,050	N/A
	Sodium	NR	N/A	819	N/A	N/A	N/A	N/A	1,190	1,300	N/A
	Thallium	NR	5.16	0.45	N/A	N/A	N/A	N/A	0.49	0.43	0.032 J
	Vanadium	NR	391	30.5 J	N/A	N/A	N/A	N/A	28.7 J	34.8 J	N/A
	Zinc	NR	23,500	88.2 J	N/A	N/A	N/A	N/A	182 J	180 J	N/A
TCL Pesticides - EPA Method 8081 (mg/Kg)	Dieldrin	NR	0.304 C	ND	0.0074	ND	ND	ND	ND	ND	N/A
	4,4'-DDD	NR	16.3 C	ND	ND	ND	ND	ND	ND	0.0309	N/A
	4,4'-DDT	NR	15.8 C	0.0143	0.0105	0.007	0.0188	ND	ND	0.0243	N/A
Explosives - EPA Method 8330B (mg/Kg)	2-Amino-4,6-dinitrotoluene	NR	N/A	ND	ND	ND	ND	ND	ND	0.3	ND
	4-Amino-2,6-dinitrotoluene	NR	N/A	ND	ND	ND	ND	ND	ND	1.2	ND
	HMX	NR	3,060	ND	ND	ND	ND	ND	ND	0.1	ND
	RDX	NR	35.6 C	ND	ND	ND	ND	ND	ND	0.7	0.6
	2,4,6-Trinitrotoluene	NR	35.9	ND	ND	ND	ND	ND	ND	**69 E**	ND
	1,3,5-Trinitrobenzene	NR	2,200[c]	ND	ND	ND	ND	ND	ND	1.3	ND

Table 5-1H. Soil Analytical Results from TetraTechNUS, 2000 for SWMU 21, Central Landfill, Fort Wingate Depot Activity (Concluded, Page 4 of 4)

Chemical Class - Laboratory Method (Units)	**Analyte**	**RL**[a]	**NMED Residential SSL**[b]	CNEW05-03	CNEW06-05	CNEW08-03	CNEW09-05	CNEW11-03	CNEW07-01	CNEW12-05	CNEW10-01
				3-feet	5-feet	3-feet	5-feet	3-feet	1-foot	5-feet	1-foot
TLC Metals - EPA Method 6010 (mg/Kg)	Arsenic	NR	3.59 C	ND	ND	2.1 J	1.1 J	ND	ND	1.3 J	3.1 J
	Thallium	NR	5.16	ND	ND	0.032 J	0.041 J	ND	ND	0.021 J	0.042 J
Explosives - EPA Method 8330B (mg/Kg)	HMX	NR	3,060	ND	ND	0.3	ND	ND	ND	ND	ND
	RDX	NR	35.6 C	0.80	ND	1.5	ND	ND	ND	ND	ND

Notes:

[a] Column provides the Reporting Limit (RL), which was the Practical Quantitation Limit (PQL) for this project.
[b] NMED Residential Direct Exposure to Soil Screening Level (SSL), August 2009.
[c] EPA Region 6 Regional Screening Levels, December 2009. Provided if no NMED SSL available for analyte.
Highlighted Value - positive detection for organic compounds and metals detected above background values
Bold Value - detected concentration above NMED Residential SSL
C - Carcinogen
HMX - cyclotetramethylenetetranitramine
J - Estimated Value
mg/Kg - milligram per kilogram
N/A - not applicable
ND - not detected
NR - not reported
RDX - cyclotrimethylenetrinitramine
SVOC - semi-volatile organic compound
TAL - target analyte list
TCL - target compound list
VOC - volatile organic compound

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Table 5-2. Proposed Sampling and Analyses for SWMU 21, Fort Wingate Depot Activity (Page 1 of 4)

Method					6010B and 7471A	8270C	8081A	8330A
					Metals	SVOCs	Pesticides	Explosives
Specific Analyses Requested					RCRA Metals	Semi-Volatile Organic Compounds	Pesticides	Explosives
Sample ID	Sample Location	Sample Depth (feet bgs)	Sample Type	Chain of Custody Comment				
2321-SB01-2021	SB01	20-21	Discrete		X	X	X	X
2321-SB01-2425	SB01	24-25	Discrete		X	X	X	X
2321-SB01-2425-DUP	SB01	24-25	Discrete Dup		X	X	X	X
2321-SB01-2930	SB01	29-30	Discrete		X	X	X	X
2321-SB01-3435	SB01	34-35	Discrete		X	X	X	X
2321-SB01-3940	SB01	39-40	Discrete		X	X	X	X
2321-SB01-4445	SB01	44-45	Discrete		X	X	X	X
2321-SB01-4950	SB01	49-50	Discrete		X	X	X	X
2321-SB01-5455	SB01	54-55	Discrete		X	X	X	X
2321-SB01-5960	SB01	59-60	Discrete		X	X	X	X
2321-SB02-2021	SB02	20-21	Discrete		X	X	X	X
2321-SB02-2021-DUP	SB02	20-21	Discrete Dup		X	X	X	X
2321-SB02-2425	SB02	24-25	Discrete	MS/MSD	X	X	X	X
2321-SB02-2930	SB02	29-30	Discrete		X	X	X	X
2321-SB02-3435	SB02	34-35	Discrete		X	X	X	X
2321-SB02-3940	SB02	39-40	Discrete		X	X	X	X
2321-SB02-4445	SB02	44-45	Discrete		X	X	X	X
2321-SB02-4950	SB02	49-50	Discrete		X	X	X	X
2321-SB02-5455	SB02	54-55	Discrete		X	X	X	X
2321-SB02-5960	SB02	59-60	Discrete		X	X	X	X
2321-SB03-2021	SB03	20-21	Discrete		X	X	X	X
2321-SB03-2425	SB03	24-25	Discrete		X	X	X	X
2321-SB03-2930	SB03	29-30	Discrete		X	X	X	X
2321-SB03-3435	SB03	34-35	Discrete		X	X	X	X
2321-SB03-3435-DUP	SB03	34-35	Discrete Dup		X	X	X	X
2321-SB03-3940	SB03	39-40	Discrete		X	X	X	X
2321-SB03-4445	SB03	44-45	Discrete		X	X	X	X
2321-SB03-4950	SB03	49-50	Discrete		X	X	X	X
2321-SB03-5455	SB03	54-55	Discrete		X	X	X	X
2321-SB03-5960	SB03	59-60	Discrete		X	X	X	X
2321-SB04-2021	SB04	20-21	Discrete		X	X	X	X
2321-SB04-2021-DUP	SB04	20-21	Discrete Dup		X	X	X	X
2321-SB04-2425	SB04	24-25	Discrete		X	X	X	X
2321-SB04-2930	SB04	29-30	Discrete		X	X	X	X
2321-SB04-3435	SB04	34-35	Discrete		X	X	X	X
2321-SB04-3940	SB04	39-40	Discrete		X	X	X	X

Table 5-2. Proposed Sampling and Analyses for SWMU 21, Fort Wingate Depot Activity (Page 2 of 4)

					Metals	SVOCs	Pesticides	Explosives
Method					6010B and 7471A	8270C	8081A	8330A
Specific Analyses Requested					RCRA Metals	Semi-Volatile Organic Compounds	Pesticides	Explosives
Sample ID	**Sample Location**	**Sample Depth (feet bgs)**	**Sample Type**	**Chain of Custody Comment**				
2321-SB04-4445	SB04	44-45	Discrete	MS/MSD	X	X	X	X
2321-SB04-4950	SB04	49-50	Discrete		X	X	X	X
2321-SB04-5455	SB04	54-55	Discrete		X	X	X	X
2321-SB04-5960	SB04	59-60	Discrete		X	X	X	X
2321-SB05-2021	SB05	20-21	Discrete		X	X	X	X
2321-SB05-2425	SB05	24-25	Discrete		X	X	X	X
2321-SB05-2930	SB05	29-30	Discrete		X	X	X	X
2321-SB05-3435	SB05	34-35	Discrete		X	X	X	X
2321-SB05-3940	SB05	39-40	Discrete		X	X	X	X
2321-SB05-4445	SB05	44-45	Discrete		X	X	X	X
2321-SB05-4950	SB05	49-50	Discrete		X	X	X	X
2321-SB05-5455	SB05	54-55	Discrete		X	X	X	X
2321-SB05-5960	SB05	59-60	Discrete		X	X	X	X
2321-SB06-2021	SB06	20-21	Discrete		X	X	X	X
2321-SB06-2425	SB06	24-25	Discrete		X	X	X	X
2321-SB06-2930	SB06	29-30	Discrete		X	X	X	X
2321-SB06-2930-DUP	SB06	29-30	Discrete Dup		X	X	X	X
2321-SB06-3435	SB06	34-35	Discrete		X	X	X	X
2321-SB06-3940	SB06	39-40	Discrete		X	X	X	X
2321-SB06-4445	SB06	44-45	Discrete		X	X	X	X
2321-SB06-4445-DUP	SB06	44-45	Discrete Dup		X	X	X	X
2321-SB06-4950	SB06	49-50	Discrete		X	X	X	X
2321-SB06-5455	SB06	54-55	Discrete		X	X	X	X
2321-SB06-5960	SB06	59-60	Discrete	MS/MSD	X	X	X	X
2321-SB07-2021	SB07	20-21	Discrete		X	X	X	X
2321-SB07-2425	SB07	24-25	Discrete		X	X	X	X
2321-SB07-2930	SB07	29-30	Discrete		X	X	X	X
2321-SB07-3435	SB07	34-35	Discrete		X	X	X	X
2321-SB07-3940	SB07	39-40	Discrete		X	X	X	X
2321-SB07-4445	SB07	44-45	Discrete		X	X	X	X
2321-SB07-4950	SB07	49-50	Discrete		X	X	X	X
2321-SB07-5455	SB07	54-55	Discrete		X	X	X	X
2321-SB07-5960	SB07	59-60	Discrete		X	X	X	X
2321-SB08-0001	SB08	0-1	Discrete		X	X	X	X
2321-SB08-0001-DUP	SB08	0-1	Discrete Dup		X	X	X	X
2321-SB08-0405	SB08	4-5	Discrete		X	X	X	X

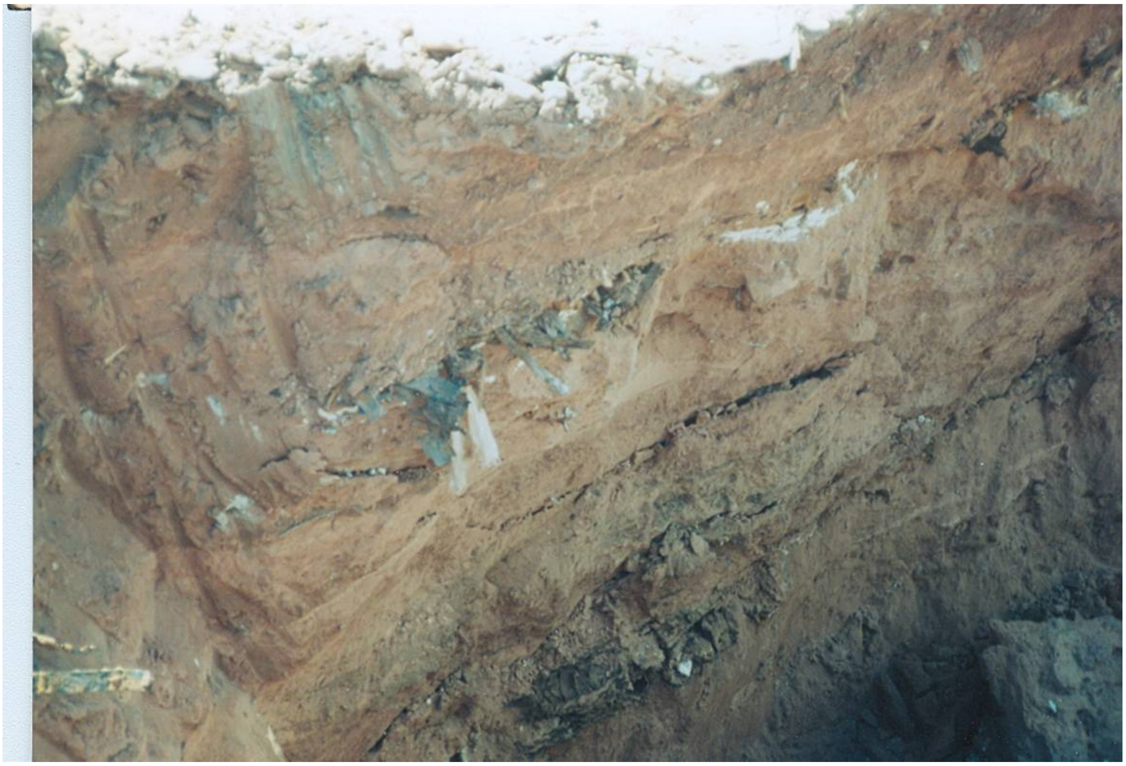
Table 5-2. Proposed Sampling and Analyses for SWMU 21, Fort Wingate Depot Activity (Page 3 of 4)

					Metals	SVOCs	Pesticides	Explosives
Method					6010B and 7471A	8270C	8081A	8330A
Specific Analyses Requested					RCRA Metals	Semi-Volatile Organic Compounds	Pesticides	Explosives
Sample ID	**Sample Location**	**Sample Depth (feet bgs)**	**Sample Type**	**Chain of Custody Comment**				
2321-SB08-0910	SB08	9-10	Discrete		X	X	X	X
2321-SB08-1415	SB08	14-15	Discrete		X	X	X	X
2321-SB08-1920	SB08	19-20	Discrete		X	X	X	X
2321-SB08-2425	SB08	24-25	Discrete		X	X	X	X
2321-SB08-2930	SB08	29-30	Discrete		X	X	X	X
2321-SB08-3435	SB08	34-35	Discrete		X	X	X	X
2321-SB08-3940	SB08	39-40	Discrete		X	X	X	X
2321-SB09-0001	SB09	0-1	Discrete		X	X	X	X
2321-SB09-0405	SB09	4-5	Discrete	MS/MSD	X	X	X	X
2321-SB09-0910	SB09	9-10	Discrete		X	X	X	X
2321-SB09-1415	SB09	14-15	Discrete		X	X	X	X
2321-SB09-1920	SB09	19-20	Discrete		X	X	X	X
2321-SB09-2425	SB09	24-25	Discrete		X	X	X	X
2321-SB09-2930	SB09	29-30	Discrete		X	X	X	X
2321-SB09-2930-DUP	SB09	29-30	Discrete Dup		X	X	X	X
2321-SB09-3435	SB09	34-35	Discrete		X	X	X	X
2321-SB09-3940	SB09	39-40	Discrete		X	X	X	X
2321-SB10-0001	SB10	0-1	Discrete		X	X	X	X
2321-SB10-0405	SB10	4-5	Discrete	MS/MSD	X	X	X	X
2321-SB10-0910	SB10	9-10	Discrete		X	X	X	X
2321-SB10-1415	SB10	14-15	Discrete		X	X	X	X
2321-SB10-1920	SB10	19-20	Discrete		X	X	X	X
2321-SB10-2425	SB10	24-25	Discrete		X	X	X	X
2321-SB10-2425-DUP	SB10	24-25	Discrete Dup		X	X	X	X
2321-SB10-2930	SB10	29-30	Discrete		X	X	X	X
2321-SB10-3435	SB10	29-30	Discrete		X	X	X	X
2321-SB10-3940	SB10	34-35	Discrete		X	X	X	X

Table 5-2. Proposed Sampling and Analyses for SWMU 21, Fort Wingate Depot Activity (Concluded, Page 4 of 4)

					Metals	SVOCs	Pesticides	Explosives
Method					6010B and 7471A	8270C	8081A	8330A
Specific Analyses Requested					RCRA Metals	Semi-Volatile Organic Compounds	Pesticides	Explosives
Sample ID	**Sample Location**	**Sample Depth (feet bgs)**	**Sample Type**	**Chain of Custody Comment**				
2321-EB01	EB01	N/A	Discrete	Equipment Blank	X (rinsate)	X (rinsate)	X (rinsate)	X (rinsate)
2321-EB02	EB02	N/A	Discrete	Equipment Blank	X (rinsate)	X (rinsate)	X (rinsate)	X (rinsate)
2321-EB03	EB03	N/A	Discrete	Equipment Blank	X (rinsate)	X (rinsate)	X (rinsate)	X (rinsate)
2321-EB04	EB04	N/A	Discrete	Equipment Blank	X (rinsate)	X (rinsate)	X (rinsate)	X (rinsate)
Total Normal Samples					90	90	90	90
Total Duplicates					9	9	9	9
Total Equipment Blanks (Rinsate water sample)					4	4	4	4
Total MS/MSD Samples (lab counts each separately)					10	10	10	10
Total Soil Samples					109	109	109	109
Total Water Samples					4	4	4	4
Total Analyses					113	113	113	113

Notes bgs = below ground surface
Discrete = discrete location sample
Dup = duplicate sample
EB = Equipment rinsate blank
Lab QC = Matrix spike/matrix spike duplicate sample set which will be **triple the normal sample volume**
MS/MSD = matrix spike/matrix spike duplicate
N/A = Not Applicable
RCRA = Resource Conservation and Recovery Act

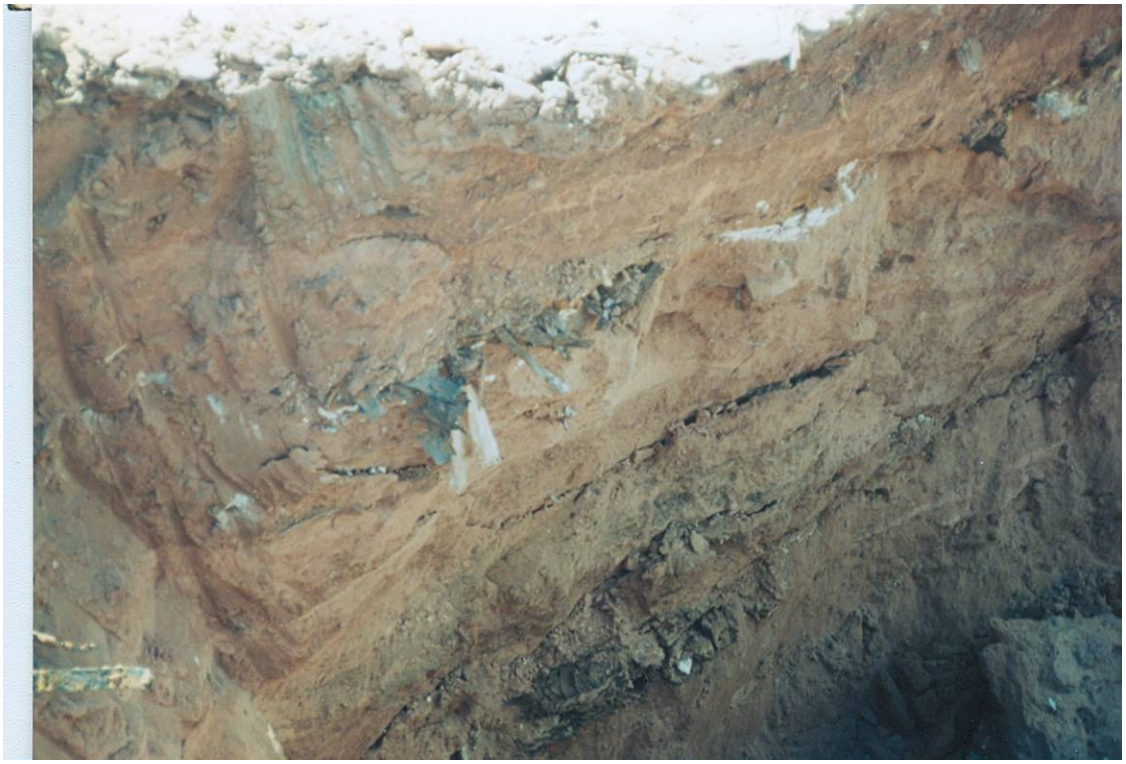


Photograph 5-1. Layer of debris in west bank Area H.

Photograph 5-2. Looking south to north of Central Landfill; screen is placed in Area D.

Photograph 5-3. Stockpile of debris; metal banding, wood, plastic, and cardboard.

Photograph 5-4. Trench looking north at Areas K, J, I, H, and G.



Photograph 5-1. Layer of debris in west bank Area H.

Photograph 5-2. Looking south to north of Central Landfill; screen is placed in Area D.

Photograph 5-3. Stockpile of debris; metal banding, wood, plastic, and cardboard.

Photograph 5-4. Trench looking north at Areas K, J, I, H, and G.

6.0 AOC 73: Former Buildings or Structures Along Road C-3

6.1 Background

6.1.1 Location, Description, and Operational History

Area of Concern (AOC) 73 is described in the RCRA Permit as former buildings or structures along Road C-3. Based on available photographs and maps, AOC 73 consists of two general site locations. One site is located in the north-central portion of Parcel 23 and the other in the south-central portion of the parcel, both located along Road C-3, as shown in Figure 6-1. Each site is approximately 100 feet by 300 feet in size. Photographs 6-1 and 6-2, which are provided at the end of this section, show various views of AOC 73.

Map A-14-3, dated September 1, 1945, lists the two AOC 73 sites as an "X-Site - Temporary Standard Above Ground Magazine 4,000 Tons Gross Class X Amm." The northern building is listed as X-21 and the southern building as X-22. Map A-14-1, dated March 1950, lists the two AOC 73 sites as a "Shed Covered Class Y Storage Site." The northern building is listed as both T-332 and X-21, and the southern site is listed as both T-333 and X-22. Map A-14-4, dated January 4, 1967, lists the two AOC 73 sites as an "Open Storage Site." The northern site is listed as Z-332 and the southern site is listed as Z-333. On this map, each site is noted along with several other Open Storage Sites across FWDA as a working site being full to capacity with leakers awaiting disposition. The northern site is noted to have 500,000 pounds (lbs) of storage and the southern site with 1,000,000 lbs. These maps are provided in the Historical Information Report for Parcel 23.

Based on review of available historical maps and aerial photographs the operational history is approximately as follows. It is expected that activities first began at AOC 73 sometime between 1940 and 1941 when a temporary standard aboveground magazine was built at each of the two locations. It is believed that these covered structures were used for the temporary storage of munitions until sometime between 1962 and 1966 when the structures were demolished. Following the removal of the buildings, AOC 73 was used for temporary open storage of munitions that were awaiting disposition. The open storage of munitions at these sites was continued until sometime between 1967 and 1973. By 1973, the aerial photographs indicate that the site had begun to re-vegetate. No additional information is available relating to the operational history of AOC 73.

6.1.2 Surface Conditions

AOC 73 has a generally flat topography with a vegetation cover of grass and sagebrush.

6.1.3 Subsurface Conditions

Previous subsurface investigations have not been completed at AOC 73.

Figure 6-1
AOC 73 Site Location
RFI Work Plan, Parcel 23
Fort Wingate Depot Activity, New Mexico

6.1.4 Waste Characteristics and Contaminants of Potential Concern

No known wastes or contaminants were historically released at AOC 73. This site was identified as an AOC based solely on aerial photography. Explosives were handled and stored at AOC 73. Therefore, explosives are considered the COPCs for this site. Other contaminants are not expected at this location because historical documentation indicates that this site was only used for the temporary storage of munitions.

6.2 Previous Investigations

6.2.1 Nonsampling Data

Nonsampling data available for AOC 73 are summarized below.

Aerial Report; Environmental Research, Inc., 2006

An aerial photography analysis was completed in 2006 based on aerial imagery obtained during a search of government and commercial records (ERI, 2006). The photographs were analyzed utilizing a stereoscope to locate potential sources of contamination and to record any findings inside the boundaries of the known AOCs and SWMUs. Aerial images dated from 1935 to 1997 were analyzed.

Activities at AOC 73 are first observed in the 1948 photograph when buildings are present at the site. It was noted that light-toned material and disturbed ground are located east of Z-332 and an access road leads to a ground scarred area southeast of Z-332 in this photo. The report indicates that the 1962 photograph shows a ground scar and probable debris present to the east of Z-332. The 1966 photograph shows that Z-332 and Z-333 have been removed and these areas appear to have been graded. Open storage activities are not observed in any of the subsequent photographs and the areas appear to begin re-vegetating by the 1973 photograph.

Report of Investigation for Potential Environmental Areas of Concern; USACE, 2007

This report documents an investigation completed at AOCs located outside of the boundaries of current SWMUs and AOCs. Investigation activities were not completed within AOC 73. However, the report includes background information relevant to areas at the FWDA that were previously used to temporarily store inert items and ordnance, such as AOC 73. The report indicates that buildings designated with an X- identifier were wood-framed structures with a roof but no walls. These buildings had earth or gravel floors and were present at the FWDA from approximately 1945 to 1980. Areas with a T- identifier were flat open storage areas with no associated building that were present at the FWDA from approximately 1945 to 1948.

6.2.2 Sampling Data

The 2008 release assessment investigation constitutes the only specific sampling data for AOC 73. The release assessment data are discussed in Section 6.3.2.

Report of Investigation for Potential Environmental Areas of Concern; USACE, 2007a

Parcel 23 once contained a WWI wooden magazine in the southeast portion of the parcel. This site was demolished prior to construction of the current infrastructure at the depot. The U.S. Army Corps of Engineers previously consulted with the NMED and performed multi-incremental sampling on those sites not within a SWMU or AOC. Results of the sampling are found in the report entitled

Report of Investigation for Potential Environmental Areas of Concern, FWDA, dated October 2007. This report is discussed here because this historical site does not relate to a specific AOC or SWMU. The report was submitted to the stakeholders and the NMED in November 2007.

In this report the Army describes the magazines as wood buildings with a metal roof approximately 20 feet by 50 feet in size with bulk explosives stored in boxes. The report details the minimal historical information, investigative methods, and sampling results and includes a figure showing sample locations. The Parcel 23 site was identified as 35B-229. Each of the sites was tested for explosives by analyzing a multi-incremental sample from 30 subsample locations, collected at depths of 0 to 6 inches below the surface. Also, each site was visually inspected by Mr. David Holladay, a Tech 3 Army Ordnance and Explosives Safety Specialist, who also surveyed each site with a Schoenstedt metal detector. The only explosive found on any of these sites was at site 35K-306. This site contained an estimated quantity (J flag – estimated value) of 0.19 mg/kg of 4-nitritoluene. This concentration is well below the NMED Residential SSL of 146 mg/kg. No munitions were detected.

6.2.3 Conceptual Model

6.2.3.1 Nature and Extent of Contamination

There is no record of previous releases to the environment at AOC 73 that would result in COPCs being present at this site. This site was identified as an AOC because aerial photography indicated that it was previously the location of two former buildings or structures. Further evaluation of historical information indicates that AOC 73 previously contained two Open Storage Sites or Standard Ammunition Magazines, which were buildings used for the temporary storage of munitions. Based on available documentation, storage of munitions occurred at this site beginning sometime between 1940 and 1941 and continued until sometime between 1962 and 1966 when the structures were demolished.

6.2.3.2 Fate and Transport

If contamination was present at AOC 73, it could pose a threat to human health and the environment through exposure to contaminated surface or subsurface soils.

6.2.3.3 Data Gaps

The 2008 release assessment investigation addressed the sample data gaps for this site. The release assessment data are discussed in Section 6.3.2.

6.3 Release Assessment

6.3.1 Historical Records/Document Review

None of the historical documents reviewed suggested that releases of hazardous wastes or hazardous constituents occurred at AOC 73. As discussed above, this site was identified as an AOC based on the presence of former buildings or structures interpreted from aerial photography. Further evaluation of historical information indicates that AOC 73 previously contained two Open Storage Sites or Standard Ammunition Magazines, which were buildings used for the temporary storage of munitions. Based on available documentation, storage of munitions occurred at this site beginning sometime between 1940 and 1941 and continued until sometime between 1962 and 1966 when the structures were demolished.

6.3.2 Soil Sampling

Soil sampling was completed at AOC 73 by the USACE on September 9, 2008. Four multi-incremental (MI) surface soil samples were collected at each of the two AOC 73 sub-locations for a total of eight samples, as shown in Figure 6-2. Each sample was analyzed for explosives using EPA Method 8330B. Each multi-incremental sample consisted of 10 individual sample locations taken from a sampling grid covering one-quarter of the footprint of the former building location and then composited into one multi-incremental sample.

No explosives were positively detected in any of the samples collected from AOC 73. Therefore, a summary table of the data is not submitted with this work plan.

6.3.3 Release Assessment Conclusion

- Based on the release assessment investigation results, the NMED directed that additional MI samples be collected from each decision unit. This sampling is discussed in the sections below.

6.4 Scope of Activities

The following field activities will be conducted during the RFI at AOC 73:

- Collection of four MI surface soil samples from 0- to 6-inches bgs and four subsurface MI soil samples from 6- to 12-inches bgs from each of the two building footprints at AOC 73 using a hand auger, for a total of 16 MI samples.
- Analysis of surface and subsurface MI soil samples to verify the results from the 2008 MI surface soil investigation.

6.4.1 Multi-Incremental Soil Sampling

Soil sampling will be conducted to evaluate the presence of environmental impacts from historical operations at AOC 73. Based on the operational history, the COPCs for AOC 73 are RCRA metals and explosives.

Field activities will include the collection of MI samples at the former locations of Buildings T-332 and T-333. Each former building location will be subdivided into four decision units, each with dimensions of approximately 150 feet by 50 feet, as shown in Figure 6-2. A total of 100 subsamples will be collected using a hand auger from each decision unit. Fifty subsamples will be collected from 0-to 6-inches bgs, and 50 subsamples from 6- to 12-inches bgs in each decision unit. These samples will be collected to verify the results from the 2008 MI surface soil investigation.

Table 6-1 summarizes the proposed MI soil sampling at AOC 73. All samples will be analyzed for RCRA metals (EPA Methods 6010B, and 7471A) and explosives (EPA Method 8330B).

