HGL
HydroGeoLogic, Inc
Exceeding Expectations

ENTERED

Corporate Headquarters

Via Federal Express

9 February 2007

Mr. John E. Kieling
Manager, Permits Management Program
State of New Mexico Environment Department
Hazardous Waste Bureau
2905 Rodeo Park Drive East, Building 1
Santa Fe, New Mexico 87505-6303

RE: ***Supplemental RCRA Facility Investigation Report, LF-19 (SWMU 105), LF-21 (SWMU 116), LF-22 (SWMU 115), and LF-23 (SWMU 108)***
Request for No Further Action, OT-44 (AOC-P)
Holloman Air Force Base, New Mexico
EPA ID# NM6572124422

Dear Mr. Kieling:

Per the direction of and on behalf of Holloman Air Force Base, HGL is pleased to submit the above-referenced reports for New Mexico Environment Department review. Please contact me at (703) 736-4563 or via e-mail at kcottrell@hgl.com should you require additional copies of these reports.

Sincerely,

Kenneth J. Cottrell, C.P.G., P.G.
Senior Project Manager

RECEIVED
FEB 2007
NMED Hazardous Waste Bureau

Enclosures

CC: George Fish, Holloman AFB (w/2 copies enc.)
Rene Hefner, AFCEE (w/enc.)
Stan Scott, ACC (w/enc.)
Dave Strasser, NMED (w/enc.)

1155 Herndon Parkway, Suite 900, Herndon, VA 20170
Phone: (703) 478-5186 Fax: (703) 471-4180
www.hgl.com

REQUEST FOR NO FURTHER ACTION
OT-44 (AOC-P)

HOLLOMAN AIR FORCE BASE
ALAMOGORDO, NEW MEXICO

Prepared for

Air Force Center for Environmental Excellence
3300 Sidney Brooks
Brooks City-Base, Texas 78235-5344

Prepared by

HydroGeoLogic, Inc.
1155 Herndon Parkway, Suite 900
Herndon, Virginia 20170-5545

Contract No. F41624-03-D-8602
Task Order No. 037

RECEIVED
FEB 2007
NMED Hazardous Waste Bureau

January 2007

REPORT DOCUMENTATION PAGE

Form Approved

Public reporting for this collection of information is estimated to average 1 hour per response, including the time for reviewing instruction, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1024, Arlington, VA 22202ñ1302, and to the Office of Management and Budget, Paperwork Reduction Project (070400188), Washington, DC 20503.

1. AGENCY USE ONLY *(Leave blank)*	2. REPORT DATE January 2007	3.REPORT TYPE AND DATES COVERED
4. TITLE AND SUBTITLE Request for No Further Action, OT-44 (AOC-P)		4. FUNDING NUMBERS F41624-03-D-8602 Task Order No. 037
6. AUTHOR(S) HydroGeoLogic, Inc.		
7. PERFORMANCE ORGANIZATION NAMES(S) AND ADDRESS(S) HydroGeoLogic, Inc. 1155 Herndon Parkway, Suite 900 Herndon, Virginia 20170-5545		8. PERFORMANCE ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(S) Air Force Center For Environmental Excellence 3300 Sidney Brooks Brooks City-Base, Texas 78235-5344		10.SPONSORING/MONITORING AGENCY REPORT NUMBER
11. SUPPLEMENTARY NOTES		
12a. DISTRIBUTION/AVAILABILITY STATEMENT Unlimited		12b. DISTRIBUTION CODE

13. ABSTRACT (Maximum 200 words)

This Request for No Further Action was prepared by HydroGeoLogic, Inc. (HGL) on behalf of Holloman Air Force Base for New Mexico Environment Department under contract to the Air Force Center for Environmental Excellence, Contract No. F41624-03-D-8602, Task Order 037. This request specifically addresses Environmental Restoration Program OT-44 which encompasses Area of Concern P and Building 301 Fuel Tank Leaks.

14. SUBJECT TERMS			15. NUMBER OF PAGES
			16. PRICE CODE
17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE.	19.SECURITY LASSIFICATION OF ABSTRACT.	20.LIMITATIONOF ABSTRACT

This page was intentionally left blank.

TABLE OF CONTENTS

Page

1.0 INTRODUCTION 1-1
1.1 BACKGROUND 1-1
1.1.1 Installation Location 1-1
1.1.2 Installation History 1-1

2.0 ENVIRONMENTAL SETTING 2-1
2.1 TOPOGRAPHY 2-1
2.2 SURFACE WATER 2-1
2.3 GEOLOGY 2-1
2.4 SOILS 2-3
2.5 HYDROGEOLOGY 2-3

3.0 OT-44 (AOC-P) - BUILDING 301 FUEL TANK LEAKS 3-1
3.1 SITE DESCRIPTION AND LOCATION 3-1
3.1.1 Surface Water 3-1
3.1.2 Geology 3-1
3.1.3 Hydrogeology 3-1
3.2 WASTE HISTORY 3-1
3.3 PREVIOUS INVESTIGATIONS 3-2
3.3.1 Site 50 IRP Phase II Stage I, Confirmation/Quantification 3-2
3.3.2 Remedial Investigation 3-3
3.3.2.1 Stage 1 3-3
3.3.2.2 Stage 2 3-4
3.3.3 UST 5RM 301 Excavation and Removal 3-5
3.3.4 Hazardous Waste Permit 3-5
3.3.5 Phase II RCRA Facility Investigation 3-5
3.3.6 Additional Characterization of POL-Contaminated Sites 3-6
3.3.7 Final Closure Report Addendum 3-6
3.3.8 Long Term Groundwater Monitoring 3-7

4.0 CONCLUSIONS 4-1

5.0 RECOMMENDATIONS 5-1

6.0 REFERENCES 6-1

APPENDIX A BORING LOGS
APPENDIX B ANALYTICAL DATA
APPENDIX C SUPPORTING INFORMATION

LIST OF FIGURES

Figure 1.1 Facility Location Map, Holloman AFB
Figure 1.2 Facility Layout Map, Holloman AFB
Figure 2.1 Facility Topographic Map, Holloman AFB
Figure 2.2 Surface Drainages, Holloman AFB
Figure 2.3 Geologic Map of the Tularosa Basin
Figure 2.4 Generalized Cross Section Tularosa Basin
Figure 2.5 Generalized Near-Surface Geologic Cross Section, Holloman AFB
Figure 2.6 Distribution of Soils, Holloman AFB
Figure 2.7 Regional 1993 Groundwater Elevation Contour Map, Holloman AFB
Figure 3.1 Site Layout Map, OT-44 (AOC-P)
Figure 3.2 Soil TPH Concentrations, OT-44 (AOC-P)

LIST OF TABLES

Table 3.1 Soil Analytical Results, IRP Phase II Stage I Confirmation/Quantification Study, OT-44 (AOC P), Holloman AFB
Table 3.2 Groundwater Analytical Results, IRP Phase II Stage 1 – Confirmation/Quantification Study, OT-44 (AOC P), Holloman AFB
Table 3.3 Soil Analytical Results, Phase II Remedial Investigation, OT-44 (AOC P), Holloman AFB
Table 3.4 Groundwater Analytical Results, Phase II Remedial Investigation, OT-44 (AOC P), Holloman AFB
Table 3.5 Soil Analytical Results, Phase II Remedial Investigation, OT-44 (AOC P), Holloman AFB
Table 3.6 Soil Analytical Results, Additional Soil Characterization Activities, OT-44 (AOC P), Holloman AFB
Table 3.7 Soil Analytical Results, Excavation Closure Verification Sampling, OT-44 (AOC P), Holloman AFB
Table 3.8 Groundwater Analytical Results, Biennial Groundwater Long Term Monitoring (1995-2001), OT-44 (AOC P), Holloman AFB

LIST OF ACRONYMS AND ABBREVIATIONS

AFB	Air Force Base
ACC	Air Combat Command
AFCEE	Air Force Center for Environmental Excellence
AMC	Air Materiel Command
AOC	Area of Concern
bgs	below ground surface
BN/AE	base, neutral, and acid extractables
BRA	Baseline Risk Assessment
BTEX	benzene, toluene, ethylbenzene, and total xylenes
DRO	diesel-range organics
EPA	Environmental Protection Agency
ERP	Environmental Restoration Program
GRO	gasoline-range organics
HGL	HydroGeoLogic, Inc.
IRP	Installation Restoration Program
LTM	long term monitoring
μg/L	micrograms per liter
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
NFA	no further action
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
NMGWQ	New Mexico Groundwater Quality
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
RI	Remedial Investigation
SSL	soil screening level

TCE	trichloroethene
TDS	total dissolved solids
TOC	total organic carbon
TOX	total organic halogens
TPH	total petroleum hydrocarbon
TRPH	total recoverable petroleum hydrocarbons
UST	underground storage tank
VOA	volatile organic analytes
VOC	volatile organic compounds
yd^3	cubic yards

REQUEST FOR NO FURTHER ACTION
OT-44 (AOC-P)
HOLLOMAN AIR FORCE BASE, NEW MEXICO

1.0 INTRODUCTION

This Request for No Further Action (NFA) was prepared by HydroGeoLogic, Inc. (HGL) on behalf of Holloman Air Force Base (AFB) for New Mexico Environment Department (NMED) under contract to the Air Force Center for Environmental Excellence (AFCEE), Contract No. F41624-03-D-8602, Task Order 037. This request specifically addresses Environmental Restoration Program (ERP) site OT-44 (Area of Concern [AOC] P, Building 301 Fuel Tank Leaks).

1.1 BACKGROUND

1.1.1 Installation Location

Holloman AFB is situated in south central New Mexico, in Otero County. A facility location map is provided as Figure 1.1. Holloman AFB has a population of 6,000 and occupies approximately 50,000 acres of the northeast quarter of Section 1 Township 17 South, Range 8 East. A facility layout map of Holloman AFB is provided as Figure 1.2.

Holloman AFB is surrounded by undeveloped rangeland. The White Sands Missile Range testing facilities occupies the land north of the Base. Private and public owned land borders the remainder of Holloman AFB. The major highway servicing Holloman AFB is Highway 70, which runs southwest from the town of Alamogordo, New Mexico and separates Holloman AFB from the publicly owned lands to the south. Alamogordo is the county seat for Otero County, and the only town of appreciable size within 30 to 50 miles of the Base. The population of Alamogordo was 23,535 in 1975, and has since grown to about 31,000. The economy of Alamogordo depends largely upon Holloman AFB and other military installations in the area. Alamogordo is located approximately seven miles east of the Base.

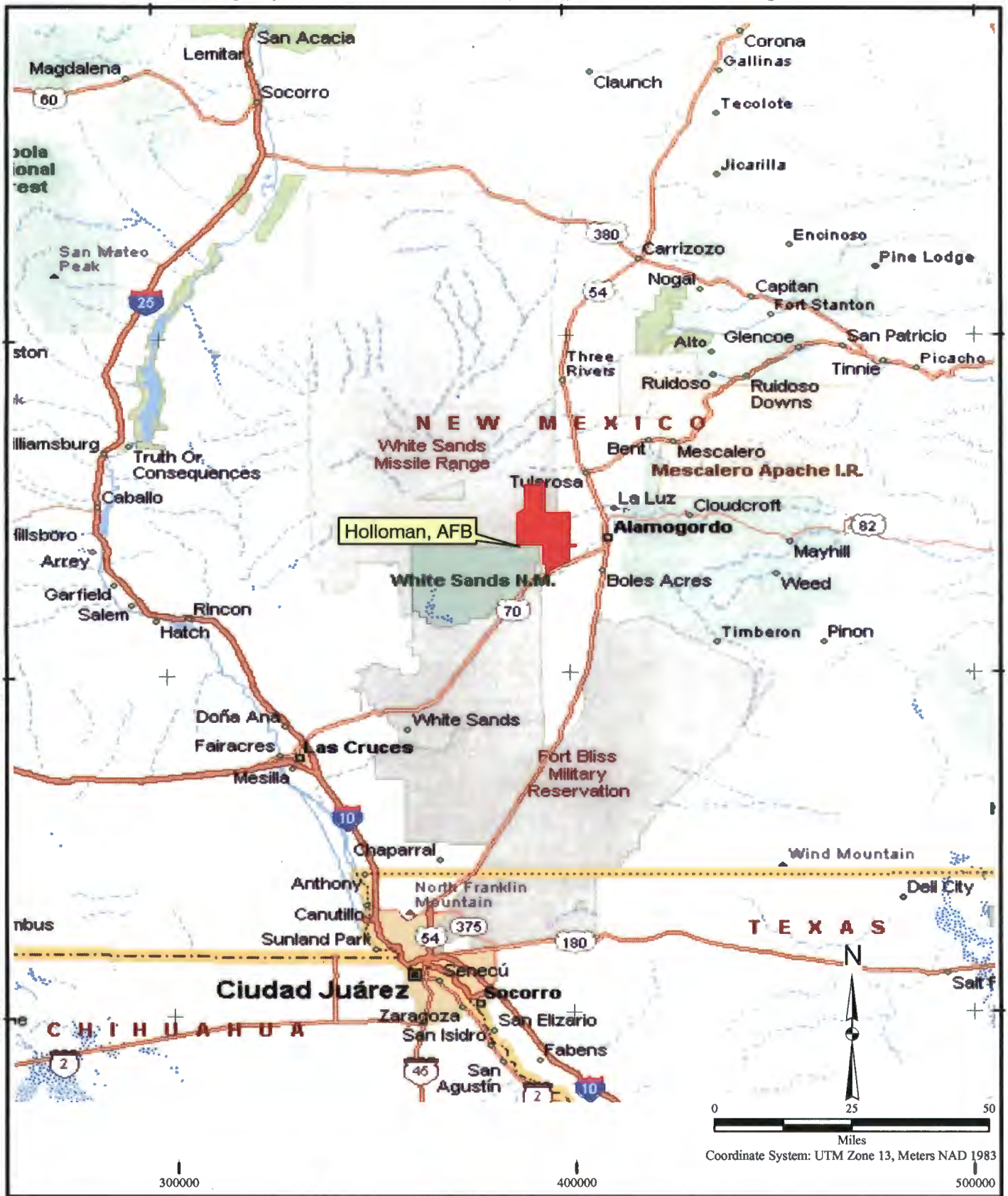
1.1.2 Installation History

Holloman AFB, formerly Alamogordo Army Airfield, began as a temporary facility during World War II. Construction of the temporary airfield was initiated on 6 February 1942. Prior to 1942 the property occupied by Holloman AFB was undeveloped rangeland. Over time, Holloman AFB's status, mission, and Command have periodically changed. Currently, Holloman AFB is operated under the Air Combat Command (ACC).

The Alamogordo Army Airfield was established in 1942 and was deactivated in 1945. The facility was reactivated in 1945 and was operated by the Air Materiel Command (AMC) until 1951. AMC tested pilot-less aircraft, guided missiles, and other equipment. The facility

mission remained largely unchanged until 1971, although the facility identification changed several times during the 20-year span: Air Force Missile Test Center (1951-1952), Holloman Air Development Center (1952-1957), and Air Force Missile Development Center (1957-1971). The Tactical Air Command operated the facility from 1972 to 1992 and housed the 49th Tactical Fighter Wing, 479th Tactical Training Wing, 833rd Air Division, and 4449th Mobile Support Squadron. In 1992, Holloman AFB was realigned under ACC.

FIGURES



File X:\AFC002\Holloman_AFB\TO37\Maps\OT-44_NFA\Site_Location.mxd
Project: AFC002-037-04-12-01
Revised: 08/05/06 PS
Map Source: Holloman AFB

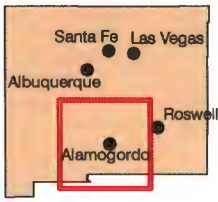
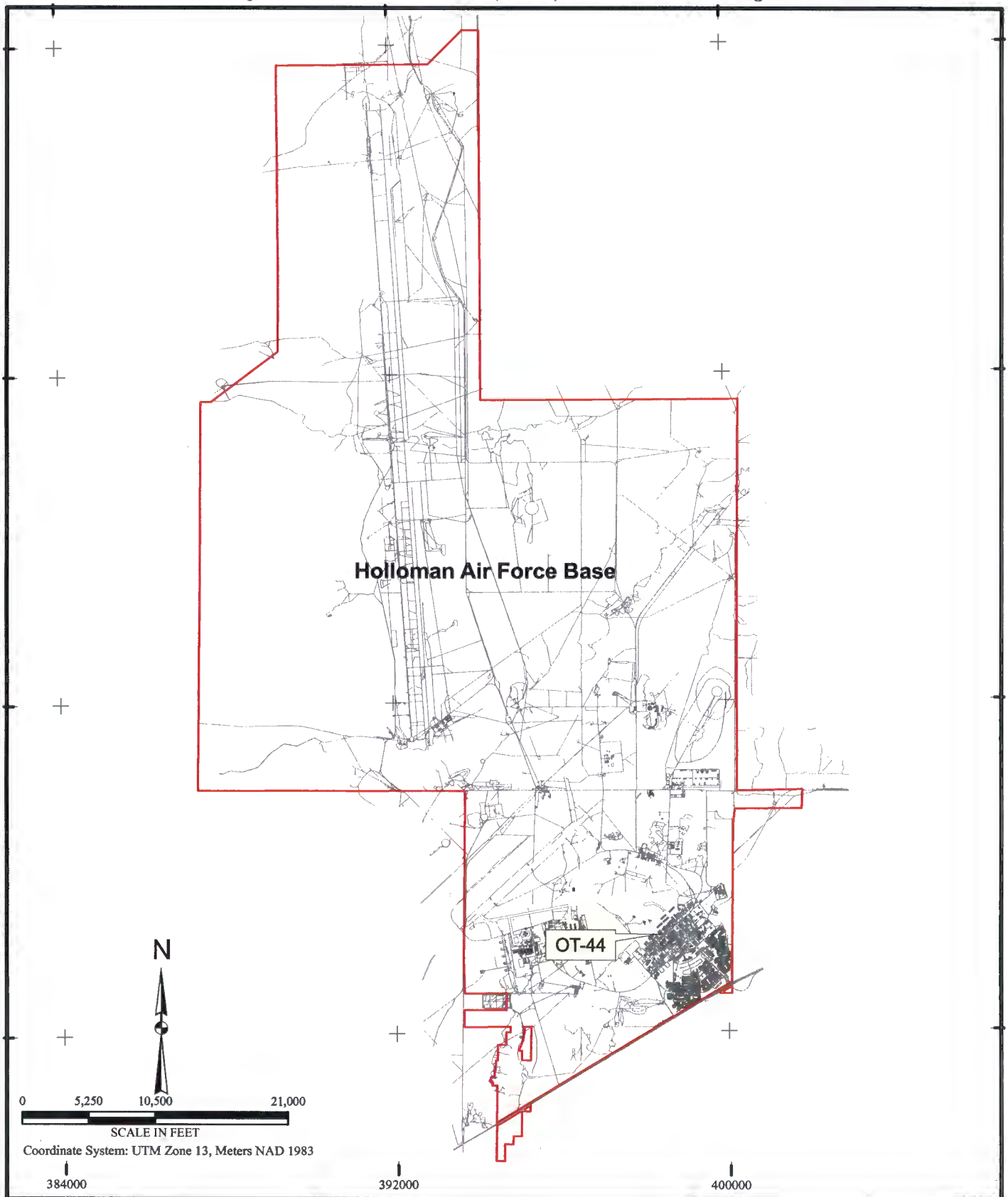


Figure 1.1
Facility Location Map
Holloman AFB



File X:\AFC002\Holloman_AFB\TO37\Maps\OT-44_NFA\Facility_Layout.mxd
Project: AFC002-037-04-12-01
Revised: 08/05/06 PS
Map Source: Holloman AFB

Legend

- Holloman AFB Boundary
- Building/Structure
- Operable Unit Boundary (Approx.)

Figure 1.2
Facility Layout Map
Holloman AFB

2.0 ENVIRONMENTAL SETTING

The environmental setting information in the following subsections is reproduced primarily from the Radian 29-site Remedial Investigation (RI) report (Radian, 1992), unless cited otherwise.

2.1 TOPOGRAPHY

Holloman AFB is located in the Tularosa Basin, which is part of a 170-mile-long structural depression. The basin is bounded on the south by a low topographic divide near the state line; on the west by the uplifted Organ, San Andres, and Oscura Mountains; on the north by Chupadera Mesa; and on the east by the uplifted Jicarilla and Sacramento Mountains. The interior plain has low relief with altitudes ranging from about 4,000 feet in the southwestern portion of the basin to about 4,400 feet in the northeastern portion. The surrounding mountains rise abruptly to altitudes of 7,000 to 12,000 feet.

The Tularosa Basin is a closed basin from which no surface water drains. Surface runoff from the mountains bordering the basin has deposited extensive alluvial fans on the interior plain. Near the Base, the ground surface is gently undulating and is composed of alluvial fan deposits, eolian dunes, and flat-bottomed playas (pan-shaped depressions carved by wind erosion). To the west of the Base lie the gypsum sand dune fields of White Sands National Monument. A facility topographic map is provided as Figure 2.1.

2.2 SURFACE WATER

Within the undeveloped portions of the Base, surface water runoff is controlled by several arroyos that trend southwest (Figure 2.2). These arroyos are: Hay Draw, in the far northern portion of the Base; Malone Draw and Ritas Draw, which discharge into Lost River; and Dillard Draw, which runs in a southwesterly direction near the southern boundary of the Base toward the facility's sewage lagoons. Lost River, the largest arroyo, is dammed near the western boundary of Holloman AFB to prevent runoff from the facility from entering White Sands National Monument. Runoff from Lost River, Malone Draw, and Ritas Draw collects behind the dam and either evaporates or infiltrates into the underlying soils.

2.3 GEOLOGY

The Tularosa Basin is the easternmost extension of the Basin and Range Province of the western United States and was created by Cenozoic extensional (i.e., normal) faulting of Precambrian- through Tertiary-age sedimentary and igneous rocks. These rocks are exposed in the fault scarps bounding the basin floor. A geologic map of the Tularosa Basin is provided as Figure 2.3; a generalized cross-section of the Basin is provided as Figure 2.4.

During the Permian period of the Paleozoic Era (approximately 270 million years ago), southern New Mexico was covered by a shallow sea. Limestone and sandstone were deposited, forming thick sedimentary units. Toward the end of the Mesozoic era

(approximately 70 million years ago), the major mountain building activities that formed the Rocky Mountains took place, resulting in southern New Mexico emerging from the ocean as the land gently up-warped. During the Cenozoic era, extensional faulting of the southwestern United States began creating the Basin and Range Physiographic Province. Approximately 10 million years ago, the extensional faulting formed the Tularosa Basin, a Cenozoic faulting formed the graben structure known as the Tularosa Basin. The basin was formed when arched portions of the up-lifted bedrock collapsed between large-scale, north-south trending faults, forming a graben. The Tularosa Basin is the central downthrown area, bounded on the east and west by fault block mountains, the Sacramento and San Andres Mountains. Bedded Permian strata can be seen along the faces of both mountain ranges. Recently (less than 10 million years ago), lava flows erupted along the existing fault planes created during active basin development. The Carrizozo lava flow north of the Base is an example of one such eruption.