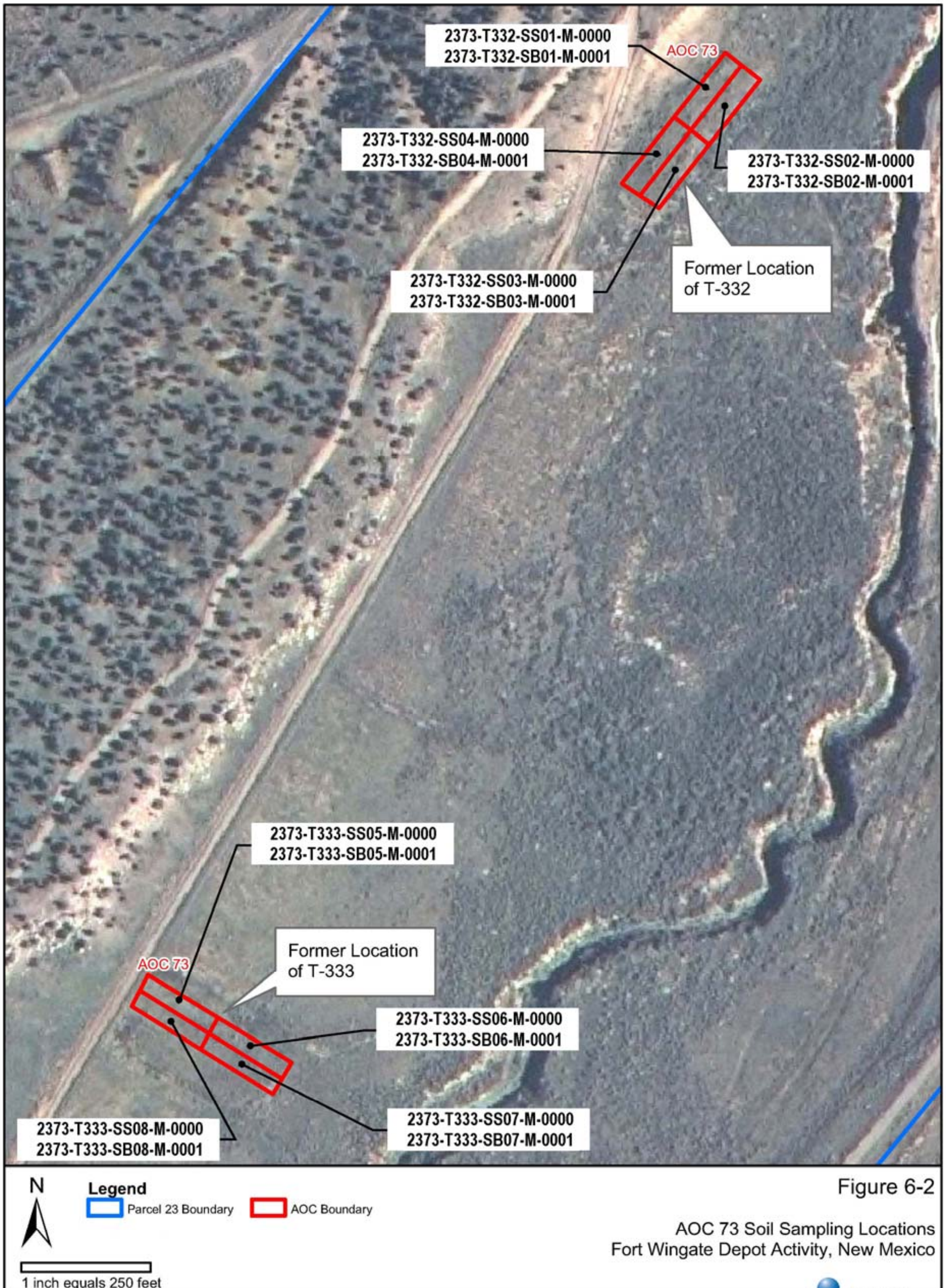


Figure 6-2

AOC 73 Soil Sampling Locations
Fort Wingate Depot Activity, New Mexico

DEN \\COBRA\GIS\PROJECTS\FORT_WINGATE\MAPFILES\PARCEL23_20081210\FIG6-1_20081210.MXD 12/10/2008 17:07:36

Table 6-1. Proposed Sampling and Analyses for AOC 73, Fort Wingate Depot Activity

Sample Analysis				**RCRA Metals**	**Explosives**
Analytical Method				**6010B and 7471A**	**8330B**
Sample ID	Site	Sample Type	Sample Depth (feet bgs)		
2373-T332-SS01-M-0000	AOC 73	MI	0 - 0.5	x	x
2373-T332-SB01-M-0001	AOC 73	MI	0.5 - 1.0	x	x
2373-T332-SS02-M-0000	AOC 73	MI	0 - 0.5	x	x
2373-T332-SB02-M-0001	AOC 73	MI	0.5 - 1.0	x	x
2373-T332-SS03-M-0000	AOC 73	MI	0 - 0.5	x	x
2373-T332-SB03-M-0001	AOC 73	MI	0.5 - 1.0	x	x
2373-T332-SS04-M-0000	AOC 73	MI	0 - 0.5	x	x
2373-T332-SB04-M-0001	AOC 73	MI	0.5 - 1.0	x	x
2373-T333-SS05-M-0000	AOC 73	MI	0 - 0.5	x	x
2373-T333-SB05-M-0001	AOC 73	MI	0.5 - 1.0	x	x
2373-T333-SS06-M-0000	AOC 73	MI	0 - 0.5	x	x
2373-T333-SB06-M-0001	AOC 73	MI	0.5 - 1.0	x	x
2373-T333-SS07-M-0000	AOC 73	MI	0 - 0.5	x	x
2373-T333-SB07-M-0001	AOC 73	MI	0.5 - 1.0	x	x
2373-T333-SS08-M-0000	AOC 73	MI	0 - 0.5	x	x
2373-T333-SB08-M-0001	AOC 73	MI	0.5 - 1.0	x	x

Notes:
bgs = below ground surface
RCRA = Resource Conservation and Recovery Act

Photograph 6-1. AOC 73 (former T-332 location) facing north

Photograph 6-2. AOC 73 (former T-333 location) facing southeast

7.0 Project Management

7.1 Project Scheduling and Reporting Requirements

A summary of the expected schedule for conducting the RFI activities at Parcel 23 is presented below.

RFI Field Activities	Start 120 days after receipt of NMED approval of Work Plan. Field work, data analysis, and evaluation will take approximately 180 days.
Submittal of Draft RFI Report	Submitted 60 days following completion of field activities.
Submittal of Tribal Draft RFI Report	Submitted 15 days after receipt of USACE comments on Draft RFI report.
Submittal of Final RFI Report	Submitted 30 days after receipt of comments on RFI report from tribes.

7.2 Quality Assurance Project Plan

A site-specific QAPP was prepared to describe the QA/QC procedures to be followed during the RFI Work Plan field activities. The QAPP is presented in Appendix C.

7.3 Health and Safety Plan

A site-specific Health and Safety Plan (HSP) has been prepared for the field investigation activities proposed in this RFI Work Plan for Parcel 23.

7.4 Investigation-Derived Waste Management Plan

A site-specific Investigation-Derived Waste Management Plan (IDWMP) and Decontamination Plan will be prepared for the field investigation activities proposed in this RFI Work Plan for Parcel 23. The IDWMP is included as Appendix D. The Decontamination Plan is discussed in Section 4.4.8.

7.5 Community Relations Plan

The Community Relations Plan (CRP) (TerranearPMC, 2006) will be adhered to during implementation of the RFI activities.

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APPENDIX A

Programmatic Agreement

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PROGRAMMATIC AGREEMENT

Among
The United States Army,
The Navajo Nation, the Pueblo of Zuni, and
The New Mexico State Historic Preservation Officer
for Environmental Restoration Activities to be Undertaken
at Fort Wingate Depot Activity and Associated Project Lands

Whereas, the United States Army (Army) is proposing to close the Open Burn/Open Detonation Unit (OB/OD) and conduct post-closure care including ordnance cleanup, environmental restoration, and associated project activities at Fort Wingate Depot Activity (FWDA) including areas outside of the FWDA boundaries in accordance with the Resource Conservation and Recovery Act (RCRA) Permit EPA ID NM6213820974 (herein referred to as "the Undertaking"); and

Whereas, the Army has determined that ordnance removal, environmental restoration at non-ordnance related areas, and associated project activities from FWDA in New Mexico may have an effect upon properties that are or may be eligible to the National Register of Historic Places (National Register), and has consulted with the New Mexico State Historic Preservation Officer (SHPO) and the Advisory Council for Historic Preservation (ACHP) pursuant to 36 CFR Part 800, regulations implementing Section 106 of the National Historic Preservation Act (16 U.S.C. Section 470(f), Section 110(f) of the same Act (16 U.S.C. Section 470h-2[f], and Section 111 of the same Act (16 U.S.C. Section 470h-3) and has invited the SHPO and ACHP to participate as signatories to this agreement; and

Whereas, the ACHP has declined to participate in a letter dated 20 March 2007; and

Whereas, the Army is responsible for government-to-government consultation with Indian tribes and has formally invited the Zuni Tribe of the Zuni Reservation (Pueblo of Zuni) and the Navajo Nation to participate as invited signatories by virtue of the potential effects of the FWDA environmental restoration and ordnance cleanup project on properties to which they ascribe traditional religious and cultural significance, and the Army understands that the Navajo Nation has delegated signature authority to the Tribal Historic Preservation Officer (THPO) for undertakings off tribal land; and

Whereas, in accordance with 36 CFR 800.2 (c)(2)(i)(A), the Army has invited the Navajo Tribal Historic Preservation Officer and Pueblo of Zuni Governor to be signatories to this agreement for any undertakings that may affect historic properties on their respective tribal lands where they have assumed the responsibilities of the SHPO under section 101(d)(2) of the NHPA; and

Whereas, the Army has consulted with the Hopi, Apache, Comanche, Isleta Pueblo, Pueblo of Laguna, Pueblo of Acoma, and Pueblo of San Ildefonso and invited them to be concurring parties; and

Whereas, the Army Base Realignment and Closure (BRAC) Office is the responsible party for ensuring that all terms of this Programmatic Agreement (PA) are executed; and

Whereas, cultural resources at FWDA are at this time known to include properties likely eligible to the National Register; and

Whereas, the Army has completed the cultural resources survey of FWDA in compliance with requirements of the 1988 BRAC action; and

Whereas, many cultural resources that are likely eligible for the National Register are in locations that present a risk to human health and safety or will be subject to clean up actions that present a risk to human health and safety; and

Whereas, interested members of the public, including the Bureau of Land Management, Bureau of Indian Affairs, New Mexico Environmental Department, Department of the Interior, and Native Americans known to have an interest in the FWDA cultural resources, have been provided opportunities to comment on the effects of the FWDA environmental restoration and ordnance cleanup projects on historic properties through public hearings, consultation meetings, and other means; and

Now, Therefore, the Army, the SHPO, Pueblo of Zuni, and the Navajo Nation agree that the undertaking described above shall be implemented according to the following stipulations to take into account the effects of the undertaking on historic properties.

Definitions:

FWDA Project Archeologist: The professional archeologist employed by the Army who meets the Secretary of the Interior's Professional Qualification Standards for Archaeology and is charged with the oversight of the cultural resources investigations at FWDA for RCRA permit activities.

Professional archaeologists: Archaeologists employed by the Army who meet the Secretary of the Interior's Professional Qualification Standards for Archaeology.

Historic Properties: As defined by 36 CFR 800.16 (l) (1), *Historic property* means any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the National Register of Historic Places maintained by the Secretary of the Interior. This term includes artifacts, records, and remains that are related to and located within such properties. The term includes properties of traditional religious and cultural importance to an Indian tribe or Native Hawaiian organization and that meet the National Register criteria.

Properties of Religious and Cultural Significance to Indian Tribes: Within **this document**, this phrase means properties to which tribes attach religious and cultural significance but for which eligibility to the National Register has NOT YET been determined.

Tribal lands: as defined in 36 CFR 800.16 (x) *Tribal lands* means all lands within the exterior boundaries of any Indian reservation and all dependent Indian communities.

STIPULATIONS- The Army shall ensure that the following measures are carried out:

1. Mitigation of Environmental Restoration and Munitions Response Activities:

All NHPA-related RCRA permit activities will follow the procedures and requirements contained within Basic Safety Concepts and Considerations for Munitions and Explosives of Concern (MEC) Response Action Operations, Engineer Pamphlet 385-1-95a (EP 385-1-95a). Given the extent and magnitude of the proposed restoration and munitions response action undertakings occurring over an extended period of time, it can be anticipated that of the over 700 archaeological sites and identified properties of religious and cultural significance to Indian Tribes on FWDA, many will be found to be eligible for the National Register and many will have a high potential for susceptibility to adverse effects. Outlined within this document is a plan that addresses the potential effects of the proposed undertakings on historic properties, including properties of traditional religious and cultural importance to Indian tribes.

1.1. Due to the potentially hazardous environment and hazardous nature of clean up activities and the scheduling requirements of clean up activities, throughout the conduct of all RCRA permitted activities, all cultural resources within the Area of Potential Effects (APE) including those known and those inadvertently discovered shall be treated as eligible for the National Register except those that have been formally determined ineligible and mitigation applied per the stipulations contained within this PA.

In order to take into account the effects of RCRA permitted activities on historic properties, the Army shall provide a list of all known cultural resources within the APE to the SHPO, THPO of the Navajo Nation and Pueblo of Zuni Fort Wingate Historic Preservation Officer and shall convene a consultation meeting and/or teleconference to initiate discussions of determinations of National Register eligibility prior to the initiation of RCRA permit activities covered by this PA. During the initial meeting/teleconference a schedule will be set with the SHPO and Navajo Nation THPO and Pueblo of Zuni Fort Wingate Historic Preservation Officer to complete any remaining determinations that are not completed in the initial meeting. If SHPO, the Navajo Nation, or Pueblo of Zuni do not concur with a determination of ineligibility, the eligibility of the property shall remain undetermined but the property shall be treated as eligible for the purposes of RCRA permit activities. Mitigation shall be applied to sites according to the stipulations within this PA.

1.2 For actions on tribal land where the tribe has assumed the responsibilities of the SHPO under section 101(d)(2) of the NHPA, the Army shall consult with the appropriate THPO, shall follow provisions of 36 CFR 800.2 (c)(2)(ii), and shall follow tribal regulations for any actions on tribal lands. For tribal land where the tribe has not assumed the responsibilities of the SHPO, the Army shall consult with the SHPO and the tribal representative designated by the tribe according to 36 CFR 800.2 (c)(2)(i)(B). The project personnel and professional archaeologists shall also follow all applicable tribal regulations.

1.3. Off-Site Mitigation Procedures
For areas and for actions on FWDA that present a threat to human health and safety, as defined by EP385-1-95a, where on-site mitigation is not possible, the Army shall employ the results of the study "Assessment of Sacred Sites and Properties of Traditional Religious and Cultural Importance within the Open Burn/Open Detonation Area at Fort Wingate Depot Activity, New Mexico" (NATHPO 2004) and the Department of Defense NALEMP study called "Conservation Plan for the Natural and Cultural Landscapes of Fort Wingate Depot Activity, New Mexico: A Demonstration Project for Partnership of The Navajo Nation, The Pueblo of Zuni, and the Department of the Army" (Office of Contract Archaeology, UNM 2007) as mitigation for adverse effects to historic properties.

1.4. On-Site Monitoring and Mitigation Procedures
Avoidance of historic properties and potential NAGPRA cultural items will be the first choice for RCRA permit activities. Where avoidance is not possible in areas and for actions determined by the Army not to represent a threat to human health and safety, the Army shall contract for professional archaeologists to accompany munitions and explosives of concern (MEC) clean-up personnel and the following measures outlined below will be implemented during munitions response and environmental restoration projects and activities under this PA.

Prior to the initiation of RCRA permit activities, the professional archaeologists and MEC personnel shall consult to develop procedures for field conduct that follow requirements of EP385-1-95a and shall discuss potential means of minimizing effects to sites when feasible during RCRA permit activities.

1.4.1.

Vehicular traffic/access roads and staging areas/ MEC surface removal

Determination of potential areas for vehicle access shall be coordinated with those persons designated by the Pueblo of Zuni and the Navajo Nation in order to minimize any adverse effects to historic properties.

When health and safety conditions permit, the Army shall employ professional archaeologists to monitor potential ground disturbing activities in areas containing or likely to contain historic properties. The professional archaeologists under contract to the Army will monitor conditions before and after surface removal of MEC within known site locations in order to avoid, if possible, or minimize any potential unnecessary adverse effects to such sites. Any work required on tribal land shall follow Stipulation 1.2.

1.4.2. MEC survey/removal

When health and safety conditions permit, the Army shall employ professional archaeologists to monitor MEC survey/removal activities within areas containing historic properties to avoid or minimize potential adverse effects. The archaeologists will document the findings before and after the activities with sketches, photos, and notes and will complete appropriate or update existing New Mexico Cultural Resource Information (NMCRIS) forms. In areas free of historic properties, during and after removal, inspections shall be accomplished to assess the possibility of the inadvertent discovery of previously unknown subsurface sites. In the event of inadvertent post-review discoveries, procedures outlined below in Stipulations 1.8 and 1.9 shall be followed. For MEC survey and removal on tribal land, the Army shall follow Stipulation 1.2.

1.4.3. MEC blow-in-place

When MEC items that are too hazardous to move are encountered, they shall be blown in place (BIP), in accordance with the provisions of EP 385-1-95a.
When health and safety considerations permit, the Army shall employ professional archaeologists to monitor MEC BIP within areas containing historic properties to avoid or minimize the potential adverse effects and shall record conditions before and after BIP. Areas subject to BIP and not containing historic properties shall be inspected by the professional archaeologists after BIP for the presence of inadvertent discoveries. In the event of inadvertent post-review discoveries, the project personnel shall follow the procedures in Stipulations 1.8 and 1.9. Where necessary, engineering controls (e.g. sandbagging), will be used during blow-in-place demolitions to minimize potential adverse impacts to historic properties.

For MEC BIP activities on tribal land the Army shall follow Stipulation 1.2.

1.4.4. New demolition craters/temporary stockpile areas/soil excavation and removal areas

The Army shall employ professional archaeologists to assist in the selection of placement of all required demolition craters in areas free of historic properties with the excavation of the required craters monitored for any inadvertently discovered subsurface cultural resources.

1.4.5. Existing demolition craters:

Existing demolition craters shall be used whenever possible and prior to any reuse, when health and safety considerations permit, shall be inspected by professional archaeologists for any evidence of historic properties. Any inadvertent discoveries shall be treated following the procedures in Stipulations 1.8 and 1.9. After consultation, reuse of existing demolition pits containing historic properties shall be used if the proposed prohibition of its use would have a detrimental effect on health and human safety.

1.4.6. Contaminated lands; excavation/posthole/soil borings by drill-rig/monitor well installation/soil sampling grids/ground-water cutoff trenches

The Army shall provide detailed maps of sampling or excavation project areas of FWDA and any other lands within the APE to the professional archaeologists, the Navajo Nation, the Pueblo of Zuni, and the SHPO and shall have all known historic properties flagged for avoidance within the area. All historic properties within the APE shall be located and flagged for avoidance. When allowed by health and safety requirements, the professional archaeologists shall accompany the Army personnel undertaking these activities to assist in the avoidance of historic properties. The professional archaeologists shall update historic property site information record the GPS (global positioning system) waypoint. Any new historic properties inadvertently discovered during this work shall be recorded according to New Mexico guidelines and the GPS waypoint will be recorded. Any inadvertent discoveries of potentially eligible historic properties during any of the above noted activities will be immediately (24 hrs) noted to the FWDA Project Archaeologist and procedures contained within Stipulations 1.8 and 1.9 shall be followed. Any activity on tribal land shall follow Stipulation 1.2.

1.5. Consultation Meetings

For all activities on non-tribal property, the Army shall consult with the Pueblo of Zuni, Navajo Nation, SHPO, and concurring parties in a conference meeting at least annually for the purpose of eliciting comments including input on access road placement and locations of historic properties for the goal of reducing the adverse effects upon these historic properties. Stipulation 1.2 shall be followed in the consultation meetings.

1.6. Tribal disclosure of Properties of Religious and Cultural Significance to Indian Tribes

The Army shall provide maps to the Pueblo of Zuni and the Navajo Nation (Tribes) showing the locations of individual projects and known properties of religious and cultural significance to Indian Tribes, archaeological sites, and any cultural resources determined to be historic properties. The Tribes shall be requested to indicate unrecorded properties of religious and cultural significance to Indian Tribes whose National Register eligibility may need to be assessed relevant to the FWDA munitions response and environmental restoration projects to the FWDA Project Archaeologist or his designee to be used in the planning the clean-up activities. This information will be maintained on an absolutely need-to-know basis. At least general locational information is critical for effective management, avoidance, and minimization of adverse impacts to these properties at FWDA and the entire APE. Such data is protected from disclosure under NHPA, Section 304, 16 U.S.C. 470w-3(a) and the Archeological Resources Protection Act (ARPA, Section 9(a), 16 U.S.C. 470hh(a). The exact location is not required unless the property of religious and cultural significance to an Indian Tribe is immediately adjacent to the proposed action.

The cultural significance of individual properties of religious and cultural significance to Indian Tribes is not required by the Army or its contractors except when such information is necessary to determine the eligibility of the site for inclusion in the National Register or under unusual circumstances where that information is critical to avoiding inadvertent impacts or other management concerns. Regardless, all information about properties of religious and cultural significance to Indian Tribes will be strictly managed and access to this information will only be provided after consultation with the Navajo Nation, Zuni Pueblo or other Tribe attaching traditional religious and/or cultural importance to the site(s) at issue. The Tribes shall be provided updated site information resulting from these activities.

1.7. Artifacts and related data

All artifacts and associated paper and electronic records and materials produced and/or procured during any and all project activities at FWDA shall be curated and managed in accordance with 36 CFR 79.

1.8 Inadvertent Discoveries

Upon any inadvertent discovery of cultural resources potentially eligible for the National Register and potentially subject to NAGPRA, the Army personnel shall immediately notify the professional archaeologists (if the discovery is not made by the archaeologists themselves), and Army personnel shall also notify the FWDA Project Archaeologist immediately. The professional archaeologists shall, in conjunction with the FWDA Project Archaeologist or his designee, make an assessment if potential NAGPRA cultural items are present. If potential NAGPRA cultural items are present, NAGPRA and Stipulation 1.9 shall be followed. If the inadvertent discovery does not include NAGPRA cultural items the professional archaeologist(s) shall treat the site as eligible, assess effects, and determine and apply appropriate mitigation per the provisions of this PA.

If threats to human health and safety preclude on-site mitigation, the alternate mitigation contained within stipulation 1.3 will be implemented. If conditions permit the recordation of information about the site before and after the required RCRA permit activity takes place, the archaeologists shall implement those procedures to mitigate adverse effects to the site.

1.9. Burials/subsurface and surface remains

Known burial locations and areas of any surface burial elements shall be avoided by restoration/ordnance clean-up activities if possible. If potential NAGPRA or NAGPRA Cultural Items are inadvertently discovered, they shall be avoided and activities relocated if possible. All instances of inadvertent discovery of NAGPRA cultural items (including human remains) shall be addressed in accordance with NAGPRA and its implementing regulations, 43 CFR Part 10 and the stipulations in the agreement document.

1.10. Buildings

The standing architectural resources and buildings of FWDA are not scheduled to be affected by restoration or remediation cleanup activities. Should such a requirement arise during the term of restoration and remediation activities, the Army shall coordinate with the SHPO.

1.11. Adverse Effects

Individual determinations of adverse effects to historic properties during environmental restoration activities will not require consultation with the ACHP and SHPO. Following the procedures outlined in the stipulations above, and taking into consideration previous historic and ethnographic studies conducted by the Army at FWDA, adverse effects will be considered to be mitigated for all environmental restoration activities.

1.12. Areas of severe risk

Due to risks to human health and safety concerns, remediation requirements shall take precedence over historic preservation concerns in highly hazardous and/or contaminated zones which shall be defined by the Army and EP385-1-95a. These areas shall be determined and clearly depicted on maps which shall be provided to all parties to this Agreement as these become known.

1.13. Cultural Resource Management reports

At the conclusion of each individual project a NMCRIS Information Abstract Form (NIAF) shall be completed and submitted to the Navajo Nation, Pueblo of Zuni, and SHPO. If historic properties or NAGPRA-related items are encountered, a preliminary report, along with copies of the appropriate state archaeological records, updated or new, as appropriate, and/or historic cultural property index (HCPI) forms for historic structures shall also accompany the NIAF form. The report shall contain a map of the project area, a description of the undertaking, results of any findings of cultural resources and/or NAGPRA related discoveries, the impacts to historic properties and/or NAGPRA-related items, and the mitigation measures employed. Any sensitive information that tribes do not want included in these reports shall be excluded upon their request.

An annual report containing the results of investigations carried out during the year shall be provided to the Navajo Nation, Pueblo of Zuni, and SHPO. In addition, a final technical cultural resources management report shall be produced for all restoration and cleanup actions at the conclusion of the RCRA clean-up process. This report shall summarize all of the work and all of the archaeological and cultural issues related to identification, determination of eligibility for the National Register, assessment and treatment of effects, data recovery, and curation. The final technical report shall be produced without tribally-defined sensitive data and shall exclude any other sensitive information that Tribes request be excluded.

A confidential technical report with project related data shall be produced in limited quantities for official use of the Army, SHPO, the Pueblo of Zuni, the Navajo Nation, and other relevant Native American tribes for all restoration and cleanup activities. If requested by Tribes, sensitive information particular to their tribe shall not be included in any other report except that provided to them.

If determined appropriate in consultation with signatories, public informational products shall be developed.

All draft reports shall be subject to 30 day review by the SHPO, Navajo Nation, and the Pueblo of Zuni, and THPOs if appropriate; the Army will consider all appropriate comments for inclusion within the final report.

2.0 DOD retained property

Provisions for historic properties on any retained lands, if any, shall be determined in consultation with the Pueblo of Zuni, the Navajo Nation, and SHPO.

3.0. Amendments

3.1. The *signatories* to this agreement may amend the terms of this Agreement and the provisions of any attachment hereto, by formal written notification of all parties (i.e., signatories and concurring parties) to this Agreement.

3.2. The Army shall ensure that any of the concurring parties to this PA whose interests may be affected by an amendment are asked to concur in such an amendment.

3.3. Upon execution of an amendment, each signatory shall attach a copy of the fully executed form to that party's copy of this PA, and shall enter the amendment number and date on the upper right hand corner of the first page of this PA.

4.0 Dispute resolution

4.1. Should any *signatory* to this Agreement object within 30 days to any plans or other documents provided by the Army or others for review pursuant to this Agreement or to any actions proposed or initiated by the Army that may pertain to the terms of this Agreement, the Army shall consult with the objecting *signatory* to resolve the objection. If the Army determines that the objection cannot be resolved, the Army shall forward the documentation relevant to the dispute to the ACHP. Within 30 days after receipt of all pertinent documentation, the ACHP will either:

4.1.1. Provide the Army with recommendations, which the Army will take into consideration in reaching a final decision regarding the dispute; or

4.1.2. Notify the Army that it will comment pursuant to 36 CFR 800.7, and proceed to comment. Any ACHP comment provided in response to such a request will be taken into consideration by the Army.

4.2. Any recommendation or comment provided by the ACHP pursuant to Stipulation 4.1 will be understood to pertain only to the subject of the dispute; the Army's responsibility to fulfill all actions under this Agreement that are not the subject(s) of the dispute will remain unchanged.

4.3. At any time during development of implementation plans for measures stipulated in this Agreement, should an objection to any such measure or its manner of implementation be raised by a member of the public, the Army shall take the objection into consideration and consult as needed with the objecting party, the SHPO, other relevant parties, and the ACHP to resolve the objection.

5.0. Termination

Any *signatory* to this PA may terminate the document by providing thirty (30) days notice to the other parties, provided that the parties will consult during the period prior to termination to seek agreement on amendments or other actions that would avoid termination. In the event of termination, the Army will comply with 36 CFR 800.4 through 800.6 with regard to individual undertakings covered by this Programmatic Agreement.

6.0 Term of Agreement

6.1 The Army intends the term of this PA document to be in effect for restoration activities until the land is transferred out of Army jurisdiction or for ten years from the date of execution of this agreement, whichever is shorter.

6.2 In the event the Army does not fulfill the terms of this PA, the Army will comply with 36 CFR 800.4 through 800.6 with regard to individual undertakings covered by this PA.

7.0 Compliance with Federal Law

No provision of this PA shall be deemed to waive the provisions of Federal law, including, but not limited to the Archaeological Resources Protection Act, the National Historic Preservation Act, and the Native American Graves Protection and Repatriation Act.

The execution and implementation of this PA evidences that the Army has afforded the SHPO, Tribes, and ACHP a reasonable opportunity to comment on the effects of the MEC cleanup and environmental restoration projects of FWDA on historic properties and that the Army has taken into account the effects of the undertaking on historic properties.

8.0 Anti-Deficiency Clause

The stipulations of this agreement are subject to the provisions of the Anti-Deficiency Act. If compliance with the Anti-Deficiency Act alters or impairs the Army's ability to implement the stipulations of the agreement, the Army will consult according to the amendment and termination provisions found at Stipulations 3 and 5 of this agreement.

Signatories:

_________________________________ Date: MAY 06 2022

Jeffrey F. Willis
Department of the Army
Chief, Operational and Medical Branch
Base Realignment and Closure Division

Jan V Biella, Acting _________________ Date: 5/12/2008

New Mexico State Historic Preservation Officer
(for undertakings affecting historic properties on non-tribal lands or where a tribe has not assumed the responsibilities of the SHPO under section 101(d)(2) of the NHPA)

_________________________________ Date: ________________

Navajo Nation Tribal Historic Preservation Officer
(signator for those affecting historic properties on Navajo Tribal lands and invited signator with designated signatory authority from the Navajo Nation for 106 undertakings on non-tribal land)

_________________________________ Date: ________________

Governor, Pueblo of Zuni (signator for undertakings affecting historic properties on Zuni Tribal lands and invited signator for undertakings on non-tribal lands)

8.0 Anti-Deficiency Clause

The stipulations of this agreement are subject to the provisions of the Anti-Deficiency Act. If compliance with the Anti-Deficiency Act alters or impairs the Army's ability to implement the stipulations of the agreement, the Army will consult according to the amendment and termination provisions found at Stipulations 3 and 5 of this agreement.

Signatories:

_______________________________ Date: MAY 06 2008

Jeffrey F. Willis
Department of the Army
Chief, Operational and Medical Branch
Base Realignment and Closure Division

_______________________________ Date: ___________

New Mexico State Historic Preservation Officer
(for undertakings affecting historic properties on non-tribal lands or where a tribe has not assumed the responsibilities of the SHPO under section 101(d)(2) of the NHPA)

_______________________________ Date: ___________

Navajo Nation Tribal Historic Preservation Officer
(signator for those affecting historic properties on Navajo Tribal lands and invited signator with designated signatory authority from the Navajo Nation for 106 undertakings on non-tribal land)

_______________________________ Date: 5/26/08

Governor, Pueblo of Zuni (signator for undertakings affecting historic properties on Zuni Tribal lands and invited signator for undertakings on non-tribal lands)

Concurring Parties:

______________________________ Date: ____________
Hopi

______________________________ Date: ____________
Pueblo of San Ildefonso

______________________________ Date: ____________
Isleta Pueblo

______________________________ Date: ____________
Apache Nation

______________________________ Date: ____________
Comanche Nation

______________________________ Date: ____________
Pueblo of Laguna

______________________________ Date: ____________
Pueblo of Acoma

______________________________ Date: ____________
New Mexico Environmental Department

______________________________ Date: ____________
Bureau of Land Management

______________________________ Date: ____________
Department of the Interior

______________________________ Date: ____________
Bureau of Indian Affairs

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APPENDIX B

Natural Resource Conservation Service Soil Descriptions for Fort Wingate Depot Activity

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United States Department of Agriculture

Natural Resources Conservation Service
In cooperation with

United States Department of Interior, Bureau of Land Management and Bureau of Indian Affairs; and the New Mexico Agricultural Experiment Station

Soil Survey of McKinley County Area, New Mexico, McKinley County and Parts of Cibola and San Juan Counties

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212—Rehobeth silty clay loam, 0 to 1 percent slopes

Map Unit Setting

MLRA: 36
Elevation: 6,600 to 6,800 feet (2,012 to 2,073 meters)
Mean annual precipitation: 10 to 13 inches (254 to 330 millimeters)
Average annual air temperature: 46 to 49 degrees F (8 to 9 degrees C)
Frost-free period: 100 to 135 days

Map Unit Composition

Rehobeth and similar soils: 90 percent
Minor components: 10 percent
Urban land

In the City of Gallup, components of this map unit are covered by buildings, parking lots, roads, and sidewalks. The percentage of Urban land ranges from less than 10 percent on the city's periphery to 60 percent in densely developed residential sections. There are also many areas that have been cut and filled with a variety of earthen materials or man-made soils.

Component Descriptions

Rehobeth soils

Geomorphic position: Flood plains and stream terraces on valley floors
Parent material: Stream alluvium derived from gypsiferous shale
Slope: 0 to 1 percent
Depth to restrictive feature: None within 60 inches
Drainage class: Well drained
Slowest permeability: About 0.06 in/hr (slow)
Available water capacity: About 8.5 inches (moderate)
Shrink-swell potential: About 7.5 LEP (high)
Flooding hazard: Occasional
Ponding hazard: Occasional
Seasonal water table minimum depth: Greater than 6 feet
Runoff class: Low
Calcium carbonate maximum: About 5 percent
Gypsum maximum: About 15 percent
Salinity maximum: About 8 mmhos/cm (slightly saline)
Sodicity maximum: About 13 SAR (moderately sodic)
Ecological site: Salty Bottomland
Present native vegetation: alkali sacaton, western wheatgrass, fourwing saltbush, black greasewood, blue grama, bottlebrush squirreltail, inland saltgrass, mat muhly, rabbitbrush
Land capability (nonirrigated): 6c
Conservation Tree/Shrub Group: 10

Typical Profile:
A—0 to 2 inches; silty clay loam
Bw—2 to 5 inches; silty clay loam
Bss—5 to 12 inches; clay
Bssny1—12 to 18 inches; clay
Bssny2—18 to 32 inches; clay
Bssny3—32 to 80 inches; clay

Minor Components

Nuffel and similar soils
Composition: About 4 percent
Slope: 0 to 1 percent
Depth to restrictive feature: None within 60 inches
Drainage class: Well drained
Ecological site: Bottomland

Aquima and similar soils
Composition: About 3 percent
Slope: 0 to 1 percent
Depth to restrictive feature: None within 60 inches
Drainage class: Well drained
Ecological site: Loamy

Zia and similar soils
Composition: About 3 percent
Slope: 0 to 1 percent
Depth to restrictive feature: None within 60 inches
Drainage class: Somewhat excessively drained
Ecological site: Sandy

215—Viuda-Penistaja-Rock outcrop complex, 1 to 5 percent slopes

Map Unit Setting

MLRA: 36
Elevation: 6,700 to 7,000 feet (2,042 to 2,134 meters)
Mean annual precipitation: 10 to 13 inches (254 to 330 millimeters)
Average annual air temperature: 49 to 54 degrees F (9 to 12 degrees C)
Frost-free period: 120 to 140 days

Map Unit Composition

Viuda and similar soils: 35 percent
Penistaja and similar soils: 30 percent
Rock outcrop: 25 percent
Minor components: 10 percent

Minor components: 15 percent

Component Descriptions

Hagerwest soils

Geomorphic position: Summits on hills and mesas and dipslopes on cuestas
Parent material: Eolian material and slope alluvium derived from sandstone and shale
Slope: 1 to 5 percent
Depth to restrictive feature: 20 to 40 inches to bedrock (lithic)
Drainage class: Well drained
Slowest permeability: About 0.60 in/hr (moderate)
Available water capacity: About 4.8 inches (low)
Shrink-swell potential: About 1.5 LEP (low)
Flooding hazard: None
Seasonal water table minimum depth: Greater than 6 feet
Runoff class: Medium
Calcium carbonate maximum: About 10 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodicity maximum: About 0 SAR (nonsodic)
Ecological site: Loamy
Present native vegetation: blue grama, western wheatgrass, Indian ricegrass, galleta, bottlebrush squirreltail, fourwing saltbush, winterfat, sand dropseed, oneseed juniper, spineless horsebrush, rabbitbrush
Land capability (nonirrigated): 6c
Conservation Tree/Shrub Group: 6D

Typical Profile:
A—0 to 2 inches; fine sandy loam
Bt—2 to 13 inches; sandy clay loam
Bk1—13 to 19 inches; sandy clay loam
Bk2—19 to 35 inches; sandy loam
2R—35 inches; sandstone bedrock

Bond soils

Geomorphic position: Summits on hills and mesas and dipslopes on cuestas
Parent material: Eolian material and slope alluvium derived from sandstone
Slope: 1 to 8 percent
Depth to restrictive feature: 10 to 20 inches to bedrock (lithic)
Drainage class: Well drained
Slowest permeability: About 0.60 in/hr (moderate)
Available water capacity: About 2.0 inches (very low)
Shrink-swell potential: About 1.5 LEP (low)
Flooding hazard: None
Seasonal water table minimum depth: Greater than 6 feet
Runoff class: High
Calcium carbonate maximum: About 5 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodicity maximum: About 0 SAR (nonsodic)
Ecological site: Shallow Sandstone
Present native vegetation: Bigelow's sagebrush, blue grama, fourwing saltbush, Indian ricegrass, New Mexico feathergrass, galleta, little bluestem, sideoats grama, winterfat, cliffrose, Mormon tea, oneseed juniper, twoneedle pinyon
Land capability (nonirrigated): 7s
Conservation Tree/Shrub Group: 10

Typical Profile:
A—0 to 2 inches; fine sandy loam
Bt1—2 to 5 inches; fine sandy loam
Bt2—5 to 14 inches; sandy clay loam
2R—14 inches sandstone bedrock

Minor Components

Rock outcrop
Composition: About 5 percent
Rock outcrop consists of barren or nearly barren areas of exposed sandstone and shale on ridges, ledges, and escarpments.

Tintero and similar soils
Composition: About 5 percent
Slope: 1 to 8 percent
Depth to restrictive feature: None within 60 inches
Drainage class: Somewhat excessively drained
Ecological site: Sandy

Penistaja and similar soils
Composition: About 5 percent
Slope: 1 to 8 percent
Depth to restrictive feature: None within 60 inches
Drainage class: Well drained
Ecological site: Loamy

225—Aquima-Hawaikuh silt loams, 1 to 5 percent slopes

Map Unit Setting

MLRA: 36
Elevation: 6,000 to 6,800 feet (1,829 to 2,073 meters)
Mean annual precipitation: 10 to 13 inches (254 to 330 millimeters)
Average annual air temperature: 49 to 54 degrees F (9 to 12 degrees C)
Frost-free period: 120 to 140 days

Map Unit Composition

Aquima and similar soils: 40 percent
Hawaikuh and similar soils: 40 percent
Minor components: 20 percent

Component Descriptions

Aquima soils

Geomorphic position: Stream terraces on valley floors and alluvial fans on valley sides
Parent material: Fan and stream alluvium derived from siltstone, sandstone and shale
Slope: 1 to 5 percent
Depth to restrictive feature: None within 60 inches
Drainage class: Well drained
Slowest permeability: About 0.20 in/hr (moderately slow)
Available water capacity: About 10.7 inches (high)
Shrink-swell potential: About 4.5 LEP (moderate)
Flooding hazard: None
Seasonal water table minimum depth: Greater than 6 feet
Runoff class: Low
Calcium carbonate maximum: About 10 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodicity maximum: About 10 SAR (slightly sodic)
Ecological site: Loamy
Present native vegetation: blue grama, western wheatgrass, Indian ricegrass, galleta, bottlebrush squirreltail, fourwing saltbush, needleandthread, winterfat, sand dropseed, rabbitbrush, broom snakeweed (fig. 4)
Land capability (irrigated): 3e
Land capability (nonirrigated): 6c
Conservation Tree/Shrub Group: 8

Typical Profile:
A—0 to 2 inches; silt loam
Bk1—2 to 11 inches; silt loam
Bk2—11 to 17 inches; sandy clay loam
2Bk3—17 to 45 inches; silt loam
3Bk4—45 to 49 inches; sandy clay loam
3Bk5—49 to 65 inches; gravelly clay loam

Hawaikuh soils

Geomorphic position: Fan remnants on valley sides and stream terraces on valley floors
Parent material: Fan and stream alluvium derived from sandstone and shale
Slope: 1 to 5 percent
Depth to restrictive feature: None within 60 inches
Drainage class: Well drained
Slowest permeability: About 0.20 in/hr (moderately slow)
Available water capacity: About 10.1 inches (high)
Shrink-swell potential: About 4.5 LEP (moderate)
Flooding hazard: None
Seasonal water table minimum depth: Greater than 6 feet
Runoff class: Medium
Calcium carbonate maximum: About 10 percent
Gypsum maximum: None
Salinity maximum: About 4 mmhos/cm (very slightly saline)
Sodicity maximum: About 2 SAR (slightly sodic)
Ecological site: Clayey
Present native vegetation: alkali sacaton, western wheatgrass, galleta, Indian ricegrass, blue grama, bottlebrush squirreltail, broom snakeweed, fourwing saltbush, threeawn, winterfat, mat muhly, spike muhly
Land capability (irrigated): 3e
Land capability (nonirrigated): 6c
Conservation Tree/Shrub Group: 4

Typical Profile:
A—0 to 3 inches; silt loam
Btk1—3 to 12 inches; silty clay loam
Btk2—12 to 29 inches; clay loam
Bk1—29 to 39 inches; sandy clay loam
Bk2—39 to 54 inches; sandy loam
Bk3—54 to 65 inches; silty clay loam

Minor Components

Venadito and similar soils
Composition: About 10 percent
Slope: 0 to 1 percent
Depth to restrictive feature: None within 60 inches
Drainage class: Well drained
Ecological site: Clayey Bottomland

Tintero and similar soils
Composition: About 6 percent
Slope: 1 to 5 percent
Depth to restrictive feature: None within 60 inches
Drainage class: Somewhat excessively drained
Ecological site: Sandy

Mido and similar soils
Composition: About 4 percent
Slope: 1 to 5 percent
Depth to restrictive feature: None within 60 inches
Drainage class: Excessively drained
Ecological site: Deep Sand

Figure 4.—Typical landscape of Aquima-Hawaikuh silt loams, 1 to 5 percent slopes. Fourwing saltbush and galleta grass dominate this unit.

230—Sparank-San Mateo-Zia complex, 0 to 3 percent slopes

Map Unit Setting

MLRA: 36
Elevation: 6,300 to 6,900 feet (1,920 to 2,090 meters)
Mean annual precipitation: 10 to 13 inches (254 to 330 millimeters)
Average annual air temperature: 49 to 54 degrees F (9 to 12 degrees C)
Frost-free period: 120 to 140 days

Map Unit Composition

Sparank and similar soils: 40 percent
San Mateo and similar soils: 35 percent
Zia and similar soils: 20 percent
Minor components: 5 percent

Component Descriptions

Sparank soils

Geomorphic position: Flood plains on valley floors and alluvial fans on valley sides
Parent material: Fan and stream alluvium derived from sandstone and shale
Slope: 0 to 3 percent
Depth to restrictive feature: None within 60 inches
Drainage class: Well drained
Slowest permeability: About 0.03 in/hr (very slow)
Available water capacity: About 10.0 inches (high)
Shrink-swell potential: About 7.5 LEP (high)
Flooding hazard: Occasional
Seasonal water table minimum depth: Greater than 6 feet
Runoff class: High
Calcium carbonate maximum: About 5 percent
Gypsum maximum: None
Salinity maximum: About 4 mmhos/cm (very slightly saline)
Sodicity maximum: About 5 SAR (slightly sodic)
Ecological site: Clayey Bottomland
Present native vegetation: western wheatgrass, alkali sacaton, fourwing saltbush, galleta, blue grama, spike muhly, mat muhly, broom snakeweed, rabbitbrush
Land capability (nonirrigated): 6c
Conservation Tree/Shrub Group: 4CC

Component Descriptions

Venzuni soils

Geomorphic position: Stream terraces on valley floors and alluvial fans on valley sides
Parent material: Fan and stream alluvium derived from shale
Slope: 1 to 3 percent
Depth to restrictive feature: None within 60 inches
Drainage class: Well drained
Slowest permeability: About 0.01 in/hr (very slow)
Available water capacity: About 9.0 inches (moderate)
Shrink-swell potential: About 7.5 LEP (high)
Flooding hazard: Rare
Seasonal water table minimum depth: Greater than 6 feet
Runoff class: Very high
Calcium carbonate maximum: About 5 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodicity maximum: About 5 SAR (slightly sodic)
Ecological site: Clayey
Present native vegetation: western wheatgrass, rush, sedge, slender wheatgrass, California brome, muttongrass, willow
Land capability (irrigated): 3s
Land capability (nonirrigated): 6c
Conservation Tree/Shrub Group: 4CC

Typical Profile:
A—0 to 2 inches; silty clay
BC—2 to 12 inches; silty clay
Bss—12 to 46 inches; clay
2Bss—46 to 65 inches; clay

Minor Components

Nutreeah and similar soils
Composition: About 5 percent
Slope: 0 to 2 percent
Depth to restrictive feature: None within 60 inches
Drainage class: Moderately well drained
Ecological site: Meadow

Suwanee and similar soils
Composition: About 5 percent
Slope: 0 to 2 percent
Depth to restrictive feature: None within 60 inches
Drainage class: Well drained
Ecological site: Bottomland

332—Evpark-Arabrab complex, 2 to 6 percent slopes

Map Unit Setting

MLRA: 36
Elevation: 6,800 to 8,000 feet (2,073 to 2,438 meters)
Mean annual precipitation: 13 to 16 inches (330 to 406 millimeters)
Average annual air temperature: 46 to 49 degrees F (8 to 9 degrees C)
Frost-free period: 100 to 135 days

Map Unit Composition

Evpark and similar soils: 50 percent
Arabrab and similar soils: 40 percent
Minor components: 10 percent

Component Descriptions

Evpark soils

Geomorphic position: Dipslopes on cuestas and summits on mesas
Parent material: Eolian material and slope alluvium derived from sandstone and shale
Slope: 2 to 6 percent
Depth to restrictive feature: 20 to 40 inches to bedrock (lithic)
Drainage class: Well drained
Slowest permeability: About 0.20 in/hr (moderately slow)
Available water capacity: About 7.0 inches (moderate)
Shrink-swell potential: About 4.5 LEP (moderate)
Flooding hazard: None
Seasonal water table minimum depth: Greater than 6 feet
Runoff class: Medium
Calcium carbonate maximum: None
Gypsum maximum: None
Salinity maximum: About 0 mmhos/cm (nonsaline)
Sodicity maximum: About 0 SAR (nonsodic)
Ecological site: Pinyon-Juniper Forest
Present native vegetation: Gambel's oak, antelope bitterbrush, banana yucca, big sagebrush, blue grama, bottlebrush squirreltail, broom snakeweed, buckwheat, muttongrass, oneseed juniper, prairie junegrass, twoneedle pinyon, western wheatgrass
Land capability (nonirrigated): 6c
Conservation Tree/Shrub Group: 6D

Figure 9.—Typical landscape of Parklei-Fraguni complex, 1 to 8 percent slopes. Profile of the Parklei soil in a roadcut.

Typical Profile:
A—0 to 2 inches; fine sandy loam
Bt1—2 to 9 inches; loam
Bt2—9 to 36 inches; clay loam
R—36 inches; sandstone bedrock

Arabrab soils

Geomorphic position: Dipslopes on cuestas and summits on mesas
Parent material: Eolian material and slope alluvium over residuum derived from sandstone
Slope: 2 to 6 percent
Surface fragments: About 23 percent
Depth to restrictive feature: 10 to 20 inches to bedrock (lithic)
Drainage class: Well drained
Slowest permeability: About 0.20 in/hr (moderately slow)
Shrink-swell potential: About 4.0 LEP (moderate)
Flooding hazard: None
Seasonal water table minimum depth: Greater than 6 feet
Runoff class: High
Calcium carbonate maximum: About 10 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodicity maximum: About 0 SAR (nonsodic)
Ecological site: Pinyon-Juniper Forest
Present native vegetation: big sagebrush, muttongrass, Utah serviceberry, banana yucca, bottlebrush squirreltail, cliff fendlerbush, thrifty goldenweed, toadflax penstemon, oneseed juniper, twoneedle pinyon
Land capability (nonirrigated): 7s
Conservation Tree/Shrub Group: 10

Typical Profile:
A—0 to 2 inches; gravelly fine sandy loam
Bt1—2 to 7 inches; sandy clay loam
Bt2—7 to 12 inches; clay loam
Btk—12 to 17 inches; gravelly clay loam
R—17 inches; sandstone bedrock

Minor Components

Highdye and similar soils
Composition: About 3 percent

Slope: 2 to 6 percent
Depth to restrictive feature: 5 to 20 inches to bedrock (lithic)
Drainage class: Well drained
Ecological site: Pinyon-Juniper Forest
Parkelei and similar soils
Composition: About 5 percent
Slope: 2 to 6 percent
Depth to restrictive feature: None within 60 inches
Drainage class: Well drained
Ecological site: Pinyon-Juniper Forest

Rock outcrop
Composition: About 2 percent
Rock outcrop consists of barren or nearly barren areas of exposed sandstone and shale on ridges, ledges, and escarpments.

335—Venadito clay, 1 to 3 percent slopes

Map Unit Setting

MLRA: 36
Elevation: 6,600 to 7,100 feet (2,012 to 2,164 meters)
Mean annual precipitation: 10 to 13 inches (254 to 330 millimeters)
Average annual air temperature: 49 to 53 degrees F (9 to 12 degrees C)
Frost-free period: 120 to 140 days

Map Unit Composition

Venadito and similar soils: 85 percent
Minor components: 15 percent

Component Descriptions

Venadito soils

Geomorphic position: Swales, depressions, and flood plains on valley floors and alluvial fans on valley sides
Parent material: Fan and stream alluvium derived from shale
Slope: 1 to 3 percent
Depth to restrictive feature: None within 60 inches
Drainage class: Well drained
Slowest permeability: About 0.01 in/hr (very slow)
Available water capacity: About 8.9 inches (moderate)
Shrink-swell potential: About 7.5 LEP (high)
Flooding hazard: Frequent
Seasonal water table minimum depth: Greater than 6 feet
Runoff class: Very high
Calcium carbonate maximum: About 10 percent
Gypsum maximum: About 1 percent
Salinity maximum: About 4 mmhos/cm (very slightly saline)
Sodicity maximum: About 10 SAR (slightly sodic)
Ecological site: Clayey Bottomland
Present native vegetation: western wheatgrass, alkali sacaton, fourwing saltbush, galleta, blue grama, spike muhly, mat muhly, broom snakeweed, rabbitbrush
Land capability (irrigated): 4w
Land capability (nonirrigated): 6w
Conservation Tree/Shrub Group: 4CC

Typical Profile:
A—0 to 3 inches; clay
BCss1—3 to 30 inches; clay
BCss2—30 to 65 inches; clay

Minor Components

Suwanee and similar soils
Composition: About 10 percent
Slope: 0 to 2 percent
Depth to restrictive feature: None within 60 inches
Drainage class: Well drained
Ecological site: Bottomland

Nuffel and similar soils
Composition: About 5 percent
Slope: 0 to 2 percent
Depth to restrictive feature: None within 60 inches
Drainage class: Well drained
Ecological site: Bottomland

336—Nuffel-Venadito complex, 1 to 3 percent slopes

Map Unit Setting

MLRA: 36
Elevation: 6,100 to 6,500 feet (1,859 to 1,981 meters)
Mean annual precipitation: 10 to 13 inches (254 to 330 millimeters)
Average annual air temperature: 49 to 53 degrees F (9 to 12 degrees C)
Frost-free period: 120 to 140 days

Map Unit Composition

Nuffel and similar soils: 45 percent
Venadito and similar soils: 35 percent
Minor components: 20 percent

Component Descriptions

Nuffel soils

Geomorphic position: Flood plains on valley floors

Component Descriptions

Knifehill soils

Geomorphic position: Stream terraces on valley floors and fan remnants on valley sides
Parent material: Fan and stream alluvium derived from sandstone and shale
Slope: 1 to 5 percent
Depth to restrictive feature: None within 60 inches
Drainage class: Well drained
Slowest permeability: About 0.06 in/hr (slow)
Available water capacity: About 9.4 inches (high)
Shrink-swell potential: About 7.5 LEP (high)
Flooding hazard: None
Seasonal water table minimum depth: Greater than 6 feet
Runoff class: High
Calcium carbonate maximum: About 15 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodicity maximum: About 0 SAR (nonsodic)
Ecological site: Meadow
Present native vegetation: western wheatgrass, rush, sedge, slender wheatgrass, California brome, muttongrass, willow
Land capability (irrigated): 3c
Land capability (nonirrigated): 4c
Conservation Tree/Shrub Group: 4C

Typical Profile:
A—0 to 2 inches; loam
Bw—2 to 6 inches; clay loam
Bt1—6 to 11 inches; clay loam
Bt2—11 to 26 inches; clay
Btk—26 to 35 inches; clay
Bk—35 to 65 inches; clay

Minor Components

Silcat and similar soils
Composition: About 10 percent
Slope: 1 to 5 percent
Depth to restrictive feature: None within 60 inches
Drainage class: Well drained
Ecological site: Clayey

Parkelei and similar soils
Composition: About 10 percent
Slope: 1 to 5 percent
Depth to restrictive feature: None within 60 inches
Drainage class: Well drained
Ecological site: Loamy

355—Rizno-Tekapo-Rock outcrop complex, 2 to 45 percent slopes

Map Unit Setting

MLRA: 36
Elevation: 6,200 to 6,700 feet (1,890 to 2,042 meters)
Mean annual precipitation: 10 to 13 inches (254 to 330 millimeters)
Average annual air temperature: 49 to 54 degrees F (9 to 12 degrees C)
Frost-free period: 120 to 140 days

Map Unit Composition

Rizno and similar soils: 35 percent
Tekapo and similar soils: 30 percent
Rock outcrop: 20 percent
Minor components: 15 percent

Component Descriptions

Rizno soils

Geomorphic position: Structural benches on escarpments on cuestas and mesas
Parent material: Eolian material over residuum derived from sandstone
Slope: 2 to 20 percent
Depth to restrictive feature: 5 to 20 inches to bedrock (lithic)
Drainage class: Well drained
Slowest permeability: About 2.00 in/hr (moderately rapid)
Available water capacity: About 0.9 inches (very low)
Shrink-swell potential: About 1.5 LEP (low)
Flooding hazard: None
Seasonal water table minimum depth: Greater than 6 feet
Runoff class: Medium
Calcium carbonate maximum: About 10 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodicity maximum: About 0 SAR (nonsodic)
Ecological site: Shallow Sandstone
Present native vegetation: Indian ricegrass, New Mexico feathergrass, blue grama, little bluestem, sideoats grama, Bigelow's sagebrush, fourwing saltbush, galleta, sand dropseed, antelope bitterbrush, cliffrose, Mormon tea, oneseed juniper
Land capability (nonirrigated): 7s
Conservation Tree/Shrub Group: 10

Typical Profile:
A—0 to 3 inches; fine sandy loam
C—3 to 8 inches; sandy loam
2R—8 inches; sandstone bedrock

Tekapo soils

Geomorphic position: Escarpments on mesas and cuestas
Parent material: Slope alluvium and colluvial material over residuum derived from shale and siltstone
Slope: 10 to 45 percent
Surface fragments: About 20 percent
Depth to restrictive feature: 5 to 20 inches to bedrock (paralithic)
Drainage class: Well drained
Slowest permeability: About 0.06 in/hr (slow)
Available water capacity: About 1.6 inches (very low)
Shrink-swell potential: About 7.5 LEP (high)
Flooding hazard: None
Seasonal water table minimum depth: Greater than 6 feet
Runoff class: Very high
Calcium carbonate maximum: About 5 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodicity maximum: About 0 SAR (nonsodic)
Ecological site: Shale Hills
Present native vegetation: alkali sacaton, galleta, Indian ricegrass, blue grama, bottlebrush squirreltail, fourwing saltbush, little bluestem, needleandthread, sideoats grama, western wheatgrass, mound saltbush, shadscale saltbush, Bigelow's sagebrush, oneseed juniper, winterfat
Land capability (nonirrigated): 7s
Conservation Tree/Shrub Group: 10

Typical Profile:
A—0 to 2 inches; channery silty clay loam
C—2 to 10 inches; silty clay
2Cr—10 inches; shale

Rock outcrop

Rock outcrop consists of barren or nearly barren areas of exposed sandstone and shale on ridges, ledges, and escarpments.

Minor Components

Aquima and similar soils
Composition: About 5 percent
Slope: 2 to 5 percent
Depth to restrictive feature: None within 60 inches
Drainage class: Well drained
Ecological site: Loamy

Mido and similar soils
Composition: About 5 percent
Slope: 2 to 5 percent
Depth to restrictive feature: None within 60 inches
Drainage class: Excessively drained
Ecological site: Deep Sand

Monpark and similar soils
Composition: About 5 percent
Slope: 2 to 5 percent
Depth to restrictive feature: 20 to 40 inches to bedrock (paralithic)
Drainage class: Well drained
Ecological site: Clayey

357—Heshotauthla clay, 0 to 1 percent slopes

Map Unit Setting

MLRA: 36
Elevation: 6,300 to 7,000 feet (1,920 to 2,134 meters)
Mean annual precipitation: 13 to 16 inches (330 to 406 millimeters)
Average annual air temperature: 46 to 49 degrees F (8 to 9 degrees C)
Frost-free period: 100 to 135 days

Map Unit Composition

Heshotauthla and similar soils: 85 percent
Minor components: 15 percent

Component Descriptions

Heshotauthla soils

Geomorphic position: Stream terraces on valley floors and flood plains on valley floors
Parent material: Stream alluvium derived from sandstone and shale
Slope: 0 to 1 percent
Depth to restrictive feature: None within 60 inches
Drainage class: Well drained
Slowest permeability: About 0.01 in/hr (very slow)
Available water capacity: About 5.4 inches (low)
Shrink-swell potential: About 7.5 LEP (high)
Flooding hazard: Occasional
Seasonal water table minimum depth: Greater than 6 feet
Runoff class: High
Calcium carbonate maximum: About 5 percent
Gypsum maximum: About 1 percent
Salinity maximum: About 16 mmhos/cm (moderately saline)

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Final

Quality Assurance Project Plan

RCRA Facility Investigation for Parcel 23
Fort Wingate Depot Activity
McKinley County, New Mexico

Prepared for

U.S. Army Corps of Engineers
Fort Worth District

819 Taylor Street
Room 3A12
Fort Worth, TX 76112

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06 April 2010

Prepared by

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Final

Quality Assurance Project Plan

Submitted to

U.S. Army Corps of Engineers
Fort Worth District

06 April 2010

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QUALITY ASSURANCE PROJECT PLAN
Fort Wingate Depot Activity

Contract No. GS-10F-0029M

Rev. 2

Prepared by: CH2M HILL Date: 06 April 2010

Approved by:

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Contents

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Appendixes

Acronyms and Abbreviations

AOC	Area of Concern
°C	degrees Celsius
COC	chain of custody
COR	USACE Contracting Officer's Representative
DoD	Department of Defense
DoD QSM	Department of Defense *Quality Systems Manual*
DQO	data quality objective
EB	equipment blank
EDD	electronic data deliverable
ELAP	Environmental Laboratory Accreditation Program
EPA	United States Environmental Protection Agency
FTL	field team leader
FWDA	Fort Wingate Depot Activity
HNO_3	nitric acid
HSP	Health and Safety Plan
ICP	Inductively Coupled Plasma Atomic Emission Spectrometry
ID	identification number
J	The constituent was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
LCS	laboratory control sample
LIMS	Laboratory Information Management System
MDL	method detection limit
μg/L	micrograms per liter
μg/kg	micrograms per kilogram
mg/kg	milligrams per kilogram
MQO	method quality objective
MS/MSD	matrix spike/matrix spike duplicate
NELAC	National Environmental Laboratory Accreditation Conference
N	The spiked sample recovery was not within the control limits

NELAP	National Environmental Laboratory Accreditation Program
NIST	National Institute of Standards and Technology
NJ	The analysis indicates the presence of a constituent that has been tentatively identified and the associated numerical value represents its approximate concentration.
NMED	New Mexico Environment Department
pH	hydrogen (ion) concentration
PM	project manager
QA	quality assurance
QAM	quality assurance manager
QAPP	Quality Assurance Project Plan
QA/QC	quality assurance/quality control
QC	quality control
QSM	Quality Systems Manual
R	The sample results are rejected because of serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the constituent cannot be verified.
%R	percent recovery
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
RL	reporting limit
RPD	relative percent difference
SI	site investigation
SOP	standard operating procedure
SVOC	semivolatile organic compound
SWMU	Solid Waste Management Unit
TPH	total petroleum hydrocarbons
U	The constituent was analyzed for but was not detected above the reported sample quantification limit.
UJ	The constituent was not detected above the reported sample quantification limit. However, the reported quantification limit is approximate and may or may not represent the actual limit of quantification necessary to accurately and precisely measure the constituent in the sample.
USACE	U.S. Army Corps of Engineers
VOC	volatile organic compound

1.0 Project Management

1.1 Introduction

This Quality Assurance Project Plan (QAPP) was prepared by CH2M HILL on behalf of the Fort Worth District of the U.S. Army Corps of Engineers (USACE) to outline the procedures that will be implemented during the Resource Conservation and Recovery Act (RCRA) Facility Investigation at Fort Wingate Depot Activity (FWDA) near Gallup, New Mexico. The primary purpose of the RCRA Facility Investigation is to define the nature and extent of contamination at the Solid Waste Management Units (SWMUs) and Areas of Concern (AOCs) within Parcel 23. The investigation is being conducted to comply with the requirements of the RCRA Permit from the United States Environmental Protection Agency (EPA) ID No. NM 6213820974 for FWDA.