The Tularosa Basin is a bolson, or a basin that has no surface drainage outlet. Bolson deposits refer to sediments carried by water into a closed basin. The bolson sediments within the Tularosa Basin are derived from the erosion of limestone, dolomite, and gypsum exposed on the faces of the surrounding mountains. Coarser material is deposited at the base of the mountains while finer material is carried to the basin's interior. The thickness of the bolson deposits progressively thin outward from the base of the mountains to the central portion of the basin. Bolson deposits within the central portion of the Tularosa Basin are approximately 8,000 feet thick. Bolson deposits within the Tularosa sub-basin ranged from nearly 4,000 feet thick near Alamogordo to less than 100 feet thick at Hurtz Spring, located west of Holloman AFB.

Near-surface geologic conditions at Holloman AFB have been established during ERP and Resource Conservation and Recovery Act (RCRA) Facility Investigations (RFI) consist of bolson sediments deposited and/or reworked by alluvial, eolian, lacustrine/playa forces. Alluvial fan deposits are characteristically laterally discontinuous units of interbedded sands, silts, and clays. Eolian deposits consist primarily of gypsum sands. The eolian and alluvial fan deposits are often indistinguishable due to wind action resulting in an intermingling of the two sediment types. Lacustrine or playa deposits in the area consist of medium to high plasticity clays containing gypsum crystals and other salts. Lacustrine deposits are juxtaposed with alluvial fan and eolian deposits throughout the Base.

A generalized near-surface geologic cross section of the Base is provided as Figure 2.5. The uppermost sediment deposits (generally the top 15 feet) are typically silty sands, typical of alluvial fans, and grade vertically and laterally into silts and small lenses of clay and sand. A 5 to 8-foot thick clay unit grades laterally into a silty, clayey sand, which underlies the alluvial sediments. These are lacustrine or playa deposits, which typically display less vertical variability than alluvial deposits but are also laterally discontinuous. These lacustrine clays almost always are highly plastic and contain abundant gypsum crystals. Below this, sands grading into silty sands, and underlain by silts, are present, and are again

characteristic of alluvial fan sediments. Lenses/beds of lacustrine clay underlie these sediments.

2.4 SOILS

The United States Department of Agriculture (USDA) Soil Conservation Service has identified two soil associations in the vicinity of Holloman AFB: the Holloman-Gypsum Land-Yesum complex, and the Mead silty clay loam. The permeability of these soil horizons ranges from $4x10^{-4}$ to $1x10^{-3}$ centimeters per second (cm/sec). The distribution of the soils in the vicinity of Holloman AFB is depicted on Figure 2.6 (USDA, 1981).

Most of the surficial soils at the Base are the well-drained, sandy loam and gypsum of the Holloman-Gypsum Land-Yesum complex. The soils of this association are formed from alluvial and eolian gypsiferous sediments. The Holloman unit makes up about 35 percent of the complex and is described as being a light brown to pink, very fine, sandy loam with high gypsum content. The soil is moderately permeable, calcareous, and mildly to moderately alkaline. The Gypsum land unit makes up about 30 percent of the complex and is described as being a soft to hard white gypsum, typically overlain by less than one inch of very fine, sandy loam. The Yesum unit, which makes up 20 percent of the complex, is light brown to pinkish-white, very fine sandy loam that is also high in gypsum. The Yesum unit is moderately permeable, calcareous, and mildly alkaline (USDA, 1981).

The Mead silty clay loam soil occurs over a small area of the Base. This soil consists of reddish-brown, silty clay loam, clay loam, and clay with a high salt content. The soil unit is derived from fine grained alluvium deposited over lacustrine sediments, has low permeability, and has a low available water capacity. The soil is moderately calcareous, and moderately to strongly alkaline. The soil has a layer of salt that is more soluble than gypsum (USDA, 1981).

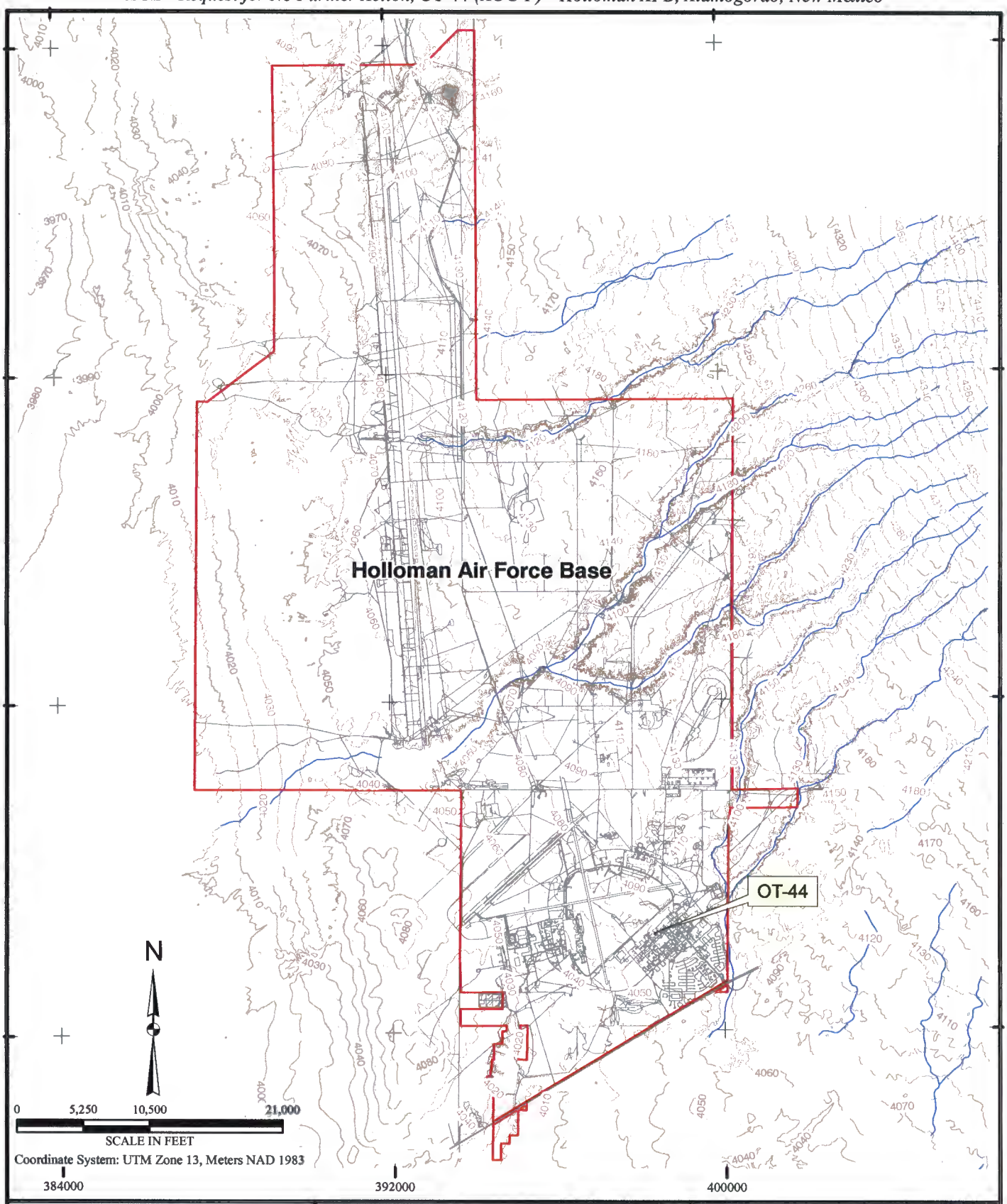
2.5 HYDROGEOLOGY

Groundwater occurs under unconfined conditions in the unconsolidated bolson deposits beneath Holloman AFB. The primary source of recharge for groundwater in the bolson aquifer is percolation of rainfall and stream infiltration through the coarse, unconsolidated alluvial fan deposits along the western flank of the Sacramento Mountains. The infiltrating water migrates downward into the bolson fill aquifer and flows downgradient through progressively finer-grained sediments into the basin. The depth to groundwater decreases from 270 feet (or more) near the mountains to less than 5 to 50 feet below ground surface (bgs) at Holloman AFB. The hydraulic gradient is steep in the recharge zones at the base of the mountains, but flattens out as groundwater migrates into the valley. Results from several studies indicated that groundwater gradients at the Base are very low, ranging from about 0.0009 to 0.007. Groundwater discharge occurs either through evapotranspiration, springs or seeps along steep-sided arroyos, or into closed playa lakes such as Lake Lucero, the regional groundwater discharge area.

Groundwater flow direction at Holloman AFB is influenced by the surface water flow along southwest trending arroyos. In general, groundwater flow direction is west to southwest depending upon the immediate proximity of the arroyos. A basewide regional groundwater elevation contour map is provided as Figure 2.7. In the southeastern portion of the Base, regional groundwater flows southwest, following the Dillard Draw surficial drainage system. In the northern portion of the Base, groundwater flows to the west, following the Ritas Draw, Malone Draw, and Lost River drainages. An apparent divide between these two drainage subsystems is seen in the northeast-central part of the Base.

Groundwater in the Tularosa Basin is of potable quality at the recharge areas in close proximity to the Sacramento Mountains, but becomes increasingly mineralized as it flows downgradient toward the interior of the basin. This natural degradation of water quality can be attributed to slow groundwater migration from recharge to discharge areas, and the presence of readily soluble minerals in the bolson sediments. The groundwater beneath Holloman AFB is designated as unfit for human consumption where it naturally exceeds total dissolved solids (TDS) and sulfate thresholds. TDS values presented in the 1992 RI report ranged from 1,600 milligrams per liter (mg/L) to 66,000 mg/L, averaging over 17,000 mg/L. Sulfate and chloride average concentrations were on the order of 4,000 mg/L and 6,000 mg/L, respectively. Using the *Guidelines for Groundwater Classification Under the Environmental Protection Agency (EPA) Groundwater Protection Strategy* (EPA, 1986), the groundwater can be classified as IIIB (i.e., not a source or a potential source of drinking water). Class III groundwater is characterized as having a TDS concentration greater than 10,000 mg/L and a low degree of interconnection to adjacent surface waters or groundwaters of a higher class, as is the case at Holloman AFB. Lower TDS areas at Holloman AFB may be attributable to localized recharge via irrigation and infiltration by anthropogenic features such as roof drains and water lines.

FIGURES

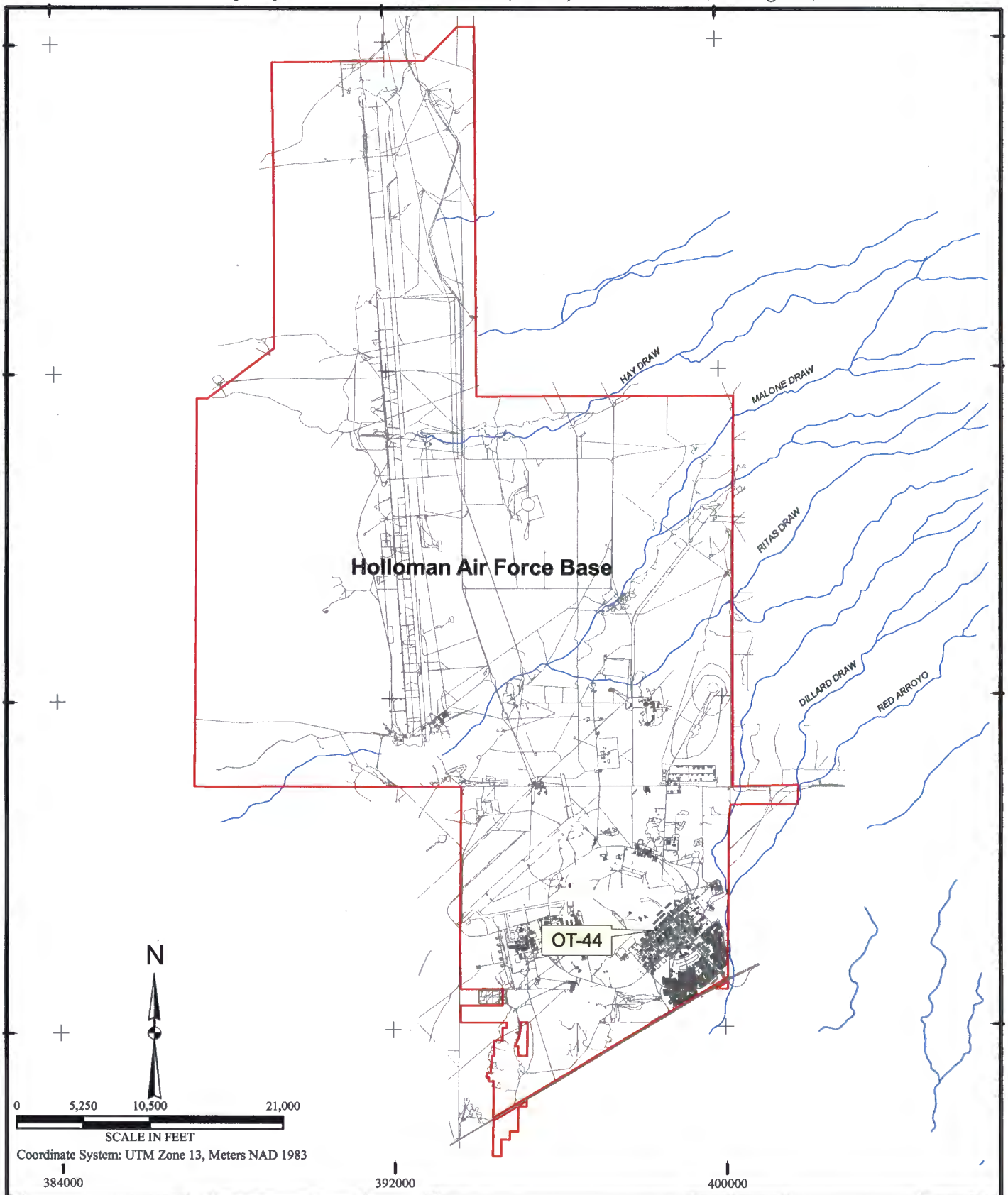


Filename: X:/AFC002/Holloman_AFB/TO37 /Maps/OT-44_NFA/Site_topo.mxd
Project: AFC002-037-04-13-01
Revised: 08/05/06 PS
Map Source: Holloman AFB

Legend

- Holloman AFB Boundary
- Drainage Feature
- Facility Road
- Building/Structure
- Operable Unit Boundary (Approx.)
- 4070 Topographic Contour

Figure 2.1
Facility
Topographic Map
Holloman AFB

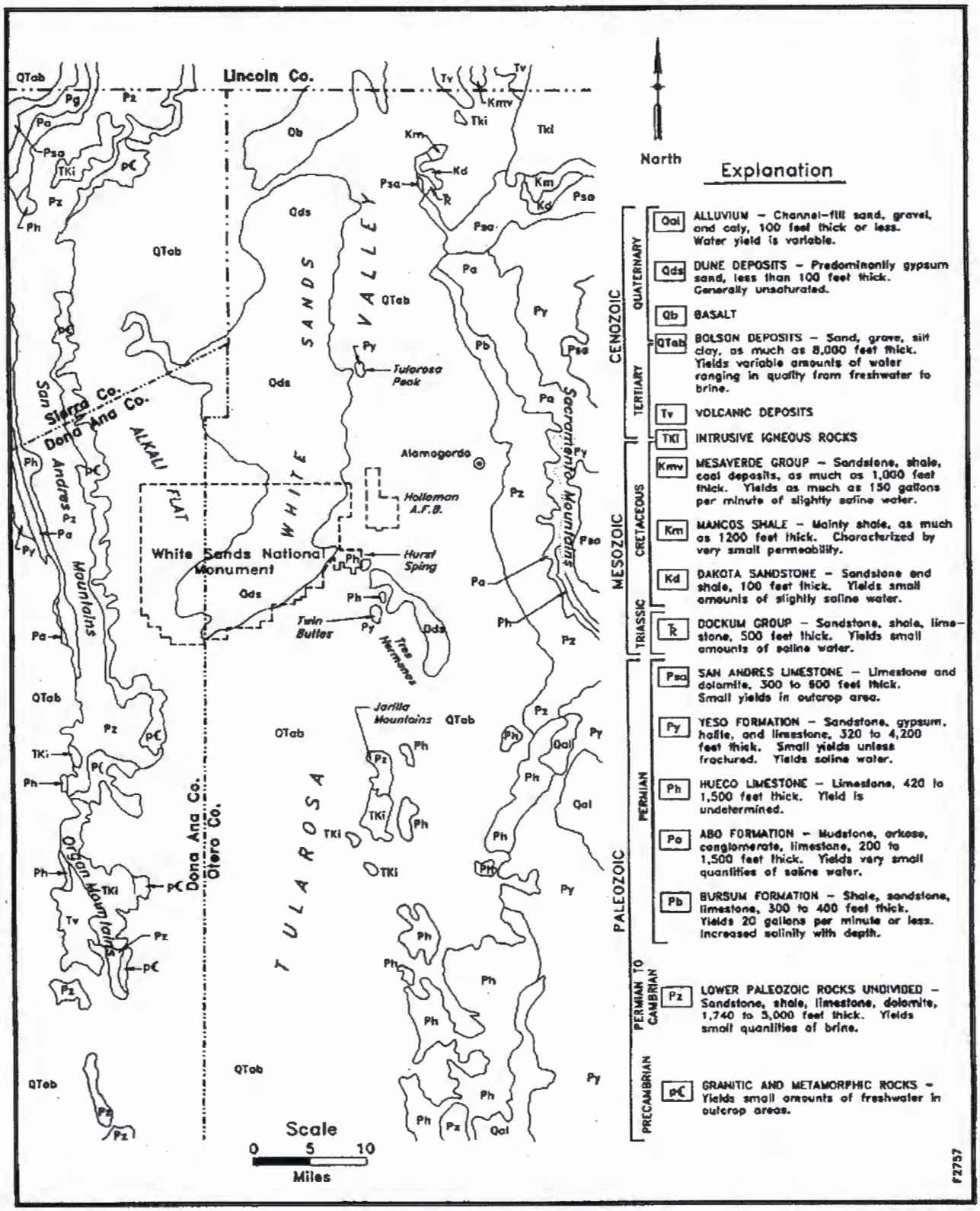


File X:\AFC002\Holloman_AFB\TO37\Maps\OT-44_NFA\Surface_Drainage.mxd
Project: AFC002-037-04-09-03
Revised: 08/05/06 PS
Map Source: Holloman AFB

Legend

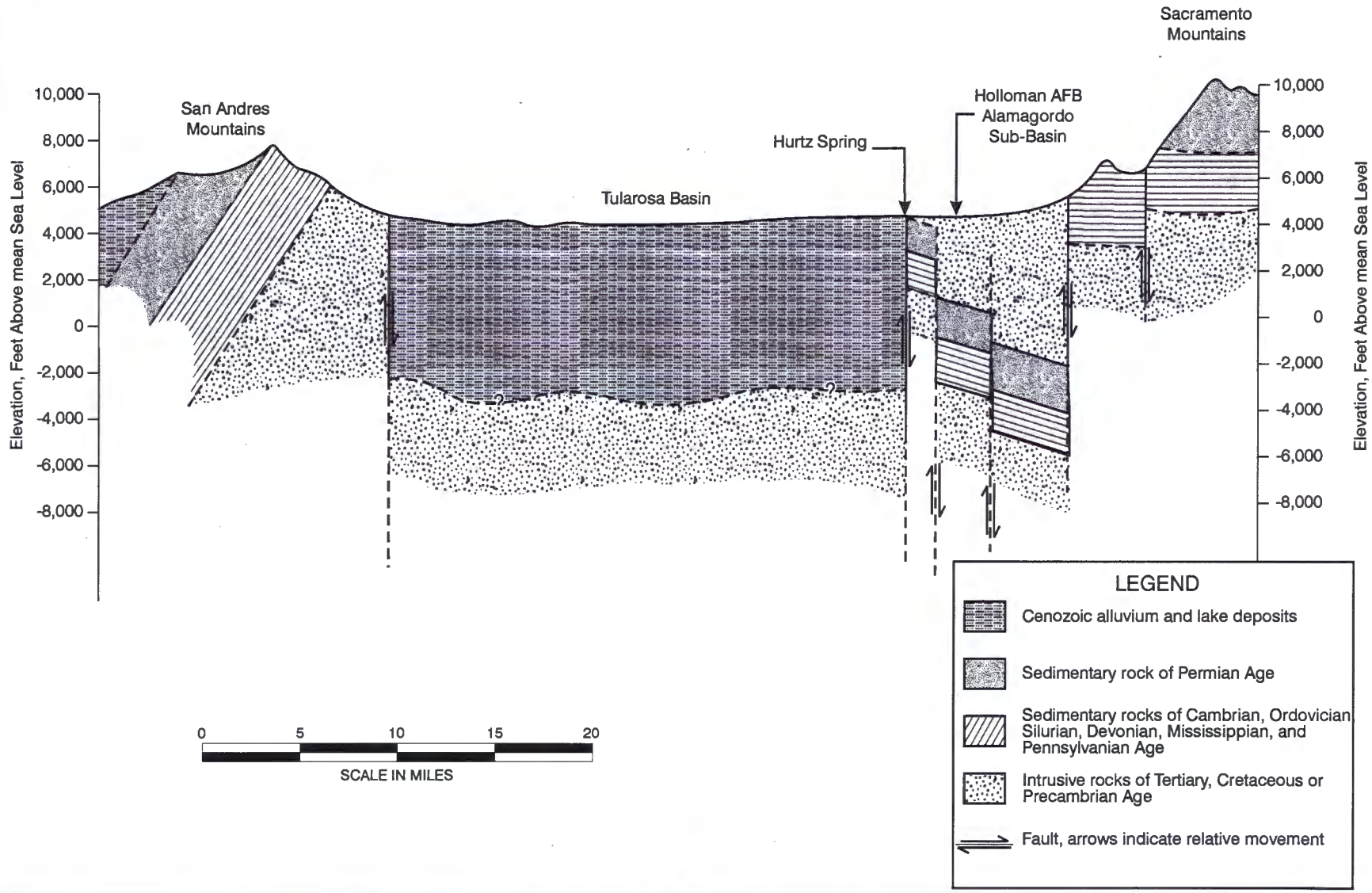
- Holloman AFB Boundary
- Building/Structure
- Operable Unit Boundary (Approx.)