1.2 Project/Task Organization

At the direction of USACE, CH2M HILL will be responsible for the RCRA Facility Investigation (RFI) Report for Parcel 23 at FWDA. The quality assurance and management responsibilities of CH2M HILL project personnel are defined below.

1.2.1 Project Manager

Mr. Jeffrey Johnston, CH2M HILL project manager (PM), has overall responsibility for all phases of the site investigation (SI). The PM is also responsible for the review and approval of technical submittals.

1.2.2 Project Chemist

Ms. Trudy Scott, CH2M HILL project chemist, is responsible for tracking data and for overseeing the data evaluation and data management tasks. Her specific responsibilities include the following:

- Approving and maintaining adherence to quality assurance/quality control (QA/QC) requirements specified in this QAPP
- Providing guidance regarding environmental analytical chemistry methods and quality control (QC) procedures applicable to environmental analytical chemistry
- Managing project tasks associated with the coordination of sample collection and analysis with the field team leader (FTL); acting as the liaison between the FTL and laboratory
- Managing sample tracking, sample analysis, and data reporting from each laboratory
- Coordinating or performing validation of the analytical data

- Performing quality audits and surveillance, preparing quality assurance (QA) reports, implementing QC activities, and suggesting corrective actions, as necessary.
- Evaluating data usability
- Communicating QA/QC issues to the PM and the FTL
- Recommending resolution of any anomalies that arise during the analysis of samples
- Coordinating with the FTL to facilitate data transfer into the project database
- Coordinating the output of data from the database to the data users (for example, PM and technical staff) and providing QC for data output

1.2.3 Field Team Leader

Mr. Jeff Gamlin, CH2M HILL's FTL, is responsible for all fieldwork performed under the SI. His specific responsibilities include:

- Procuring field equipment (if necessary), supplies, and subcontractors
- Developing field forms and field instructions
- Preparing the Health and Safety Plan (HSP)
- Leading the field team in SI field activities
- Coordinating field sample control and custody (that is, sample management)
- Conducting SI field activities in a safe manner

1.2.4 Health and Safety Lead

Mr. Dan Young, Certified Safety Professional, is designated as CH2M HILL's Responsible Health and Safety Manager for the SI.

1.2.5 Laboratory Project Manager

A subcontract laboratory project manager will be identified as a point of contact for analytical services. The selected laboratory will participate in the Department of Defense (DoD) Environmental Laboratory Accreditation Program (ELAP) and be DoD ELAP certified for the project specified analytical methods. The laboratory project manager will be the primary point of contact for the following:

- Ordering sample bottles, coolers, custody seals, and packing material.
- Sample receipt documentation and chain of custody (COC) issues.
- Laboratory QA/QC issues related to sample analysis and reporting.
- Hardcopy and electronic data reports

1.3 Problem Definition/Background Information

One SWMU and one AOC within Parcel 23 have been identified as requiring additional investigation for the RCRA Facility Investigation. SWMU 21 will be investigated during the RFI to determine the nature and extent of explosives, metals, semivolatile organic compounds (SVOCs), and pesticides in soil. Soil sampling will consist of discrete-point sampling using direct-push sampling techniques. The proposed sampling scheme for SWMU 21 is presented in the RFI Work Plan.   AOC 73 will be investigated during the RFI to determine the nature and extent of explosives and metals in soil. Soil sampling will consist of multi-incremental surface and subsurface sampling techniques. The proposed sampling scheme for AOC 73 is presented in the RFI Work Plan.

1.4 Site History

The site history for SWMU 21 is presented in the RFI Work Plan.

1.5 Project Description and Schedule

1.5.1 Project Description

The RFI will be performed in compliance with this QAPP and the project-specific RFI Work Plan. The primary goal of the RFI is to determine the nature and extent of contamination related to historical operations at the site.

In general, field activities will include the collection of subsurface soil samples (1 to 20 feet below ground surface [bgs]). Soil samples will be analyzed for constituents relevant to the historical use of the site. Sampling will be conducted as indicated in the RFI Work Plan.

1.5.2 Project Schedule

A schedule of major milestones including submittal dates is provided in Table 1-1.

TABLE 1-1
RCRA Facility Investigation Schedule

Milestone	Date
Mod 1 Contract Award/Notice to Proceed	September 29, 2008
Preliminary Draft RFI Work Plan	December 28, 2008
Tribal Draft RFI Work Plan	January 27, 2009
NMED Final RFI Work Plan	April 27, 2009
Final RFI Work Plan	April 6, 2010

1.5.3 RCRA Facility Investigation Report

The RFI Report will be prepared upon completion of the site investigation activities. Fieldwork activities, figures, sample analyses, data assessment, data validation, and data evaluation will be contained in the RFI Report. Laboratory analytical results will be used to identify the nature and extent of contamination at SWMU 21 and AOC 73.

1.6 Data Quality Objectives and Criteria for Measurement Data

1.6.1 Data Quality Objectives

This is an RFI for SWMU 21 and AOC 73 within Parcel 23. The primary objective is to determine if explosives, metals, semivolatile organic compounds (SVOC), pesticides, volatile organic compounds (VOC), perchlorate, or total petroleum hydrocarbon (TPH) gasoline or diesel range compounds have been released to the environment and the extent of potential releases at SWMU 21 and to determine if explosives and metals have been released to the environment and the extent of potential releases as AOC 73.

The data quality objectives (DQOs) were established based on the EPA's *Guidance for the Data Quality Objectives Process* (EPA, 2006). The DQOs were developed through a seven-step process (defined below), each step of which is developed from valuable criteria that are used to establish the final data collection design. The DQOs are the basis for the design of the data collection plan. As such, these DQOs specify the type, quality, and quantity of data to be collected and how the data are to be used to make the appropriate decisions for the project.

1. **State the problem.** Concisely describe the problem to be studied.
2. **Identify the decisions.** State the decisions to be made to solve the problem.
3. **Identify input to the decisions.** Identify information and supporting measurements needed to make the decisions and describe the source(s) of the information.
4. **Define the boundaries of the study.** Specify conditions (such as time periods and spatial locations).
5. **Develop a decision rule.** Define the conditions by which a decision-maker will select alternatives, usually specified as "if/then" statements (for example, if the average concentration in soil is less than cleanup level, then the site achieves remedial action goals).
6. **Specify tolerable limits on decision errors.** Define the limits in statistical terms.
7. **Optimize the design for obtaining data.** Evaluate the results of the previous steps and develop the most resource-efficient design for data collection.

Table 1-2 defines the basic thought process behind the sample collection objectives.

TABLE 1-2
DQO Summary
RCRA Facility Investigation Release Assessment

Location	Step 1: Statement of Problem	Step 2: Identify the Decision	Step 3: Input to Decisions	Step 4: Study Boundaries	Step 5: Decision Rules	Step 6: Limits of Decision Errors	Step 7: Optimize the Sampling Design
Parcel 23, Fort Wingate Depot Activity	The extent of explosives, metals, perchlorate, VOCs, SVOCs, TPH-GRO, TPH-DRO, and pesticides releases due to historical activities at SWMU 21 is not defined. The extent of explosives and metals releases due to historical activities at AOC73 is not defined.	Determine extent of explosives, metals, perchlorate, VOCs, SVOCs, TPH-GRO, TPH-DRO, and pesticide contamination in subsurface soil at SWMU 21 and the extent of explosives and metals at AOC 73. Do concentrations, if present, exceed screening action levels?	Analytical results from surface soil or concrete samples collected. NMED residential soil screening objectives as defined by *NMED Technical Background Document for Development of Soil Screening Levels* (NMED, 2009) Data to determine if the soil exceeds project screening objectives.	SWMU 21, Central Landfill AOC 73, Buildings or Structures along Road C-3	If the concentration in surface and subsurface soil is less than screening objectives, then the site contamination will be considered acceptable.	Sample locations will be biased based on site knowledge and observations. The precision, accuracy, representativeness, comparability, and completeness of the data to provide a measure of how well the established method quality objectives (MQO) were met. For this investigation, MQOs for chemical measurements are specified in the QAPP. The QAPP specifies all QA/QC objectives for sample measurement. Method reporting limits will be less than regulatory screening objectives as much as is possible using standard EPA methods. Sample data will be reported down to the method detection limit (MDL) as evidence of a detect or non-detect. The MDL may also be used for screening objective comparison. Limits for accuracy and precision have been based on requirements of the Department of Defense Quality Systems Manual (DoD) (QSM).	Collect discrete-point subsurface soil samples from SWMU 21. Samples will be analyzed for explosives, metals, perchlorate, VOCs, SVOCs, TPH-GRO, TPH-DRO, and pesticides. Collect multi-incremental surface and subsurface soil samples from AOC 73. Samples will be analyzed for explosives and metals.

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1.6.2 Measurement Performance Criteria

The measurement performance criteria will be checked on several levels using:

- Built-in QC standards
- Senior review
- Management controls

The measurement data must abide by specific QC standards, and data that do not meet these standards will be qualified accordingly. The analytical data and the QC results will be checked by the laboratory bench chemist, the laboratory's quality assurance manager (QAM), and CH2M HILL's project chemist.

CH2M HILL staff members with relevant technical expertise will review key documents that pertain to project quality standards. The FTL will supervise activities to confirm that standard operating procedures (SOP) are being followed during field sampling activities. Section 3 describes specific QC checks and corrective action measures.

1.7 Instructions for Special Training Requirements/ Certification

Project team members with the necessary expertise and technical skills will be chosen to perform the required project tasks.

The subcontractor chosen to perform laboratory analyses will comply with the project-specific requirements and will maintain DoD ELAP certification for the project requested analytical methods. Changes to the status of the DoD ELAP will be communicated to CH2M HILL as quickly as possible. A copy of the DoD ELAP certification will be provided to the USACE Contracting Officer's Representative (COR) prior to initiation of the laboratory services on this task order.

1.8 Instructions for Documentation and Records

1.8.1 Field Sampling Documentation

Field sampling activities will be recorded in field logbooks. Field logbook entries will be described in enough detail as necessary so that persons going to the site are able to reconstruct a particular situation. Modifications to protocols for field sampling should be documented in the field logbook. The FTL is responsible for confirming that modifications to sampling protocols are documented.

The field logbooks will be bound field survey books or notebooks. Logbooks will be assigned to the field crew and stored in a secure location when not in use. Project-specific document numbers will identify each logbook, the title page of which will contain:

- Name of the person to whom the logbook is assigned
- Logbook number
- Project name
- Project start date

- Project end date

At the beginning of each day's notes, the date, start time, weather, names of each sampling team member present, and the signature of the person recording the notes will be documented. Measurements and samples collected will be recorded with a description of the station location. Photographs of the sample locations will be taken and a photo log will be created for the release assessment investigation. Equipment used to make measurements will be identified, along with the date of calibration, if applicable.

Logbook entries will be made in ink with no erasures. If an incorrect entry is made, the information will be crossed out with a single strike mark and initialed. Blank pages will be noted as being intentionally blank.

Samples will be collected following the sampling procedures documented in the SOPs in the RFI Work Plan. Sample collection equipment will be identified, along with the time of sampling, sample description, parameters being analyzed, and number of containers used. Unique sample identification numbers (ID) will be assigned to each sample. Field duplicate samples, which will receive an entirely separate sample ID, will be noted in the field logbook.

Field personnel will provide documentation of the field sampling, field analysis, and sample chain-of-custody (COC). This documentation constitutes a record that allows field events to be reconstructed to aid in the data review and interpretation process. All documents, records, and information relating to the fieldwork will be retained in the project file.

1.8.2 Data Reporting

1.8.2.1 Field Data Reporting

Information collected in the field through visual observation, manual measurement, and field instrumentation will be recorded in field logbooks. The FTL will review the data for the following:

- General completeness
- Legibility
- Use of appropriate procedures
- Clearly stated modifications to sampling procedures
- Appropriate instrument calibration and maintenance records
- Reasonability of data collected
- Accuracy of sample locations
- Accuracy of reporting units, calculations, and interpretations

Significant concerns identified as a result of this review will be discussed with the PM, corrected if possible, and incorporated into the data evaluation process. Where appropriate, notes and calculations from the field logbooks will be processed and included as appendixes to the Release Assessment Report. Original field logs, documents, and data reductions might be kept in the project file.

1.8.2.2 Laboratory Data Reporting

Laboratory reports will consist of Level IV data packages and will include the following:

- Cover letter with the following information:
  - Title of report and laboratory unique report identification (for example, sample delivery group number)
  - Project name and site location
  - Name and location of laboratory and second-site or subcontracted laboratory
  - Client name and address
  - Statement of authenticity and official signature and title of person authorizing release of the report
- Table of contents
- Summary of samples received, which correlates field sample IDs with laboratory IDs
- Laboratory qualifier flags and definitions
- Analytical batch reference number that cross references samples to QC sample analyses
- Completed COC forms and sample receipt checklist
- Case narrative that addresses the following:
  - Sample receipt discrepancies (for example, temperature exceedances)
  - Descriptions of all nonconformances in the sample receipt, handling, preparation, analytical and reporting processes, and the corrective action taken for each occurrence
  - Identification and justification for sample dilution
- Field ID
- Date received
- Date prepared
- Date analyzed (and time of analysis if the holding time is less than or equal to 48 hours)
- Preparation and analytical method
- Result for each analyte (dry-weight basis for soils)
- Percent solids result for soil samples
- Dilution factor (provide both diluted and undiluted results when available)
- Sample-specific reporting limit (RL) adjusted for sample size, dilution/concentration
- Sample-specific method detection limit (MDL) adjusted for sample size, dilution/concentration (when project objectives require reporting less than the RL)
- Unit of measure

- Surrogate percent recovery (%R)
- Matrix spike/matrix spike duplicate (MS/MSD) and laboratory control sample (LCS) spike concentrations, native sample results, spiked sample results, %R, and relative percent differences (RPD) between the MS and MSD results; associated QC limits must also be provided
- Method blank results
- Analytical sequence or laboratory run log that contains sufficient information to correlate samples reported in the summary results to the associated method QC information, such as initial and continuing calibration analyses
- Confirmation results
- Calibration blank results for inorganic analyses (required in hard copy format only)
- Inductively Coupled Plasma Atomic Emission Spectrometry (ICP) interference check sample results that include true concentrations, measured concentrations, and the calculated %R of the elements included (required in hard copy format only)
- ICP post-digestion spike recoveries, if applicable (required in hard copy format only)
- Internal standard recovery and retention time information, as applicable
- Initial calibration summary, including standard concentrations, response factors, average response factors, relative standard deviations or correlation coefficients, and calibration plots or equations, if applicable (required in hard copy format only)
- Continuing calibration verification summary, including expected and recovered concentrations and percent differences (required in hard copy format only)
- Any other method-specific QC sample results
- Sample preparation logs that include the following:
  - Preparation start and end times
  - Beginning and ending temperatures (for example, water baths and digestion blocks)
- Each algorithm and an example calculation for at least one sample for each matrix analyzed
- Raw data, including manual integrations

1.8.3 Electronic Analytical Record Format

CH2M HILL will obtain electronic data deliverables (EDD) in CH2M HILL 's Lab Spec 7 format as presented in Appendix B. All electronic data files will match the final hard copy of results. CH2M HILL requires receipt of a final hard copy of results along with electronic files.

1.8.4 Project Record Maintenance and Storage

Project records will be stored and maintained in accordance with CH2M HILL's data management policies and Section 2.11 of this QAPP. Each project team member will be responsible for filing project information or providing it to the project assistant familiar with the project filing system. Individual team members may maintain separate files or notebooks for individual tasks, but are to provide such materials to the project file upon completion of each task. The general project file categories are as follows:

- Correspondence
- Non-laboratory project invoices and approvals by vendor
- Original unbound reports
- Non-laboratory requests for proposals (solicitations), bids, contracts, and statements of work
- Field data
- Data evaluation and calculations
- Site reports from others
- Photographs
- Insurance documentation
- Laboratory analytical data and associated documents/memos
- Regulatory submittals, licensing, and permitting applications
- Site and reference material
- Health and safety plans
- Figures and drawings

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2.0 Data Generation and Acquisition

This section describes the procedures for acquiring, collecting, handling, measuring, and managing data in support of this sampling activity. It addresses the following data generation and acquisition aspects:

- Sampling process design
- Sample handling and custody requirements
- Sampling method requirements
- Laboratory analytical method requirements
- Laboratory QC requirements
- Field and laboratory instrument calibration and frequency
- Inspection and acceptance requirements for supplies and consumables
- Data acquisition requirements
- Data management
- Field and laboratory instrument and equipment testing, inspection, and maintenance requirements

2.1 Sampling Process Design

The number and location of samples for the site are discussed in the RFI Work Plan. The sampling design is a function of the medium sampled, information about the sampling site, the type of data to be collected, and how the data are to be used. The specific protocols for sampling, equipment decontamination, handling of investigation-derived wastes and field QC are discussed in the RFI Work Plan.

2.2 Sampling Method Requirements

Sampling methods are addressed in the RFI Work Plan.

2.3 Preservation and Holding Times

The sample containers, minimum sample quantities, required preservatives, and maximum holding times for the analytical parameters are shown in Table 2-1.

TABLE 2-1
Required Analytical Method, Sample Containers, Preservation, and Holding Times
RCRA Facility Investigation

Analysis	Preparatory / Analytical Method	Container	Qty	Preservative	Holding Time
Explosives	SW8330B SW8330	Soil: 4-ounce wide-mouthed glass jar with Teflon-lined caps. Triplicate samples needed for each MIS. Water: 1-liter amber glass bottle with Teflon-lined cap	4 2	Cool to 4°C±2°C	Soil: 14 days until extraction and 40 days from extraction until analysis Water: 7 days until extraction and 40 days from extraction until analysis
Arsenic, Barium, Cadmium, Chromium, Lead, Selenium, Silver	SW6010B	Soil: 4-ounce glass jar Water: 1-liter poly bottle	1 1	Soil: Cool 4°C±2°C Water: preserved with HNO_3 to pH <2 and cool to 4°C±2°C	180 days
Mercury	SW7471A	Soil: 4-ounce glass jar Water: 1-liter poly bottle	1 1	Soil: Cool 4°C±2°C Water: preserved with HNO_3 to pH <2 and cool to 4°C±2°C	28 days
Organochlorine pesticides	SW8081A	Soil: 4-ounce wide-mouthed glass jar with Teflon-lined caps Water: 1-liter glass bottle with Teflon-lined cap	1 2	Cool to 4°C±2°C	Soil: 14 days until extraction and 40 days from extraction until analysis Water: 7 days until extraction and 40 days from extraction until analysis
Semivolatile Organic Compounds	SW8270C	Soil: 4-ounce wide-mouthed glass jar with Teflon-lined caps Water: 1-liter glass bottle with Teflon-lined cap	1 2	Cool to 4°C±2°C	Soil: 14 days until extraction and 40 days from extraction until analysis Water: 7 days until extraction and 40 days from extraction until analysis
Volatile Organic Compounds	SWSW8260B	Soil: 40-ml glass vial containing stir bars. 5 gram soil sample aliquot added by using a Terracore or similar coring devices and sealed	3	Frozen on site with dry ice	Soil: 14 days Or 48 hours if only cooled to 4°C

TABLE 2-1
Required Analytical Method, Sample Containers, Preservation, and Holding Times
RCRA Facility Investigation

Analysis	Preparatory / Analytical Method	Container	Qty	Preservative	Holding Time
		or EnCore® sampler or equivalent	3	Cool to 4°C±2°C	48 hours for Encore® or equivalent samplers unless extruded and preserved within 48 hours as follows: • Frozen • Sodium bisulfate • Methanol 14 days for extruded and preserved samples.
		Water: 40-ml glass vial	3	1:1 HCL to pH<2; Cool to 4°C±2°C	Water: 14 days preserved; 7 days unpreserved
Perchlorate	SW6850 or SW6860	Soil: 4-ounce wide-mouthed glass jar with Teflon-lined caps	1	Cool to 4°C±2°C	28 days
		Water: 80 ml sample in 100-ml glass or plastic. Filter sample though a sterile 0.2um filter to remove microorganisms. Pre-filtering with a 0.45um filter may be required.	2		
Total Petroleum Hydrocarton (TPH)-Gasoline range	SW8015B	Soil: 40-ml glass vial containing stir bars. 5 gram soil sample aliquot added by using a Terracore or similar coring devices and sealed	3	Frozen on site with dry ice	Soil: 14 days Or
		or EnCore® sampler or equivalent	3	Cool to 4°C±2°C	48 hours if only cooled to 4°C 48 hours for Encore® or equivalent samplers unless extruded and preserved within 48 hours as follows: • Frozen • Sodium bisulfate • Methanol

TABLE 2-1
Required Analytical Method, Sample Containers, Preservation, and Holding Times
RCRA Facility Investigation

Analysis	Preparatory / Analytical Method	Container	Qty	Preservative	Holding Time
		Water: 40-ml glass vial	3		14 days for extruded and preserved samples. Water: 14 days preserved; 7 days unpreserved
TPH-Diesel	SW8015B	Soil: 4-ounce wide-mouthed glass jar with Teflon-lined caps Water: 1-liter glass bottle with Teflon-lined cap	1 2	Cool to 4°C±2°C	Soil: 14 days until extraction and 40 days from extraction until analysis Water: 7 days until extraction and 40 days from extraction until analysis

Notes:
Water analyses are listed for equipment blanks only
°C = degrees Celsius
HNO_3 = nitric acid

2.4 Sample Handling and Custody Requirements

2.4.1 Sample Handling

Sample handling protocols including sample identification, packaging, and transportation are detailed in the RFI Work Plan.

2.4.2 Sample Custody

Collecting data of known quality begins at the point of sample collection. Legally defensible data are generated by adhering to proven evidentiary procedures. These procedures are outlined in the following subsections and must be followed to preserve and ensure the integrity of samples from the time of collection through analysis. Sample custody records must be maintained both in the field and in the subcontracted laboratory. A sample is considered to be in someone’s custody if it is in his or her physical possession or view, locked up, or kept in a secured and restricted area. Until shipment, sample custody will be the responsibility of the FTL.

The COC forms document sample collection and shipment to the laboratory. A COC form will be completed for each sampling cooler. The original copy will be provided to the laboratory with the sample shipping cooler, and a copy will be retained in the field documentation files. The COC form will identify the contents of each shipment and track the custodial integrity of the samples. COC forms will be signed and dated by the responsible sampling team personnel. The "relinquished by" box will be signed by the responsible sampling team personnel, and the date, time, and air bill number will be noted on the COC form. The laboratory will return the executed copy of the COC with the hard copy of the report.

The shipping coolers containing the samples will be sealed with a custody seal any time the coolers are not in an individual's possession or view before shipping. Custody seals will be signed and dated by the responsible sampling team personnel.

At a minimum, the COC form must contain:

- Site name
- Names of the project manager and project chemist, and their telephone numbers and fax numbers
- Unique sample identification number
- Date and time of sample collection
- Source of sample (including name, location, sample type, and matrix)
- Number of containers
- Designation of MS/MSD
- Preservative used
- Analyses required
- Name of sampler
- Custody transfer signatures and dates and times of sample transfer from the field to transporters and to the laboratories
- Bill of lading or transporter tracking number (if applicable)
- Turnaround time
- Lab name, address, and contact information
- Any special instructions

Erroneous entries on COC records will be corrected by drawing a line through the error and entering the corrected information. The person performing the correction will date and initial each change made on the COC form.

2.4.2.1 Field Custody Procedures

Field custody procedures including COC procedures are outlined the RFI Work Plan.

2.4.2.2 Laboratory Custody Procedures

Once the samples reach the laboratory, they will be checked against information on the COC form for anomalies. The condition, temperature, and appropriate preservation of samples will be checked and documented on a Sample Receipt Form. Checking an aliquot of the sample using pH paper is an acceptable procedure (the pH paper should not be inserted into the sample container to avoid contamination of the sample). The occurrence of any anomalies in the received samples and their resolution will be documented in laboratory records. Sample information will then be entered into a tracking system, and unique analytical sample identifiers will be assigned. A copy of this information will be reviewed by the laboratory for accuracy.

Tracking the sample holding time begins with the collection of samples and continues until the analysis is complete. Laboratory analyses will be documented on the COC form. Procedures ensuring internal laboratory COC will also be implemented and documented by the laboratory. Ideally, sample custody will be maintained using an internal custody system that requires samples to be kept in a secured and restricted area when not in use, and to be checked out and checked back in by the analysts who use the samples. Internal custody records must be maintained by the laboratory as part of the documentation file for each sample. Detailed instructions concerning the analysis specified for each sample will be communicated to the analysts. Analytical batches will be created, and laboratory QC samples will be introduced into each batch.

Samples kept in the laboratory will be stored in limited-access, temperature-controlled areas. Refrigerators, coolers, and freezers will be monitored for temperature 7 days a week. The acceptance criterion for the temperatures of the refrigerators and coolers is 4 degrees Celsius (°C) ±2°C. The acceptance criterion for the temperatures of the freezers will be less than 0°C. All of the cold-storage areas will be monitored by thermometers that have been calibrated with a National Institute of Standards and Technology (NIST)-traceable thermometer. As indicated by the findings of the calibration, correction factors will be applied to each thermometer. Records that include acceptance criteria will be maintained. Samples for determination of volatile organic compounds will be stored separately from other samples, standards, and sample extracts. Samples will be stored after analysis until disposed of in accordance with applicable local, state, and federal regulations. Disposal records will be maintained by the laboratory.

Along with sample receipt documentation, the following information will be documented on Sample Receipt Forms by the sample custodian and provided to the CH2M HILL project chemist within 24 hours of receipt of samples:

- Date samples received
- CH2M HILL sample identification number
- Laboratory sample identification number
- Analytical tests requested for the sample batch

- Sample matrix
- Number of samples in the batch
- Container description and location in the laboratory
- Verification of sample preservation

SOPs describing sample control and custody will be maintained by the laboratory.

2.4.2.3 Laboratory Sample Receipt

Upon sample receipt, the laboratory sample custodian will verify package seals, open the coolers, check temperature blanks (and record temperatures), verify sample integrity, and inspect contents against COC forms. The laboratory project manager will be contacted to resolve any discrepancies between sample containers and COC forms. Once the shipment and COC form are in agreement, the sample custodian will release the samples for analysis. Ideally, the laboratory will use an internal COC form to track samples in the laboratory. The laboratory will provide a sample acknowledgement letter or email. The cooler temperature and sample preservation will be verified and documented. If the cooler temperature is outside the criterion (4°C±2°C) upon receipt, or any other discrepancies are identified, the laboratory will contact the project chemist, who will determine the proper course of action.

Samples will be logged into the Laboratory Information Management System (LIMS), which assigns a unique laboratory number to each sample. The LIMS will be used by all laboratory personnel handling samples, to ensure all sample information is captured. Analyses required will be specified by codes assigned to samples at log-in. Labels containing the laboratory sample number will be generated and placed on sample bottles.

2.4.2.4 Laboratory Sample Storage

After the samples are labeled, they will be moved to refrigerators where they will be maintained at 4°C. Access to the laboratory will be limited by either locked doors or front desk sign in.

When samples are required, laboratory staff will sign and date the appropriate internal COC forms if used by the laboratory.

Sample extracts will be stored in designated secure, refrigerated storage areas. Samples and sample extracts will be maintained in secure storage until disposal. No samples or extracts will be disposed of without prior written approval from an appropriate member of the project team. The sample custodian will note the sample disposal date in the sample ledger. The laboratory will dispose of samples in accordance with applicable regulations.

2.4.2.5 Laboratory Logbooks

Workbooks, bench sheets, instrument logbooks, and instrument printouts will be maintained such that the history of samples through the analytical process can be traced and to document important aspects of the work, including associated QC. As such, all logbooks, bench sheets, instrument logs, and instrument printouts will be part of the laboratory's permanent record. Relevant information will be entered into the LIMS at the time information is generated.

Each page or entry will be dated and initialed by the analyst at the time of entry. Entry errors will be crossed out in indelible ink with a single stroke, corrected without obliterating or writing directly over the erroneous entry, and initialed and dated by the individual making the correction. Logbooks will be completed by lining out unused portions, or pages, and initialing.

The analyst will record information regarding the sample, the analytical procedures performed, and the results on laboratory forms and will enter this information in LIMS. These notes will be dated and will identify the analyst, instruments used, and instrument conditions.

Sufficient raw data records must be retained to permit reconstruction of initial instrument calibrations. These data include calibration date, test method, instrument, analysis date, each constituent name, concentrations and responses, calibration curves, response factors, or unique equations or coefficients used to reduce instrument responses into concentrations.

2.4.2.6 Laboratory Project File

Documentation will be placed in a single, secured project file, maintained by the laboratory project manager. This file will consist of these components, all filed chronologically:

- Agreements
- Correspondence
- Memorandums
- Notes and data

Reports (including QA reports) will be filed with correspondence. Analytical laboratory documentation and field data will be filed with notes and data. Filed materials are allowed to be removed only by authorized personnel on a temporary basis. Laboratories will retain project files and data packages for at least 5 years unless otherwise specified.

2.4.2.7 Laboratory Computer Tape and Hard Copy Storage

Laboratory electronic files will be maintained on CD-ROM or DVD for minimum of 5 years. Hard copy data packages (including chromatograms) will be maintained in files for 5 years. The computer file and hard copy storage should include notations of instrument run files and calibration.

2.5 Analytical Method Requirements

Samples will be analyzed in accordance with this QAPP, the Department of Defense *Quality Systems Manual* (DoD QSM) (DoD, 2009), and the specified EPA method.

Soil results will be reported on a dry weight basis. Units will be micrograms per liter (µg/L) and micrograms per kilogram (µg/kg) for organic analyses of water and soil, respectively, and milligrams per kilogram (mg/kg) for analyses for metals in soil samples. The analytical results will be delivered within the timeframe specified in the laboratory statement of work.

Appendix C specifies the target constituents laboratory-specific MDL and the laboratory-specific RL by method and matrix. Appendix C also contains accuracy and precision objectives for each constituent. The accuracy and precision objectives were derived from the

DoD QSM as required by the project Statement of Work. Appendix C was developed in conjunction with the laboratory.

Appendix C also defines the project-specific screening levels based upon New Mexico Environmental Department (NMED) soil screening levels. The table shows that the MDL and RL for each listed target analyte will meet the project-specific screening level. If the MDL is below the screening level, the RL is sufficient for the DQOs. If sample-specific conditions such as moisture, dilution, or matrix interferences cause the final sample-specific MDL to exceed the screening-level objective, the MDL will be used to achieve the screening-level objective. In addition, other analyte-specific factors (potential use at the site, mobility, and toxicity) could be considered during data evaluation on a more qualitative basis. Chemicals are being analyzed by the most commonly used and technologically advanced method approach.

Samples to be analyzed should be undiluted or at the lowest necessary dilution. The laboratory will contact the project chemist when dilutions are required due to matrix interference. When the concentration of a target constituent exceeds its calibration range, a dilution analysis will be performed to accurately determine the concentration of the constituent. The laboratory will report the undiluted/lowest dilution performed and any diluted analyses that are required.

The laboratory will use analytical SOPs to ensure that the samples submitted are accurate and analyzed precisely. The laboratory will follow the requirements in this QAPP, DoD QSM, and the analytical SOP or the EPA method guidance when this QAPP does not specify QC criteria. Individual laboratory SOPs will be provided upon request.

2.6 Quality Control Requirements

The analytical laboratory will have a QC program to assess the reliability and validity of the analyses being performed. The purpose and creation of QC samples are discussed and summarized below. Laboratory QC checks indicate the state of control that prevailed at the time of sample analysis. QC checks that involve field samples, such as matrix, surrogate spikes, and field duplicates, also indicate the presence of matrix effects. Field-originated blanks provide a way to monitor for potential contamination to which field samples are subjected. This QAPP specifies requirements for a method blank, LCS, surrogate spike, and MS/MSD that the laboratory participating in the data analysis effort must follow.

A laboratory QC batch is defined as a method blank, LCS, MS/MSD, or a sample duplicate, depending on the method and on the fact that 20 or fewer environmental samples of similar matrix are extracted or analyzed together. Each preparation or analytical batch will be identified in such a way as to be able to associate environmental samples with the appropriate laboratory QC samples.

2.6.1 Quality Control Samples

2.6.1.1 Quality Control Analyses/Parameters Originated by the Laboratory

Method Blank

Blanks are used to monitor each preparation or analytical batch for interference and/or contamination from glassware, reagents, and other potential sources within the laboratory. A method blank is a contaminant-free matrix (laboratory reagent water for aqueous samples or Ottawa sand, sodium sulfate, or glass beads [metals] for soil samples) to which all reagents are added in the same proportional amount as are added to the samples. It is processed through the entire sample preparation and analytical procedures along with the samples in the batch.

There will be at least one method blank per preparation or analytical batch. If a target constituent is found at a concentration that exceeds one half the reporting limit, corrective action must be performed in an attempt to identify and, if possible, eliminate the contamination source. If sufficient sample volume remains in the sample container, samples associated with the blank contamination should be prepared again and reanalyzed after the contamination source has been eliminated.

Laboratory Control Sample

The LCS will consist of a contaminant-free matrix, such as laboratory reagent water for aqueous samples or Ottawa sand, sodium sulfate, or glass beads (metals) for soil samples, spiked with known amounts of constituents that come from a source different than that used for calibration standards. Target constituents specified in the QAPP will be spiked into the LCS. The spike levels will be less than or equal to the midpoint of the calibration range. If LCS results are outside the specified control limits, corrective action must be taken, including preparing the sample again along with reanalysis, if appropriate. If more than one LCS is analyzed in a preparation or analytical batch, the results for each LCS must be reported. Any LCS recovery outside QC limits affects the accuracy for the entire batch and requires corrective action.

Matrix Spike/Matrix Spike Duplicate

A sample matrix fortified with known quantities of specific compounds is called a matrix spike. It is subjected to the same preparation and analytical procedures as the native sample. For this project, all target constituents specified in the QAPP will be spiked into the sample. Matrix spike recoveries are used to evaluate the effect of the sample matrix on the recovery of the analytes of interest. An MSD is a second fortified sample matrix. The RPD between the results of the duplicate matrix spikes measures the precision of sample results.

Only project-specific samples designated on the COC form will be spiked. The spike levels will be less than or equal to the midpoint of the calibration range. MS/MSD pairs will be collected at a frequency of 5 percent. An MS/MSD pair is required in every analytical batch regardless of the rate of collection or how samples are received at the laboratory.

2.6.1.2 Quality Control Analyses Originated by the Field Team

Field QC samples will be collected to determine the accuracy and precision of the analytical results. The QC sample frequencies are stated in the following subsections.

Equipment Blank

Equipment blanks (EBs) will be collected to monitor the cleanliness of sampling equipment and the effectiveness of decontamination procedures. Contamination from the sampling equipment can bias the analytical results high or lead to false positive results being reported. The EBs will be prepared by filling sample containers with laboratory-grade contaminant-free water that has been passed through a decontaminated or unused disposable sampling device. The required QC limits for EB concentrations are to be less than the method's reporting limit. The EBs will be collected at a frequency of approximately 5 percent based on the professional judgment of the FTL and conditions as presented in the field. Samples associated with EBs that have detected target constituents will be assessed. The usability of the associated analytical data will be documented and affected data will be appropriately qualified.

Trip Blank

Trip blanks are used to monitor for contamination during sample shipping and handling, and for cross-contamination through volatile component migration among the collected samples. They are prepared in the laboratory by pouring organic-free water into a volatile component sample container. They are then sealed, transported to the field, stay sealed while volatile component samples are taken, and transported back to the laboratory in the same cooler as the volatile component samples. One trip blank should accompany each volatile component sample cooler.

Field Duplicate

Field duplicates are collected in the field from a single aliquot of the sample to determine the precision and accuracy of the field team's sampling procedures. Field duplicates will be collected and analyzed at a frequency of 10 percent.

2.6.2 Data Precision, Accuracy, Representativeness, Comparability, and Completeness

Field QA/QC samples and laboratory internal QA/QC samples are collected and analyzed to assess usability of the data. The method quality objectives (MQOs) presented in Appendix D are used to assess data usability. The MQOs and precision and accuracy objectives are compliant with the QSM.

2.6.2.1 Precision

The precision of laboratory analysis will be assessed by comparing the analytical results between MS/MSD. The precision of the field sampling procedures will be assessed by reviewing field duplicate sample results. The RPD will be calculated for the duplicate samples using the following equation:

$$\%RPD = \{(S - D)/[(S + D)/2]\} \times 100$$

where:

S = First sample value (original value)
D = Second sample value (duplicate value)

The precision criteria for the duplicate samples will be ±50 percent in soil samples and ±30 percent in water samples.

2.6.2.2 Accuracy

Accuracy of laboratory results will be assessed for compliance with the established QC criteria using the analytical results of method blanks, reagent/preparation blanks, and MS/MSD samples. Laboratory results accuracy will be assessed for compliance with the established QC criteria described in the analytical SOPs. The %R of laboratory control samples will be calculated using the following equation:

$$\%R = (A/B) \times 100$$

where:

A = The analyte concentration determined experimentally from the laboratory control sample

B = The known amount of concentration in the sample

2.6.2.3 Completeness

The data completeness of laboratory analyses results will be assessed for compliance with the amount of data required for decision making. Complete data are data that are not rejected. Data with qualifiers such as "J" or "UJ" are deemed acceptable and can be used to make project decisions. The completeness of the analytical data is calculated using the equation

$$\%\ \text{Completeness} = [(\text{valid data obtained})/(\text{total data planned})] \times 100$$

The percent completeness goal for this sampling event is 90 percent.

2.6.2.4 Representativeness

Representativeness is the degree to which sampling data accurately and precisely represent site conditions, and it is dependent on sampling and analytical variability and the variability of environmental media at the site. Representativeness is a qualitative "measure" of data quality.

The goal of achieving representative data in the field starts with a properly designed and executed sampling program that carefully considers the overall DQOs of the project. Proper location controls and sample handling are critical to obtaining representative samples.

The goal of achieving representative data in the laboratory is measured by assessing accuracy and precision. The laboratory will provide representative data when all of the analytical systems are in control. Therefore, representativeness is a redundant DQO for laboratory systems if proper analytical procedures are followed and holding times are met.

In addition, laboratories must demonstrate that the staff is qualified to perform the analyses, certified, and proficient in the analytical methods being employed.

2.6.2.5 Comparability

Comparability is the degree of confidence to which one data set can be compared to another. Comparability is a qualitative "measure" of data quality.

The goal of achieving comparable data in the field starts with a properly designed and executed sampling program that carefully considers the overall DQOs of the project. Proper location controls and sample handling are critical to obtaining comparable samples.

The goal of achieving comparable data in the laboratory is measured by assessing accuracy and precision. The laboratory will provide comparable data when all of the analytical systems are in control. Therefore, comparability is a redundant DQO for laboratory systems if proper analytical procedures are followed and holding times are met.

2.6.2.6 Sensitivity

Sensitivity is the ability of the method or instrument to detect the contaminant of concern and other target compounds at the level of interest. Appropriate sampling and analytical methods were selected that have QC acceptance limits that support the achievement of established performance criteria. Assessment of analytical sensitivity will require thorough data validation.

2.7 Instrument/Equipment Testing, Inspection, and Maintenance Requirements

2.7.1 Field Instrument Maintenance

Maintenance of field equipment will be conducted, as necessary. Equipment maintenance procedures will be followed in general accordance with manufacturer specifications. Major repairs of field equipment will not be attempted by field staff. Equipment will be shipped to the manufacturer or equipment vendor if repairs are required.

Prior to any measurement activities, field equipment will be decontaminated as outlined in the RFI Work Plan. Field equipment also will be decontaminated between sampling locations.

2.7.2 Laboratory Equipment/Instruments

Only qualified personnel will service instruments and equipment. Repairs, adjustments, and calibrations will be documented in the appropriate logbook or data sheet.

2.7.2.1 Instrument Maintenance

Preventive maintenance of laboratory equipment will follow guidelines recommended by the manufacturer. A malfunctioning instrument will be repaired by in-house staff or through a service call to the manufacturer.

The laboratory will maintain a sufficient supply of spare parts for its instruments to minimize downtime. Whenever possible, backup instrumentation will be on hand.

Whenever practical, analytical equipment should be maintained under a service contract. Such contracts allow for preventive system maintenance and repair on an “as-needed” basis. The laboratory should have sufficiently trained staff to allow for the day-to-day maintenance of equipment. All laboratory instruments will be maintained in accordance with manufacturer’s specifications and within the requirements of the laboratory quality assurance manual.

Maintenance activities must be documented in the logbooks.

2.7.2.2 Equipment Monitoring

Operation of balances, ovens, refrigerators, and water purification systems will be checked daily and documented. Discrepancies will be reported immediately to the appropriate laboratory personnel for resolution.

Specific laboratory preventive maintenance procedures are found in the internal quality assurance manual for the laboratory.

2.8 Instrument Calibration and Frequency

2.8.1 Laboratory Instruments

Laboratory instruments will be calibrated by qualified personnel before sample analysis according to the procedures specified in each method, analytical SOPs, and as noted below. Calibration will be verified at method-specified intervals throughout the analysis sequence. The frequency and acceptance criteria for calibration are specified for each analytical method, with supplemental requirements defined below for organic methodologies. When multipoint calibration is specified, the concentrations of the calibration standards should bracket those expected in the samples. Samples will be diluted, if necessary, to bring constituent responses to within the calibration range. Data that exceed the calibration range cannot be reported by the laboratory. The initial calibration curve will be verified as accurate with a standard that is purchased or prepared from an independent second source. The initial calibration verification involves the analysis of a standard containing all the target constituents, typically in the middle of the calibration range, each time the initial calibration is performed. Quantification based on extrapolation is not acceptable. Designated laboratory personnel performing QC activities will maintain records of calibration, repairs, or replacement. These records will be filed where the work is performed and will be subject to a QA audit.

Standards used in equipment must be traceable, directly or indirectly, to the NIST. All standards received will be logged into standard receipt logs maintained by the individual analytical groups. Each group will maintain a standards log that tracks the preparation of standards used for calibration and QC purposes.

2.8.2 Calibration Techniques

Calibration will be performed in accordance with DoD QSM and the requested methods. The summaries of calibration requirements are included in the MQO tables in Appendix D.

Periodic verification of the initial calibration is essential in generating analytical data of known quality. The continuing calibration verification analyses will ensure that the instrument has not been adversely affected by the sample matrix or other instrument failures that would increase or decrease the sensitivity or accuracy of the method. The laboratory will perform continuing calibration for all methods according to the specific requirements in the DoD QSM, the requested methods, and MQOs listed in Appendix D.

2.9 Inspection/Acceptance Requirements for Supplies and Consumables

The required services must meet the task scope, specified levels of quality, and the submittal schedule. Project contractors or vendors should have contractual arrangements with their material suppliers.

2.10 Data Acquisition Requirements for Nondirect Measurements

This subsection describes the identity of the types of data needed for project implementation and decision making not obtained from direct measurements.

The project objectives are first identified to assess what types of information are needed to implement a project plan to achieve the objectives stated in Section 1. Typically, the data needed to achieve project objectives include site maps, sampling location selection and sample identifiers, laboratory method selection and detection limit verification, analytical parameter lists and critical values, field measurement lists, and a project schedule. This information is included in this QAPP.

The sampling design and rationale of the SI activities were determined in the DQO workshop and were based upon recommendations from the preliminary assessment, previously collected data, and the USACE statement of work. Site maps and other site characterization data were used in the selection of sample locations.

2.11 Data Management

Data management entails storing, handling, accessing, and securing data collected during the project. Data gathered during this project will be consolidated and compiled into a project database that can be used to support project data reporting. The following sections describe the project’s data management process and associated project staff responsibilities.

2.11.1 Team Organization and Responsibilities

The following is an overview of the team roles and responsibilities for the data management process:

- **Project Manager—**Ensures that the project team follows the RFI Work Plan such that the team properly collects, documents, and implements the plan to ensure that all data collected are properly managed.
- **Project Chemist—**Oversees the sample tracking, data management process that includes upload into the database, data verification, data validation, data conversion for other applications, and the preparation and review of required data tables.
- **Field Team Leader—**Manages and archives all field information in the project files.

2.11.2 Sample Tracking

The project chemist is responsible for tracking samples and deliverables to ensure that the analytical results for all samples sent for analysis are received. The FTL will send the project chemist the COCs to initiate the sample tracking process.

2.11.3 Data Types

Activities performed at the site will involve accessing a number of different types of data collected or retained for various uses. The following provides a general description of the overall contents of the project files/database.

Data will be added to the project database as available. The data will include new data collected in the field and laboratory and reviewed by CH2M HILL. The data will be reviewed using CH2M HILL's internal data validation and data management systems and retained in the project database for export to the other applications.

CH2M HILL will maintain a tracking system for each COC/laboratory sample delivery group collected. The data will be tracked from collection through completion and review of the data verification process.

2.11.3.1 Electronic Data Deliverables

EDDs will be submitted from the laboratory in the specified format in Appendix B.

2.11.3.2 Hard Copy

All raw analytical laboratory data are stored as the original hard copy by the laboratory. Hardcopy information includes COC forms, analytical bench sheets, instrument printouts and chromatograms, certificates of analyses, and QA/QC report summaries.

2.11.3.3 Data Input Procedures

Sampling information, analytical results, applicable QA/QC data, data validation qualifiers, and other field-related information will be applied to the electronic data using CH2M HILL's data validation system.

2.11.4 EDD Verification and Automated Data Review

Before the laboratory analytical data are entered into the database, the laboratory EDD must be processed through a QC tool that CH2M HILL provides. The EDD verification application includes several automated diagnostic checks to verify format and content compliance with EDD specifications. The analytical laboratory must use the EDD verification tool to check the format and content compliance of its EDD files, and correct any errors prior to transmitting the EDD. The laboratory must forward the checked (and corrected as necessary) EDD and hard copy of the data to the project chemist, who will ensure that the EDD verification process and loading occurs.

The EDD must be checked again (by CH2M HILL) using the EDD verification tool to verify correct format and content. If errors are found, the file will be returned to the laboratory for correction and resubmittal. Even if the formatting of the EDD is completely correct, the data loader could reject the EDD if the contents of the file do not comply with the data library standardization requirements.

These checks must be conducted to ensure the consistency, completeness, and validity of EDD content before data validation. The objectives of applying the EDD verification application are to ensure that the verification/validation process is carried out on consistently high-quality data, to minimize the chance of finding data errors later in the validation process, and to avoid rework.

At import, the data are checked against a list of valid values. Once all error messages are resolved, validation can begin. A semi-automated mode of data validation will be performed. Criteria will be flagged based on this QAPP.

2.11.5 Evidence File

The final evidence file will be the central repository for all documents that constitute evidence relevant to sampling and analysis activities. The CH2M HILL PM will be the custodian of the evidence file and maintain the contents of the evidence files for the project, including relevant records, reports, logs, field notebooks, pictures, contractor reports, and data reviews in a secured area with limited access.

CH2M HILL will keep all records until completion and closeout of the project.

2.11.6 Presentation of Site Characterization Data

Depending on the needs of the data user, data presentation might consist of any of the following formats:

- Tabulated results of data summaries or raw data
- Figures showing concentration isopleths or location-specific concentrations
- Tables providing statistical evaluation or results of calculations

Other physical data might also be collected during field efforts, such as soil types. This information could be stored in a project database.

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3.0 Assessment and Oversight

3.1 Assessments and Response Actions

Field and laboratory assessments will be performed to assess technical and procedural compliance with this QAPP. Performance and system audits will be paramount to document compliance. The audits will be conducted for the following purposes:

- To confirm that appropriate documents are properly completed, and kept current and orderly
- To ensure measurement systems are accurate
- To identify nonconformance or deficiencies and to initiate necessary corrective actions
- To verify that field and laboratory QA procedures called for in this QAPP are properly followed and executed

The project chemist and the laboratory QAM will be responsible for ensuring conformance with this QAPP and internal laboratory analytical SOPs. The FTL will be responsible for ensuring conformance with SOPs for field activities as specified in the RFI Work Plan. Activities selected for audit will be evaluated against specified requirements, and the audit will include an evaluation of the method, procedures, and instructions. Documents and records will be examined as necessary to evaluate whether the QA program is effective and properly implemented.

Reports and recommendations must be prepared for all audits and be submitted to the QAM for retention in the project files.

3.1.1 Field Audits

3.1.1.1 Planned Audits

Planning, scheduling, and conducting QA audits and surveillance are to verify that site activities are being performed efficiently in conformance with approved plans, standards, federal and state regulatory requirements, sound scientific practices, and contractual requirements. Planned and scheduled audits might be performed to verify compliance with aspects of the QA program and to evaluate its effectiveness. Audits include:

- Objective examination of work areas, activities, and processes
- Review of documents and records
- Interviews with project personnel
- Review of plans and standards

At the discretion of the FTL, an internal review of the sampling program will be conducted during the investigation. This review will pay particular attention to the sampling program with respect to representativeness, comparability, and completeness of the specific measurement parameters involved.

The FTL or a designee will review field documentation (COC forms, field daily sheets, and logbooks) as it is generated for accuracy, completeness, and compliance with the RFI Work Plan and QAPP requirements. The FTL may audit field sampling procedures for compliance with QAPP procedures. The auditor may check that the following are performed:

- Sampling protocols are followed
- Samples are placed in proper containers
- Samples are stored and transported properly
- Field documentation is completed

3.1.1.2 Field Corrective Action

Any project team member could initiate a field corrective action process. The process consists of identifying a problem, acting to eliminate it, monitoring the effectiveness of the corrective action, verifying that the problem has been eliminated, and documenting the corrective action.

Corrective actions include correcting COC forms, addressing problems associated with sample collection, packaging, shipping, field recordkeeping, or additional training in sampling and analysis. Additional approaches could include resampling, or evaluating and amending sampling procedures. The FTL will summarize the problem, establish possible causes, and designate the person responsible for a corrective action. The FTL will verify that the initial action has been taken and appears effective, and will follow up to verify that the problem has been resolved.

Technical staff and project personnel will be responsible for reporting suspected technical or QA nonconformances or suspected deficiencies by reporting the situation to the FTL. The FTL will be responsible for assessing suspected problems in consultation with the PM and will make a decision based on the potential of the situation to affect quality of data. If it is determined that the situation warrants a reportable nonconformance requiring corrective action, the FTL will initiate a Nonconformance Report.

The FTL will be responsible for ensuring that corrective actions for nonconformances are initiated by:

- Evaluating all reported nonconformances
- Controlling additional work on nonconforming items
- Determining the disposition or action to be taken
- Maintaining a log of nonconformances
- Reviewing nonconformance reports and corrective actions taken
- Ensuring that nonconformance reports are included in the final documentation in the project files

3.1.2 Laboratory Audits

3.1.2.1 Internal Audits

The laboratory QAM might conduct internal system audits, which are qualitative evaluations of all components of the laboratory QC measurement system. The audit serves to determine whether all measurement systems are used appropriately. The system audits are conducted to evaluate the following:

- Sample handling procedures
- Calibration procedures
- Analytical procedures
- QC results
- Safety procedures
- Recordkeeping procedures
- Timeliness of analysis and reporting

Laboratories also are subject to external audits, which focus on assessing general laboratory practices and conformance to this QAPP. Laboratory audits might be performed before the start of analyses and at any time during the course of the project as deemed necessary.

The laboratory QAM will review internal laboratory performance. The laboratory QAM will evaluate laboratory precision and accuracy by comparing results of duplicate samples, QC samples, spikes, and blanks. The laboratory QAM or other client service individual will check the analytical data prior to distribution when a beyond-control-limit situation is encountered.

External laboratory performance reviews might be conducted based on the evaluation of results of check samples, which are analyzed as part of the requirements for EPA or state certification. Performance audits could be conducted by sending “double blind” performance evaluation samples (those not discernable from routine field samples) to the analytical laboratory.

3.1.2.2 Laboratory Corrective Action

Corrective actions might be required for two classes of problems—analytical/equipment problems and noncompliance problems. Analytical/equipment problems could occur during sampling, sample handling, sample preparation, laboratory instrumental analysis, or data review.

When a noncompliance problem is identified, a corrective action program will be determined and implemented, if appropriate. The person identifying the problem will be responsible for notifying the proper project member. If the problem is analytical in nature, information on the problem will be communicated to the laboratory QAM and the project chemist, who will in turn direct information to proper project members.

Corrective actions will be required whenever an actual or potential out-of-control event is noted. The specific investigative action taken will depend on the analysis and the event in question. Laboratory personnel are alerted that corrective action might be necessary if any of the following occur:

- QC data are outside the warning or acceptable windows for precision and accuracy
- Blanks contain target analytes above acceptable levels
- Undesirable trends are detected in spike recoveries or RPD between duplicates
- Unusual changes in detection limits occur
- Inquiries concerning data quality are received
- Deficiencies are detected by the laboratory QAM during internal or external audits or from results of performance evaluation samples

Corrective action procedures in the laboratory are often handled at the bench level by the analyst, who reviews preparation or extraction procedures for possible errors, and checks instrument calibrations, spike and calibration mixes, and instrument sensitivity. If problems persist or cannot be identified, matters are referred to the laboratory supervisor, laboratory project manager, or laboratory QAM for further investigation. The laboratory project manager is to contact the CH2M HILL project chemist to discuss any corrective action needed. The project chemist is responsible for notifying the PM of any corrective action needed. Once resolved, full documentation of corrective action procedures is filed with the laboratory QAM after approval by the PM or the project chemist. Corrective action might include:

- Re-sampling and analyzing
- Evaluating and amending sampling procedures
- Evaluating and amending analytical procedures
- Accepting data and acknowledging the level of uncertainty
- Reanalyzing the samples, if sample or extract volume is adequate and holding time criteria allow

If re-sampling is deemed necessary because of laboratory problems, the project chemist and the PM together must identify the appropriate course of action to be taken, including potential cost recovery from the laboratory for the additional sampling effort.

3.2 Reports to Management

Audit reports should be submitted to the PM in accordance with this QAPP. After sample results have been received from the laboratory, evaluated, reduced, and tabulated, a data evaluation report will be generated and submitted to USACE as part of the SI report.

4.0 Data Verification, Review, Validation, and Usability

4.1 Data Verification, Review, and Validation

Data review, verification, and validation are the processes by which data generated in support of a project are reviewed against the data QA/QC requirements. The data are evaluated for precision and accuracy against the analytical protocol requirements. Nonconformances or deficiencies that could affect the precision or accuracy of the reported result are identified and noted. The effect on the result is then considered when assessing whether the result is sufficient to achieve DQOs.

Deficiencies discovered as a result of data verification, review, and/or validation, as well as corrective actions implemented in response, will be documented and submitted in the form of a written report. QC criteria defined in the QAPP, DoD QSM, and specified methods will be used as guidance for data validation.

Appendix E contains the flagging criteria that will be used as guidance. The qualifier flags are defined in Table 4-1.

The analytical results of the data collection effort will be verified by CH2M HILL. Four levels of data assessment are described below. Data verification and data review will be performed by the project chemist or other program team members. Data evaluation will be performed by the USACE chemist, and data validation will be performed by the CH2M HILL project chemist with USACE approval.

Data Verification	Verification that the data packages are complete, correct, consistent, and compliant with the data package requirements
Data Review	Verification that samples were analyzed for the methods requested, review of the laboratory case narrative for events in the laboratory that affect the accuracy or precision of the data, review of summary QC indicator data, and a "reasonableness" review of the data
Data Evaluation	Performance by a USACE chemist and intent to ensure that the project DQOs are achieved
Data Validation	Validation of the analytical data, including review of the analytical raw data

TABLE 4-1
Data Validation Flags
RCRA Facility Investigation and Release Assessment Report

Flag	Interpretation
R	The sample results are rejected because of serious deficiencies in the ability to analyze the sample and achieve quality control criteria. The presence or absence of the constituent cannot be verified.
NJ	The analysis indicates the presence of a constituent that has been tentatively identified and the associated numerical value represents its approximate concentration.
UJ	The constituent was not detected above the reported sample quantification limit; however, the reported quantification limit is approximate and might or might not represent the actual limit of quantification necessary to accurately and precisely measure the constituent in the sample.
U	The constituent was analyzed for but was not detected above the reported sample quantification limit.
J	The constituent was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.

Note: Flags are listed in order of severity, from most severe (R) to least severe (J).

4.2 Data Verification and Data Review Procedures

Personnel involved in data validation will be independent of any data generation effort. The project chemist will be responsible for the oversight of data verification, review, and validation. Data verification and review will be carried out when the data packages are received from the laboratory. Verification will be performed on an analytical-batch basis using the summary results of calibration and laboratory QC, as well as those of the associated field samples. One hundred percent of the data packages will undergo data verification and data review. The following items will be addressed in the data verification and data review:

- Review of the data set narrative to identify any issues that the lab reported in the data deliverable
- Check of sample integrity (sample collection, preservation, and holding times)
- Evaluation of basic QC measurements used to assess the accuracy, precision, and representativeness of data, including QC blanks, LCSs, MS/MSDs, surrogate recoveries when applicable, and field or laboratory duplicate results
- Review of sample results, target compound lists, and detection limits to verify compliance with project analytical requirements
- Initiation of corrective actions, as necessary, based on the data review findings
- Qualification of the data using appropriate qualifier flags, as necessary, to reflect data usability limitations

Qualifier flags, if required, will be applied to the electronic sample results. If multiple flags are required for a result, the most severe flag will be applied to the electronic result. The hierarchy of flags from the most severe to the least severe will be as follows: R, NJ, UJ, U, N, and J.