Figure 2.2
Surface Drainages
Holloman AFB



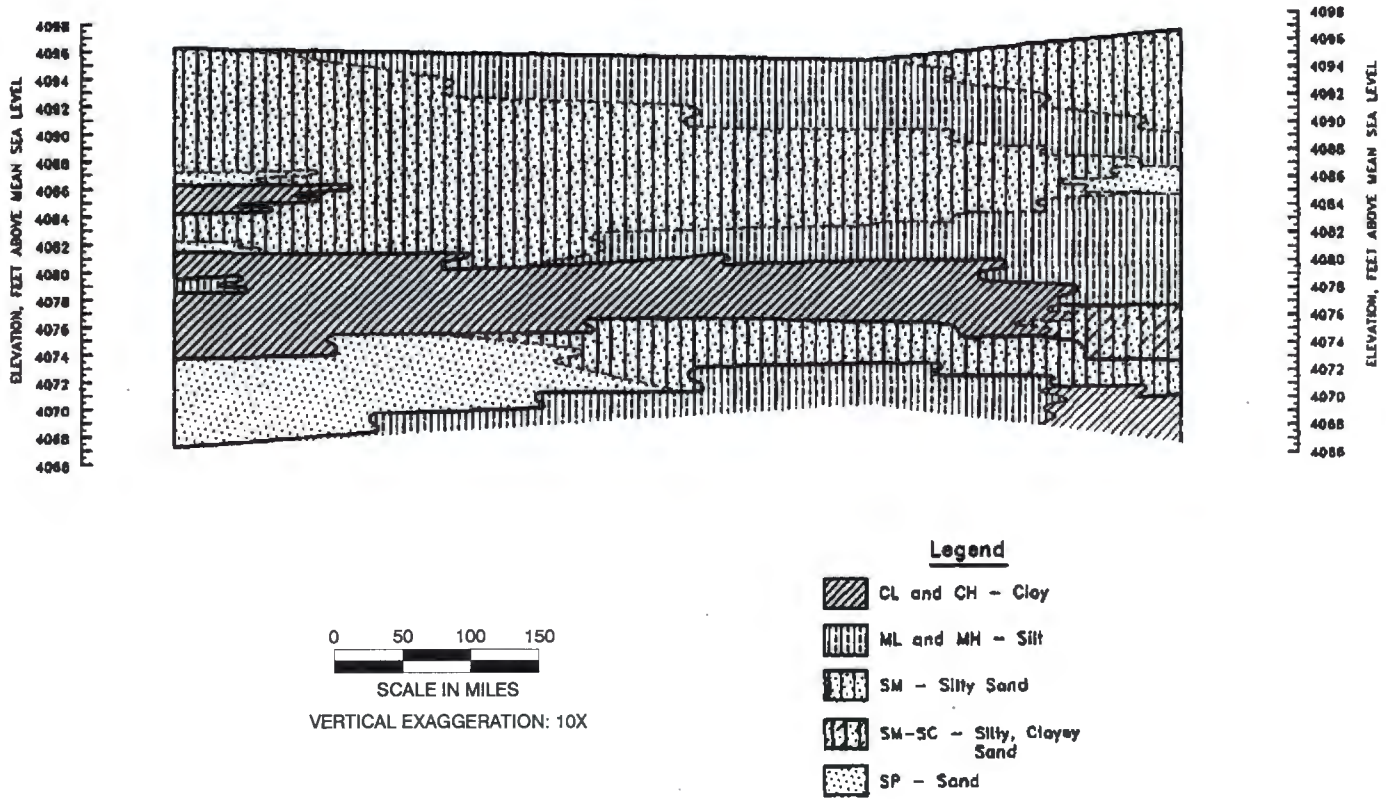
Filename: X:/AFC002/Holloman_AFB/TO37 /Maps/OT-44_NFA/geo_site-map
Project: AFC002-037-04-09-01
Revised: 08/05/06 PS
Source: Orr and Myers, 1986

Figure 2.3
Geologic Map of the Tularosa Basin



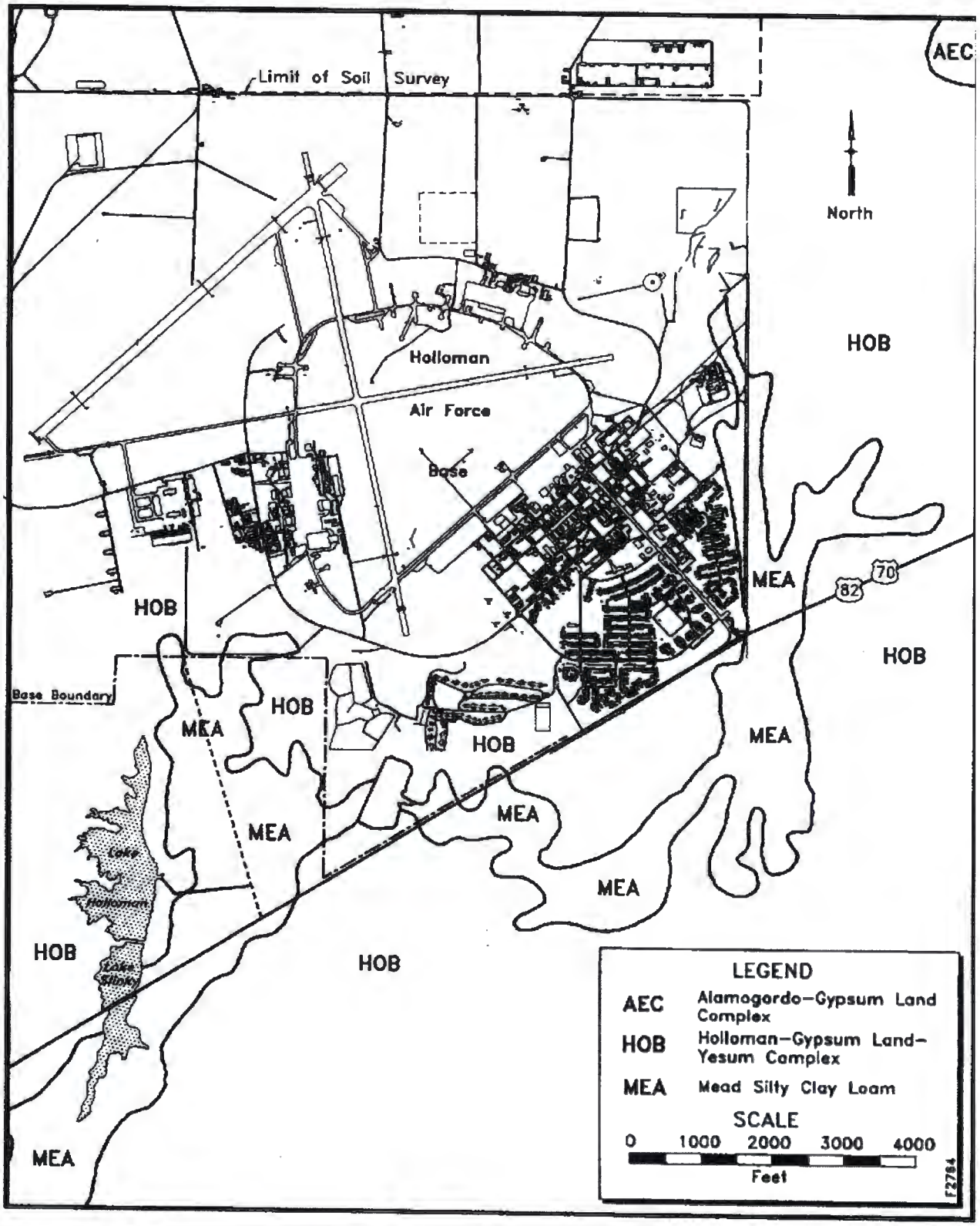
Filename: X:/AFC002/Holloman_AFB/TO37 /Maps/OT-44_NFA/general_xsection.cdr
Project: AFC002-037-04-13-01
Revised: 08/04/06 PS
Source: Radian, 1992

Figure 2.4
Generalized Cross Section
Tularosa Basin



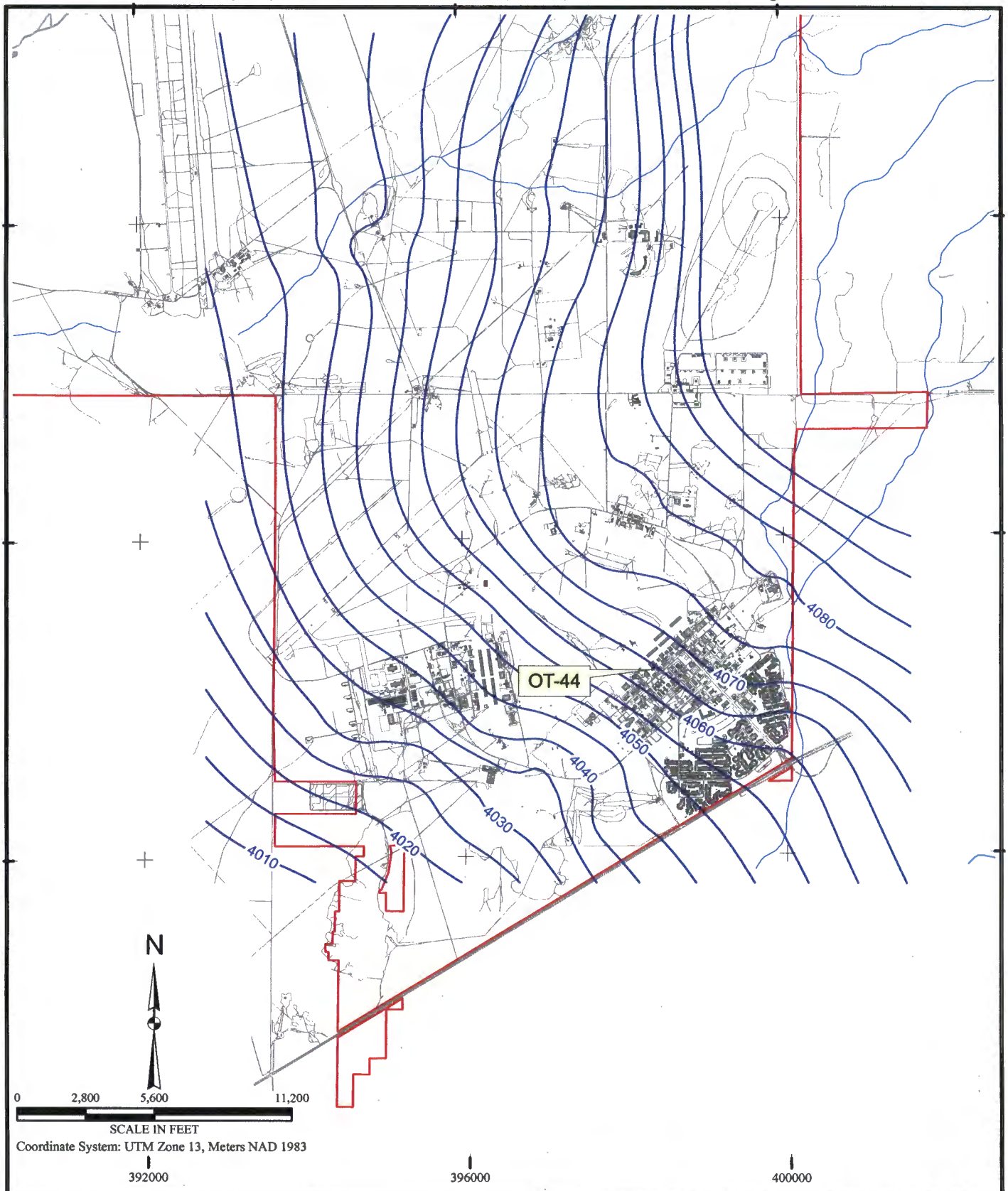
X:\AFC002\Holloman_AFB\TO37\Maps\OT-44_NFA\near-surface_xsection.cdr
Project: AFC002-037-04-09-03
Revised: 08/04/06 TH
Source: Radian, 1992

Figure 2.5
Generalized Near-Surface Geologic Cross Section
Holloman AFB



Filename: X:/AFC002/Holloman_AFB/TO37 /Maps/OT-44_NFA/Site_Soils.cdr
Project: AFC002-037-04-09-01
Revised: 08/04/06 PS
Source: USDA, 1981

Figure 2.6
Distribution of Soils
Holloman AFB



File X:\AFC002\Holloman_AFB\TO37\Maps\OT-44_NFA\Regional_GW.mxd
Project: AFC002-037-04-12-01
Revised: 08/04/06 PS
Map Source: Holloman AFB

Legend

- Holloman AFB Boundary
- Building/Structure
- Operable Unit Boundary (Approx.)
- 4010 — Groundwater Contour and Associated Groundwater Elevation (ft MSL)

Figure 2.7
Regional 1993 Groundwater Elevation Contour Map
Holloman AFB

3.0 OT-44 (AOC-P) - BUILDING 301 FUEL TANK LEAKS

3.1 SITE DESCRIPTION AND LOCATION

OT-44 (AOC-P) encompasses a historic hydrocarbon plume observed in the groundwater immediately south of Building 301, an aircraft maintenance hanger adjacent to the Holloman AFB main taxiway. OT-44 is located within the Building 301 asphalt-paved service access roadway located between the building and the airfield's cinder block perimeter wall. The location of OT-44 (AOC-P) with respect to the surrounding facility is shown on Figure 1.2. An aerial photograph of OT-44 (AOC-P) is included as Figure 3.1.

3.1.1 Surface Water

The area encompassed by OT-44 is paved with concrete and/or asphalt. All surface water runoff at OT-44 is directed towards adjacent or nearby storm drains. A long, narrow storm drain trench is present immediately south of Building 301 and west of OT-44.

3.1.2 Geology

The majority of the site is overlain with approximately 2 inches of asphalt and 0 to 10 inches of concrete. Beneath the pavement, poorly graded sands extend laterally from the central portion of the unit to the southwest and underlie the site to a maximum depth of 19 feet bgs. To the northeast, the poorly graded sands grade laterally into a silty sand. The silty sand is also approximately 19 feet thick but contains 6 foot thick beds of silts and very fine sands. Boring logs completed at OT-44 are included as Appendix A.

3.1.3 Hydrogeology

The depth to groundwater beneath OT-44 has fluctuated from five to seven feet bgs over the investigated history of OT-44. Groundwater monitoring indicates the water table is relatively flat with a slight west to southwesterly flow direction. During the OT-44 RI, the average hydraulic gradient for the site was calculated as being approximately 0.006 feet per foot (Radian, 1992). Estimated hydraulic conductivity for OT-44 wells range from 0.001 to 0.0001 centimeters per second (Walk Haydel, 1989b).

3.2 WASTE HISTORY

OT-44 was initially identified after free phase hydrocarbons were observed on the water table during exploratory trenching activities for installation of a sewer line. The source of the hydrocarbons was not determined at that time; however, the source was since identified as a leak within a 25,000 gallon diesel underground storage tank (UST) pipeline. The location of the UST and associated piping is shown on Figure 3.1. The UST was closed and removed in February 1991 after the piping failed a tank tightness test in 1990. The UST was recorded as being in good condition with no corrosion pits, holes, or leaks noted during the removal process.

In March 1997, approximately 60 tons (44.4 cubic yards [yd^3]) of total petroleum hydrocarbon (TPH) contaminated soil was removed from OT-44. Excavation activities continued vertically to the top of the water table, located at approximately 5.5 feet bgs during excavation activities. The excavation was then backfilled and resurfaced to grade with asphalt (Foster Wheeler, 1997).

3.3 PREVIOUS INVESTIGATIONS

Analytical results previous investigations are included as Tables 3.1 through 3.8 with laboratory analytical data sheets included as Appendix B. Historic sample locations and associated TPH concentrations are shown on Figure 3.2.

3.3.1 Site 50 IRP Phase II Stage I, Confirmation/Quantification

An Installation Restoration Program (IRP) Phase II, Stage I Confirmation/ Quantification study was conducted after hydrocarbons were observed on the groundwater during the installation of a sewer line (Dames and Moore, 1987). At the time of the IRP Phase II Stage 1 investigation the source of the hydrocarbons was unknown but assumed to be either associated with former aircraft operation fuel releases west of Building 301 or from a 15,000 gallon, precast-concrete heating oil UST supposedly located south of Building 301 and partially uncovered during excavation activities for the sewer line. Based on the unknown source of the hydrocarbons, the site was designated as 'Site 50,' the Building 301 Aircraft Maintenance Hangar.

The investigation included the installation of an 8-inch monitoring well (designated 50W1) and the completion of one soil boring (designated 50B1). Soil samples obtained from boring 50W1 at 5 to 6.5 feet bgs, 7.5 to 9 feet bgs, and 10 to 11.5 feet bgs and from boring 50B1 at 5 to 6.5 feet bgs and 7.5 to 9 feet bgs, were submitted for laboratory analysis. In addition, one groundwater sample was collected from monitoring well 50W1 and submitted for laboratory analysis. The groundwater sample and five soil samples were submitted for oil and grease, total organic halogens (TOX), and phenolic analyses. In addition, the groundwater sample (50W1) was also submitted for total organic carbon (TOC) and pesticide analyses.

All five soil samples contained detectable concentrations of oil and grease, ranging from 160 milligrams per kilogram (mg/kg) to 4,265 mg/kg. Four of the five soil samples contained TPH at concentrations exceeding the NMED-approved Holloman AFB TPH action level (herein referred to as 'former TPH action level' at the time of 1,000 mg/kg. The TPH concentrations in these four soil samples also exceeded current NMED diesel #2 residential and industrial TPH soil screening levels (SSLs), included for reference on Table 3.1. The four samples with TPH concentrations above criteria were collected at or below the top of the water table, with the highest oil and grease concentrations detected in the 7.5 to 9 foot bgs soil interval in both borings (50W1 and 50B1). The 5 to 6.5 foot bgs soil from boring 50W1 also contained phenolics at 17 mg/kg. IRP Phase II, Stage I soil analytical results are presented on Table 3.1.

The groundwater sample collected during the investigation contained oil and grease and low levels of TOC and TOX. Oil and grease was detected at a concentration of 140 mg/L, which exceeds the current diesel #2 TPH screening level of 1.72 mg/L for groundwater (NMED, 2005). IRP Phase II, Stage I groundwater analytical results are presented on Table 3.2.

Based on the results of the investigation, additional monitoring wells and soil borings were recommended. The investigation did not determine the source of the petroleum.

3.3.2 Remedial Investigation

3.3.2.1 Stage 1

Stage 1 of the RI included the installation and sampling of four soil borings (designated B1 through B4) which were converted into groundwater monitoring wells (MW1 through MW4) (Walk Haydel, 1988). Soil samples were collected from the soil borings at 2.5, 5, and 10 feet bgs and submitted for volatile organic compounds (VOCs) and total recoverable petroleum hydrocarbons (TRPH).

Fifteen additional borings (designated as P1 through P15) were completed, in a 5 by 3 grid on a 10 foot by 10 foot spacing, south of Building 301 in an area believed to contain the 15,000 gallon heating oil UST. The 15 borings were conducted in an effort to locate the heating oil UST. No soil or groundwater samples were collected from these borings for laboratory analysis. The additional borings failed to locate the UST; consequently, one additional boring, B5, was completed near a newer fiberglass diesel UST. Soil samples, obtained from boring B5 at 12.5, 15, and 17.5 feet bgs, were collected based on field screening results and analyzed for TRPH.

TRPH concentrations were detected in soil samples obtained from boring B1 (MW1) and B2 (MW2). In B1, TRPH was detected solely in the 2.5 foot soil sample (526 mg/kg) and at a concentration well below the former TPH action level of 1,000 mg/kg. Based on the current NMED diesel #2 SSLs, TPH concentrations in boring B1 at 2.5 feet bgs slightly exceed the NMED residential diesel #2 SSL. Within B2 (MW2), TRPH were detected solely in the 5 foot soil sample, near the top of the water table, and were detected at concentrations of 7,946 mg/kg, exceeding the former TPH action level of 1,000 mg/kg as well as current residential and industrial diesel #2 SSLs. Several VOCs including benzene, chlorobenzene, ethylbenzene, styrene, tetrachloroethene, toluene, and trichlorofluoromethane were detected in B1 (MW1) and/or B2 (MW2) in the 5 and/or 10 foot samples at concentrations well below residential SSLs. No TRPH or VOCs were detected in the soil samples collected from B3 (MW3) and B4 (MW4), and no TRPH was detected in B5. Soil RI Stage I results are presented on Table 3.3.

Groundwater samples collected from MW1 through MW4 contained TRPH, trichloroethene (TCE), and 1,1,1-trichloroethane. With the exception of TRPH, all were below New Mexico Groundwater Quality (NMGWQ) standards. TCE was detected in all four wells and ranged in

concentration from 2.4 micrograms per liter (μg/L) in MW4 to 49.1 μg/L in MW1. 1,1,1-Trichloroethane was detected in MW1 and MW2 at 28.6 μg/L and 125 μg/L, respectively. Only groundwater samples from MW2, MW3, and MW4 were submitted for TRPH analysis. TRPH were detected solely within MW2 and were detected at a concentration of 17 mg/L, above the diesel #2 screening level of 1.72 mg/L. Groundwater RI Stage I analytical results are presented in Table 3.4.

The source of the petroleum hydrocarbons was not identified in the Stage 1 portion of the RI. Consequently, the Stage I RI report recommended the installation of a background groundwater monitoring well as well as the collection of additional soil and groundwater samples to identify the source of the petroleum hydrocarbons (Walk Haydel, 1988).

3.3.2.2 Stage 2

The Stage 2 portion of the RI included the completion of five soil borings (designated P16 through P20) in an effort to locate the 15,000 gallon heating oil UST; the installation of a background monitoring well, MW6; and one round of groundwater sampling of the onsite monitoring wells.

The five soil borings were completed in an area between Building 301 and the previous 15 soil borings. The locations of borings P16 through P20 are shown on Figure 3.2. None of the soil borings located the heating oil UST. MW6, the upgradient monitoring well, was installed to determine if organic contaminants previously detected in MW1 and MW2 were from an upgradient source.

Three soil samples, from 2.5, 5, and 20 feet bgs were collected from the MW6 borehole (identified as B6) and analyzed for volatile organic analytes (VOAs), base, neutral, and acid extractables (BN/AE), and TRPH. A groundwater sample from MW6 was also collected and submitted for VOCs, BN/AE, and TRPH. Groundwater samples were also collected from MW1 and MW2 and analyzed for VOCs and TRPH.

No organic compounds were detected in the MW6 soil samples. TRPH was detected in the MW6 groundwater sample at a concentration of 2 mg/L, which exceeds the groundwater diesel #2 TPH screening level of 1.72 mg/L. The elevated TRPH concentration in MW6 indicated an upgradient TPH source impacting the OT-44 groundwater. 2,4-Dinitrotoluene was detected in the MW6 groundwater sample at 58 μg/L. TCE was detected in MW1 at 16 μg/L and in MW2 at 9 μg/L. Results of the RI Stage II soil and groundwater investigation are presented on Tables 3.3 and 3.4, respectively.

Based on the data collected, soil and groundwater contamination, to a depth of 10 feet bgs, was identified south of Building 301. Contaminants detected included TRPH, fuel-related VOCs, and solvents. In addition, groundwater was determined to flow from the northeast to the southwest, suggesting the source of the hydrocarbons was not from former aircraft releases west of Building 301.