Any significant data quality problems will be brought to the attention of the project chemist.

4.3 Data Assessment

All data generated for this project will be evaluated according to the QA acceptance criteria specified in this QAPP. Limitations on data usability will be assigned, if appropriate, as a result of the validation process described earlier.

The results of the data validation will be discussed in a separate report so that overall data quality can be verified through the precision, accuracy, representativeness, comparability and completeness of sample results.

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5.0 References

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New Mexico Environment Department (NMED). 2009. *New Mexico Environmental Department Technical Background Document for Development of Soil Screening Levels.* Revision 5.0. August 2009.

United States Environmental Protection Agency (EPA). 2006. *Guidance for the Data Quality Objectives Process.* EPA QA/G-4.

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APPENDIX A

CH2M HILL
Electronic Data Deliverable Format

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Electronic Data Deliverable Format for CH2M HILL

The electronic data deliverable (EDD) file from the laboratory will be a comma-delimited ASCII (CDA) file in the format listed below. There will be one file per hard copy report, and the filename of the EDD file will be in the format REPORTID.txt or REPORTID.csv, where REPORTID is the hard copy report identifier of sample delivery group.

The first row of the EDD will contain the 47 field name values as listed in the EDD Specification Table.

The EDD Specification Table lists the attributes of the columns for each row of the CDA file. The fields should be reported in the order indicated.

The **Data Type** column describes the value in the field as either text (alphanumeric), number (numeric only), date (mm/dd/yyyy), or time (24-hour format: hh:mm). If the field is conditional or optional and there is no value to be reported, report a null (that is, no) value. For a text field, do not report a zero-length string (that is, “”).

The **Data Length** column contains the maximum length of a text value for the particular data field.

The **Rqmt** column contains a code indicating whether the value is required (R) for all rows, optional (O) for all rows, or conditional (C) and depends on the type of result reported.

Each row is uniquely identified by the values in the following fields:

- FieldID
- AnalysisMethod
- ExtractionMethod
- LeachMethod
- ParamID

If an analytical sample must be diluted or reanalyzed and reported in addition to the original analytical sample, the diluted or reanalyzed sample should have a FieldID value that is different than that of the original sample. This can be accomplished through the addition of a suffix to the original FieldID that establishes a new and unique FieldID for the associated records.

EDD Specification Table

Field Number	Field Name	Data Type	Data Length	Rqmt	Description and Comments
1	VersionCode	Text	15	R	Code identifying the version of the EDD deliverable.
2	LabName	Text	10	R	Identification code for the laboratory performing the work. This value is used to distinguish among different facilities.
3	SDG	Text	8	R	Sample delivery group designation. Always populated for all samples, including QC.
4	FieldID	Text	13	R	Client sample ID as appears on COC with optional lab-assigned suffixes and/or prefixes to make it unique. If the sample identifier on the COC and the prefix/suffix is greater than 13 characters, abbreviate the value but make it unique. For laboratory QC samples (that is, method blanks, lab control samples), use a unique lab sample identifier.
5	NativeID	Text	13	R	Client sample ID, exactly as on the COC. No prefix or suffix allowed. Used to identify the native sample from which other samples are derived (for example, QAQCType = ”LR”, “MS”, or “SD”). For laboratory QC samples (i.e., method blanks, lab control samples), use a unique lab sample identifier. For lab blank spike (and blank spike duplicate) samples, use the FieldID value that was assigned to the associated method blank.
6	QAQCType	Text	2	R	This is the code for the sample type. Any field sample that is not used as lab QC and is not otherwise marked on the COC should have the designation of “N” (normal field sample). No suffix allowed (that is, do not add numbers as suffixes to the QAQCType values as is called for in the ERPIMS guidelines). Note that if all analyses for a given sample are diluted, then the first dilution should be designated as the normal sample. If more dilutions are required, then the next dilution should be designated as the first true dilution with a QAQCType value of “LR” and a LRType value of “DL” (see LRType, below).

EDD Specification Table

Field Number	Field Name	Data Type	Data Length	Rqmt	Description and Comments
7	LRType	Text	3	C	This is the code for laboratory replicate sample type. Values are: • blank (if QAQCType value is not "LR"), • "DL" (dilution), • "RE" (re-analysis), • "D" (inorganic duplicate), • "CF" (confirmation). For multiple dilutions or re-analyses of the same sample, append the replicate number after the LRType value (that is, "RE", "RE2", "RE3", etc.).
8	Matrix	Text	5	R	Sample matrix code. Valid values are as follows: "AIR", "WATER", "SOIL", unless otherwise provided by the project data manager and marked on the COC. The use of "liquid", "solid", etc. for lab QC is not allowed.
9	LabSampleID	Text	20	R	Laboratory sample ID. Prefix or suffix is allowed. This is where dilutions or re-extractions are noted. Example: "D97-11111RE" is acceptable.
10	AnalysisMethod	Text	20	R	Analysis method code. This is the identifier of the analytical method that was performed on the sample. Example: SW8260A. Generic names such as "EPA" should not be used.
11	ExtractionMethod	Text	20	R	Preparation method code. A value in this field is required. If the preparation is described in the method, use "METHOD". If there is no separate preparation required, use "NONE". Note that Total and Dissolved metal analyses are differentiated by the value in this column. Note that Total, TCLP, and SPLP analyses are now differentiated by the value in the LeachMethod column (see below).
12	SampleDate	Date		C	Date of sample collection. Value is required for all samples sent to the laboratory and samples derived from those samples. Format: mm/dd/yyyy
13	SampleTime	Time		C	Time of sample collection. Value is required for all samples sent to the laboratory and samples derived from those samples. 24-hour format: hh:mm
14	ReceiveDate	Date		C	Date of sample receipt in the lab. Value is required for all samples sent to the laboratory and samples derived from those samples. Format: mm/dd/yyyy

EDD Specification Table

Field Number	Field Name	Data Type	Data Length	Rqmt	Description and Comments
15	ExtractDate	Date		C	Date of sample preparation (extraction or digestion). Value is required if the ExtractionMethod field value is other than "NONE". Format: mm/dd/yyyy
16	ExtractTime	Time		C	Time of sample preparation. Value is required if the ExtractionMethod field value is other than "NONE". 24-hour format: hh:mm
17	AnalysisDate	Date		R	Date of sample analysis. Value is required for all records. Format: mm/dd/yyyy
18	AnalysisTime	Time		R	Time of sample analysis. Value is required for all records. 24-hour format: hh:mm
19	PercentSolids	Number		R	Percent solids within the sample. Should be zero for water samples.
20	LabLotCtlNum	Text	10	C	Identifier of an autonomous group of environmental samples and associated QC samples **prepared** together. For example, its value can be a digestion or extraction batch ID. If there is no separate extraction or preparation performed, leave this field blank.
21	CAS	Text	20	C	CAS number of analyte, if available.
22	ParamID	Text	12	R	Parameter identifier code for the parameter listed in the Analyte field.
23	Analyte	Text	60	R	Name of analyte, chemical name.
24	Result	Text	10	R	Result of the analysis. Surrogate analytes will be reported in units of percent. All others will be reported in sample concentration units. If undetected, report the adjusted MDL or adjusted RL, depending on the project. (Reported as a text field to preserve significant figures.)
25	ExpectedValue	Number		C	"100" for surrogates; "0" (zero) for blanks; spike level plus parent result for LCS, and MS/MSD; parent value for lab duplicate; etc.
26	Units	Text	10	R	Units of measure used in the analysis. Report "PERCENT" for surrogate analytes and concentration units for all others.
27	Dilution	Number		R	Total dilution reported in the analysis. Default value should be 1 (one). This value should reflect changes to sample preparation amounts as defined by the method (for example, less sample used for standard VOC analysis).

EDD Specification Table

Field Number	Field Name	Data Type	Data Length	Rqmt	Description and Comments
28	MDL	Number		C	Minimum detection limit adjusted for preparation and dilution. Note that this value may be the method detection limit or the instrument detection limit, depending on the method and the project requirements. This value is **not** adjusted for percent moisture.
29	RL	Number		C	Reporting limit adjusted for preparation and dilution. Value is **not** adjusted for percent moisture. Equivalent to PQL.
30	LabQualifier	Text	6	R	Lab qualifier for the results, as reported on the hard copy. Use "=" as first (or only) qualifier value for detected results.
31	Surrogate	Text	1	R	Is the chemical a surrogate? Report "Y" for yes or "N" for no.
32	Comments	Text	240	O	Comment field
33	ParValUncert	Text	16	C	Radiological parameter value uncertainty.
34	Recovery	Number		C	Percent recovery for MS, SD, LCS, and surrogate compounds.
35	LowerControlLimit	Number		C	Lower control limit value for spiked compounds, expressed in units of Percent. A value in this field is required if there is a value in the Recovery field (Field No. 34).
36	UpperControlLimit	Number		C	Upper control limit value for spiked compounds, expressed in units of Percent. A value in this field is required if there is a value in the Recovery field (Field No. 34).
37	Basis	Text	1	R	Weight basis for soil (or solid) sample analysis. Use "D" for dry-weight basis, "W" for wet-weight basis, or "X" if not applicable.
38	ConcQual	Text	1	R	Concentration qualifier. Use "=" for detects, "J" for estimated value (value between detection limit and reporting limit), "U" for undetected result, or "E" for exceeded result.
39	MDLAdjusted	Number		C	Minimum detection limit adjusted for preparation, dilution **and percent moisture**. See the description of the MDL field (Field No. 28) for an explanation of the contents of this field.
40	RLAdjusted	Number		C	Reporting limit adjusted for preparation, dilution **and percent moisture**. Equivalent to PQL

EDD Specification Table

Field Number	Field Name	Data Type	Data Length	Rqmt	Description and Comments
41	SampleDescription	Text	20	C	Full sample identifier value as it appears on the COC. In some cases, this may be the name of the sampling location instead of the sample. Required for all samples that are either collected in the field and specified on the COC, or derived from samples that are collected in the field and specified on the COC.
42	LeachMethod	Text	20	R	Analytical method used for leaching the sample. This applies to TCLP, SPLP, or other leaching or pre-extraction leaching procedures. Use “NONE” if the sample was not leached.
43	LeachDate	Date		C	Date that the leaching method was performed (start date for multi-date leaching procedures). Value is required if the LeachMethod field value is other then “NONE”. Format: mm/dd/yyyy.
44	LeachTime	Time		C	Time that the leaching procedure started. Value is required if the LeachMethod field value is other then “NONE”. 24 hour format: hh:mm.
45	LeachLot	Text	20	C	Identifier of an autonomous group of environmental samples and associated QC samples **leached** at the same time. If the sample was not leached, leave this field blank.
46	AnalysisLot	Text	20	R	Identifier of an autonomous group of environmental samples and associated QC samples **analyzed** together. A value in this field is mandatory (i.e., it should not be blank).
47	CalRefID	Text	20	C	Identifier of a group of environmental and QC samples linked by a common set of calibration records. All results with the same CalRefID value will have had the same initial calibration run.

Example Valid Values

The project data manager will provide the laboratory with a list of valid values that the laboratory will use in constructing the EDD. The following table lists some example valid values.

Field Name	Valid Value	Meaning
VersionCode	4.00AFCEE3	Format 4.00, AFCEE data values. LabQualifier field contains the laboratory qualifier values defined in the AFCEE QAPP, version 3.0.
VersionCode	4.00EPACLP	Format 4.00, EPA data values. LabQualifier field contains the standard EPA CLP lab qualifiers.
QAQCType	N	Normal, environmental sample
QAQCType	LB	Laboratory method blank
QAQCType	MS	Laboratory matrix spike sample
QAQCType	SD	Laboratory matrix spike duplicate
QAQCType	LR	Laboratory replicate (dilution, re-analysis, duplicate)
QAQCType	BS	Laboratory method blank spike
QAQCType	BD	Laboratory method blank spike duplicate
LRType	DL	First dilution sample
LRType	DL2	Second dilution sample
LRType	DL3	Third dilution sample
LRType	RE	First re-analysis/re-extraction sample
LRType	RE2	Second re-analysis/re-extraction sample
LRType	RE3	Third re-analysis/re-extraction sample
LRType	D	Inorganic duplicate sample
LRType	CF	First confirmation analysis sample
LRType	CF2	Second confirmation analysis sample
LRType	CF3	Third confirmation analysis sample
AnalysisMethod	SW8260A	Volatiles by method 8260A in EPA SW846.
AnalysisMethod	SW8270	Semivolatiles by method 8270 in EPA SW846.
AnalysisMethod	SW6010	ICP metals by method 6010 in EPA SW846.
AnalysisMethod	SW7060	GFAA Arsenic by method 7060 in EPA SW846.
ExtractionMethod	FLDFLT	Field filtration for dissolved metals analysis
ExtractionMethod	C3050	CLP-modified SW3050 acid digestion for metals analysis in soil samples.
ExtractionMethod	SW1311	TCLP extraction

Field Name	Valid Value	Meaning
ExtractionMethod	DISWAT	Distilled water extraction for analytes in soil samples.
ExtractionMethod	SW3510	Separatory funnel extraction
ExtractionMethod	SW3540	Soxhlet extraction
ExtractionMethod	TOTAL	Digestion of unfiltered waters for total metals analysis
ParamID	ACE	Acetone
ParamID	AS	Arsenic
ParamID	BHCGAMMA	gamma-BHC (Lindane)
ParamID	BZ	Benzene
ParamID	CDS	Carbon disulfide
ParamID	PB	Lead
ParamID	PHENOL	Phenol
ParamID	SE	Selenium
ParamID	TCE	Trichloroethene

APPENDIX B

Analytical Method Limits and Objectives

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TABLE B-1
Comparison of Reporting Limits to Screening Objectives for Soil
RCRA Facility Investigation, Parcel 23, Fort. Wingate, New Mexico

Method	Analyte	CAS Number	Units	NMED Residential Soil Screening Objectives	LOD/ MDL	LOQ/RL	Does the LOD/MDL Exceeds Screening Objective	Surrogate Spike	Laboratory Internal QC Limits /a	QSM QC Limits
Explosives										
SW8330B	1,3,5-Trinitrobenzene	99-35-4	mg/kg	24.80	0.06	0.2	No	No	50-135	75-125
SW8330B	1,3-Dinitrobenzene	99-65-0	mg/kg	---	0.04	0.13	No	No	50-120	80-125
SW8330B	2,4,6-Trinitrotoluene	118-96-7	mg/kg	30.6	0.08	0.24	No	No	44-120	55-140
SW8330B	2,4-Dinitrotoluene	121-14-2	mg/kg	122	0.04	0.23	No	No	50-136	80-125
SW8330B	2,6-Dinitrotoluene	606-20-2	mg/kg	---	0.06	0.2	No	No	50-144	80-120
SW8330B	2-Amino-4,6-dinitrotoluene	35572-78-2	mg/kg	6.11	0.06	0.18	No	No	50-120	80-125
SW8330B	2-Nitrotoluene	88-72-2	mg/kg	10.8	0.05	0.14	No	No	59-120	80-125
SW8330B	3-Nitrotoluene	99-08-1	mg/kg	569	0.07	0.22	No	No	50-136	75-120
SW8330B	4-Amino-2,6-dinitrotoluene	19406-51-0	mg/kg	---	0.08	0.25	No	No	50-159	80-125
SW8330B	4-Nitrotoluene	99-99-0	mg/kg	146	0.07	0.23	No	No	58-136	75-125
SW8330B	HMX	2691-41-0	mg/kg	3060	0.07	0.21	No	No	60-140	75-125
SW8330B	Nitrobenzene	98-95-3	mg/kg	22.8	0.05	0.15	No	No	50-120	75-125
SW8330B	Nitroglycerin	55-63-0	mg/kg	347	0.6	2	No	No	50-150	80-120
SW8330B	PETN	78-11-5	mg/kg	---	0.8	2.6	No	No	50-150	80-120
SW8330B	RDX	121-82-4	mg/kg	44.2	0.06	0.18	No	No	59-120	70-135
SW8330B	Tetryl	479-45-8	mg/kg	---	0.07	0.23	No	No	37-120	10-150
SW8330B	1,2-Dinitrobenzene	528-29-0	% Recovery	---	---	---	---	Yes	---	50-150
Metals										
SW6010B	Arsenic	7440-38-2	mg/kg	3.9	0.30	1.0	No	No	78-106	80-120
SW6010B	Barium	7440-39-3	mg/kg	15600	0.20	0.68	No	No	86-110	80-120
SW6010B	Cadmium	7440-43-9	mg/kg	39	0.016	0.054	No	No	82-115	80-120
SW6010B	Chromium	7440-47-3	mg/kg	234/100000	0.060	0.20	No	No	85-115	80-120
SW6010B	Lead	7439-92-1	mg/kg	400	0.10	0.32	No	No	84-111	80-120
SW6010B	Selenium	7782-49-2	mg/kg	391	0.13	0.43	No	No	68-120	80-120
SW6010B	Silver	7440-22-4	mg/kg	391	0.31	1.0	No	No	76-120	75-125
SW7471A	Mercury	7439-97-6	mg/kg	100000	0.0016	0.0052	No	No	80-110	80-120
SVOCs										
SW8270C	1,2,4-Trichlorobenzene	120-82-1	µg/kg	69,300	16	100	No	No	41-119	45-110
SW8270C	1,2-Dichlorobenzene	95-50-1	µg/kg	37,400	10	100	No	No	39-119	45-95
SW8270C	1,3-Dichlorobenzene	541-73-1	µg/kg	32,600	11	100	No	No	39-114	40-100
SW8270C	1,4-Dichlorobenzene	106-46-7	µg/kg	39,500	13	100	No	No	40-115	35-105
SW8270C	1,5-Dimethylnaphthalene	571-61-9	µg/kg	--	100	500	--	No	-	50-150
SW8270C	2,4,5-Trichlorophenol	95-95-4	µg/kg	6.11E+06	105	349	No	No	46-117	50-110
SW8270C	2,4,6-Trichlorophenol	88-06-2	µg/kg	6,110	76	253	No	No	35-116	45-110

TABLE B-1
Comparison of Reporting Limits to Screening Objectives for Soil
RCRA Facility Investigation, Parcel 23, Fort. Wingate, New Mexico

Method	Analyte	CAS Number	Units	NMED Residential Soil Screening Objectives	LOD/ MDL	LOQ/RL	Does the LOD/MDL Exceeds Screening Objective	Surrogate Spike	Laboratory Internal QC Limits /a	QSM QC Limits
SW8270C	2,4-Dichlorophenol	120-83-2	µg/kg	183,000	93	311	No	No	29-125	45-110
SW8270C	2,4-Dimethylphenol	105-67-9	µg/kg	1.22E+06	77	255	No	No	28-124	30-105
SW8270C	2,4-Dinitrophenol	51-28-5	µg/kg	122,000	211	705	No	No	19-107	15-130
SW8270C	2,4-Dinitrotoluene	121-14-2	µg/kg	122,000	23	100	No	No	52-115	50-115
SW8270C	2,6-Dichlorophenol	87-65-0	µg/kg	--	31	105	--	No	35-126	48-126
SW8270C	2,6-Dinitrotoluene	606-20-2	µg/kg	6,110	20	100	No	No	52-125	50-110
SW8270C	2-Chloronaphthalene	91-58-7	µg/kg	3.99E+06	13	100	No	No	40-118	45-105
SW8270C	2-Chlorophenol	95-57-8	µg/kg	166,000	105	349	No	No	30-127	45-105
SW8270C	2-Methylnaphthalene	91-57-6	µg/kg	--	19	100	--	No	40-111	45-105
SW8270C	2-Methylphenol	95-48-7	µg/kg	--	101	337	--	No	26-128	40-105
SW8270C	2-Nitroaniline	88-74-4	µg/kg	--	26	100	--	No	45-118	45-120
SW8270C	2-Nitrophenol	88-75-5	µg/kg	--	118	395	--	No	42-114	40-110
SW8270C	3 & 4-Methylphenol	1319-77-3	µg/kg	--	104	347	--	No	26-134	40-105
SW8270C	3,3'-Dichlorobenzidine	91-94-1	µg/kg	10,800	278	928	No	No	29-110	10-130
SW8270C	3-Nitroaniline	99-09-2	µg/kg	--	32	108	--	No	30-113	25-110
SW8270C	4,6-Dinitro-2-methylphenol	534-52-1	µg/kg	--	71	500	--	No	24-124	30-135
SW8270C	4-Bromophenyl-phenyl ether	101-55-3	µg/kg	--	10	100	--	No	53-117	45-115
SW8270C	4-Chloro-3-methylphenol	59-50-7	µg/kg	--	91	303	--	No	47-115	45-115
SW8270C	4-Chloroaniline	106-47-8	µg/kg	--	65	216	--	No	14-112	35-115
SW8270C	4-Chlorophenyl-phenyl ether	7005-72-3	µg/kg	--	31	104	--	No	47-120	45-110
SW8270C	4-Nitroaniline	100-01-6	µg/kg	--	31	102	--	No	37-116	35-115
SW8270C	4-Nitrophenol	100-02-7	µg/kg	--	322	1100	--	No	22-133	15-140
SW8270C	Acenaphthene	83-32-9	µg/kg	3.73E+06	15	100	No	No	42-122	45-110
SW8270C	Acenaphthylene	208-96-8	µg/kg	--	20	100	--	No	45-124	45-105
SW8270C	Acetophenone	98-86-2	µg/kg	1.48E+06	32	107	No	No	31-141	48-126
SW8270C	Aniline	62-53-3	µg/kg	--	61	203	--	No	13-109	14-110
SW8270C	Anthracene	120-12-7	µg/kg	2.20E+07	10	100	No	No	54-123	55-105
SW8270C	Azobenzene & 1,2-Diphenylhydrazine	103-33-3/122-66-7	µg/kg	--	32	108	--	No	50-114	55-115
SW8270C	Benzidine	92-87-5	µg/kg	21.1	1200	3900	No	No	1-161	1-161
SW8270C	Benzo(a)anthracene	56-55-3	µg/kg	6,210	9	100	No	No	56-118	50-110
SW8270C	Benzo(a)pyrene	50-32-8	µg/kg	621	19	100	No	No	53-124	50-110
SW8270C	Benzo(b)fluoranthene	205-99-2	µg/kg	6,210	11	100	No	No	51-123	45-115
SW8270C	Benzo(g,h,i)perylene	191-24-2	µg/kg	--	25	100	--	No	36-132	40-125
SW8270C	Benzo(k)fluoranthene	207-08-9	µg/kg	62,100	21	100	No	No	46-134	45-125
SW8270C	Benzoic acid	65-85-0	µg/kg	--	291	971	--	No	None	0-110
SW8270C	Benzyl alcohol	100-51-6	µg/kg	--	78	261	--	No	None	20-125
SW8270C	Bis(2-chloroethoxy)methane	111-91-1	µg/kg	--	20	100	--	No	41-122	45-110
SW8270C	Bis(2-chloroethyl)ether	111-44-4	µg/kg	2,440	14	100	No	No	33-128	40-105

TABLE B-1
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RCRA Facility Investigation, Parcel 23, Fort. Wingate, New Mexico

Method	Analyte	CAS Number	Units	NMED Residential Soil Screening Objectives	LOD/ MDL	LOQ/RL	Does the LOD/MDL Exceeds Screening Objective	Surrogate Spike	Laboratory Internal QC Limits /a	QSM QC Limits
SW8270C	Bis(2-chloroisopropyl)ether	108-60-1	µg/kg	38,700	11	100	No	No	33-137	20-115
SW8270C	Bis(2-ethylhexyl)phthalate	117-81-7	µg/kg	347,000	28	100	No	No	56-127	45-125
SW8270C	Butylbenzylphthalate	85-68-7	µg/kg	--	24	100	--	No	56-115	50-125
SW8270C	Carbazole	86-74-8	µg/kg	--	11	100	--	No	53-117	45-115
SW8270C	Chrysene	218-01-9	µg/kg	615,000	12	100	No	No	53-120	55-110
SW8270C	Di-n-butylphthalate	84-74-2	µg/kg	6.11E+06	40	134	No	No	60-121	55-110
SW8270C	Di-n-octylphthalate	117-84-0	µg/kg	--	39	129	--	No	51-124	40-130
SW8270C	Dibenzo(a,h)anthracene	53-70-3	µg/kg	621	11	100	No	No	45-126	40-125
SW8270C	Dibenzofuran	132-64-9	µg/kg	142,000	37	124	No	No	42-117	50-105
SW8270C	Diethylphthalate	84-66-2	µg/kg	4.89E+07	38	127	No	No	50-125	50-115
SW8270C	Dimethylphthalate	131-11-3	µg/kg	1.00E+08	26	100	No	No	47-118	50-110
SW8270C	Fluoranthene	206-44-0	µg/kg	2.29E+06	21	100	No	No	54-116	55-115
SW8270C	Fluorene	86-73-7	µg/kg	2.66E+06	11	100	No	No	45-124	50-110
SW8270C	Hexachlorobenzene	118-74-1	µg/kg	3,040	15	100	No	No	53-116	45-120
SW8270C	Hexachlorobutadiene	87-68-3	µg/kg	38,000	31	102	No	No	42-119	40-115
SW8270C	Hexachlorocyclopentadiene	77-47-4	µg/kg	366,000	26	100	No	No	34-135	30-137
SW8270C	Hexachloroethane	67-72-1	µg/kg	61,100	17	100	No	No	41-117	35-110
SW8270C	Indeno(1,2,3-cd)pyrene	193-39-5	µg/kg	6,210	8	100	No	No	43-126	40-120
SW8270C	Isophorone	78-59-1	µg/kg	5.12E+06	27	100	No	No	43-110	45-110
SW8270C	N-Nitroso-di-n-propylamine	621-64-7	µg/kg	--	30	101	--	No	43-127	40-115
SW8270C	N-Nitrosodimethylamine	62-75-9	µg/kg	--	138	459	--	No	27-131	20-115
SW8270C	N-Nitrosodiphenylamine & Diphn	86-30-6/122-39-4	µg/kg	--	17	200	--	No	52-119	50-115
SW8270C	N-Nitrosopyrrolidine	930-55-2	µg/kg	--	37	122	--	No	42-116	59-110
SW8270C	Naphthalene	91-20-3	µg/kg	79,500	9	100	No	No	42-125	40-105
SW8270C	Nitrobenzene	98-95-3	µg/kg	22,800	40	100	No	No	44-115	40-115
SW8270C	Pentachlorophenol	87-86-5	µg/kg	29,800	70	500	No	No	23-129	25-120
SW8270C	Phenanthrene	85-01-8	µg/kg	1.83E+06	11	100	No	No	51-121	50-110
SW8270C	Phenol	108-95-2	µg/kg	1.83E+07	122	406	No	No	29-120	40-100
SW8270C	Pyrene	129-00-0	µg/kg	2.29E+06	11	100	No	No	51-120	45-125
SW8270C	Pyridine	110-86-1	µg/kg	--	68	226	No	No	13-122	16-121
SW8270C	Surr: 2,4,6-Tribromophenol	118-79-6	% Recovery	--	---	---	--	Yes	47-123	35-125
SW8270C	Surr: 2-Fluorobiphenyl	321-60-8	% Recovery	--	---	---	--	Yes	42-115	45-105
SW8270C	Surr: 2-Fluorophenol	367-12-4	% Recovery	--	---	---	--	Yes	34-113	35-105
SW8270C	Surr: Nitrobenzene-d5	4165-60-0	% Recovery	--	---	---	--	Yes	46-110	35-100
SW8270C	Surr: Phenol-d5	4165-62-2	% Recovery	--	---	---	--	Yes	34-119	40-100
SW8270C	Surr: Terphenyl-d14	98904-43-9	% Recovery	--	---	---	--	Yes	52-118	30-125

TABLE B-1
Comparison of Reporting Limits to Screening Objectives for Soil
RCRA Facility Investigation, Parcel 23, Fort. Wingate, New Mexico

Method	Analyte	CAS Number	Units	NMED Residential Soil Screening Objectives	LOD/ MDL	LOQ/RL	Does the LOD/MDL Exceeds Screening Objective	Surrogate Spike	Laboratory Internal QC Limits /a	QSM QC Limits
Organochlorine Pesticides										
SW8081A	4,4'-DDD	72-54-8	µg/kg	24,400	0.3	1.2	No	No	56-128	30-135
SW8081A	4,4'-DDE	72-55-9	µg/kg	17,200	0.3	1.1	No	No	54-127	70-125
SW8081A	4,4'-DDT	50-29-3	µg/kg	17,200	0.5	1.5	No	No	52-132	45-140
SW8081A	Aldrin	309-00-2	µg/kg	284	0.5	1.7	No	No	55-127	45-140
SW8081A	alpha-BHC	319-84-6	µg/kg	902	0.6	1.9	No	No	52-123	60-125
SW8081A	alpha-Chlordane	5103-71-9	µg/kg	--	0.3	1.1	No	No	54-128	65-120
SW8081A	beta-BHC	319-85-7	µg/kg	3,160	0.6	2	No	No	53-125	60-125
SW8081A	Chlordane (Technical)	57-74-9	µg/kg	16,200	4	30	No	No	70-109	50-150
SW8081A	delta-BHC	319-86-8	µg/kg	--	0.3	1.1	--	No	37-113	55-130
SW8081A	Dieldrin	60-57-1	µg/kg	304	0.3	1.2	No	No	54-127	65-125
SW8081A	Endosulfan I	959-98-8	µg/kg	--	0.7	2.2	--	No	55-126	15-135
SW8081A	Endosulfan II	33213-65-9	µg/kg	--	0.3	1.2	--	No	56-125	35-140
SW8081A	Endosulfan sulfate	1031-07-8	µg/kg	--	0.9	3.1	--	No	52-119	60-135
SW8081A	Endrin	72-20-8	µg/kg	18,300	0.4	1.4	No	No	47-141	60-135
SW8081A	Endrin aldehyde	7421-93-4	µg/kg	--	1.1	3.6	--	No	39-118	35-145
SW8081A	Endrin ketone	53494-70-5	µg/kg	--	0.8	2.8	--	No	55-128	65-135
SW8081A	gamma-Chlordane	5103-74-2	µg/kg	--	0.3	1.1	--	No	55-127	65-125
SW8081A	Heptachlor	76-44-8	µg/kg	1,080	0.4	1.2	No	No	55-128	50-140
SW8081A	Heptachlor epoxide	1024-57-3	µg/kg	--	0.5	1.7	--	No	55-127	65-130
SW8081A	Lindane	58-89-9	µg/kg	4,370	0.5	1.6	No	No	54-125	60-125
SW8081A	Methoxychlor	72-43-5	µg/kg	--	0.7	2.3	--	No	54-131	55-145
SW8081A	Toxaphene	8001-35-2	µg/kg	4,420	5	30	No	No	71-120	50-150
SW8081A	SURR:2,4,5,6-CL4-m-xylene	877-09-8	% Recovery	--	---	---	--	Yes	61-120	70-125
SW8081A	SURR:Decachlorobiphenyl	2051-24-3	% Recovery	--	---	---	--	Yes	46-136	55-130

Notes:

NMED = New Mexico Environmental Department

LOD = limit of detection

LOQ = limit of quantitation

MDL = method detection limit

RL = reporting limit

QSM = quality services manual

RPD = relative percent difference

APPENDIX C

Method Quality Control Objectives

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TABLE C-1
Summary of Quality Objectives for Methods SW8330 – Explosive Water, SW8081A – Organochlorine Pesticides and SW8015B – TPH-Gasoline and TPH-Diesel
RCRA Facility Investigation, Fort Wingate, New Mexico

Quality Control Element	Description of Element	Frequency of Implementation	Acceptance Criteria	Corrective Action	Laboratory Flagging Criteria
Initial Calibration	Minimum 5-point curve.	Initially prior to sample analysis	Instrument Evaluation:	Correct problem and rerun. There should be no failures for an ICAL– correct and repeat is the corrective action, otherwise it will be rejected.	Problem must be corrected. Samples may not be analyzed until the calibration has been verified
			One of the options below Option 1: RSD for each analyte ≤20% Option 2: linear least squares regression: r ≥ 0.995 Option 3: non-linear regression: coefficient of determination (COD) r2 ≥ 0.99 (6 points shall be used for second order, 7 points shall be used for third order)		
Method detection limit (MDL) study	At initial setup and subsequently once per 12-month period;	MDL verification check once per quarter per instrument used	See 40 CFR 136B. MDL verification checks must produce a signal at least 3 times the instrument's noise level	Run MDL verification check at higher level and set MDL higher or reconduct MDL study	Sample can not be analyzed without a valid MDL

TABLE C-1
Summary of Quality Objectives for Methods SW8330 – Explosive Water, SW8081A – Organochlorine Pesticides and SW8015B – TPH-Gasoline and TPH-Diesel
RCRA Facility Investigation, Fort Wingate, New Mexico

Quality Control Element	Description of Element	Frequency of Implementation	Acceptance Criteria	Corrective Action	Laboratory Flagging Criteria
Retention Time	Retention time window position established for each analyte and surrogate	Each ICAL and at the beginning of the analytical shift	Position shall be set using the midpoint standard of the calibration curve or the value in the calibration verification run at the beginning of the analytical shift (ICV). or RT width is ±3 times standard deviation for each analyte RT from 72-hour study.	N/A	N/A
ICV	Mid-level (2nd source) verification	After initial calibration	20% for each analyte	Correct problem and repeat.	Problem must be corrected. Samples may not be analyzed until the calibration has been verified
CCV	Mid-level verification	Daily, before sample analysis and after every 10 field samples and at the end of the analysis sequence	Instrument Evaluation: GC: %D ≤20% for each analyte HPLC: %D ≤15% for each analyte	Correct the problem, reanalyze CCV, if problem continues repeat initial calibration	Problem must be corrected. Samples may not be analyzed until the calibration has been verified. Apply Q-flag to all results for the specific analyte(s) in all samples since the last acceptable calibration verification, if re-analysis is not possible.
Second Column Confirmation	Second Column Confirmation (excludes toxaphene and technical chlordane in SW8081A Second column confirmation not required for SW8015B.	100% for all positive results	Calibration and QC criteria same for initial or primary analysis. Results between the primary and secondary column RPD ≤40%	NA	Apply J-flag if RPD >40% from first column result. Apply Q-flag to all results for the specific analyte(s) in the sample not confirmed.