A Baseline Risk Assessment (BRA), conducted on the site determined the only applicable migration route was soil to groundwater leaching and groundwater transport. Holloman AFB groundwater contain high TDS concentrations and other sources of potable water exist, groundwater is not used as a potable water source in the vicinity of OT-44. Consequently, the BRA concluded that contaminant exposure was limited to groundwater consumption by livestock. Onsite worker exposure was also considered. Based on the information collected, the BRA determined OT-44 (old Site 50) posed no significant risk to human health or the environment (Walk Haydel, 1989a). Consequently, the RI recommended NFA (Walk Haydel, 1989b).

Based on the results of the 1989 RI (Walk Haydel, 1989b) and BRA Report (Walk Haydel, 1989a), Holloman AFB submitted a Decision Document for OT-44 requesting NFA (Walk Haydel, 1990). After reviewing the Decision Document, NMED required additional investigation of OT-44 to confirm that TRPH concentrations in soil did not exceed the former TPH action level of 1,000 mg/kg.

3.3.3 UST 5RM 301 Excavation and Removal

In 1990, the 25,000 gallon diesel UST (UST 5RM 301) failed a tank tightness test. The locations of the diesel UST and associated piping are shown on Figure 3.1. Three vapor detection points were installed adjacent to an underground pipe running north from the UST into Building 301. A small intermittent leak was detected. Based on facility records, the UST was closed in February 2001. During the closure process, the UST was excavated from the subsurface and visually inspected. The UST was determined to be in good condition with no corrosion pits, holes, or leaks noted. The UST was also noted to have been located within the water table, but no indication of soil and groundwater quality was obtained from facility records. Copies of the facility's records regarding the UST removal are included in Appendix C.

3.3.4 Hazardous Waste Permit

On August 22, 1991, the EPA and NMED jointly issued a Hazardous Waste Permit for Holloman AFB to operate a hazardous waste disposal facility (EPA, 1991). Site OT-44 is included as AOC-P in Table 1 of the permit.

3.3.5 Phase II RCRA Facility Investigation

A Phase II RFI, addressing NMED concerns on TPH concentrations exceeding the former TPH action level, was conducted in 1994 and consisted of completing six soil borings designated as 44-B07 through 44-B12 (Foster Wheeler, 1995). Soil samples, collected from 1 to 3 feet bgs and 3 to 5 feet bgs from 44-B08 through 44-B12 and from 0.5 to 2.5 feet bgs, 2.5 to 4.5 feet bgs, and 4.5 to 6.5 feet bgs in boring 44-B07 were submitted for TRPH analysis using EPA Method 418.1.

Stained soils were encountered in boring 44-B07 and slightly stained soils were encountered in boring 44-B11. TRPH were detected in five of the six soil borings (44-B07 and 44-B09 through 44-B12); concentrations, with the exception of boring 44-B07, were below the formerly TPH action level of 1,000 mg/kg and current diesel #2 residential SSL (included in Table 3.5 for reference). Soil samples collected from 0.5 to 2.5 and 2.5 to 4.5 feet bgs in boring 44-B07 contained TRPH concentrations of 17,100 mg/kg and 30,700 mg/kg, respectively, exceeding the former TPH action level (1,000 mg/kg) and current residential and industrial diesel #2 SSLs. TRPH was not detected in the 4.5 to 6.5 foot bgs soil sample in boring 44-B07. Results of the 1994 Phase II RFI are included as Table 3.5.

Based on sampling results, the Phase II RFI recommended conditional NFA with NFA status requiring remediation of the TRPH-contaminated soils to the Base-specific cleanup level of 1,000 mg/kg. A Class 3 permit modification request was submitted to EPA Region VI recommending site closure (Foster Wheeler, 1995).

3.3.6 Additional Characterization of POL-Contaminated Sites

In February 1996, additional characterization was performed to further delineate contaminated soil in excess of 1,000 mg/kg (Groundwater Technology, 1996). Three soil borings (OT44-DP1 through OT44-DP3) were completed, characterized and sampled. Two soil samples per boring, based on field screening results, were collected and analyzed for gasoline-range organics (GRO), diesel-range organics (DRO), TRPH, and benzene, toluene, ethylbenzene, and total xylenes (BTEX).

None of the analyzed compounds were detected in boring OT44-DP1. GRO, DRO, and TRPH were detected in borings OT44-DP2 and OT44-DP3, while ethylbenzene and total xylenes were detected solely within boring OT44-DP2. Boring OT44-DP3 was completed in the vicinity of the former UST pipe leak. The highest GRO, DRO, and TRPH concentrations detected in boring OT44-DP3 were detected in the 2 to 4 foot soil interval. TRPH concentrations dropped significantly in the 4 to 5 foot soil interval sample. Within boring OT44-DP2, maximum concentrations of the detected analytes were reported in the 5 to 6 foot soil interval. DRO and TRPH concentrations in borings OT44-DP2 and OT44-DP3 exceeded the former TPH action level of 1,000 mg/kg and current residential and industrial diesel #2 SSLs. Analytical results are included as Table 3.6.

3.3.7 Final Closure Report Addendum

Approximately 60 tons (44.4 yd^3) of TPH-impacted soils were excavated from OT-44 and disposed off site in March 1997 (Foster Wheeler, 1997). Excavation activities were conducted in an area where vadose zone soils contained TRPH concentrations above the former TPH action level of 1,000 mg/kg based on previous soil sampling activities. The excavated area correlates with the leak from the product pipeline sampling from the 25,000 gallon diesel UST. TPH-impacted soils were excavated to the top of the water table, estimated to be approximately 5 feet bgs. Verification soil samples were collected from the excavation sidewalls during advancement of the excavation and submitted for TRPH analysis. Excavation activities above

the water table ceased when TRPH analysis results were below the former TPH action level of 1,000 mg/kg. Analytical results are summarized on Table 3.7. For reference, diesel #2 residential and industrial SSLs have also been included on Table 3.7. None of the verification soil samples contained TRPH at concentrations exceeding the diesel #2 SSLs; however, the TRPH concentration in sample OT44-01-03 equaled the diesel #2 residential SSL. The location of the verification soil samples used in determining the extent of excavation activities and their associated TRPH analytical results are depicted on Figure 3.2.

3.3.8 Long Term Groundwater Monitoring

Biennial long term monitoring (LTM) of VOC concentrations in groundwater beneath OT-44 was initiated in 1995 and conducted through 2001. Based on the analytical results obtained during the four LTM events, Holloman AFB recommended a cessation of LTM activities in the 2001 LTM report (Foster Wheeler, 2002). In the NMED 2001 LTM report comment response letter, dated February 24, 2003, NMED had no comment on the proposed cessation of LTM activities at OT-44 (AOC P). Consequently, LTM activities at OT-44 ceased. A copy of the NMED 2001 LTM report comment response letter is included in Appendix C.

VOCs detected in the OT-44 groundwater included benzene, sec-butylbenzene, carbon disulfide, chloroform, methylene chloride, toluene, and TCE. The majority of the VOCs detected were in MW2 during the 1997 LTM event. With the exception of carbon disulfide and TCE, all of the VOCs were detected solely during the 1997 LTM event. Carbon disulfide was detected in MW2 in 1995, 1997 and 1999 while TCE was detected in MW2 only during the 1999 LTM event. TCE was detected below the MCL at 1 μg/L. OT-44 LTM analytical results are presented in Table 3.8.

The 1997 LTM event was conducted in September 1997 after TPH excavation activities (i.e., March 1997) had been completed. The presence of the VOCs in groundwater samples retrieved from the downgradient wells was most likely attributable to the agitation of the groundwater system that occurred during excavation activities. None of the historically detected VOCs were detected during the 2001 LTM event, leading to cessation of LTM.

This page was intentionally left blank.

TABLES

Table 3.1
Soil Analytical Results
IRP Phase II Stage I Confirmation/Quantification Study
OT-44 (AOC P)
Holloman AFB

Parameter	NMED-approved Holloman TPH Action Level	NMED Soil Screening Levels[1]			50W1			50B1	
		Residential	Industrial/ Commercial	Construction	5-6.5 (feet)	7.5-9 (feet)	10-11.5 (feet)	5-6.5 (feet)	7.5-9 (feet)
Metals (mg/kg)									
Arsenic		3.90	17.7	85.2	--	--	--	--	--
Cadmium		39	564	154	--	--	--	--	--
Chromium (hexavalent)		234	3,400	26.1	--	--	--	--	--
Nickel		1,560	22,700	6,190	--	--	--	--	--
Lead		400	800	800	--	--	--	--	--
Silver		391	5,680	1,550	--	--	--	--	--
Oil and grease (mg/kg)	1,000	520[2]	1,120[2]	NA	160	**3,700**	**1,143**	**1,192**	**4,265**
TOC (mg/kg)		NA	NA	NA	--	--	--	--	--
TOX (mg/kg)		NA	NA	NA	<5	<5	<5	<5	<5
Phenolics (mg/kg)		NA	NA	NA	17	<1	<1	<1	<1

[1] Obtained from Table A-1 (NMED, 2006).
[2] Diesel #2 TPH SSL (NMED, 2005).
mg/kg = milligrams per kilogram
-- = not detected
TOC = total organic carbon
TOX = total organic halides
NA = not applicable
Results in **BOLD** indicate concentration above screening criteria
Source: Dames and Moore, 1987.

Table 3.2
Groundwater Analytical Results
IRP Phase II, Stage 1 – Confirmation/Quantification Study
OT-44 (AOC P)
Holloman AFB

Parameter	NMGWQ Standards[1]	EPA MCLs	Unit	50W1	
				Result	DL
Arsenic	100	10	μg/L	<	10
Cadmium	10	5	μg/L	<	10
Chromium (hexavalent)	50	100	μg/L	<	4
Nickel	200	NA	μg/L	<	10
Lead	50	15[2]	μg/L	<	10
Silver	50	NA	μg/L	<	10
Oil and grease	1,720[3]	NA	μg/L	**140,000**	600
TOC	NA	NA	μg/L	95,000	1,000
TOX	NA	NA	μg/L	120	10
Phenolics	NA	NA	μg/L	<	10

[1] New Mexico Administrative Code (NMAC) 20.6.2.3103
[2] action level
[3] Diesel #2 TPH screening level (NMED, 2005)
μg/L = micrograms per liter
< = Not detected above the detection limit
DL = detection limit
TOC = total organic carbon
TOX = total organic halides
MCL = Maximum Contaminant Level
EPA = United States Environmental Protection Agency
NA = not applicable
Results in **BOLD** exceed one or more screening criteria
Source: Dames and Moore, 1987.

Table 3.3
Soil Analytical Results
Phase II Remedial Investigation
OT-44 (AOC P)
Holloman AFB

Location	NMED-approved Holloman TPH Action Level	NMED Soil Screening Levels[1]			B1			B2			B3		
Depth (feet)		Residential	Industrial/ Occupational	Construction	2.5	5	10	2.5	5	10	2.5	5	10
Benzene		10,300	25,800	174,000	--*	9	--	--	--	--	--	--	--
Chlorobenzene		194,000	245,000	245,000	--	--	--	--	40	--	--	--	--
Ethylbenzene		128,000	128,000	128,000	--	--	--	--	33	--	--	--	--
Styrene		100,000	100,000	100,000	--	5	--	--	--	--	--	--	--
Tetrachloroethene		12,500	31,600	134,000	--	39	5*	--	9	--	--	--	--
Toluene		252,000	252,000	252,000	--	6	--	--	9	--	--	--	--
Trichlorofluoromethane		588,000	983,000	983,000	--	374	83	--	39	103	--	--	--
BN/AE (μg/kg)		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TRPH (mg/kg)	1,000	520[2]	1,120[2]	NA	**526**	--	--	--	**7,946**	--	--	--	--

Location	NMED-approved Holloman TPH Action Level	NMED Soil Screening Levels[1]			B4			B5			B6		
Depth (feet)		Residential	Industrial/ Occupational	Construction	5	7.5	10	12.5	15	17.5	2.5	5	20
Benzene		10,300	25,800	174,000	--	--	--	NA	NA	NA	(--)	(--)	(--)
Chlorobenzene		194,000	245,000	245,000	--	--	--	NA	NA	NA	(--)	(--)	(--)
Ethylbenzene		128,000	128,000	128,000	--	--	--	NA	NA	NA	(--)	(--)	(--)
Styrene		100,000	100,000	100,000	--	--	--	NA	NA	NA	(--)	(--)	(--)
Tetrachloroethene		12,500	31,600	134,000	--	--	--	NA	NA	NA	(--)	(--)	(--)
Toluene		252,000	252,000	252,000	--	--	--	NA	NA	NA	(--)	(--)	(--)
Trichlorofluoromethane		588,000	983,000	983,000	--	--	--	NA	NA	NA	(--)	(--)	(--)
BN/AE (μg/kg)		NA	NA	NA	NA	NA	NA	NA	NA	NA	(--)	(--)*	(--)
TRPH (mg/kg)	1,000	520[2]	1,120[2]	NA	--	--	--	--	--	--	(24)	(25)	(--)

[1] Obtained from Table A-1 (NMED, 2006)
[2] Diesel #2 TPH SSL (NMED, 2005)
μg/kg = micrograms per kilogram
mg/kg = milligrams per kilogram
-- = not detected
( ) = stage II data
* = Corps of Engineers lab data
Source: Walk Haydel, 1989b.

BN/AE = base neutrals/acid extractables
TRPH = total recoverable petroleum hydrocarbons
VOCs = volatile organic compound
NA = not analyzed / not applicable
Results in **BOLD** exceeded the base-specific TRPH limit of 1,000 mg/kg

Table 3.4
Groundwater Analytical Results
Phase II Remedial Investigation
OT-44 (AOC P)
Holloman AFB

	NMGWQ[1] Standards	EPA MCL	Monitoring Well									
			STAGE I				STAGE II					
			MW 1	MW 2	MW 3	MW 4	MW 1	MW 2	MW 3	MW 4	MW 6	MW 6-D[2]
Volatiles (μg/L)												
1,1,1-Trichloroethane	60	200	22*	--	--	--	(--)	(--)	NA	NA	(--)	(--)
Trichloroethene	100	5	*75**	--	--	--	*(16)*	*(9)*	NA	NA	(--)	(--)
1,1-Dichloroethane	25	NA	7*	--	--	--	(--)	(--)	NA	NA	(--)	(--)
1,1-Dichloroethylene	5	7	2*	--	--	--	(--)	(--)	NA	NA	(--)	(--)
1,2-trans-Dichloroethylene	NA	100	5*	--	--	--	(--)	(--)	NA	NA	(--)	(--)
Acid/Base/Neutral Extractables (μg/L)												
2,4-Dinitrotoluene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	(58)	(56)
TRPH (mg/L)	1.72[3]	NA	--	**17**	--	--	(--)	**(9)**	NA	NA	**(2)**	**(2)**

[1] NMAC 20.6.2.3103
[2] Duplicate of MW-6
[3] Diesel #2 TPH screening level (NMED, 2005)
NMGWQ = New Mexico Groundwater Quality
EPA = United States Environmental Protection Agency
MCL = Maximum Contaminant Level
TRPH = total recoverable petroleum hydrocarbon
μg/L = micrograms per liter
mg/L = milligrams per liter
-- = not detected
( ) = stage II data
* = Corps of Engineers lab data
NA = not analyzed / not applicable
Results in **BOLD** and *italics* exceed NMGWQ Standards for human health and EPA Primary Drinking Water MCLs
Results in **BOLD** exceed NMGWQ Standards for human health
Results in *italics* exceed EPA MCLs
Source: Walk Haydel, 1989b.

Table 3.5
Soil Analytical Results
Phase II RCRA Facility Investigation
OT-44 (AOC P)
Holloman AFB

Location ID	Depth (feet)	TRPH Result (mg/kg)	TRPH DL
NMED-approved Holloman TPH action level		1,000	
NMED Residential Diesel #2 SSL		520	
NMED Industrial Diesel #2 SSL		1,120	
44-B07	0.5-2.5	**17,100**	565
	2.5-4.5	**30,700**	791
	4.5-6.5	<	29
44-B08	1-3	<	29
	3-5	<	29
44-B09	1-3	<	29
	3-5	145	29
44-B10	1-3	<	31
	3-5	264	28
44-B11	1-3	156	26
	3-5	404	25
44-B12	1-3	70	26
	3-5	169	29

mg/kg = milligrams per kilogram
< = Not detected at or above the detection limit
DL = detection limit
TRPH = total recoverable petroleum hydrocarbons
Results in **BOLD** exceed the diesel #2 residential (520 mg/kg) and/or industrial (1,120 mg/kg) SSLs
Source; Foster Wheeler, 1995.

Table 3.6
Soil Analytical Results
Additional Soil Characterization Activities
OT-44 (AOC P)
Holloman AFB

Parameter	NMED Soil Screening Levels[1]			OT-44-DP1		OT44-DP2		OT44-DP3	
	Residential	Industrial/ Commercial	Construction	2-3	4-5	5-6	6-8	2-4	4-5
GRO (mg/kg)	NA	NA	NA	--	--	490	413	42	3 J
DRO (mg/kg)	520[2]	1,120[2]	NA	--	--	**11,000**	**11,000**	**8,200**	32
TRPH (μg/kg	520[2]	1,120[2]	NA	--	--	**19,100**	**12,600**	**12,500**	74
Benzene (μg/kg)	10,300	25,800	174,000	--	--	--	--	--	--
Toluene (μg/kg)	252,000	252,000	252,000	--	--	--	--	--	--
Ethylbenzene (μg/kg)	128,000	128,000	128,000	--	--	1,360	790	--	--
Xylene (μg/kg)	82,000	82,000	82,000	--	--	810	550 J	--	--

[1] Obtained from Table A-1 (NMED, 2006)
[2] NMED Diesel #2 TPH SSL (NMED, 2005)
-- = not detected
J = estimated value less than sample quantitation limit
GRO = gasoline-range total petroleum hydrocarbons
DRO = diesel-range total petroleum hydrocarbons
TRPH = total recoverable petroleum hydrocarbons
mg/kg = milligrams per kilogram
μg/kg = micrograms per kilogram
Values in **BOLD** indicate TRPH concentrations exceeding base-specific TPH action level of 1,000 mg/kg
Source: Groundwater Technology, 1996.

Table 3.7
Soil Analytical Results
Excavation Closure Verification Sampling
OT-44 (AOC P)
Holloman AFB

Sample ID	NMED-approved Holloman TPH Action Level	NMED Diesel #2 SSL[1]		OT44-01-03	OT44-01-03^	OT44-02-03	OT44-020-03^	OT44-03-03	OT44-030-03^	OT44-04-03	OT44-040-03^
		Residential	Industrial								
Date Sampled				**3/17/1997**	**3/17/1997**	**3/17/1997**	**3/17/1997**	**3/17/1997**	**3/17/1997**	**3/17/1997**	**3/17/1997**
TRPH (mg/kg)	1,000	520	1,120	260	520	46	49	<20	27	32	25

[1] NMED, 2005
mg/kg = milligrams per kilogram
< = Constituent not detected above laboratory quantitation limit
TRPH = total recoverable petroleum hydrocarbons
NMED = New Mexico Environment Department
SSL = soil screening level
^ = duplicate sample; acceptance limit is 50%
Source: Foster Wheeler, 1997.

Table 3.8
Groundwater Analytical Results
Biennial Groundwater Long Term Monitoring (1995-2001)
OT-44 (AOC P)
Holloman AFB

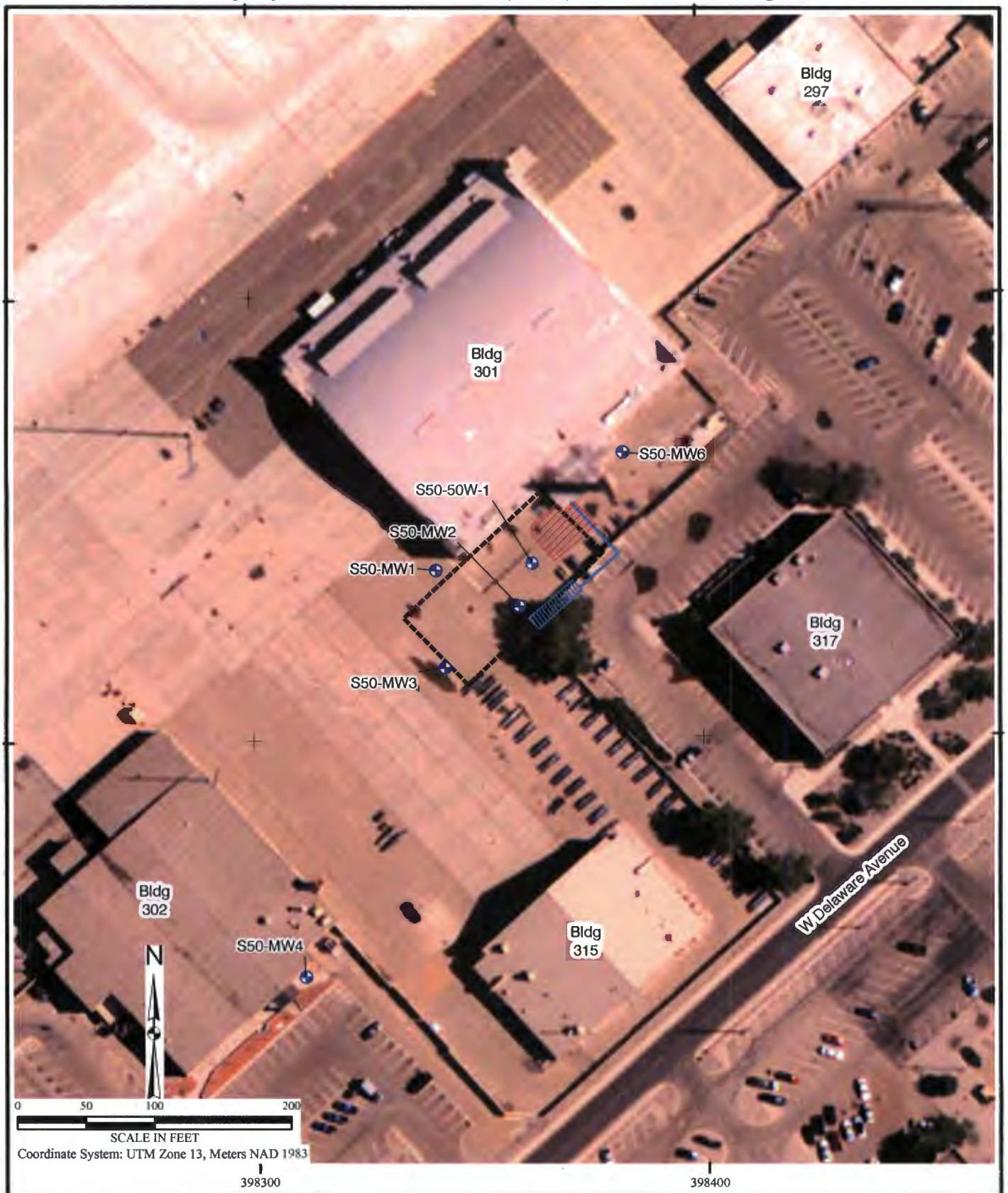
Sampling Date	NMGWQ Standards[1]	EPA MCL	S50-MW1				S50-MW2			
			Aug-95	Sep-97	Sep-99	Sep-01	Aug-95	Sep-97	Sep-99	Sep-01
VOCs (μg/L)										
Benzene	10	5	NS	--	--	--	--	1.2	--	--
sec-Butylbenzene	NA	NA	NS	--	NA	--	--	1.9 J	NA	--
Carbon disulfide	NA	NA	NS	--	--	--	11	2.6 J	5	--
Chloroform	100	NA	NS	0.76 J	--	--	--	--	--	--
Methylene chloride	100	NA	NS	--	--	--	--	7.2 UB	--	--
Toluene	750	1,000	NS	--	--	--	--	1.4	--	--
Trichloroethylene	100	5	NS	--	--	--	--	--	1 J	--

Sampling Date	NMGWQ Standards[1]	EPA MCL	S50-MW3				S50-MW6[2]			
			Aug-95	Sep-97	Sep-99	Sep-01	Aug-95	Sep-97	Sep-99	Sep-01
VOCs (μg/L)										
Benzene	10	5	NS	--	--	--	--	--	--	--
sec-Butylbenzene	NA	NA	NS	--	NA	--	--	--	NA	--
Carbon disulfide	NA	NA	NS	--	--	--	--	1.8 J	--	--
Chloroform	100	NA	NS	--	--	--	--	--	--	--
Methylene chloride	100	NA	NS	7.6 UB	--	--	--	7.1 UB	--	--
Toluene	750	1,000	NS	--	--	--	--	--	--	--
Trichloroethylene	100	5	NS	--	--	--	--	--	--	--

[1] NMAC 20.6.23103
[2] upgradient monitoring well
-- = not detected
NS = not sampled
NA = not analyzed/not applicable
VOCs = volatile organic compounds
μg/L = micrograms per liter
NMGWQ = New Mexico Groundwater Quality
EPA = United States Environmental Protection Agency
MCL = Maximum Contaminant Level
Source: Foster Wheeler, 2002.