TABLE C-1
Summary of Quality Objectives for Methods SW8330 – Explosive Water, SW8081A – Organochlorine Pesticides and SW8015B – TPH-Gasoline and TPH-Diesel
RCRA Facility Investigation, Fort Wingate, New Mexico

Quality Control Element	Description of Element	Frequency of Implementation	Acceptance Criteria	Corrective Action	Laboratory Flagging Criteria
Breakdown check (Method SW8081A)	Determine breakdown of Endrin and DDT	Daily prior to analysis of samples	Degradation ≤15% for both Endrin and DDT	N/A	N/A
Method Blank	Reagent Blank to assess method contamination	1 per sample batch	Analytes <1/2 RL. For common laboratory contaminants , no analytes detected ≥RL.	Re-prep.	Apply B to all associated positives when less than 5X blank concentration
LCS containing all analytes required to be reported, including surrogates	Interference-free matrix containing all target analytes	1 per sample batch	See limits in Appendix C, Table 1	Correct problem and repeat.	If corrective action fails, apply Q-flag to the specific analyte(s) in all samples in the associated preparatory batch.
MS/MSD containing all analytes required to be reported, including surrogates	Sample matrix spiked with all target analytes	1 set per sample batch	See limits in Appendix C, Table 1		For the specific analyte(s) in the parent sample, apply J-flag if acceptance criteria are not met.
Results between the MDL and RL					Apply a J-flag to all results between the MDL and RL.
Surrogates		All field and QC samples	See limits in Appendix C Table 1	Rerun samples and/or re-extract	For the specific analyte(s) in all field samples collected from the same site matrix as the parent, apply J-flag if acceptance criteria are not met. For QC samples, apply Q-flag to specific analyte(s) in all samples in the associated preparatory batch. Q-flag to all results for all associated analytes.

TABLE C-2
Summary of Quality Objectives for Method 6010B – Inductively Coupled Plasma Atomic Emission Spectrometer (ICP) Metals
RCRA Facility Investigation, Fort Wingate, New Mexico

Quality Control Element	Description of Element	Frequency of Implementation	Acceptance Criteria	Corrective Action	Laboratory Flagging Criteria
Initial Calibration	Minimum one high standard and a calibration blank 3 standards and a blank	Daily prior to sample analysis	R ≥0.995	Correct problem and repeat.	N/A
Method detection limit (MDL) study	At initial set-up and subsequently once per 12-month period;	MDL verification check once per quarter per instrument used	See 40 CFR 136B. MDL verification checks must produce a signal at least 3 times the instrument's noise level	Run MDL verification check at higher level and set MDL higher or re-conduct MDL study	Sample can not be analyzed without a valid MDL
Low-level calibration check standard	QC/RL: Low-level check standard at RL	At the beginning of every daily sequence	Within ±20% of expected value	Correct problem and repeat.	No samples may be analyzed without a valid low-level calibration check standard.
Initial Calibration Verification (ICV)	Mid-level (2^{nd} source) verification	After initial calibration	90–110%	Correct problem and repeat.	N/A
Initial Calibration Blank (ICB)	Interference-free matrix to assess analysis contamination	After initial calibration verification	Analytes <1/2 RL	Correct problem and repeat.	Apply B to all associated positives when less than 5X blank concentration
Continuing Calibration Blank (CCB)	Interference-free matrix to assess analysis contamination	Every 10 samples and at end of analytical sequence	Analytes <1/2 RL	Correct problem and repeat.	Apply B to all associated positives when less than 5X blank concentration
Continuing Calibration Verification (CCV)	Mid-level verification	Every 10 samples and at end of analytical sequence	90–110%	Correct problem and repeat.	N/A
Method Blank (MB)	Reagent Blank to assess method contamination	1 per sample batch	Analytes <1/2 RL	Re-digest and repeat.	Apply B to all associated positives when less than 5X blank concentration

TABLE C-2
Summary of Quality Objectives for Method 6010B – Inductively Coupled Plasma Atomic Emission Spectrometer (ICP) Metals
RCRA Facility Investigation, Fort Wingate, New Mexico

Quality Control Element	Description of Element	Frequency of Implementation	Acceptance Criteria	Corrective Action	Laboratory Flagging Criteria
Laboratory Control Sample (LCS) containing all analytes required to be reported, including surrogates	Interference-free matrix containing all target analytes	1 per sample batch	See limits in Appendix C, Table 1	Correct problem and repeat	If corrective action fails apply Q-flag to specific analyte(s) in all samples in the associated preparatory batch
MS/MSD containing all analytes required to be reported, including surrogates	Sample matrix spiked with all of target analytes prior to digestion	1 per sample batch	See limits in Appendix C, Table 1		For the specific analyte(s) in the parent sample, apply J-flag if acceptance criteria are not met.
Post Digestion Spike	When dilution test fails or analyte concentration in all samples <50 x MDL	As needed to confirm matrix effect	Recovery: 75–125%		Apply J-flag to all sample results (for same matrix) for specific analyte(s) for all samples associated with the post-digestion spike addition.
Serial Dilution	5X dilution analyzed to assess matrix effect	Each preparatory batch	Agreement between undiluted and diluted results within 10%		Flag associated positives with J.
Results between the MDL and RL					Apply a J-flag to all results between the MDL and RL.

TABLE C-3
Summary of Quality Objectives for Cold Vapor Atomic Absorption (CVAA) Mercury
RCRA Facility Investigation, Fort Wingate, New Mexico

Quality Control Element	Description of Element	Frequency of Implementation	Acceptance Criteria	Corrective Action	Laboratory Flagging Criteria
Initial Calibration	5 standards and blank	Daily	R ≥0.995	Correct problem and repeat.	
Method detection limit (MDL) study	At initial set-up and subsequently once per 12-month period;	MDL verification check once per quarter per instrument used	See 40 CFR 136B. MDL verification checks must produce a signal at least 3 times the instrument's noise level	Run MDL verification check at higher level and set MDL higher or re-conduct MDL study	Sample can not be analyzed without a valid MDL
Low-level calibration check standard	QC/RL: Low-level check standard at RL	At the beginning of every daily sequence	Within 20% of expected value	Correct problem and repeat.	No samples may be analyzed without a valid low-level calibration check standard.
ICV	Mid-level (2nd source) verification	After initial calibration	80–120%	Correct problem and repeat.	
ICB	Interference-free matrix to assess analysis contamination	After initial calibration	Analytes <1/2 RL	Correct problem and repeat	Apply B to all associated positives when less than 5X blank concentration
CCB	Interference-free matrix to assess analysis contamination	Every 10 samples and at end of analytical sequence	Analytes <1/2 MRL	Correct problem and repeat.	Apply B to all associated positives when less than 5X blank concentration
CCV	Mid-level verification	Every 10 samples and at end of analytical sequence	80–120%	Correct problem and repeat	
MB	Reagent Blank to assess method contamination	1 per sample batch	Analytes <1/2 RL	Re-prep and repeat	Apply B to all associated positives when less than 5X blank concentration
LCS	Interference-free matrix containing all target analytes	1 per sample batch	See limits in Appendix C, Table 1	Re-digest and repeat.	If corrective action fails apply Q-flag to specific analyte(s) in all samples in the associated preparatory batch
MS/MSD (pre-digested)	Sample matrix spiked with all of target analytes prior to digestion	1 per sample batch	See limits in Appendix C, Table 1		For the specific analyte(s) in the parent sample, apply J-flag if acceptance criteria are not met.

TABLE C-3
Summary of Quality Objectives for Cold Vapor Atomic Absorption (CVAA) Mercury
RCRA Facility Investigation, Fort Wingate, New Mexico

Quality Control Element	Description of Element	Frequency of Implementation	Acceptance Criteria	Corrective Action	Laboratory Flagging Criteria
Recovery Test	Sample digestate spiked	When dilution test fails or when analyte concentration is <25X MDL.	Recovery: 85–115%		For positive associated results where recovery is >125% or between 50-74%, flag with J. For non-detect associated results where recovery is between 50-74%, flag UJ. All results associated with an analyte recovery <30%, Q-flag.
Serial Dilution	5X dilution analyzed to assess matrix effect	Each preparatory batch	Agreement between undiluted and diluted results within 10%		Flag associated positives with J.
Results between the MDL and RL					Apply a J-flag to all results between the MDL and RL.

TABLE C-4
Summary of Quality Objectives for Method SW8270C – Semivolatiles and SW8260B - Volatiles
RCRA Facility Investigation, Fort Wingate, New Mexico

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Demonstrate acceptable analyst capability	Prior to using any test method and at any time there is a significant change in instrument type, personnel, or test method	QC acceptance criteria published by DoD, if available; otherwise method- specific criteria.	Recalculate results; locate and fix problem, then rerun demonstration for those analytes that did not meet criteria	N/A	This is a demonstration of ability to generate acceptable accuracy and precision using four replicate analyses of a QC check sample (for example, LCS or PT sample). No analysis shall be allowed by analyst until successful demonstration of capability is complete.
MDL study	At initial set-up and subsequently once per 12-month period; otherwise quarterly MDL verification checks shall be performed	See 40 CFR 136B. MDL verification checks must produce a signal at least 3 times the instrument's noise level.	Run MDL verification check at higher level and set MDL higher or re-conduct MDL study	N/A	Samples cannot be analyzed without a valid MDL.
Tuning	Prior to calibration and every 12 hours during sample analysis	Refer to method for specific ion criteria.	Retune instrument and verify. Rerun affected samples.	Flagging criteria are not appropriate	Problem must be corrected. No samples may be accepted without a valid tune.
Breakdown check (DDT Method 8270C only)	Daily prior to analysis of samples	Degradation **<**20% for DDT	Correct problem then repeat breakdown check	Flagging criteria are not appropriate	No samples shall be run until degradation 20%. Benzidine and pentachlorophenol should be present at their normal responses and no peak tailing should be observed.

TABLE C-4
Summary of Quality Objectives for Method SW8270C – Semivolatiles and SW8260B - Volatiles
RCRA Facility Investigation, Fort Wingate, New Mexico

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Minimum 5-point initial calibration for all analytes (ICAL)	Initial calibration prior to sample analysis	Method CCC and SPCC criteria must be met and one of the following options used: Option 1: Average RRF, RSD for each analyte ≤15%; Mean RSD may NOT be used Option 2: linear least squares regression r ≤0.995 Option 3: non-linear regression – coefficient of determination (COD) r2 0.99 (6 points shall be used for second order, 7 points shall be used for third order)	Correct problem then repeat initial calibration,	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until ICAL has passed.
Second source calibration verification	Once after each initial calibration	Value of second source for all analytes within ±20% of expected value (initial source)	Correct problem and verify second source standard. Rerun second source verification, If that fails, correct problem and repeat initial calibration.	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until calibration has been verified.
Retention time window position establishment for each analyte and surrogate	Once per ICAL	Position shall be set using the midpoint standard of the initial calibration curve.	N/A	N/A	

TABLE C-4
Summary of Quality Objectives for Method SW8270C – Semivolatiles and SW8260B - Volatiles
RCRA Facility Investigation, Fort Wingate, New Mexico

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Evaluation of relative retention times (RRT)	With each sample	RRT of each target analyte in each calibration standard within ±0.06 RRT units.	Correct problem, then rerun ICAL.	Flagging criteria are not appropriate.	
Calibration verification (CV)	Daily, before sample analysis, and every 12 hours of analysis time	Method CCC and SPCC criteria must be met Percent Difference/Drift ≤20% (Note: D = difference when using RRFs or drift when using least squares regression or non-linear calibration.)	Correct problem, then rerun CV. If that fails, repeat initial calibration.	Apply Q-flag if no sample material remains and analyte exceeds criteria.	
Internal standards verification	In all field samples and standards	Retention time ±30 seconds from retention time of the midpoint standard in the ICAL EICP area within -50% to +100% of ICAL midpoint standard	Inspect mass spectrometer and GC for malfunctions, Reanalysis of samples analyzed while system was malfunctioning is mandatory.	If corrective action fails in field samples, apply Q-flag to analytes associated with the non-compliant IS. Flagging criteria are not appropriate for failed standards.	Sample results are not acceptable without a valid IS verification.
Method blank	One per preparatory batch	No analytes detected >½ RL. For common laboratory contaminants, no analytes detected >RL.	Correct problem. If required, re-prep and reanalyze method blank and all samples processed with the contaminated blank.	Apply B-flag to all results for the specific analyte(s) in all samples in the associated preparatory batch when less than 5X blank concentration.	

TABLE C-4
Summary of Quality Objectives for Method SW8270C – Semivolatiles and SW8260B - Volatiles
RCRA Facility Investigation, Fort Wingate, New Mexico

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
LCS containing all analytes required to be reported, including surrogates	One LCS per preparatory batch	QC acceptance criteria specified Appendix C, Table 1	Correct problem, then re-prep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available	If corrective action fails, apply Q-flag to specific analyte(s) in all samples in the associated preparatory batch.	
MS containing all analytes required to be reported, including surrogates	One MS per preparatory batch per matrix (see box D-15)	For matrix evaluation, use QC acceptance criteria specified in Appendix C, Table 1	Contact the client as to additional measures to be taken.	For the specific analyte(s) in the parent sample, apply J-flag if acceptance criteria are not met.	For matrix evaluation only. If MS results are outside the LCS limits, the data shall be evaluated to determine the source of difference and to determine if there is a matrix effect or analytical error.
MSD or sample duplicate	One per preparatory batch per matrix	For matrix evaluation, use QC acceptance criteria specified in Appendix C, Table 1	Examine the project-specific DQOs. Contact the client as to additional measures to be taken.	For the specific analyte(s) in the parent sample, apply J-flag if acceptance criteria are not met.	The data shall be evaluated to determine the source of difference.

TABLE C-4
Summary of Quality Objectives for Method SW8270C – Semivolatiles and SW8260B - Volatiles
RCRA Facility Investigation, Fort Wingate, New Mexico

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Surrogate spike	All field and QC samples	QC acceptance criteria specified Appendix C, Table 1	For QC and field samples, correct problem, then reprep and reanalyze all failed samples for failed surrogates in the associated preparatory batch, if sufficient sample material is available.	For the specific analyte(s) in all field samples collected from the same site matrix as the parent, apply J-flag if acceptance criteria are not met. For QC samples, apply Q-flag to specific analyte(s) in all samples in the associated preparatory batch.	
Results reported between MDL and RL	N/A	N/A	N/A	Apply J-flag to all results between MDL and RL	

TABLE C-5
Summary of Quality Objectives for Method SW6850 or SW6860 - Perchlorate
RCRA Facility Investigation, Fort Wingate, New Mexico

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Demonstrate acceptable analyst capability	Prior to using any test method and at any time there is a significant change in instrument type, personnel, or test method	QC acceptance criteria published by DoD, if available; otherwise method- specific criteria.	Recalculate results; locate and fix problem, then rerun demonstration for those analytes that did not meet criteria	N/A	This is a demonstration of ability to generate acceptable accuracy and precision using four replicate analyses of a QC check sample (for example, LCS or PT sample). No analysis shall be allowed by analyst until successful demonstration of capability is complete.
MDL study	At initial set-up and subsequently once per 12-month period; otherwise quarterly MDL verification checks shall be performed	See 40 CFR 136B. MDL verification checks must produce a signal at least 3 times the instrument's noise level.	Run MDL verification check at higher level and set MDL higher or re-conduct MDL study	N/A	Samples cannot be analyzed without a valid MDL.
Level of Detection (LOD) and Level of Quantitation (LOQ)	Follow the DoD Quality Systems Manual Version 4.1, section D, boxes D-13 and D-14				
Minimum 5-point initial calibration for all analytes (ICAL)	Initial calibration prior to sample analysis	r ≥ 0.995 or RSD ≤ 20%	Correct problem then repeat initial calibration,	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until ICAL has passed. The calibration is linear and shall not be forced through the origin.
Second source calibration verification	Once after each initial calibration	Value of second source within ±15% of expected value	Correct problem and verify second source standard. Rerun second source verification, If that fails, correct problem and repeat initial calibration.	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until calibration has been verified.

TABLE C-5
Summary of Quality Objectives for Method SW6850 or SW6860 - Perchlorate
RCRA Facility Investigation, Fort Wingate, New Mexico

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Calibration verification (CCV)	Analysis of mid-level standard after every 10 field samples. All samples must be bracketed by the analysis of a standard.	Within ±15% of expected value	Correct problem, rerun calibration verification. If that fails, repeat ICAL. Reanalyze all samples since the last successful calibration verification.	If reanalysis cannot be performed, data must be qualified and explained in case narrative. Apply a Q-flag to all results since the last acceptable calibration verification.	Problem must be corrected. Results may not be reported without a valid CCV. Flagging is only appropriate in cases where the samples cannot be reanalyzed.
Limit of detection verification (LODV)	Prior to sample analysis and at the end of the analysis sequence. It can be analyzed after every 10 samples in order to reduce the reanalysis rate.	Within ±30% of expected value	Correct problem, rerun the LODV and all samples since the last acceptable LODV.	If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to all results since the last acceptable LODV.	Problem must be corrected. Results may not be reported without a valid LODV. Flagging is only appropriate in cases where the samples cannot be reanalyzed Perchlorate spike concentration is approximately 2 times the limit of detection.
Isotope ratio $^{35}Cl/^{37}CL$	Every sample, batch QC, and standard.	Monitor for either the parent ion at masses 99/101 or the daughter ion at masses 83/85 depending on which ions are quantitated. Theoretical ratio ~ 3.06. Must fall within 2.3 to 3.8.	If criteria are not met, sample must re rerun. If the sample was not pretreated, the sample should be reextracted using cleanup procedures. If, after cleanup, the ratio still falls, use alternative techniques to confirm presence of perchlorate (i.e., a post spike or dilution to reduce interference).	Apply J-flag if acceptance criteria not met.	Document in case narrative.

TABLE C-5
Summary of Quality Objectives for Method SW6850 or SW6860 - Perchlorate
RCRA Facility Investigation, Fort Wingate, New Mexico

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Internal standard (IS)	Addition of ^{18}O-labeled perchlorate to every sample, batch QC sample, standard, instrument blank, and method blank.	Measured ^{18}O IS area within ± 50% of the value from the average of the IS area counts of the ICAL. Relative retention time of the perchlorate ion must be 1.0 ± 2% (0.98-1.02).	Rerun the sample at increasing dilutions until the ± 50% acceptance criteria are met. If criteria cannot be met with dilution, interference is suspected and the sample must be reprepped sing additional pretreatment steps.	Apply Q-flag and discuss in the case narrative.	If peak is not within retention time window, presence is not confirmed. Use for quantitation and to ensure identification. Failing IS should be documented in case narrative.
Interference threshold study	At initial setup and when major changes occur in the method operating procedures (e.g., addition of cleanup procedures, column changes, mobile phase changes).	Measure the threshold of common suppressors (chloride, sulfate, carbonate, bicarbonate) that can be present in the system without affecting the quantitation of perchlorate. The threshold is the concentration of the common suppressors where perchlorate recovery falls outside an 85-115% window.	NA	NA	
Laboratory reagent blank	Prior to calibration, after samples over ICAL range, and at the end of the analytical sequence.	No perchlorate detected >½ RL.	Reanalyze reagent blank (until no carryover is observed) and all samples processed since the contaminated blank.	If re-analysis cannot be performed, apply B-flag to specific analyte(s) in all samples in the associated preparatory batch.	Flagging is only appropriate in cases where the samples cannot reanalyzed.

TABLE C-5
Summary of Quality Objectives for Method SW6850 or SW6860 - Perchlorate
RCRA Facility Investigation, Fort Wingate, New Mexico

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Tuning	Prior to ICAL and after any mass calibration or maintenance performed.	Tune standards must contain the analytes of interest and meet method acceptance criteria.	Retune instrument. If tuning does not meet criteria, an instrument mass calibration must be performed and the tuning redone.	NA	
Method blank	One per preparatory batch	No perchlorate detected >½ RL.	Correct problem. If required, re-prep and reanalyze method blank and all samples processed with the contaminated blank	Apply B-flag to all results for perchlorate in all samples in the associated preparatory batch.	Flagging is only appropriate in cases where the samples cannot reprepped.
LCS containing all analytes required to be reported, including surrogates	One LCS per preparatory batch	Recovery within 80-120%	Correct problem, then re-prep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available	If re-analysis cannot be performed, apply Q-flag to specific analyte(s) in all samples in the associated preparatory batch.	Flagging is only appropriate in cases where the samples cannot reprepped.
MS containing all analytes required to be reported, including surrogates	One MS per preparatory batch per matrix	Recovery within 80-120%	Contact the client as to additional measures to be taken.	For the specific analyte(s) in the parent sample, apply J-flag if acceptance criteria are not met.	For matrix evaluation only. If MS results are outside the LCS limits, the data shall be evaluated to determine the source of difference and to determine if there is a matrix effect or analytical error.

TABLE C-5
Summary of Quality Objectives for Method SW6850 or SW6860 - Perchlorate
RCRA Facility Investigation, Fort Wingate, New Mexico

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
MSD or sample duplicate	One per preparatory batch per matrix	MSD Recovery within 80-120% MS/MSD or laboratory duplicate: 15% RPD.	Examine the project-specific DQOs. Contact the client as to additional measures to be taken.	For the specific analyte(s) in the parent sample, apply J-flag if acceptance criteria are not met.	The data shall be evaluated to determine the source of difference.
Results reported between MDL and LOQ	Positive detections calculated per the method.	N/A	N/A	Apply J-flag to all results between MDL and LOQ.	

TABLE C-6
Summary of Quality Objectives for Method SW8330B Explosive Soil
RCRA Facility Investigation, Fort Wingate, New Mexico

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Demonstrate acceptable analyst capability	Prior to using any test method and at any time there is a significant change in instrument type, personnel, or test method	QC acceptance criteria published by DoD, if available; otherwise method- specific criteria.	Recalculate results; locate and fix problem, then rerun demonstration for those analytes that did not meet criteria	N/A	This is a demonstration of ability to generate acceptable accuracy and precision using four replicate analyses of a QC check sample (for example, LCS or PT sample). No analysis shall be allowed by analyst until successful demonstration of capability is complete.
MDL study	At initial set-up and subsequently once per 12-month period; otherwise quarterly MDL verification checks shall be performed	See 40 CFR 136B. MDL verification checks must produce a signal at least 3 times the instrument's noise level.	Run MDL verification check at higher level and set MDL higher or re-conduct MDL study	N/A	Samples cannot be analyzed without a valid MDL.
Level of Detection (LOD) and Level of Quantitation (LOQ)	Follow the DoD Quality Systems Manual Version 4.1, section D, boxes D-13 and D-14				
Soil drying Procedure	Each sample and batch LCS	Laboratory must have a procedure to determine when the sample is dry to constant weight. Record date, time, and ambient temperature on a daily basis while drying samples.	NA	NA	

TABLE C-6
Summary of Quality Objectives for Method SW8330B Explosive Soil
RCRA Facility Investigation, Fort Wingate, New Mexico

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Soil sieving procedure	Each sample and batch LCS	Weigh entire sample. Sieve entire sample with a 10 mesh sieve. Breakup pieces of soil with gloved hands. Do not intentionally include vegetation in the portion of the sample that passes through the sieve unless this is a project specific requirement. Collect and weigh any portion unable to pass through the sieve.	NA	NA	
Soil grinding procedure	Initial demonstration.	The laboratory must initially demonstrate that the grinding procedure is cable of reducing the particle size to < 75µm by passing representative portions of ground sample through a 200 mesh sieve (ASTM E11).	NA	NA	

TABLE C-6
Summary of Quality Objectives for Method SW8330B Explosive Soil
RCRA Facility Investigation, Fort Wingate, New Mexico

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Soil grinding blank	Between each sample.	A grinding blank using clean solid matrix (such as Ottawa sand) must be prepared (e.g. ground and subsamples) and analyzed in the same manner as the field sample. Grinding blanks can be analyzed individually or composited. No target analytes detected > ½ RL.	All blank results must be reported and the affected samples must be flagged accordingly if blank criteria are not met.	Apply a B-flag to all samples associated with the grinding blank.	
Soil subsampling process	Each sample, duplicate, and batch LCS.	Entire ground sample is mixed, spread out on a large flat surface (e.g. baking tray) and 30 or more randomly located increments are removed from the entire depth to sum ~ 10g subsample.	NA	NA	
Minimum 5-point initial calibration for all analytes (ICAL)	Initial calibration prior to sample analysis. Lowest standard must be at or below the RL.	r ≥ 0.995 or if using internal standardization RSD ≤ 15%. The signal-to- noise ration of the RL must be at least 5:1.	Correct problem then repeat initial calibration,	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until ICAL has passed. The calibration is linear and shall not be forced through the origin.
Second source calibration verification	Once after each initial calibration	Value of second source within ±20% of expected value	Correct problem and verify second source standard. Rerun second source verification, If that fails, correct problem and repeat initial calibration.	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until calibration has been verified.

TABLE C-6
Summary of Quality Objectives for Method SW8330B Explosive Soil
RCRA Facility Investigation, Fort Wingate, New Mexico

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Calibration verification (CCV)	Prior to sample analysis and after every 10 field samples. All samples must be bracketed by the analysis of a standard.	Within ±20% of expected value	Correct problem, rerun calibration verification. If that fails, repeat ICAL. Reanalyze all samples since the last successful calibration verification.	If reanalysis cannot be performed, data must be qualified and explained in case narrative. Apply a Q-flag to all results since the last acceptable calibration verification.	Problem must be corrected. Results may not be reported without a valid CCV. Flagging is only appropriate in cases where the samples cannot be reanalyzed.
Method blank	One per preparatory batch	No analyte detected >½ RL.	Correct problem. If required, re-prep and reanalyze method blank and all samples processed with the contaminated blank.	Apply B-flag to all results for analyte in all samples in the associated preparatory batch.	Flagging is only appropriate in cases where the samples cannot reprepped.