Laboratory Qualifiers - assigned as a result of laboratory data assessment procedures
J = Estimated value, less than CRDL but greater than or equal to IDL
UB = Qualifies as nondetect due to presence of analyte in associated laboratory blank

FIGURES

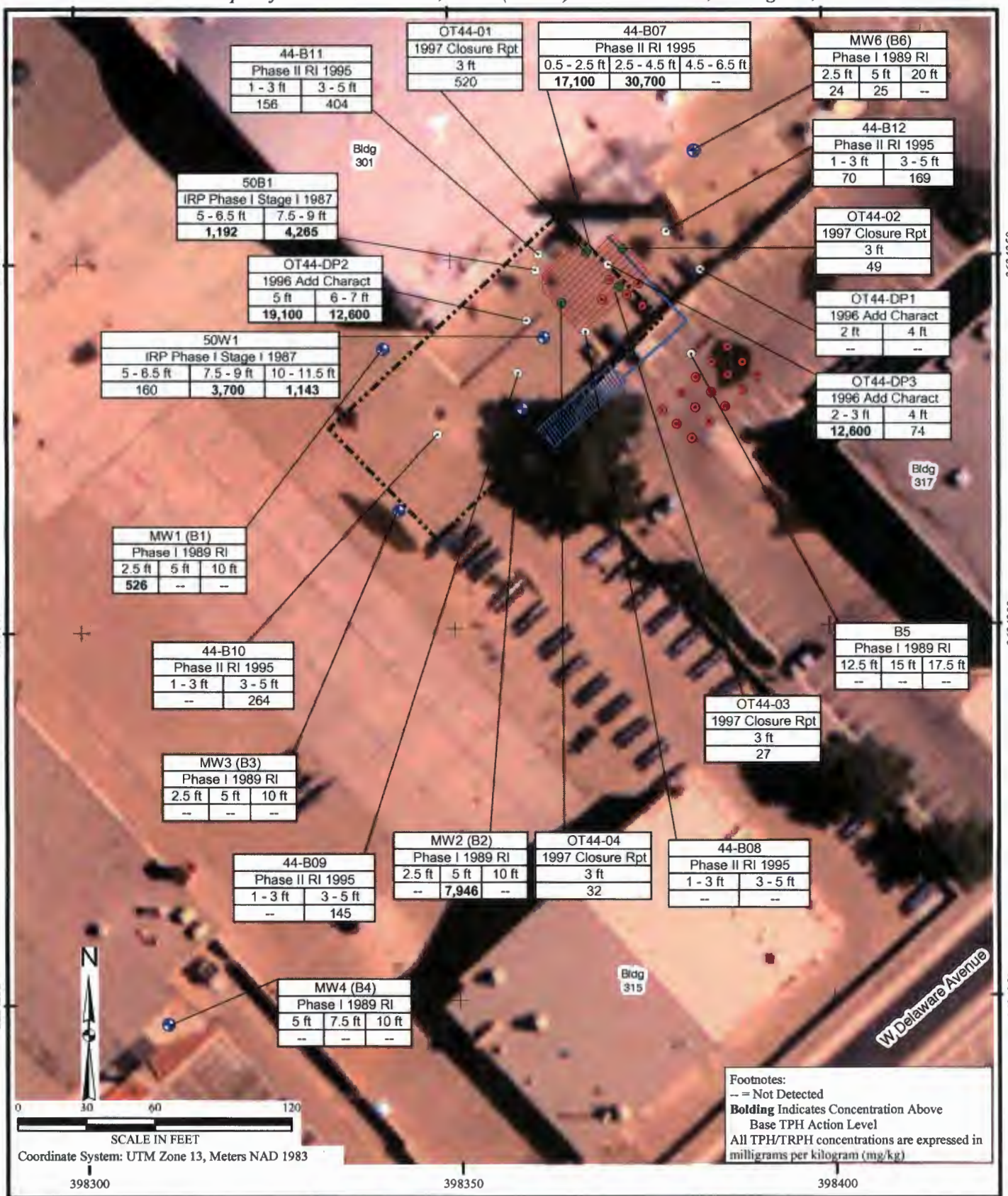


File X:\AFC002\Holloman_AFB\TO37\Maps\OT-44_NFA\Aerial_OT-44.mxd
Project: AFC002-037-04-09-03
Revised: 08/04/06 PS
Map Source: Holloman AFB

Legend

- Monitoring Well
- Excavation Area
- Former UST Location
- Fuel Line
- SWMU Boundary (Base GIS)

Figure 3.1
Site Layout Map
OT-44 (AOC-P)
Holloman AFB



File X:\AFC002\Holloman_AFB\TO37\Maps\OT-44_NFA\OT-44_tables.mxd
Project: AFC002-037-04-12-01
Revised: 09/14/06 PS
Map Source: Holloman AFB

Legend

- Monitoring Well
- Soil Boring
- Field Screened Soil Borings
- Excavation Verification Soil Sample
- Fuel Line
- SWMU Boundary (Base GIS)
- Excavation Area
- Former UST Location (Approximate Location)

Figure 3.2
Soil TRPH Concentrations
OT-44 (AOC-P)
Holloman AFB

4.0 CONCLUSIONS

TPH contaminated media south of Building 301 was the result of a leak within a product pipeline running from the 25,000 gallon diesel UST to Building 301. The pipeline leak was identified during a tank tightness test conducted on the UST in 1990. No other leaks were identified during the tightness test. The diesel UST was closed and removed in February 1991. Subsurface soil sampling of OT-44 identified TPH concentrations, in the vadose zone, above the former TPH action level of 1,000 mg/kg and the current diesel #2 residential (520 mg/kg) and industrial (1,120 mg/kg) TPH SSLs in the vicinity of the former pipeline leak as well as below the underlying water table.

In March 1997, Holloman AFB conducted remediation at OT-44 (AOC-P). Approximately 60 tons (44.4 yd^3) of diesel-impacted soil were excavated from the vadose zone and removed from the site. Verification soil samples collected from the excavation sidewalls were used to verify the removal of impacted soils (i.e., TPH concentrations above the former TPH action level [1,000 mg/kg]. Based on verification sampling, soils containing TPH above the current residential diesel #2 SSL were removed from the site. Soils below the water table containing TPH concentrations above 1,000 mg/kg were left in place since impacts from these soils would be assessed during LTM activities.

Biennial groundwater LTM activities were initiated in 1995 and continued until 2001 to monitor VOC concentrations. During the first three LTM events several VOCs were detected; however, VOC concentrations were well below applicable groundwater standards. During the 2001 LTM, no VOCs were detected, and a cessation of LTM activities at OT-44 was proposed in the 2001 LTM report. NMED had no comments on this proposal in their comment response letter to the 2001 LTM report. Consequently, LTM activities at OT-44 ceased.

This page was intentionally left blank.

5.0 RECOMMENDATIONS

Vadose zone soils impacted with TPH at concentrations above 520 mg/kg, the current diesel #2 residential SSL, were excavated and removed from the site. Verification soil samples collected from the edges of the soil excavation confirmed the removal of the TPH impacted soils above SSLs. Soils below the water table containing TPH at concentrations above 520 mg/kg were left in place, since LTM would assess impacts to the underlying groundwater. Four biennial rounds of LTM determined that minor VOC-impact to the groundwater had occurred. Several VOCs were detected sporadically over the seven years; however, all of the VOCs detected were at concentrations well below the detection limit of the analytical method and groundwater standards. No VOCs were detected in the final round of LTM conducted in 2001. Therefore, No Further Action, under NMED Criterion 5, and modification of the permit to reflect same is recommended for this site.

This page was intentionally left blank.

6.0 REFERENCES

Dames and Moore, 1987. Installation Restoration Program Phase II - Confirmation / Quantification Stage 1 Report (April 1984 to March 1985), Holloman Air Force Base, New Mexico. March 6.

EPA (U.S. Environmental Protection Agency), 1986. Guidelines for Groundwater Classification Under the EPA Groundwater Protection Strategy. Final Draft. Office of Groundwater Protection (WH-550G), Washington, D.C. December.

EPA (Environmental Protection Agency), 1991. Transmittal of Hazardous Waste Permit for Holloman Air Force Base NM6572124422.

Foster Wheeler (Foster Wheeler Environmental Corp.), 1995. Draft Final Phase II RCRA Facility Investigation Report, Table 1 Solid Waste Management Units, Volume 1. June.

Foster Wheeler (Foster Wheeler Environmental Corp.), 1997. Final Closure Report Addendum for Phase II Remediation of POL Contaminated Sites and Oil/Water Separator and Waste Oil Tank Removals. December.

Foster Wheeler (Foster Wheeler Environmental Corp.), 2002. Final 2001 Long-Term Groundwater Monitoring Report, Holloman Air Force Base, New Mexico. July.

Groundwater Technology (Groundwater Technology Government Services), 1996. Additional Characterization of POL-Contaminated Sites SWMU-3, SWMU-8, SWMU-36, SWMU-123, and OT-44, Holloman Air Force Base, New Mexico. February 29.

NMED (New Mexico Environment Department), 2005. New Mexico Environment Department TPH Screening Guidelines. November.

NMED (New Mexico Environment Department), 2006. Technical Background Document for Development of Soil Screening Levels, Revision 4.0. June.

Radian (Radian Corporation), 1992. Final Draft Risk Assessment Report for the Remedial Investigation, Volume 1 - Text, Investigation, Study and Recommendation for 29 Waste Sites. June.

USDA (U.S. Department of Agriculture Soil Conservation Service and Forest Service), 1981. Soil Survey of Otero Area, New Mexico, Parts of Otero, Eddy and Chaves Counties.

Walk Haydel (Walk, Haydel and Associates, Inc.), 1988. Stage 1 Drilling and Sampling Technical Report. June.

Walk Haydel (Walk, Haydel and Associates, Inc.), 1989a. Installation Restoration Program Remedial Investigation, Final Baseline Risk Assessment. December.

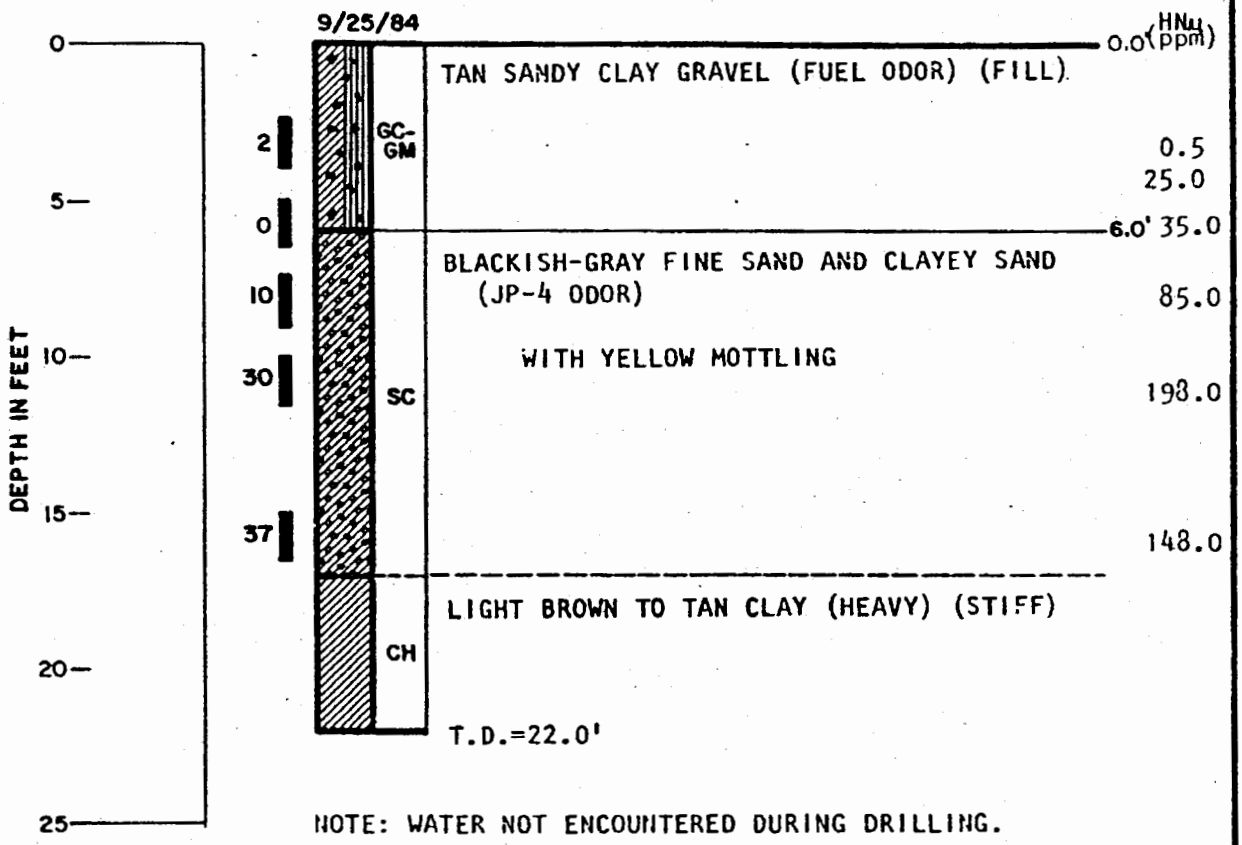
Walk Haydel (Walk, Haydel and Associates, Inc.), 1989b. Installation Restoration Program Remedial Investigation Final Remedial Investigation Report, Holloman Air Force Base, New Mexico, Volume I. December.

Walk Haydel (Walk, Haydel and Associates, Inc.), 1990. Installation Restoration Program, Holloman Air Force Base, New Mexico, Decision Documents, Site LF-01 (Old Site 1) - Main Base Landfill; Site LF-10 (Old Site 10) - Old Main Base Landfill; Site SD-25 (Old Site 25) - Drainage Lagoon; Site FT-31 (Old Site 31) - Fire Department Training Area; Site OT-44 (Old Site 50) - Building 301, Aircraft Maintenance Hangar; Site SS-46 (Old Site 53) - JP4 Underground Waste Tank; and Site SS-48 (Old Site 55) - Military Gas Station. November.

APPENDIX A

BORING LOGS

HOLLOMAN AFB
BORING 50-BI

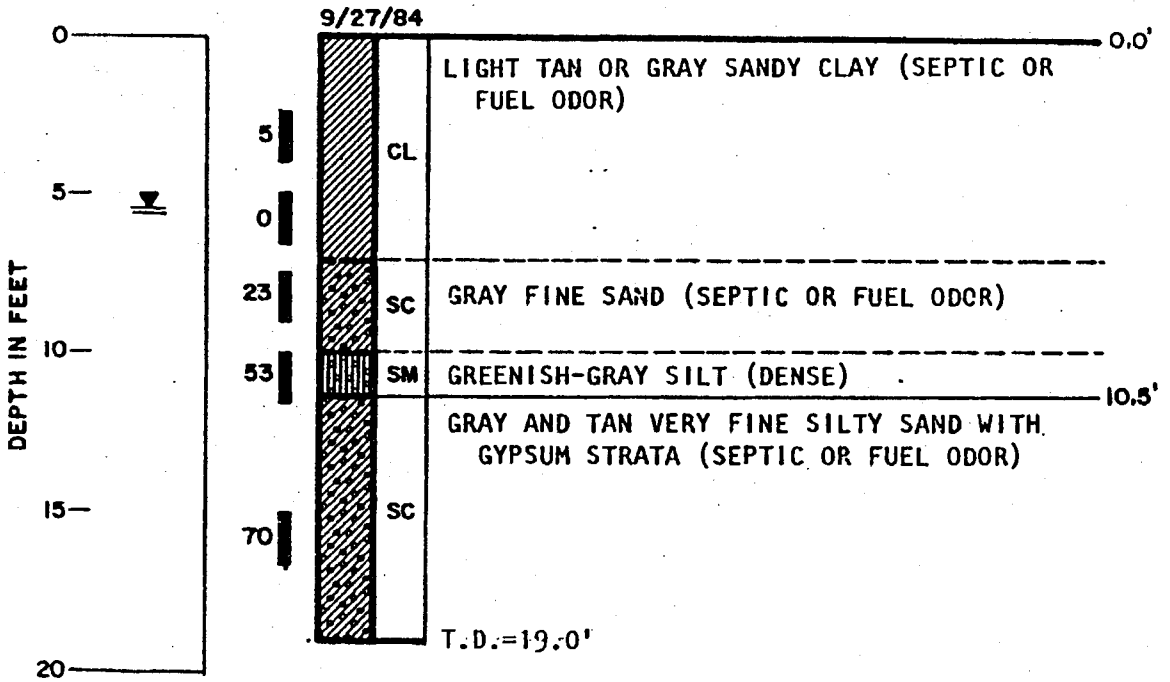


NOTE: WATER NOT ENCOUNTERED DURING DRILLING.

LOG OF BORING

Dames & Moore

HOLLOMAN AFB
BORING 50-WI



NOTES: 1. STATIC WATER LEVEL MEASURED 10/2/84.

2. HN_4 READINGS WERE NOT RECORDED DUE TO EQUIPMENT MALFUNCTION.

LOG OF BORING

Dames & Moore

PROFESSIONAL SERVICE INDUSTRIES, INC.

BORING NO. S50-MW1 PROJECT NO. 342-65219H PROJECT NAME Holloman Air Force Base

DATE/TIME START 3/28/88 8:00 DATE/TIME END 3/28/88 9:30 DRILL CREW Mitchell*/Caho/Flair
* Engineer

DRILLING METHOD: AUGER 0 FT TO 23 FT, ROTARY - FT TO - FT DRILL RIG CME 55

AUGER/BIT SIZE(S) & INTERVAL(S) 6¼" I.D. 0'-7'/3¼" I.D. 7-23' SURFACE COVER Asphalt

TOC ELEV. 4069.69 BORING COORDINATES N 670186 E 550435 WATER DURING DRILLING 5.0'

WATER AT COMPLETION 5.0' DELAYED WATER LEVEL Monitor well installed in boring

DATE GROUTED N/A MATERIAL(S) & QUANTITY N/ A

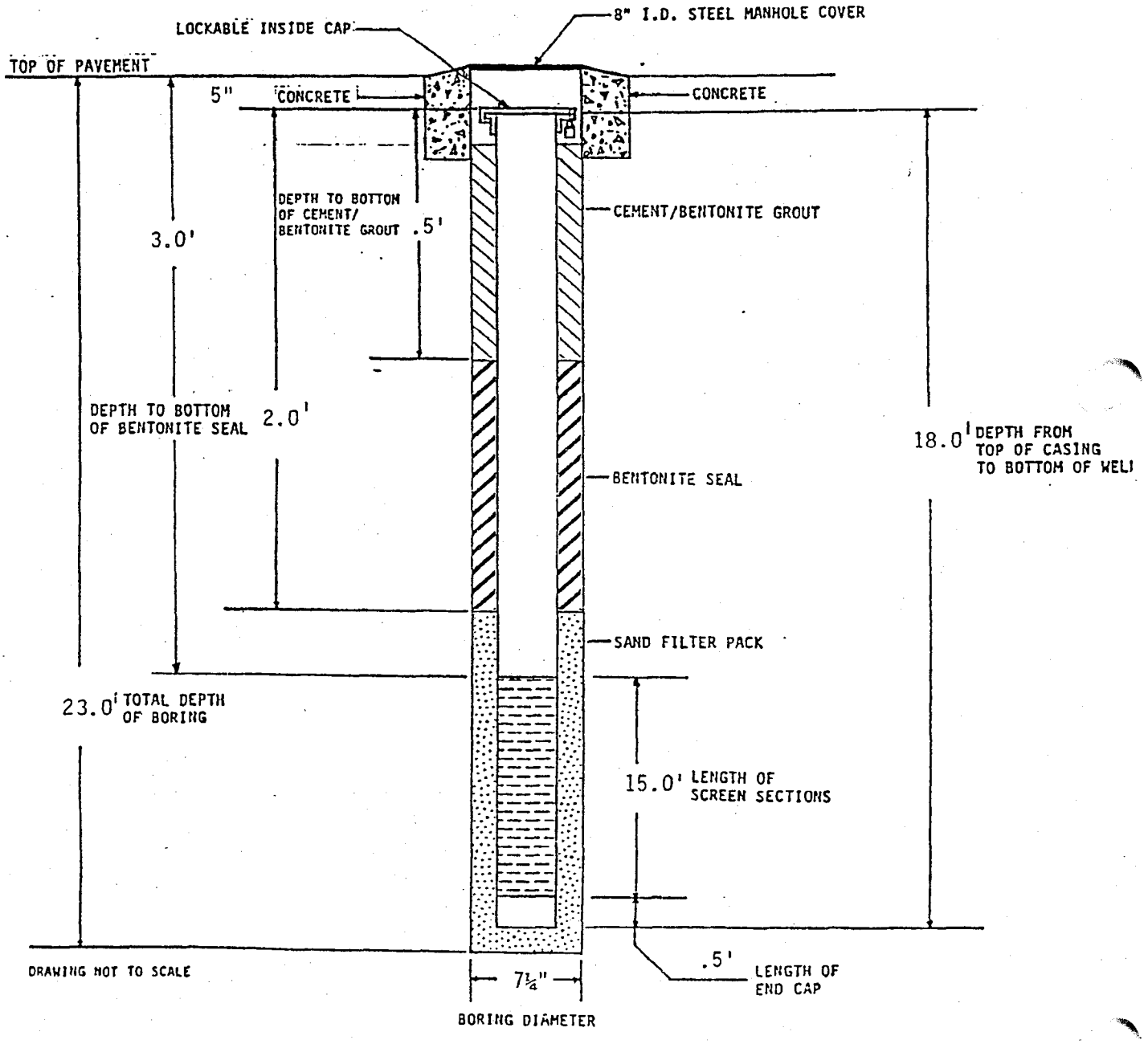
DEPTH FT.	SAMPLE TYPE & INTERVAL	MOISTURE	SOIL DESCRIPTION & VISUAL CLASSIFICATION	SPT	PID (ppm)	HAND PENETROMETER (tsf)	OTHER
			2" Asphalt				LL=27,PI=2
	SS	M/W	Light tan sandy SILT (ML)	1-3-6	0.4		Mc=25
	SS	W	Red-brown silty SAND (SM)	4-6-7	0.2		
5	SS	W		5-8-13	0.2		
	SS	W		10-15-20	0.2		
10	SS		Red-brown & tan clayey silty SAND (SM)	12-16-19	0.3		LL=34,PI=5 Mc=28
15	SS	M		9-19-35	0.3		
							No HNU or CGM
20				6-14-22	0.2		readings
	SS	M	Light tan SAND w/ gypsum crystals & iron seams (SP)				above background breathing zone measurements (BZM)
25			Total Depth of Boring = 23.0 feet LL=Liquid Limit Mc=Moisture Content PI=Plasticity Index				

SOIL SAMPLE KEY
T - SPLIT SPOON
S - SHELBY TUBE
PB - PITCHER BARREL
RC - ROCK CORE
TC - TRIO CONE

MOISTURE KEY
D - DRY (VERY LITTLE MOISTURE)
M - MOIST (SOME MOISTURE)
W - WET (SATURATED)

PROJECT Holloman Air Force Base MONITOR WELL I.D. NO. H-STE-50-MW1

Monitor Well Data Sheet



MONITOR WELL MATERIAL LIST

PROJECT: Holloman Air Force Base DATE: February 28, 1988

PROJECT NO.: 342-65219 SITE NO.: 50 MONITOR WELL NO.: MW1

MONITOR WELL DIA.: 2 (in) SCREEN OPENING: .010 (in)

SCREEN: SLOTTED X WIRE WOUND ____

BRAND OF PIPE & SCREEN: Tri-loc

STARTING AT WELL BOTTOM AND GOING UP

END PLUG LENGTH	.5'	PVC	X	STAINLESS	____
SCREEN LENGTH	10'	PVC	X	STAINLESS	____
SCREEN LENGTH	5'	PVC	X	STAINLESS	____
SCREEN LENGTH	____	PVC	____	STAINLESS	____
RISER LENGTH	5'	PVC	X	STAINLESS	____
RISER LENGTH	____	PVC	____	STAINLESS	____
RISER LENGTH	____	PVC	____	STAINLESS	____
RISER LENGTH	____	PVC	____	STAINLESS	____
RISER LENGTH	____	PVC	____	STAINLESS	____
CAP: SLIP X	THREADED ____	PVC	____	STAINLESS	____

DOES WELL CAP LOCK? YES X NO ____

COVER: FLUSH MOUNT X ABOVE GRADE ____

PADLOCK NO. 2004

SACKS SAND 5 PAILS BENTONITE 1/2

SACKS CEMENT - SACKS BENTONITE -

SACKS VOLCLAY - SACKS SACRETE 1/2

CONCRETE PAD SIZE 10 1/4' diameter X 6'

NO. CENTRALIZERS 1 LOCATION 7.5' from bottom

OTHER ____

PROFESSIONAL SERVICE INDUSTRIES, INC.

BORING NO. S50-MW2 PROJECT NO. 342-65219H PROJECT NAME Holloman Air Force Base

DATE/TIME START 3/28/88 12:00 DATE/TIME END 3/28/88 1:45 DRILL CREW Mitchell*/Caho/Flair *Engineer

DRILLING METHOD: AUGER 0 FT TO 23 FT, ROTARY - FT TO - FT DRILL RIG CME 55

AUGER/BIT SIZE(S) & INTERVAL(S) 6¼" I.D. 0-.6'/3¼" I.D. .6-23 SURFACE COVER Asphalt

TOC ELEV. 4069.90 BORING COORDINATES N 670175 E 550514 WATER DURING DRILLING 3.0'

WATER AT COMPLETION 2.0' DELAYED WATER LEVEL Monitor well installed in boring

DATE GROUTED N/A MATERIAL(S) & QUANTITY N/A

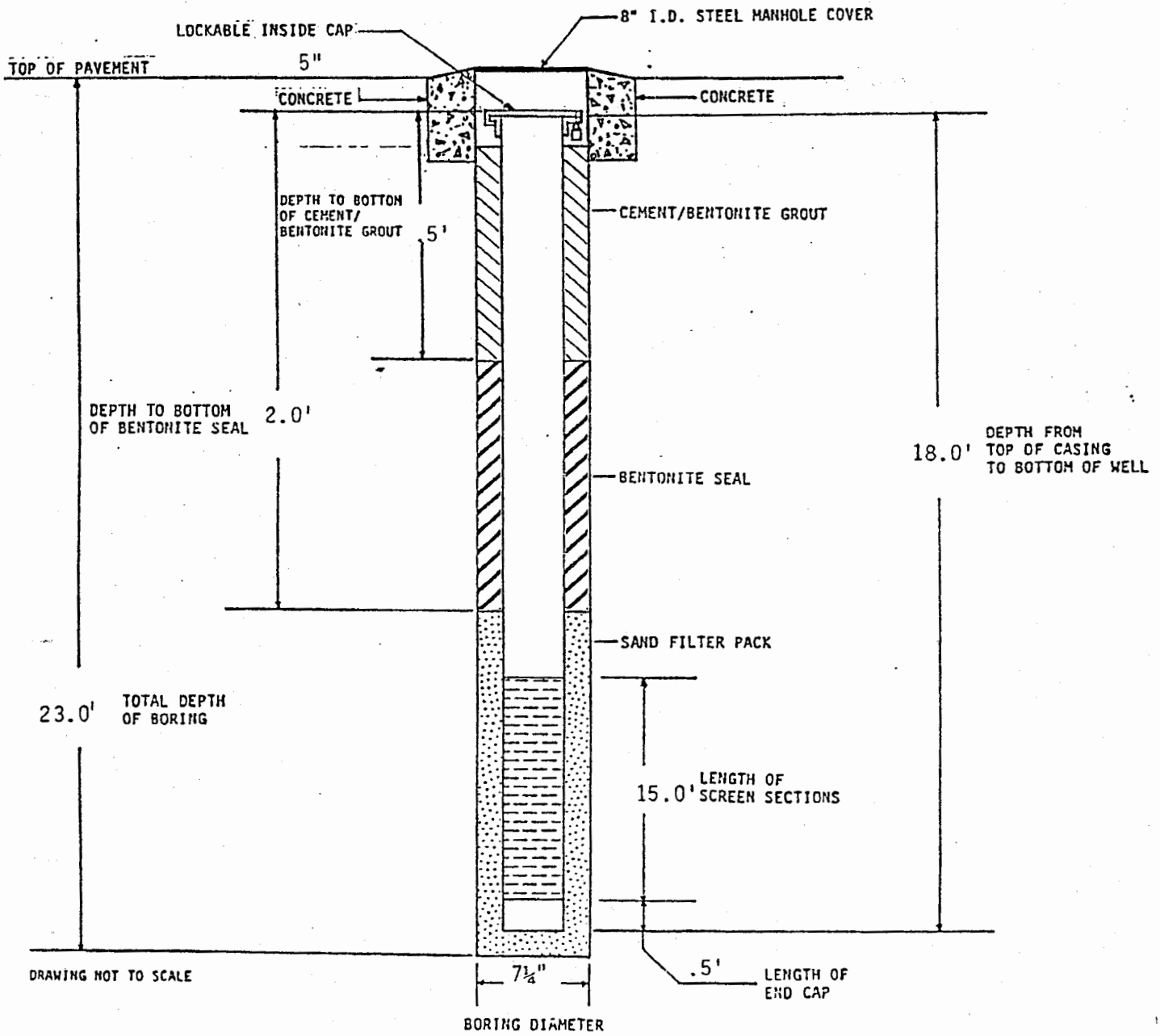
DEPTH FT.	SAMPLE TYPE & INTERVAL	MOISTURE	SOIL DESCRIPTION & VISUAL CLASSIFICATION	SPT	PID (ppm)	HAND PENETROMETER (tsf)	OTHER
			Tan SAND (SP)				LL=32,PI=6
	SS	M/W		3-7-7	0.4		Mc=33
	SS	W		3-8-7	0.3		
5							
	SS	W	Gray silty SAND (SM) Start of gray discoloration	2-1/12"	56		
	SS	W		5-13-17	36		
10	SS	M	Contamination decreasing	6-20-40	4.8		
15							
	SS	M	Light tan silty SAND (SM-SP)	33-67/6"	1.0		
20							
	SS	M/W	Brown clayey silty SAND w/gypsum crystals (SM)	13-42-40	0.4		Nonplastic Mc=21
25			Total Depth of Boring = 23.0 feet				

SOIL SAMPLE KEY
SS - SPLIT SPOON
ST - SHELBY TUBE
PB - PITCHER BARREL
RC - ROCK CORE
TC - TWO CORE

MOISTURE KEY
D - DRY (VERY LITTLE MOISTURE)
M - MOIST (SOME MOISTURE)
W - WET (SATURATED)

PROJECT Holloman Air Force Base MONITOR WELL I.D. NO. H-STE-50-MW2

Monitor Well Data Sheet



MONITOR WELL MATERIAL LIST

PROJECT: Holloman Air Force Base DATE: March 28, 1988

PROJECT NO.: 342-65219 SITE NO.: 50 MONITOR WELL NO.: MW2

MONITOR WELL DIA.: 2 (in) SCREEN OPENING: .010 (in)

SCREEN: SLOTTED X WIRE WOUND ____

BRAND OF PIPE & SCREEN: Tri-loc

STARTING AT WELL BOTTOM AND GOING UP

END PLUG LENGTH	.5'	PVC X	STAINLESS ____
SCREEN LENGTH	10'	PVC X	STAINLESS ____
SCREEN LENGTH	5'	PVC X	STAINLESS ____
SCREEN LENGTH	____	PVC ____	STAINLESS ____
RISER LENGTH	5'	PVC X	STAINLESS ____
RISER LENGTH	____	PVC ____	STAINLESS ____
RISER LENGTH	____	PVC ____	STAINLESS ____
RISER LENGTH	____	PVC ____	STAINLESS ____
RISER LENGTH	____	PVC ____	STAINLESS ____
CAP: SLIP X THREADED ____		PVC ____	STAINLESS ____

DOES WELL CAP LOCK? YES X NO ____

COVER: FLUSH MOUNT X ABOVE GRADE ____

PADLOCK NO. 2004

SACKS SAND 5½ PAILS BENTONITE 1/2

SACKS CEMENT - SACKS BENTONITE -

SACKS VOLCLAY ____ SACKS SACRETE 1/2

CONCRETE PAD SIZE 10 1/4" Diameter X 6"

NO. CENTRALIZERS 1 LOCATION 7.5' from bottom

OTHER ____

PROFESSIONAL SERVICE INDUSTRIES, INC.

BORING NO. S50-MW3 PROJECT NO. 342-65219H PROJECT NAME Holloman Air Force Base

DATE/TIME START 4/1/88 8:30 DATE/TIME END 4/1/88 11:00 DRILL CREW Heitman*/Flair/Alexander
* Engineer

DRILLING METHOD: AUGER 0 FT TO 23 FT, ROTARY - FT TO - FT DRILL RIG CME55

AUGER/BIT SIZE(S) & INTERVAL(S) 3¼" I.D./All SURFACE COVER Asphalt

TOC ELEV. 4069.66 BORING COORDINATES N 670080 E 550460 WATER DURING DRILLING 5.0'

WATER AT COMPLETION 5.0' DELAYED WATER LEVEL Monitor well installed in boring

DATE GROUTED N/A MATERIAL(S) & QUANTITY N/A

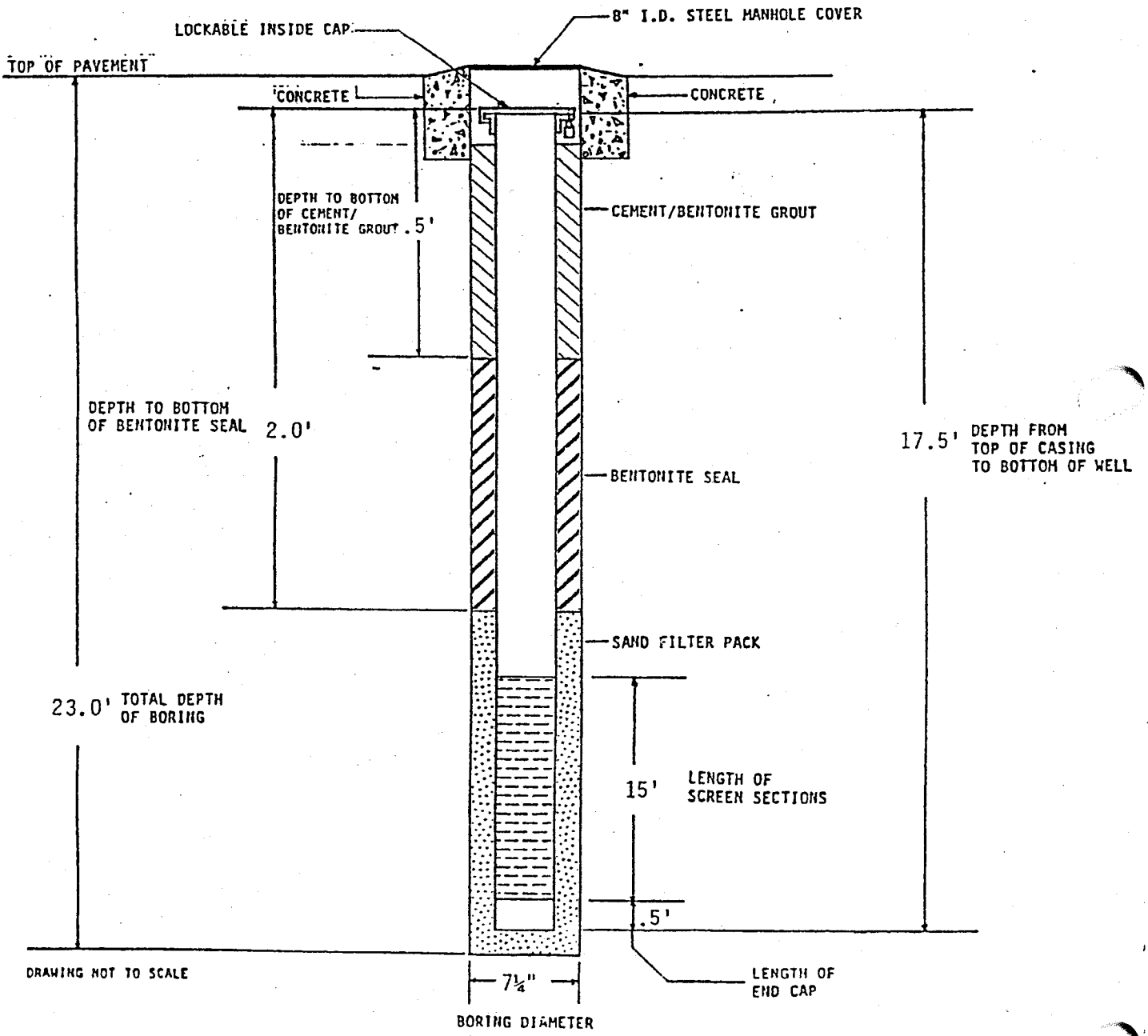
DEPTH FT.	SAMPLE TYPE & INTERVAL	MOISTURE	SOIL DESCRIPTION & VISUAL CLASSIFICATION	SPT	PID (ppm)	HAND PENETROMETER (tsf)	OTHER
		M	1 3/4" Asphalt & 6 1/2" Concrete	9-9-6	0.1		
	SS		Tan SAND (SP)				
	SS	M/W		2-2-3	0.2		
5							
	SS	W	Light brown SAND (SP)	4-4-6	0.3		
							Nonplastic
							Mc=28
	SS	W		13-15-20	0.3		
10							
	SS	W/M		17-33-30	0.2		
15							
	SS	M		17-30-70	0.1		
20							
	SS	M	Light tan sandy SILT w/gypsum crystals (ML)	10-15-20	0.1		LL=44,PI=17
							Mc=16
			Total Depth of Boring = 23.0 feet				
25							

SOIL SAMPLE KEY
SS - SPLIT SPOON
T - SHELBY TUBE
PB - PITCHER BARREL
RC - ROCK CORE
TC - THO CORE

MOISTURE KEY
D - DRY (VERY LITTLE MOISTURE)
M - MOIST (SOME MOISTURE)
W - WET (SATURATED)

PROJECT Holloman Air Force Base MONITOR WELL I.D. NO. H-STE-50-MW3

Monitor Well Data Sheet



MONITOR WELL MATERIAL LIST

PROJECT: Holloman Air Force Base DATE: April 1, 1988

PROJECT NO.: 342-65219 SITE NO.: 50 MONITOR WELL NO.: MW3

MONITOR WELL DIA.: 2 (in) SCREEN OPENING: .010 (in)

SCREEN: SLOTTED X WIRE WOUND ____

BRAND OF PIPE & SCREEN: Tri-Loc

STARTING AT WELL BOTTOM AND GOING UP

END PLUG LENGTH	.5'	PVC X	STAINLESS ____
SCREEN LENGTH	10'	PVC X	STAINLESS ____
SCREEN LENGTH	5'	PVC X	STAINLESS ____
SCREEN LENGTH		PVC ____	STAINLESS ____
RISER LENGTH	5'	PVC X	STAINLESS ____
RISER LENGTH		PVC ____	STAINLESS ____
RISER LENGTH		PVC ____	STAINLESS ____
RISER LENGTH		PVC ____	STAINLESS ____
RISER LENGTH		PVC ____	STAINLESS ____
CAP: SLIP X	THREADED ____	PVC ____	STAINLESS ____

DOES WELL CAP LOCK? YES X NO ____

COVER: FLUSH MOUNT X ABOVE GRADE ____

PADLOCK NO. 2004

SACKS SAND 5 bags PAILS BENTONITE 1/2

SACKS CEMENT 1/4 SACKS BENTONITE 1 cup

SACKS VOLCLAY - SACKS SACRETE 1/2

CONCRETE PAD SIZE 10 1/4" diameter X 6"

NO. CENTRALIZERS 1 LOCATION 7.5' from bottom

OTHER ____

PROFESSIONAL SERVICE INDUSTRIES, INC.

BORING NO. S50-MW4 PROJECT NO. 342-65219H PROJECT NAME Holloman Air Force Base

DATE/TIME START 3/29/88 1:00 DATE/TIME END 3/29/88 DRILL CREW Mitchell*/Flair *Engineer

DRILLING METHOD: AUGER 0 FT TO 23 FT, ROTARY - FT TO - FT DRILL RIG CME55

AUGER/BIT SIZE(S) & INTERVAL(S) 3¼" I.D./All SURFACE COVER Gravel

TOC ELEV. 4071.40 BORING COORDINATES N 669868 E 550353 WATER DURING DRILLING 6.0'

WATER AT COMPLETION 6.0' DELAYED WATER LEVEL Monitor well installed in boring

DATE GROUTED N/A MATERIAL(S) & QUANTITY N/A

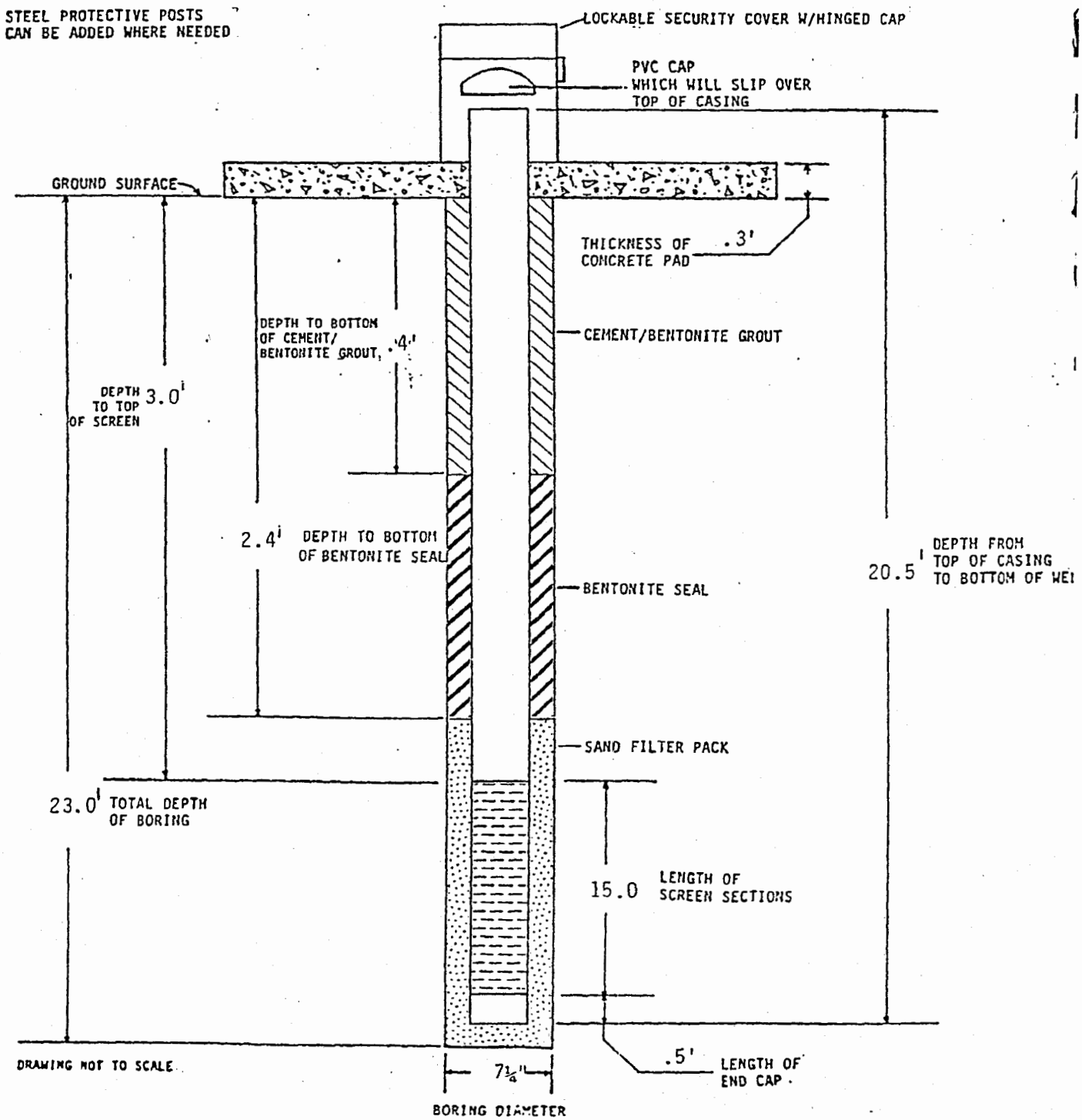
DEPTH FT.	SAMPLE TYPE & INTERVAL	MOISTURE	SOIL DESCRIPTION & VISUAL CLASSIFICATION	SPT	PID (ppm)	HAND PENETROMETER (tsf)	OTHER
	SS	D/M	Brown silty SAND (SM)	2-5-4	1.9		
	SS	M	Red-brown silty SAND (SM)	4-7-8	0.7		
5	SS	M/W		7-9-14	0.5		Nonplastic MC=26
	SS	M/W	Dark brown silty SAND (SM) discoloration	10-15-23	0.4		
10	SS	W		8-22-48			
			Light tan sandy SILT w/gypsum crystals (ML)				
15	SS	W	Brown clayey silty SAND w/gypsum crystals (SM-SP)	12-17-34	0.5		LL=30,PI=1 MC=28
20	SS		Light tan SAND (SP)	53-47/2¼"	0.5		
25			Total Depth of Boring = 23.0 feet				