TABLE C-6
Summary of Quality Objectives for Method SW8330B Explosive Soil
RCRA Facility Investigation, Fort Wingate, New Mexico

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
LCS containing all analytes required to be reported	One LCS per preparatory batch	A solid reference material containing all reported analytes must be prepared (e.g. ground and subsamples) and analyzed in exactly the same manner as a field sample. In-house laboratory control limits must demonstrate the laboratory's ability to meet the method quality objectives.	Correct problem, then re-prep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available	If re-analysis cannot be performed, apply Q-flag to specific analyte(s) in all samples in the associated preparatory batch.	Flagging is only appropriate in cases where the samples cannot reprepped.
MS containing all analytes required to be reported, including surrogates	One MS per preparatory batch per matrix	For matrix evaluation only, therefore, is taken post grinding from the same ground sample as parent subsample taken, percent recovery must meet the LCS limits.	Contact the client as to additional measures to be taken.	For the specific analyte(s) in the parent sample, apply J-flag if acceptance criteria are not met.	For matrix evaluation only. If MS results are outside the LCS limits, the data shall be evaluated to determine the source of difference and to determine if there is a matrix effect or analytical error.

TABLE C-6
Summary of Quality Objectives for Method SW8330B Explosive Soil
RCRA Facility Investigation, Fort Wingate, New Mexico

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
MSD or sample duplicate	One per preparatory batch per matrix	Same as MS. MS/MSD or laboratory duplicate: 20% RPD.	Examine the project-specific DQOs. Contact the client as to additional measures to be taken.	For the specific analyte(s) in the parent sample, apply J-flag if acceptance criteria are not met.	The data shall be evaluated to determine the source of difference.
Confirmation analysis	100% for all positive results	Calibration and QC criteria same for initial or primary analysis. Results between the primary and secondary column RPD ≤40%	Report from both columns	If there is a > 40% RPD between the two column results, data must be J-flagged.	Second column must be capable of resolving all of the analytes of interest and must have a different retention time order relative to the primary column.
Results reported between MDL and LOQ	Positive detections calculated per the method.	N/A	N/A	Apply J-flag to all results between MDL and LOQ.	

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APPENDIX D

Data Validation Guidance Criteria

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TABLE D-1
Data Qualifying Conventions – General
RCRA Facility Investigation

QC Requirement	Criteria	Flag	Flag Applied To
Holding Time	Time exceeded for extraction or analysis	J for the detected results; R or UJ for non-detected results*	All analytes in the sample
Sample Preservation	Sample not preserved (If sample preservation was not done in the field but was performed at the laboratory upon sample receipt, no flagging is required)	J for detected results; R or UJ for non-detected results*	Sample
	Temperature out of control	J for detected results; R or UJ for non-detected results*	Sample
Instrument Tuning	Ion abundance method-specific criteria not met	R all results	All associated samples in analysis batch
Initial Calibration	All analytes must be within method specified criteria (reference Appendix D tables)	J detected results; R for non-detected results	All associated samples in analysis batch
Second Source Check or Continuing Calibration	All analytes must be within method specified criteria (reference Appendix D tables)	High Bias: J for detected results, no flag for non-detected results Low Bias: J for detected results, UJ for non-detected results R for non-detected results greater than twice the control criteria	All associated samples in analysis batch
Low Level Calibration Check or Interference Check Sample	All analytes must be within 20% of expected value	High Bias: J for detected results, no flag for non-detected results Low Bias: J for detected results, UJ for non-detected results R for non-detected results greater than twice the control criteria	All associated samples in analysis batch
LCS	%R > UCL %R < LCL	J for detected results J for detected results, R for non-detected results	The specific analyte(s) in all samples in the associated preparation or analytical batch, whichever applies

TABLE D-1
Data Qualifying Conventions – General
RCRA Facility Investigation

QC Requirement	Criteria	Flag	Flag Applied To
Internal Standards	Area > UCL Area < LCL Sample is re-extracted AND reanalyzed AND recovery outside of criteria is confirmed as a matrix effect	J for detected results, R or UJ for non-detected results* J for detected results J for positive results, UJ for non-detected results	Sample
Surrogate Spikes	%R > UCL %R < LCL and >10% %R <10% Excessive dilution*	J for detected results J for detected results, UJ for non-detected results J for detected results, R for non-detected results No flag required	Sample
Blanks (Method, Equipment or Trip)	Analyte(s) detected >½ RL (use the blank of the highest concentration)	U for positive sample results ≤5x highest blank concentration (10x for common lab contaminants)[1]	All samples in preparation, field or analytical batch, whichever one applies
Field duplicates	RPD > control limit and field duplicates >RLs or one field duplicate >RL, one non-detect	J detected results UJ for the non-detected results	The specific analyte(s) in all samples collected on the same sampling date. **Note:** No flagging is required for RPDs based on "J"-flagged results between the MDL and RL.
MS/MSD	MS or MSD %R > UCL or MS or MSD %R < LCL or MS/MSD RPD > control limit Sample concentration > 4x spike concentration Excessive dilution*	J for detected results J for detected results; UJ for non-detected results J for detected results No flag required	The specific analyte(s) in the parent sample
Post-Digestion Spike	All analytes must be within 25% of expected value	High Bias: J for detected results Low Bias: J for detected results, UJ for non-detected results	The specific analyte(s) in the parent sample

TABLE D-1
Data Qualifying Conventions – General
RCRA Facility Investigation

QC Requirement	Criteria	Flag	Flag Applied To
Serial Dilutions	All analytes must be within 10% of expected value	If post spike not analyzed High bias: J for detected results Low bias: J for detected results; UJ for non-detected results	The specific analyte(s) in the parent sample
Confirmation	RPD between primary and confirmation results > 40%	J for detected results	Sample
Retention Time Window	Analyte within established window	R for all results	Sample

Notes:

[1]If the sample concentration is > MDL < RL, qualified as non-detect at the RL and flag "U". If the sample concentration is > RL, qualify as non-detect at the detected result and flag "U".

* = Based on analyte-specific review

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APPENDIX D

Investigation Derived Waste Management Plan

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Final

Investigation-Derived Waste Management Plan

RCRA Facility Investigation for Parcel 23 Fort Wingate Depot Activity, McKinley County, New Mexico

Prepared for

U.S. Army Corps of Engineers
Fort Worth District
819 Taylor Street
Room 3A12
Fort Worth, TX 76112

Contract No. GS-10F-0029M
Contract Task Order No. W9126G-08-F-0070

April 2010

Prepared by

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Final

Investigation-Derived Waste Management Plan

Submitted to

U.S. Army Corps of Engineers Fort Worth District

April 2010

CH2MHILL

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Contents

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Acronyms

AOC	Area of Concern
BEC	Base Realignment and Closure Plan Environmental Coordinator
BRAC	Base Realignment and Closure Plan
CFR	Code of Federal Regulations
DOT	U.S. Department of Transportation
EPA	U.S. Environmental Protection Agency
FWDA	Fort Wingate Depot Activity
IDW	investigation-derived waste
kg	kilogram(s)
LDR	Land Disposal Restriction
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
PPE	personal protective equipment
RCRA	Resource Conservation and Recovery Act
SQG	Small Quantity Generator
SWMU	Solid Waste Management Unit
TSD	treatment, storage, and disposal
USACE	U.S. Army Corps of Engineers

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1.0 Introduction

This Investigation-Derived Waste (IDW) Management Plan provides guidance regarding general requirements for management of IDW generated during the site investigations and remedial activities at Fort Wingate Depot Activity (FWDA).

FWDA is an inactive U.S. Army depot whose former mission was to receive, store, maintain, and ship assigned materials (primarily explosives and military munitions), and to dispose of obsolete or deteriorated explosives and military munitions. The active mission of FWDA ceased, and the installation closed in January 1993. FWDA has been undergoing final environmental restoration prior to property transfer/reuse.

Investigation and remediation activities will be conducted at Solid Waste Management Unit (SWMU) 21, which is potentially affected by historical operations.

Investigations and remedial activities at FWDA will generate IDW, such as potentially contaminated soil, sediment, and groundwater; equipment decontamination fluids; disposable sampling equipment; used personal protective equipment (PPE); and general refuse. Proper management of this IDW, as specified in this plan, is required to ensure compliance with federal, state, and Army regulations applicable to the collection, storage, transport, and disposal of potentially hazardous materials. Required IDW management measures for FWDA investigations or remedial activities will be waste segregation, containerization and labeling, temporary storage, waste characterization, and disposal.

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2.0 IDW Segregation

Process knowledge for SWMU 21 such as historical operational records, previous analytical data, and field screening results obtained during an investigation or remedial action will be utilized when available to segregate potentially hazardous IDW from that likely to be nonhazardous. These preliminary categorizations of IDW will only be qualitative; the application of process knowledge is intended to minimize costs associated with the handling, transportation, and disposal of wastes.

IDW generated from SWMU 21 will initially be segregated according to whether the material is solid or liquid. Solid IDW will be further segregated into one of three waste types—soil and sediment, sampling equipment and PPE, or general refuse.

Soil and sediment includes material extracted during the completion of subsurface soil borings, trenches, and other excavations; soil cuttings from the installation of groundwater monitoring wells; and excess soil and sediment sample media collected with hand tools or machinery. Sampling equipment includes disposable soil-coring devices, monitoring well bailers, and bailer rope or twine in direct contact with sample media. PPE includes disposable gloves, coveralls, and respirator cartridges worn by field personnel. General refuse includes items such as waste paper, boxes, and miscellaneous containers.

Liquid IDW will be further segregated into one of two waste types—groundwater or decontamination fluids. Groundwater includes monitoring well development and presample purge water. Decontamination fluids include muddy water, detergents, rinse water, and laboratory-grade solvents used to decontaminate nondisposable sampling equipment and PPE.

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3.0 IDW Containerization and Labeling

Soil and sediment IDW will be placed in open-head drums or roll-off containers. Used, nondecontaminated, sampling equipment and PPE will be disposed of in polyethylene trash bags that will be placed in removable-head drums. Liquid IDW will be placed in open-head drums or portable tanks. All drums and tanks will conform to United Nations Performance-Oriented Packaging standards and U.S. Department of Transportation (DOT) specifications in 49 Code of Federal Regulations (CFR) 178. General refuse and decontaminated sampling equipment and PPE will be placed in polyethylene trash bags or other suitable containers.

A label reading "Caution: This Drum/Container May Contain Hazardous Material" or similar will be affixed to each container of IDW.

Each drum, roll-off, or portable tank containing IDW will be labeled with a unique 10-character identifier. The first two characters are "FW," the second two are the SWMU number, the next four are the Julian date on which filling commenced, and the last two are the consecutive number of the container among all being filled on a given day.

Example Identifier:

FW21264801 is:

FW	Fort Wingate Depot Activity
21	SWMU 21 (Building 600)
264	26 April
8	2008
01	Container 01

The label also will indicate the contents (for example, soil, sediment, sampling equipment, PPE, groundwater, and decontamination fluids), source (for example, soil or sediment sample numbers, soil boring numbers, and monitoring well numbers), and the date on which filling is completed (such as, the 90-day start date).

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4.0 Temporary Storage

Small IDW containers such as drums and tanks will be transported to and accumulated at a 90-day holding area within 3 days of the date that project activities are completed. Bulk IDW containers such as roll-off containers will be covered and secured at their respective staging area. A less-than-90-day holding area has been established at Building 5, situated in the Administration Area of FWDA, in accordance with U.S. Environmental Protection Agency (EPA) regulations in 40 CFR 262.34(a), 40 CFR 265.16, 40 CFR 265.111, 40 CFR 265.114, and 40 CFR 265.170-178 (Subpart I). The FWDA Base Realignment and Closure Plan (BRAC) Environmental Coordinator (BEC) will be contacted for access to the holding area.

Currently, FWDA is considered a Small Quantity Generator (SQG), which places restrictions on the amount of hazardous material that can be shipped offsite and stored onsite. Under the SQG status, FWDA can ship up to 1,000 kilograms (kg) per month offsite and can store up to 6,000 kg onsite (awaiting disposal). Based on a 55-gallon drum of water weighing 459 pounds, this translates into a shipping capacity of roughly five drums of water per month (or 264 gallons per month); storage capacity would be roughly 29 drums of water (or 1,585 gallons). Additionally, based on a 55-gallon drum of soil weighing 735 pounds, this translates into a shipping capacity of roughly 3 drums of soil per month, storage capacity of roughly 18 drums of soil.

Inventory forms will be completed for all IDW containers placed at the less-than-90-day holding area. Information on the form will be verified with respect to container labeling. Copies of inventory forms will be provided to the FWDA BEC. An example inventory form is provided on the following page.

FORT WINGATE
CARETAKERS
90-DAY FACILITY CHECK SHEET

CONT. NUMBER	NOMENCLATURE DESCRIPTION	START DATE	CHARACTERIZATION STATUS

CARETAKER SIGNATURE:______________________________ DATE:______________

5.0 IDW Characterization

5.1 IDW Sampling

Representative samples will be collected for each container of soil/sediment, groundwater, or decontamination fluids, consisting of a composite of the material, to characterize IDW for disposal as hazardous, special, or nonhazardous waste. Characterization results for these media will serve to classify associated sampling equipment and PPE for disposal, unless this PPE and equipment were decontaminated prior to disposal, in which case the PPE and equipment will be handled as general refuse. Samples could be collected because containers are filled at the SWMU or Area of Concern (AOC) or within 5 days of transfer to the less than 90-day holding area, and analytical results shall be provided within 10 days of sampling.

A complete list of waste characterization parameters and analytical methods approved by the EPA is published in *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods* (SW-846). Process knowledge will be used to evaluate the physical state of the IDW to determine which specific parameters will be required to properly characterize waste generated from a given SWMU or AOC.

Upon receipt of waste characterization results, copies will be provided to the FWDA BEC and U.S. Army Corps of Engineers (USACE) Technical Manager. Additionally, inventory forms at the 90-day holding area will be updated with IDW classifications and applicable EPA waste codes.

5.2 IDW Classification

IDW will be classified as hazardous waste if the material exhibits the characteristics of ignitibilty, corrosivity, reactivity, or toxicity as listed by EPA in 40 CFR 261.20-24 (Subpart C).

Solid IDW not classified as hazardous waste will be classified as special waste if the material is listed as such by the New Mexico Environment Department (NMED) in 20 New Mexico Administrative Code (NMAC) 9.1.

IDW will be classified as nonhazardous waste if potential contaminants are not detected or are detected at concentrations less than applicable regulatory limits.

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6.0 IDW Disposal

All IDW will be manifested and transported offsite within 30 days of receipt of results of characterization samples or within 90 days of placement at the temporary holding area, whichever is less. No IDW containers will be stored beyond 90 days at the holding area, unless the FWDA BEC grants an extension.

6.1 Hazardous Waste

IDW classified as hazardous waste will be disposed of offsite at a Resource Conservation and Recovery Act (RCRA) Subtitle C permitted treatment, storage, and disposal (TSD) facility. Prior to transport, containers of will be labeled according to DOT regulations in 49 CFR 172. Additionally, those containers with a capacity of 110 gallons or less will be labeled as follows:

HAZARDOUS WASTE - Federal Law Prohibits Improper Disposal. If found, contact the nearest police or public safety authority or the U.S. Environmental Protection Agency.
Generator's Name and Address ________________________________
Manifest Document Number ___________________________________

This labeling will be displayed in accordance with DOT requirements in 49 CFR 172.304.

Manifests will be prepared according to EPA requirements in 40 CFR 262.20. Acquisition, copies, and use of the manifest will be in accordance with EPA requirements in 40 CFR 262.21-23. The FWDA BEC will sign the manifest as the generator. The transporter, who will be fully licensed and insured to transport hazardous waste, will then sign the manifest, and a copy will be provided both the FWDA BEC and USACE Technical Manager. Inventory forms at the less-than-90-day storage area will be annotated with the transport date and manifest number.

Concurrent with the manifest, a Land Disposal Restriction (LDR) will be prepared in accordance with EPA requirements in 40 CFR 268.7 and will be submitted for review and signature by the FWDA BEC. The signed LDR will accompany each shipment of hazardous waste and will serve as notification to the receiving TSD facility of any requirements for treatment prior to land disposal.

6.2 Special Waste

IDW classified as special waste will be disposed of offsite at a solid waste landfill authorized for disposal of such material. Containers will be labeled, manifested, and transported in accordance with NMED requirements in 20 NMAC 9.1 (Subpart VII). Requirements for manifest signatures, distribution of copies, and annotation of inventory forms in the less-than-90-day storage area will be the same as those for hazardous waste.

6.3 Nonhazardous/Nonregulated Waste

Soil/sediment IDW classified as nonhazardous waste will be shipped to a landfill authorized for disposal of such material. Nonhazardous sampling equipment, PPE, and general refuse could be disposed of in FWDA trash receptacles, or transported offsite for disposal as municipal waste if large quantities of material are generated. Liquid IDW classified as nonhazardous waste will be transported offsite to a TSD facility approved for disposal of such material.

APPENDIX E

Comments Response Table

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Comment Response Table							
for							
Final, RCRA Facility Investigation Work Plan, Parcel 23							
USACE, Ft. Worth District, Contract GS-10F-0029, - FINAL for NMED REVIEW (27 April 2009)							
Response Code: A = **A**gree with comment C = Comment requires **C**larification from commenter D = **D**isagree with comment E = **E**xplanation provided							
Comment Number	**Commenter**	**Page(s)**	**Section**	**Line(s)**	**Comment**	**Response Code**	**Response**
1	NMED	4-1	4.2.2	34-37	In Section 4.2.2 (Sampling Data), page 4-1, lines 34-37, the Permittee states "[i]f a NMED Residential SSL was not available for a specific compound then the compound was compared to the EPA Region 6 Residential Human-Health Medium Specific Screening Levels (HHMSSLs)." The most recent HHMSSLs have been replaced by EPA's Regional screening levels (RSLs), which can be found at http://www.epa.gov/earth1r6/6pd/rcra_c/pd-n/screen.htm. The Permittee must revise the Work Plan to incorporate this change.	**A**	**The Work Plan was revised to incorporate the most recent (December 2009) EPA Regional Screening Levels (RSLs). The change was documented in work plan sections 4.2.2 and 4.3 and in the historical investigation data tables 5-1A through 5-1H in section 5.**
2	NMED		Appendix D		The Permittee included a Health and Safety Plan in Appendix D. While Permit Attachment 4, Section 4.1.2, requires a Health and Safety plan, the plan is required to be developed and submitted as a stand-alone document. The Permittee must remove it from the revised Work Plan, and all future document submittals.	**A**	**The Health and Safety Plan was removed from the Work Plan.**
3	NMED	5-11	5.4		In Section 5.4 (Scope of Activities), page 5-11, the Permittee proposes to collect soil samples from boreholes in and near SWMU 21 (Central Landfill), but not investigate groundwater. The Permittee must propose to install at least one monitoring well downgradient of SWMU 21 near the arroyo. The Permittee must include RCRA metals, SVOCs, pesticides, explosives, perchlorate, volatile organic compounds (VOCs), semi volatile organic compounds (SVOCs), gasoline range organics (GRO) and diesel range organics (DRO extended) in the groundwater analytical suite. The Permittee must revise the Work Plan to include the installation of the well, the proposed sampling details, and a figure that depicts the proposed well location.	**E**	**It is proposed that four of the soil boring locations (SB01, SB03, SB05, and SB07) be advanced to the water table or to drilling refusal if the water table is not encountered. In addition to the sampling proposed in the Work Plan, one additional soil sample will be collected from each of the four soil borings at the water table or at the bottom of the borehole if the water table is not encountered before drilling refusal. The soil samples will be sampled for RCRA metals, VOCs, SVOCs, TPH-GRO, TPH-DRO, pesticides, explosives, and perchlorate.** **Based on the bedrock surface elevation map, no alluvial groundwater is believed to exist in the vicinity of SWMU 21 (*Supplemental Goundwater Investigation – Administration and TNT Leaching Bed Areas, Fort Wingate Depot Activity*. Terranear PMC, March 24, 2006). The need for installation of a groundwater monitoring well and an appropriate location will be evaluated using a phased approach with the results of the soil boring investigation. If no alluvial groundwater is encountered during the soil boring investigation, then a well will not be installed at this location.**

Comment Response Table							
for							
Final, RCRA Facility Investigation Work Plan, Parcel 23							
USACE, Ft. Worth District, Contract GS-10F-0029, - FINAL for NMED REVIEW (27 April 2009)							
Response Code: A = **A**gree with comment C = Comment requires **C**larification from commenter D = **D**isagree with comment E = **E**xplanation provided							
Comment Number	**Commenter**	**Page(s)**	**Section**	**Line(s)**	**Comment**	**Response Code**	**Response**
							As discussed during the March 17, 2010 conference call with NMED, a monitoring well will be installed if alluvial groundwater is encountered during the soil boring investigation. **These changes are documented in work plan sections 5.4.1 and 5.4.2.**
4	NMED	5-11	5.4.1	13	In Section 5.4.1(Borehole Installation and Soil Sampling), page 5-11, line 13, the Permittee states that "[s]ample locations, depths, and analytical parameters are summarized in Table 5-3." The Permittee did not include sample depths or sample locations in Table 5-3. The Permittee must revise the table accordingly in the revised Work Plan.	**A**	**As described on page 5-11 lines 20-22 and in Section 4.4.6, the Sample ID includes the sample location and sample depth. However, for clarification Table 5-2 has been revised to include additional columns for the sample depths and locations. Additionally, the sample locations are shown on Figure 5-5.**
5	NMED	5-11 and 5-13	5.4.1		In Section 5.4.1(Borehole Installation and Soil Sampling), pages 5-11 & 5-13, the Permittee briefly discusses soil investigations. The Permittee does not address in sufficient detail the decontamination activities or lithologic characterization. The Permittee must include detailed investigation methods for the proposed sampling at Parcel 23. The Permittee should refer to the RFI Work Plan for Parcel 22, dated September 18, 2009, Section 10 (Investigation Methods) and to the guidance provided in Attachment 1, for a better understanding of the level of detail required in the revised Work Plan.	**E**	**Soil investigation activities are described in detail in Section 4 (Investigation Methods), in the QAPP (Appendix C) and the Investigation-Derived Waste Management Plan (Appendix E). Section 4 of this Work Plan is similar to Section 10 of the RFI Work Plan for Parcel 22.** **Additional detail has been added to Sections 5.4.1 and 5.4.2 of the work plan to describe the soil and groundwater sampling procedures. Decontamination procedures are described in detail in Section 4.4.10.**
6	NMED		5.0		In Section 5.0, Tables 5-1B through 5-1H include constituents that are non-detects (ND). The Permittee must remove all non-detects from the summary tables and include only data with detects or data quality exceptions that may mask detections. The Permittee must also include a column that shows the sampling depths for the results reported in all applicable soil data summary tables. These changes must be included in the revised Work Plan and must be applied to future work plan submittals.	**A**	**Tables 5-1B through 5-1H have been revised so that they do not include constituents that are non-detect.**

Comment Response Table							
for							
Final, RCRA Facility Investigation Work Plan, Parcel 23							
USACE, Ft. Worth District, Contract GS-10F-0029, - FINAL for NMED REVIEW (27 April 2009)							
Response Code: A = **A**gree with comment C = Comment requires **C**larification from commenter D = **D**isagree with comment E = **E**xplanation provided							
Comment Number	**Commenter**	**Page(s)**	**Section**	**Line(s)**	**Comment**	**Response Code**	**Response**
7	NMED	6-5	6.3.2	2-4	In Section 6.3.2 (Soil Sampling), page 6-5, lines 2-4, the Permittee states that "[f]our multi-incremental (MI) surface soil samples were collected at each of the two AOC 73 sub-locations for a total of eight samples, as shown in Figure 6-2." The Permittee also states that "[e]ach MI sample consisted of 10 individual sample locations taken from a sampling grid covering one-quarter of the footprint of the former building location and then composited into one MI sample." Based on the dimensions of Buildings T-332 and T-333, the Permittee did not collect a representative number of subsurface soil samples to determine if contamination is present. Additionally, the collection of ten individual samples is not in accordance with the MI sampling method. As stated in EPA method 8330B "[t]o reduce the influence of these sources of error in the estimate of the mean concentration for a decision unit, the collection of a 1 kg or larger sample comprised of 30 or more evenly spaced soil aliquots of the top 2.5 to 5.0 cm of the ground surface is recommended." The Permitee must revise the Work Plan and propose to collect 30 soil samples from each decision unit from depths of 0-6 inches and 6-12 inches below ground surface, resulting in two MI soil samples containing a minimum of 30 subsamples per decision unit. The revised Work Plan must also state that soil samples will be analyzed for TAL metals and explosives.	**A**	**The MI sample was collected within the footprint of the former temporary buildings. The site is similar to AOC 79 (temporary building). Additional clarification will be added to the text about the location of the sample. Since the MI sample collected did not have any positive detections for explosives and this was a former open storage site, the Army believes additional MI sampling is not warranted. Going forward, the Army recommends that the MI decision unit size be 0.25 acre, an area consistent with the size of a residential lot.** **As described in section 13.2.1 of USACE, October 2007, Report of Investigation for Potential Environmental Areas of Concern, Ft. Wingate Depot Activity, NM, many sites similar to this have been sampled across the facility and no releases have been identified.** **As discussed during the March 17, 2010 conference call with NMED, MI samples will be collected from each of the eight decision units at AOC 73 to confirm the results of the Release Assessment. A total of 16 MI samples will be collected in AOC 73. One hundred subsamples will be collected from each decision unit, 50 subsamples from 0- to 6-inches below ground surface and 50 subsamples from 6- to 12-inches below ground surface. The samples will be analyzed for RCRA Metals and Explosives.** **These changes are documented in Section 6.4 of the work plan.**

Comment Responses Table
Tribal Draft RCRA Facility Investigation Work Plan for Parcel 23 February 2009

This work plan describes how the USACOE proposes to characterize release to soil from a former landfill (SWMU 23) and propose AOC 73 for no further action (NFA).

Cmt. No.	Section No./Paragraph No.	Comment	Recommendation	Response
Commenter: Zuni Pueblo ***CH2M HILL Respondent: Jeff Johnston***				
1	Tribal Draft RCRA Facility Investigation Work Plan for Parcel 23	This work plan meets all requirements of the permit and when implemented as described will result in data of known quality and support the characterization of releases from a former landfill to soil.	None.	Comment acknowledged.
2	Page 5-11, Section 5.4	We concur with the scope of activities proposed. When the scope is implemented as described it will result in a characterization of release to soil in SWMU 23.	None.	Comment acknowledged.
3	Page 6-5, Section 6.3.5	We concur with the NFA recommendation for AOC 73.	None	Comment acknowledged.
4	Appendix C QAPP, Contents	1.5.3 section name should be "RCRA Facility Investigation Report"	See comment	Section 1.5.3 in the table of contents will be corrected to read "RCRA Facility Investigation Report".
5	Appendix C QAPP, Contents	Table 1-1 name should be "RCRA Facility Investigation Schedule"	See comment	The citation for Table 1-1 in the table of contents will be corrected to read "RCRA Facility Investigation Schedule".
6	Appendix C QAPP, Contents	Table page numbers incorrect	Page numbers should be: Table 1-1 page 1-3, Table 1-2 page 1-5, Table 2-1 page 2-2	The table page numbers listed in the Table of Contents will be corrected to read: Table 1-1 on Page 1-3, Table 1-2 on Page 1-5, and Table 2-1 on Page 2-2.
7	Appendix C QAPP, Contents	Appendix C name should be "Analytical Method Limits and Objectives"	See comment	The citation for Appendix C in the table of contents will be corrected to read "Analytical Method Limits and Objectives".
8	Appendix C QAPP,	Appendix D name has "Control" listed twice.	See comment	The citation for Appendix D in the table of contents will be corrected to read "Method

Comment Responses Table
Tribal Draft RCRA Facility Investigation Work Plan for Parcel 23 February 2009

Cmt. No.	Section No./Paragraph No.	Comment	Recommendation	Response
	Contents			Quality Control Objectives".
9	Appendix C QAPP, Acronyms and Abbreviations	HNO_3 and SVOCs missing	Add HNO_3 and SVOCs	The acronyms for nitric acid (HNO_3) and semi-volatile organic compounds (SVOCs) will be added to the acronym list.
10	Appendix C QAPP, 1.6.1	Second paragraph, first sentence: DQOs needs to be spelled out.	See comment	The first occurrence of DQOs will be defined in the text.
11	Appendix C QAPP, Table 1-2	Last sentence of Step 6 lists Quality Assurance Manual, should be Quality Systems Manual	See comment	The reference will be corrected to list the Department of Defense Quality Systems Manual.
12	Appendix C QAPP, 1.8.1	First paragraph, second sentence: "Field logbook entries will be described with as enough…", remove "as"	See comment	The first occurrence of the word "as" will be deleted from the sentence.
13	Appendix C QAPP, 2.6.1.1.2	First paragraph, first sentence: "The LCS will consist of an contaminant-free…", should be "a" not "an"	See comment	The sentence will be corrected to read "The LCS will consist of a contaminant-free matrix".
14	Appendix C QAPP, 2.6.2	Appendix C referenced, should be Appendix D if about MQOs	See comment	The sentence will be corrected to reference Appendix D.
15	Appendix C QAPP, 2.11.4	First paragraph, first sentence: EDD has already been called out, no need to define again.	See comment	The words "electronic data deliverable" will be deleted from the sentence.
16	Appendix C QAPP, Table 4-1 and Section 4.2	Table 4-1 lists "N" flag without an interpretation. N is also listed in the second paragraph of Section 4.2.	Either define N or remove from these sections.	The "N" data validation flag is defined as: The spiked sample recovery was not within the control limits. This definition will be added to Table 4-1.