SOIL SAMPLE KEY
SS - SPLIT SPOON
ST - SHELBY TUBE
PB - PITCHER BARREL
RC - ROCK CORE
TC - TWO CONE

MOISTURE KEY
D - DRY (VERY LITTLE MOISTURE)
M - MOIST (SOME MOISTURE)
W - WET (SATURATED)

PROJECT Holloman Air Force Base MONITOR WELL I.D. NO. H-STE-50-MW4

Monitor Well Data Sheet



MONITOR WELL MATERIAL LIST

PROJECT: Holloman Air Force Base DATE: March 29, 1988

PROJECT NO.: 342-65219 SITE NO.: 50 MONITOR WELL NO.: MW4

MONITOR WELL DIA.: 2 (in) SCREEN OPENING: .010 (in)

SCREEN: SLOTTED X WIRE WOUND ____

BRAND OF PIPE & SCREEN: Tri-Loc

STARTING AT WELL BOTTOM AND GOING UP

END PLUG LENGTH	.5'	PVC X	STAINLESS ____
SCREEN LENGTH	10'	PVC X	STAINLESS ____
SCREEN LENGTH	5'	PVC X	STAINLESS ____
SCREEN LENGTH		PVC ____	STAINLESS ____
RISER LENGTH	5'	PVC X	STAINLESS ____
RISER LENGTH		PVC ____	STAINLESS ____
RISER LENGTH		PVC ____	STAINLESS ____
RISER LENGTH		PVC ____	STAINLESS ____
RISER LENGTH		PVC ____	STAINLESS ____
CAP: SLIP X	THREADED ____	PVC X	STAINLESS ____

DOES WELL CAP LOCK? YES ____ NO X

COVER: FLUSH MOUNT ____ ABOVE GRADE X

PADLOCK NO. 2004

SACKS SAND 5 PAILS BENTONITE 1/2

SACKS CEMENT 1/4 SACKS BENTONITE 1 cup

SACKS VOLCLAY - SACKS SACRETE 5

CONCRETE PAD SIZE 3'X3'X4"

NO. CENTRALIZERS 1 LOCATION 7.5' from bottom

OTHER ____

PROFESSIONAL SERVICE INDUSTRIES, INC.

BORING NO. S50-B5 PROJECT NO. 342-65219H PROJECT NAME Holloman Air Force Base

DATE/TIME START - DATE/TIME END - DRILL CREW Mitchell*/Flair
* Engineer

DRILLING METHOD: AUGER 0 FT TO 19 FT, ROTARY - FT TO - FT DRILL RIG CME55

AUGER/BIT SIZE(S) & INTERVAL(S) 3¼" I.D. / All SURFACE COVER Gravel

G.S. ELEV. - BORING COORDINATES - WATER DURING DRILLING -

WATER AT COMPLETION - DELAYED WATER LEVEL Backfilled

DATE GROUTED N/A MATERIAL(S) & QUANTITY N/A

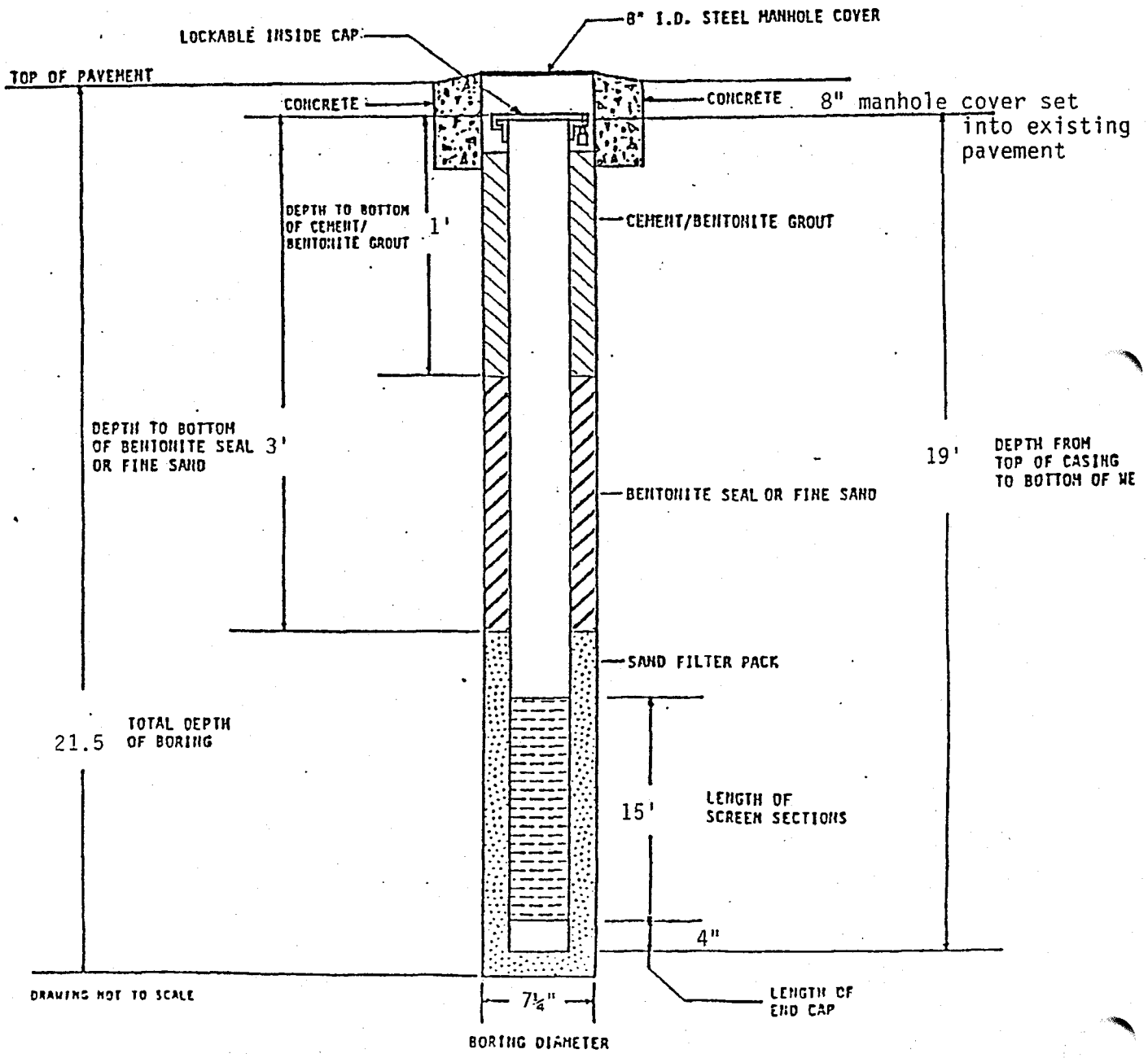
DEPTH FT.	SAMPLE TYPE & INTERVAL	MOISTURE	SOIL DESCRIPTION & VISUAL CLASSIFICATION	SPT	PID (ppm)	HAND PENETROMETER (tsf)	OTHER
	SS		Brown clayey silty SAND (SM)		—		
	SS				—		
5	SS				—		
	SS		Light brown & tan silty SAND (SM)		—		
10	SS				—		
	SS		Tan silty SAND (SM)		—		
15	SS				—		
	SS				—		
20			Total Depth of Boring = 19.0 feet				
25							

SOIL SAMPLE KEY
SS - SPLIT SPOON
ST - SHELBY TUBE
PB - PITCHER BARREL
RC - ROCK CORE
TC - TWO CONE

MOISTURE KEY
D - DRY (VERY LITTLE MOISTURE)
M - MOIST (SOME MOISTURE)
W - WET (SATURATED)

PROJECT Holloman Air Force Base MONITOR WELL I.D. NO. H-50-MW6

Monitor Well Data Sheet



MONITOR WELL MATERIAL LIST

PROJECT: Holloman Air Force Base DATE: 1/23/89

PROJECT NO.: 342-65219H SITE NO.: H-50 MONITOR WELL NO.: MW6

MONITOR WELL DIA.: 2 (in) SCREEN OPENING: .010 (in)

SCREEN: SLOTTED X WIRE WOUND ____

BRAND OF PIPE & SCREEN: Monoflex

STARTING AT WELL BOTTOM AND GOING UP

END PLUG LENGTH	4"	PVC X	STAINLESS ____
SCREEN LENGTH	10'	PVC X	STAINLESS ____
SCREEN LENGTH	5'	PVC X	STAINLESS ____
SCREEN LENGTH		PVC ____	STAINLESS ____
RISER LENGTH	4'	PVC X	STAINLESS ____
RISER LENGTH		PVC ____	STAINLESS ____
RISER LENGTH		PVC ____	STAINLESS ____
RISER LENGTH		PVC ____	STAINLESS ____
RISER LENGTH		PVC ____	STAINLESS ____
CAP: SLIP X THREADED ____		PVC X	STAINLESS ____

DOES WELL CAP LOCK? YES X NO ____

COVER: FLUSH MOUNT X ABOVE GRADE ____

PADLOCK NO. 2004

SACKS SAND 4 PAILS BENTONITE 1

SACKS CEMENT 1 SACKS BENTONITE 1/4

SACKS VOLCLAY N/A SACKS SACRETE 1

CONCRETE PAD SIZE set into existing pavement

NO. CENTRALIZERS 1 LOCATION 8' from bottom of screen

OTHER ____

PROFESSIONAL SERVICE INDUSTRIES, INC.

BORING NO. S-50-MW6 PROJECT NO. 342-65219H PROJECT NAME Holloman Air Force Base

DATE/TIME START 1/23/89 8:00 DATE/TIME END 1/23/89 DRILL CREW Flair, Monroe*, Arthur *Geologist

DRILLING METHOD: AUGER 0 FT TO 21.5 FT, ROTARY - FT TO - FT DRILL RIG CME55

AUGER/BIT SIZE(S) & INTERVAL(S) 3¼" I.D./HCA SURFACE COVER Asphalt/Concrete

T.O.C. ELEV. 4069.97 BORING COORDINATES N 670262 E 550572 WATER DURING DRILLING 5'

WATER AT COMPLETION 6' DELAYED WATER LEVEL Water @ 4.2' below TOC on 1/27/89 @ 1:15pm Monitor Well Installed in Boring

DATE GROUTED N/A MATERIAL(S) & QUANTITY See Monitor Well Materials List

DEPTH FT.	SAMPLE TYPE & INTERVAL	MOISTURE	SOIL DESCRIPTION & VISUAL CLASSIFICATION	SPT	PID (ppm)	HAND PENETROMETER (tsf)	OTHER
			2" Asphalt & 10" concrete				
	SS	M/W	Brown silty SAND w/some gravel (SM)	4/5/6	—		LL=28 PI=3
	SS		Tan clayey silty SAND w/2" wet seam (SM)	5/6/5	—		Mc=20% Mc=16%
5	SS	M/W	Tan silty SAND (SM) Highly discolored w/sewage smell	WH/1/1	—		Mc=15%
	SS	M	Gray clayey sandy SILT (ML)	4/5/8	—		LL=37 PI=9 Mc=15%
10	SS	W/M	Brown silty SAND w/gypsum deposits (SM)	8/33/55	—		LL=35 PI=2 Mc=14%
15	SS	W	Tan silty SAND (SM)	45/55/3½"	—		No sample Recovery
20	SS	W/M	Gray silty sandy CLAY w/gypsum crystals (CL)	41/39/20=2"	—		Mc=21%
			Boring terminated at 21.5 feet				
25							

SOIL SAMPLE KEY

SS - SPLIT SPOON
ST - SHELBY TUBE
PB - PITCHER BARREL
RC - ROCK CORE

MOISTURE KEY

D - DRY (VERY LITTLE MOISTURE)
M - MOIST (SOME MOISTURE)
W - WET (SATURATED)

APPENDIX B

ANALYTICAL DATA

Site 50 IRP

Phase II Stage 1

Confirmation/Quantification

UBTL ANALYTICAL REPORT
Holloman IRP - Soil Analyses (1)

Parameter	Method	Units	Detection Limit	Date Received	Date Analyzed	50B1 5-6.5'	50B1 7.5-9'	50W1 5-6.5'	50W1 7.5-9'	50W1 10-11.5'
% Moisture	Grav.	%	1	10/01/84	11/16/84	27	32	25	27	23
Oil & Grease	413.2 (2)	mg/g	0.007	10/01/84	10/29/84	.87	2.9	.12	2.7	.88
TOX	9020 (3)(4)	µg/g	5.0	10/01/84	11/28/84	*	*	*	*	*
Phenolics	420.2 (2)	µg/g	1	10/01/84	11/08/84	*	*	13	*	*

(1) Results are not corrected for percent moisture.
(2) Methods for Chemical Analysis of Water and Wastes, E600/4-79-020, Revised March 1983, Modified for use with soil samples.
(3) EPA Manual for "Test Methods for Evaluating Solid Waste," EPA Publication No. SW-846.
(4) Modified for use on an O.I. Corp. Model 610 TOX Analyzer.
* Denotes value less than the limit of detection.

UETL ANALYTICAL REPORT
Holloman IRP - Soil Analyses (1)

arameter	Method	Units	Detection Limit	Date Received	Date Analyzed	50B1 Comp	51W1 Comp	50W1 Comp
enic	7060 (2)(4)	mg/L	0.01	10/01/84	11/12/84	*	*	*
ium	7080 (2)(4)	mg/L	0.1	10/01/84	11/12/84	18.	18.	19.
ium	7130 (2)(4)	mg/L	0.01	10/01/84	11/12/84	0.01	0.01	*
l	7421 (2)(4)	mg/L	0.01	10/01/84	11/12/84	*	*	*
cury	7470 (2)(4)	mg/L	0.0001	10/01/84	11/12/84	*	*	*
enium	7740 (2)(4)	mg/L	0.01	10/01/84	11/12/84	*	*	*
ver	7760 (2)(4)	mg/L	0.01	10/01/84	11/12/84	0.02	0.02	0.02
mium	7190 (2)(4)	mg/L	0.05	10/01/84	11/12/84	*	*	*
lane	8080 (2)(4)	µg/L	0.02	10/01/84	11/09/84	*	*	*
oxychlor	8080 (2)(4)	µg/L	0.2	10/01/84	11/09/84	*	*	*
in	8080 (2)(4)	µg/L	0.02	10/01/84	11/09/84	*	*	*
phene	8080 (2)(4)	µg/L	1.	10/01/84	11/09/84	*	*	*
D	8150 (2)(4)	µg/L	0.05	10/01/84	11/09/84	*	*	*
,5-TP Silvex)	8150 (2)(4)	µg/L	0.05	10/01/84	11/09/84	*	*	*
tability	(3)(2)			10/01/84	(5)	NI	NI	NI

All samples have been extracted for EP Toxicity according to Method No. 1310 published in EPA Publication No. SW-846.
EPA Manual for "Test Methods for Evaluating Solid Waste," EPA Publication No. SW-846.
Section 3 of EPA Publication No. SW-846.
The analytical technique between the SW-846 methods and the methods in "Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater" (EPA-600/4-82-057, July 1982) and "Methods for Chemical Analysis of Water and Wastes" (EPA 600/4-79-020, March 1983) are the same.
Analyzed before 11/30/84.
Denotes value less than the limit of detection.
Denotes the sample was not ignitabile.

UBTL ANALYTICAL REPORT
Holloman IRP - Water Analyses

Parameter	Method	Units	Detection Limit	Date Received	Date Analyzed	1W1	1W2	1W3	51W1	13W1	18W1	31W1	50W1
Arsenic	206.2 (1)	mg/L	0.01	10/04/84	10/29/84	*	*	*		0.01			
Cadmium	213.1 (1)	mg/L	0.01	10/04/84	10/29/84	0.09	0.21	0.24					
Nickel	249.2 (1)	mg/L	0.1	10/04/84	10/29/84	0.2	0.4	0.5					
Lead	239.2 (1)	mg/L	0.01	10/04/84	10/29/84	*	0.03	0.05				*	
Silver	272.1 (1)	mg/L	0.01	10/04/84	10/29/84	0.10	0.18	0.21					
Chromium	218.2 (1)	mg/L	0.1	10/04/84	10/29/84	*	*	*			*		
Chromium (Hexavalent)	312.B (4)	µg/L	4.	10/04/84	10/29/84						7.		
Oil & Grease	413.2 (1)	mg/L	0.6	10/04/84	10/29/84	4.2	3.4	5.3	85.			15	140
T.O.C.	415.1 (1)	mg/L	1.	10/04/84	11/26/84	14.	24.	7.	68.			170	95
T.O.X.	9020 (2)	µg/L	10.	10/04/84	11/27/84	140,000	200,000	220,000	27,000			17,000	120
Phenolics	420.2 (1)	µg/L	10.	10/04/84	11/02/84	*	*	20	290			*	*
Aldrin	608 (5)	µg/L	0.01	10/04/84	11/08/84	*	*	*					* (3)
Dieldrin	608 (5)	µg/L	0.01	10/04/84	11/08/84	*	*	*					*
Endrin	608 (5)	µg/L	0.01	10/04/84	11/08/84	*	*	*					*
Heptachlor	608 (5)	µg/L	0.01	10/04/84	11/08/84	*	*	*					* (3)
Heptachlor Epoxide	608 (5)	µg/L	0.02	10/04/84	11/08/84	*	*	*					* (3)
Lindane	608 (5)	µg/L	0.01	10/04/84	11/08/84	*	*	*					* (3)
Methoxychlor	608 (5)	µg/L	0.02	10/04/84	11/08/84	*	*	*					*
Diazinon	608 (5)	µg/L	0.1	10/04/84	11/08/84	*	*	*					*
Malathion	608 (5)	µg/L	0.1	10/04/84	11/08/84	*	*	*					*
Parathion	608 (5)	µg/L	0.1	10/04/84	11/08/84	*	*	*					*
p,p'-DDT	608 (5)	µg/L	0.02	10/04/84	11/08/84	*	*	*					*
o,p-DDT	608 (5)	µg/L	0.02	10/04/84	11/08/84	*	*	*					*
DDE	608 (5)	µg/L	0.02	10/04/84	11/08/84	*	*	*					*
DDD	608 (5)	µg/L	0.02	10/04/84	11/08/84	*	*	*					*

(1) "EPA Methods for Chemical Analysis of Water and Wastes," EPA 600/4-79-020, Revised March 1983
(2) EPA Manual "Test Methods for Evaluating Solid," SW 846, 2nd Ed., July 1982.
(3) LOD is elevated by 100 due to interfering chromatographic peaks.
(4) "Standard Methods for the examination of Wastes and Wastewater," for analysis on Technicon Auto Analyzer II.
(5) Organochlorine Pesticides and PCBs - Method 608, EPA Manual 600/4-82-057, July 1982.
* Denotes value less than the limit of detection.

This page was intentionally left blank.

RI

Stage 2

SITE 50:

AIRCRAFT MAINTENANCE HANGAR

SOIL

FACILITY: Holloman, AFB, New Mexico		+	+	
SAMPLE NUMBER		88-221-12	88-221-17	88-221-18
SAMPLE SITE		S50-B1-2.5	S50-B1-10	S50-B2-2.5
DATE COLLECTED		3-28-88	3-28-88	3-28-88
TIME COLLECTED		8:44	9:07	12:42
DATE RECEIVED		3-29-88	3-29-88	3-29-88
DATE ANALYZED		4-10-88	4-11-88	4-11-88
SURROGATE: Units (Percent)	SOIL RANGE			
1,2-Dichloroethane-d4	70-121	142	136	90
Toluene-d8	81-117	85	102	115
p-Bromofluorobenzene	74-121	80	84	78
PARAMETER: UNITS(ug/kg-dry weight)	SPQL			
Acetone	100	<100	<100	<100
Acrolein	10	<10	<10	<10
Acrylonitrile	10	<10	<10	<10
Benzene	5	<5	<5	<5
Bromodichloromethane	5	<5	<5	<5
Bromoform	5	<5	<5	<5
Bromomethane	10	<10	<10	<10
2-Butanone	100	<100	<100	<100
2-Butenoic Acid, ethyl Ester	100	<100	<100	<100
Carbon Disulfide	5	<5	<5	<5
Carbon Tetrachloride	5	<5	<5	<5
Chlorobenzene	5	<5	<5	<5
Chloroethane	10	<10	<10	<10
2-chloroethyl Vinyl Ether	10	<10	<10	<10
Chloroform	5	<5	<5	<5
Chloromethane	10	<10	<10	<10
cis-1,3-Dichloropropene	5	<5	<5	<5
cis-1,4-Dichlorobutene	5	<5	<5	<5
Dibromochloromethane	5	<5	<5	<5
Dibromomethane	5	<5	<5	<5
1,1-Dichloroethane	5	<5	<5	<5
1,2-Dichloroethane	5	<5	<5	<5
1,1-Dichloroethene	5	<5	<5	<5
1,2-Dichloroethene	5	<5	<5	<5
1,2-Dichloropropane	5	<5	<5	<5
Dichlorodifluoromethane	10	<10	<10	<10
Ethanol	10	<10	<10	<10
Ethyl Benzene	5	<5	<5	<5
2-Hexanone	50	<50	<50	<50
Iodomethane	10	<10	<10	<10
Methylene Chloride	5	<5	<5	<5
4-methyl-2-pentanone	50	<50	<50	<50
Styrene	5	<5	<5	<5
Tetrachloroethene	5	<5	5.3	<5
Toluene	5	<5	<5	<5
Total Xylenes	5	<5	<5	<5
trans-1,4-Dichlorobutene	5	<5	<5	<5
trans-1,3-Dichloropropene	5	<5	<5	<5
1,1,1-Trichloroethane	5	<5	<5	<5
1,1,2,2-Tetrachloroethane	5	<5	<5	<5
1,1,2-Trichloroethane	5	<5	<5	<5

FACILITY: Holloman, AFB, New Mexico		+	+	
SAMPLE NUMBER		88-221-12	88-221-17	88-221-18
SAMPLE SITE		S50-B1-2.5	S50-B1-10	S50-B2-2.5
DATE COLLECTED		3-28-88	3-28-88	3-28-88
TIME COLLECTED		8:44	9:07	12:42
DATE RECEIVED		3-29-88	3-29-88	3-29-88
DATE ANALYZED		4-10-88	4-11-88	4-11-88
SURROGATE: Units (Percent)	SOIL RANGE			
1,2-Dichloroethane-d4	70-121	142	136	90
Toluene-d8	81-117	85	102	115
p-Bromofluorobenzene	74-121	80	84	78
PARAMETER: UNITS(ug/kg-dry weight)	*PQL			
Trichloroethene	5	<5	<5	<5
Trichlorofluoromethane	10	<10	82.9	<10
Vinyl Acetate	50	<50	<50	<50
Vinyl Chloride	10	<10	<10	<10

*** Internal Standard No. 1 had low area counts because of water elution front. The calculation for this surrogate is not valid and recovery data is not reported.

*Practical Quantitation Limit

+ Sample analysis outside QC limits - one surrogate out.

FACILITY: Holloman, AFB, New Mexico

SAMPLE NUMBER		88-221-19	88-221-20	88-221-20
SAMPLE SITE		S50-B2-5	S50-B2-10	S50-B2-10-SP
DATE COLLECTED		3-28-88	3-28-88	3-28-88
TIME COLLECTED		12:51	1:06	1:06
DATE RECEIVED		3-29-88	3-29-88	3-29-88
DATE ANALYZED		4-11-88	4-11-88	4-11-88
SURROGATE: Units (Percent)	SOIL RANGE			
1,2-Dichloroethane-d4	70-121	104	120	111
Toluene-d8	81-117	116	107	112
p-Bromofluorobenzene	74-121	86	91	89
PARAMETER: UNITS(ug/kg-dry weight)	SPQL			
Acetone	100	<100	<100	<100
Acrolein	10	<10	<10	<10
Acrylonitrile	10	<10	<10	<10
Benzene	5	<5	<5	45.9
Bromodichloromethane	5	<5	<5	<5
Bromoform	5	<5	<5	<5
Bromomethane	10	<10	<10	<10
2-Butanone	100	<100	<100	<100
2-Butenoic Acid, ethyl Ester	100	<100	<100	<100
Carbon Disulfide	5	<5	<5	<5
Carbon Tetrachloride	5	<5	<5	<5
Chlorobenzene	5	40	<5	48.1
Chloroethane	10	<10	<10	<10
2-chloroethyl Vinyl Ether	10	<10	<10	<10
Chloroform	5	<5	<5	<5
Chloromethane	10	<10	<10	<10
cis-1,3-Dichloropropene	5	<5	<5	<5
cis-1,4-Dichlorobutene	5	<5	<5	<5
Dibromochloromethane	5	<5	<5	<5
Dibromomethane	5	<5	<5	<5
1,1-Dichloroethane	5	<5	<5	<5
1,2-Dichloroethane	5	<5	<5	<5
1,1-Dichloroethene	5	<5	<5	<5
1,2-Dichloroethene	5	<5	<5	<5
1,2-Dichloropropane	5	<5	<5	<5
Dichlorodifluoromethane	10	<10	<10	<10
Ethanol	10	<10	<10	<10
Ethyl Benzene	5	33.3	<5	<5
2-Hexanone	50	<50	<50	<50
Iodomethane	10	<10	<10	<10
Methylene Chloride	5	<5	<5	<5
4-methyl-2-pentanone	50	<50	<50	<50
Styrene	5	<5	<5	<5
Tetrachloroethene	5	8.6	<5	<5
Toluene	5	9	<5	42.3
Total Xylenes	5	<5	<5	<5
trans-1,4-Dichlorobutene	5	<5	<5	<5
trans-1,3-Dichloropropene	5	<5	<5	<5
1,1,1-Trichloroethane	5	<5	<5	<5

FACILITY Holloman, AFB, New Mexico

SAMPLE NUMBER		88-221-19	88-221-20	88-221-20
SAMPLE SITE		S50-82-5	S50-82-10	S50-82-10-SP
DATE COLLECTED		3-28-88	3-28-88	3-28-88
TIME COLLECTED		12:51	1:06	1:06
DATE RECEIVED		3-29-88	3-29-88	3-29-88
DATE ANALYZED		4-11-88	4-11-88	4-11-88
SURROGATE: Units (Percent)	SOIL RANGE			
1,2-Dichloroethane-d4	70-121	104	120	111
Toluene-d8	81-117	110	107	112
p-Bromofluorobenzene	74-121	86	91	89
PARAMETER: UNITS(ug/kg-dry weight)	*PQL			
Trichloroethene	5	<5	<5	47.4
Trichlorofluoromethane	10	38.9	103	98.1
Vinyl Acetate	50	<50	<50	<50
Vinyl Chloride	10	<10	<10	<10

*** Internal Standard No. 1 had low area counts because of water elution front. The calculation for this surrogate is not valid and recovery data is not reported.

*Practical Quantitation Limit

FACILITY: Holloman, AFB, New Mexico

SAMPLE NUMBER		88-234-5	88-234-6	88-234-4
SAMPLE SITE		S50-B3-5	S50-B3-10	S50-B3-2.5
DATE COLLECTED		4-1-88	4-1-88	4-1-88
TIME COLLECTED		--	--	--
DATE RECEIVED		4-4-88	4-4-88	4-4-88
DATE ANALYZED		4-15-88	4-15-88	4-15-88
SURROGATE: Units (Percent)	SOIL RANGE			
1,2-Dichloroethane-d4	70-121	102	84	93
Toluene-d8	81-117	106	106	89
p-Bromofluorobenzene	74-121	79	79	78
PARAMETER: UNITS(ug/kg-dry weight)	%PQL			
Acetone	100	<100	<100	<100
Acrolein	10	<10	<10	<10
Acrylonitrile	10	<10	<10	<10
Benzene	5	<5	<5	<5
Bromodichloromethane	5	<5	<5	<5
Bromoform	5	<5	<5	<5
Bromomethane	10	<10	<10	<10
2-Butanone	100	<100	<100	<100
2-Buteneic Acid, ethyl Ester	100	<100	<100	<100
Carbon Disulfide	5	<5	<5	<5
Carbon Tetrachloride	5	<5	<5	<5
Chlorobenzene	5	<5	<5	<5
Chloroethane	10	<10	<10	<10
2-chloroethyl Vinyl Ether	10	<10	<10	<10
Chloroform	5	<5	<5	<5
Chloromethane	10	<10	<10	<10
cis-1,3-Dichloropropene	5	<5	<5	<5
cis-1,4-Dichlorobutene	5	<5	<5	<5
Dibromochloromethane	5	<5	<5	<5
Dibromomethane	5	<5	<5	<5
1,1-Dichloroethane	5	<5	<5	<5
1,2-Dichloroethane	5	<5	<5	<5
1,1-Dichloroethene	5	<5	<5	<5
1,2-Dichloroethene	5	<5	<5	<5
1,2-Dichloropropane	5	<5	<5	<5
Dichlorodifluoromethane	10	<10	<10	<10
Ethanol	10	<10	<10	<10
Ethyl Benzene	5	<5	<5	<5
2-Hexanone	50	<50	<50	<50
Iodomethane	10	<10	<10	<10
Methylene Chloride	5	<5	<5	<5
4-methyl-2-pentanone	50	<50	<50	<50
Styrene	5	<5	<5	<5
Tetrachloroethene	5	<5	<5	<5
Toluene	5	<5	<5	<5
Total Xylenes	5	<5	<5	<5
trans-1,4-Dichlorobutene	5	<5	<5	<5
trans-1,3-Dichloropropene	5	<5	<5	<5
1,1,1-Trichloroethane	5	<5	<5	<5
1,1,2,2-Tetrachloroethane	5	<5	<5	<5
1,1,2-Trichloroethane	5	<5	<5	<5

FACILITY: Holloman, AFB, New Mexico

SAMPLE NUMBER		88-234-5	88-234-6	88-234-4
SAMPLE SITE		S50-B3-5	S50-B3-10	S50-B3-2.5
DATE COLLECTED		4-1-88	4-1-88	4-1-88
TIME COLLECTED		--	--	--
DATE RECEIVED		4-4-88	4-4-88	4-4-88
DATE ANALYZED		4-15-88	4-15-88	4-15-88
SURROGATE: Units (Percent)	SOIL RANGE			
1,2-Dichloroethane-d4	70-121	102	84	93
Toluene-d8	81-117	186	186	89
p-Bromofluorobenzene	74-121	79	79	78
PARAMETER: UNITS(ug/kg-dry weight)	*PQL			
Trichloroethene	5	<5	<5	<5
Trichlorofluoromethane	10	<10	<10	<10
Vinyl Acetate	50	<50	<50	<50
Vinyl Chloride	10	<10	<10	<10

*** Internal Standard No. 1 had low
area counts because of water elution front.
The calculation for this surrogate is
not valid and recovery data is not reported.

*Practical Quantitation Limit

FACILITY: Holloman, AFB					
SAMPLE NUMBER:		89-073-08	89-073-09	89-073-09	89-073-10
SAMPLE DESCRIPTION:		S50-96-2.5/4	S50-96-5/6.5	S50-96-5/6.5-FDUP	S50-96-20/21.5
DATE COLLECTED:		01-23-89	01-23-89	01-23-89	01-23-89
TIME COLLECTED:		09:17	09:40	09:40	10:38
DATE RECEIVED:		01-24-89	01-24-89	01-24-89	01-24-89
DATE ANALYZED:		01-30-89	01-30-89	01-30-89	01-30-89
SURROGATE:	RANGE				
1,2-Dichloroethane-d4	70-121	100	100	96	99
Toluene-d8	81-117	94	94	110	94
p-Bromofluorobenzene	74-121	96	100	90	102
PARAMETER: UNITS(ug/kg-dry weight)	PQL				
Acetone	100	<124	<130	<133	<129
Benzene	5	<6	<7	<7	<6
Bromodichloromethane	5	<6	<7	<7	<6
Bromoform	5	<6	<7	<7	<6
Bromomethane	10	<12	<13	<13	<13
2-Butanone	100	<124	<130	<133	<129
Carbon Disulfide	5	<6	<7	<7	<6
Carbon Tetrachloride	5	<6	<7	<7	<6
Chlorobenzene	5	<6	<7	<7	<6
Chloroethane	10	<12	<13	<13	<13
2-chloroethyl Vinyl Ether	10	<12	<13	<13	<13
Chloroform	5	<6	<7	<7	<6
Chloromethane	10	<12	<13	<13	<13
cis-1,3-Dichloropropene	5	<6	<7	<7	<6
Dibromochloromethane	5	<6	<7	<7	<6
1,1-Dichloroethane	5	<6	<7	<7	<6
1,2-Dichloroethane	5	<6	<7	<7	<6
1,1-Dichloroethene	5	<6	<7	<7	<6
1,2-Dichloroethene (Total)	5	<6	<7	<7	<6
1,2-Dichloropropane	5	<6	<7	<7	<6
Ethyl Benzene	5	<6	<7	<7	<6
2-Hexanone	50	<62	<65	<67	<65
Methylene Chloride	5	<6	<7	<7	<6
4-methyl-2-pentanone	50	<62	<65	<67	<65
Styrene	5	<6	<7	<7	<6
Tetrachloroethene	5	<6	<7	<7	<6
Toluene	5	<6	<7	<7	<6
Total Xylenes	5	<6	<7	<7	<6
trans-1,3-Dichloropropene	5	<6	<7	<7	<6
1,1,1-Trichloroethane	5	<6	<7	<7	<6
1,1,2,2-Tetrachloroethane	5	<6	<7	<7	<6
1,1,2-Trichloroethane	5	<6	<7	<7	<6
Trichloroethene	5	<6	<7	<7	<6
Vinyl Acetate	50	<62	<65	<67	<65
Vinyl Chloride	10	<12	<13	<13	<13

FACILITY: Hollman, AFB	
SAMPLE NUMBER:	48 BLANK
SAMPLE DESCRIPTION:	1089
DATE COLLECTED:	--
TIME COLLECTED:	--
DATE RECEIVED:	01-24-89
DATE ANALYZED:	01-30-89

SURROGATE:	RANGE	
1,2-Dichloroethane-d4	70-121	96
Toluene-d8	81-117	92
p-Bromofluorobenzene	74-121	100

PARAMETER: UNITS(ug/kg-dry weight)	PQL	
Acetone	100	<100
Benzene	5	<5
Bromodichloromethane	5	<5
Bromoform	5	<5
Bromomethane	10	<10
2-Butanone	100	<100
Carbon Disulfide	5	<5
Carbon Tetrachloride	5	<5
Chlorobenzene	5	<5
Chloroethane	10	<10
2-chloroethyl Vinyl Ether	10	<10
Chloroform	5	<5
Chloromethane	10	<10
cis-1,3-Dichloropropene	5	<5
Dibromochloromethane	5	<5
1,1-Dichloroethane	5	<5
1,2-Dichloroethane	5	<5
1,1-Dichloroethene	5	<5
1,2-Dichloroethene (Total)	5	<5
1,2-Dichloropropane	5	<5
Ethyl Benzene	5	<5
2-Hexanone	50	<50
Methylene Chloride	5	<5
4-methyl-2-pentanone	50	<50
Styrene	5	<5
Tetrachloroethene	5	<5
Toluene	5	<5
Total Xylenes	5	<5
trans-1,3-Dichloropropene	5	<5
1,1,1-Trichloroethane	5	<5
1,1,2,2-Tetrachloroethane	5	<5
1,1,2-Trichloroethane	5	<5
Trichloroethene	5	<5
Vinyl Acetate	50	<50
Vinyl Chloride	10	<10

FACILITY: Holloman, AFB, New Mexico

SAMPLE NUMBER		88-221-12	88-221-13	88-221-17	88-221-18
SAMPLE SITE		S50-B1-2.5	S50-B1-5	S50-B1-10	S50-B2-7.5
DATE COLLECTED		3-28-88	3-29-88	3-28-88	3-29-88
TIME COLLECTED		8:44	9:55	9:07	12:42
DATE RECEIVED		3-29-88	3-29-88	3-29-88	3-29-88
DATE EXTRACTED		4-3-88	4-4-88	4-4-88	4-4-88
DATE ANALYZED		4-7-88	5-13-88	4-14-88	4-14-88
SURROGATE: Units (Percent)	RANGE%				
2-Fluorobiphenyl	30-115	96	----	34	42
Nitrobenzene-d5	23-120	61	----	39	55
p-Terphenyl-d14	18-137	61	----	45	58
Phenol-d6	24-113	107	----	66	80
2-Fluorophenol	25-121	81	----	46	54
2,4,6-Tribromophenol	19-122	88	----	21	20
PARAMETER: Units(ug/kg dry-weight)	%PQL				
Acenaphthene	660	<660	<13200	<660	<660
Acenaphthylene	660	<660	<13200	<660	<660
Acetophenone	3300	<3300	<66000	<3300	<3300
Aniline	3300	<3300	<66000	<3300	<3300
Anthracene	660	<660	<13200	<660	<660
4-Aminobiphenyl	3300	<3300	<66000	<3300	<3300
Benzidine	3300	<3300	<66000	<3300	<3300
Benzoic acid	3300	<3300	<66000	<3300	<3300
Benzo(a)anthracene	660	<660	<13200	<660	<660
Benzo(b)fluoranthene	660	<660	<13200	<660	<660
Benzo(k)fluoranthene	660	<660	<13200	<660	<660
Benzo(g,h,i)perylene	660	<660	<13200	<660	<660
Benzo(a)pyrene	660	<660	<13200	<660	<660
Benzl alcohol	1300	<1300	<26000	<1300	<1300
Bis(2-chloroethoxy)methane	660	<660	<13200	<660	<660
Bis(2-chloroethyl)ether	660	<660	<13200	<660	<660
Bis(2-chloroisoprpyl)ether	660	<660	<13200	<660	<660
Bis(2-ethylhexyl)phthalate	660	<660	<13200	<660	<660
4-Bromophenyl phenyl ether	660	<660	<13200	<660	<660
Butyl benzyl phthalate	660	<660	<13200	<660	<660
4-Chloroaniline	1300	<1300	<26000	<1300	<1300
1-Chloronaphthalene	3300	<3300	<66000	<3300	<3300
2-Chloronaphthalene	660	<660	<13200	<660	<660
4-Chloro-3-methylphenol	1300	<1300	<26000	<1300	<1300
2-Chlorophenol	660	<660	<13200	<660	<660
4-Chlorophenyl phenyl ether	660	<660	<13200	<660	<660
Chrysene	660	<660	<13200	<660	<660
Dibenz(a,j)acridine	3300	<3300	<66000	<3300	<3300
Dibenz(a,h)anthracene	660	<660	<13200	<660	<660
Dibenzofuran	660	<660	<13200	<660	<660
Di-N-Butylphthalate	660	<660	<13200	<660	<660
1,3-Dichlorobenzene	660	<660	<13200	<660	<660
1,4-Dichlorobenzene	660	<660	<13200	<660	<660
1,2-Dichlorobenzene	660	<660	<13200	<660	<660
3,3'-Dichlorobenzidine	1300	<1300	<26000	<1300	<1300
2,4-Dichlorophenol	660	<660	<13200	<660	<660

FACILITY Holloman, AFB, New Mexico

SAMPLE NUMBER		89-221-12	89-221-13	89-221-13	89-221-17	89-221-18
SAMPLE SITE		S50-B1-2.5	S50-B1-5	S50-B1-5-DUP	S50-B1-10	S50-B2-2.5
DATE COLLECTED		3-29-88	3-29-88	3-29-88	3-29-88	3-29-88
TIME COLLECTED		8:44	8:55	8:55	9:07	12:42
DATE RECEIVED		3-29-88	3-29-88	3-29-88	3-29-88	3-29-89
DATE EXTRACTED		4-3-89	4-4-88	4-3-88	4-4-88	4-4-88
DATE ANALYZED		4-7-89	5-13-88	4-6-88	4-14-88	4-14-88
SURROGATE: Units (Percent)	RANGE%					
2-Fluorobiphenyl	30-115	96	----	67	34	42
Nitrobenzene-d5	23-120	61	----	46	39	55
p-Terphenyl-d14	18-137	61	----	48	45	50
Phenol-d6	24-113	107	----	80	66	80
2-Fluorophenol	25-121	81	----	63	46	54
2,4,6-Tribromophenol	19-122	88	----	106	21	20
PARAMETER: Units(ug/kg dry-weight)	%PQL					
7,12-Dimethylbenz(a)anthracene	3300	<3300	<66000	<3300	<3300	<3300
alpha,alpha-Dimethylphenethylamine	3300	<3300	<66000	<3300	<3300	<3300
2,4-Dimethylphenol	660	<660	<13200	<660	<660	<660
Dimethylphthalate	660	<660	<13200	<660	<660	<660
4,6-Dinitro-2-methylphenol	3300	<3300	<66000	<3300	<3300	<3300
2,4-Dinitrophenol	3300	<3300	<66000	<3300	<3300	<3300
2,4-Dinitrotoluene	660	<660	<13200	<660	<660	<660
2,6-Dinitrotoluene	660	<660	<13200	<660	<660	<660
Diphenylamine	3300	<3300	<66000	<3300	<3300	<3300
1,2-Diphenylhydrazine	3300	<3300	<66000	<3300	<3300	<3300
Di-n-octylphthalate	660	<660	<13200	<660	<660	<660
Ethyl methanesulfonate	3300	<3300	<66000	<3300	<3300	<3300
Fluoranthene	660	<660	<13200	<660	<660	<660
Fluorene	660	<660	<13200	<660	<660	<660
Hexachlorobenzene	660	<660	<13200	<660	<660	<660
Hexachlorobutadiene	660	<660	<13200	<660	<660	<660
Hexachlorocyclopentadiene	660	<660	<13200	<660	<660	<660
Hexachloroethane	660	<660	<13200	<660	<660	<660
Indeno(1,2,3-cd)pyrene	660	<660	<13200	<660	<660	<660
Isophorone	660	<660	<13200	<660	<660	<660
3-Methylcholanthrene	3300	<3300	<66000	<3300	<3300	<3300
Methyl Methanesulfonate	3300	<3300	<66000	<3300	<3300	<3300
2-Methylnaphthalene	660	<660	<13200	<660	<660	<660
2-Methylphenol	660	<660	<13200	<660	<660	<660
4-Methylphenol	660	<660	<13200	<660	<660	<660
Naphthalene	660	<660	<13200	<660	<660	<660
1-Naphthylamine	3300	<3300	<66000	<3300	<3300	<3300
2-Naphthylamine	3300	<3300	<66000	<3300	<3300	<3300
2-Nitroaniline	3300	<3300	<66000	<3300	<3300	<3300
3-Nitroaniline	3300	<3300	<66000	<3300	<3300	<3300
4-Nitroaniline	3300	<3300	<66000	<3300	<3300	<3300
Nitrobenzene	660	<660	<13200	<660	<660	<660
2-Nitrophenol	3300	<3300	<66000	<3300	<3300	<3300
4-Nitrophenol	3300	<3300	<66000	<3300	<3300	<3300
N-Nitroso-di-N-Butylamine	660	<660	<13200	<660	<660	<660
N-Nitrosodimethylamine	3300	<3300	<66000	<3300	<3300	<3300
N-Nitrosodiphenylamine**	660	<660	<13200	<660	<660	<660

FACILITY Holloman, AFB, New Mexico

SAMPLE NUMBER		88-221-12	88-221-13	88-221-13	88-221-17	88-221-18
SAMPLE SITE		S50-B1-2.5	S50-B1-5	S50-B1-5-DUP	S50-B1-10	S50-B2-7.5
DATE COLLECTED		3-28-88	3-28-88	3-28-88	3-28-88	3-28-88
TIME COLLECTED		8 44	8:55	8:55	9:07	12:42
DATE RECEIVED		3-29-88	3-29-88	3-29-88	3-29-88	3-29-88
DATE EXTRACTED		4-3-88	4-4-88	4-3-88	4-4-88	4-4-88
DATE ANALYZED		4-7-88	5-13-88	4-6-88	4-14-88	4-14-88
SURROGATE: Units (Percent)	RANGES					
2-Fluorobiphenyl	30-115	96	----	67	34	42
Nitrobenzene-d5	23-120	61	----	46	39	55
p-Terphenyl-d14	18-137	61	----	48	45	50
Phenol-d6	24-113	107	----	88	66	80
2-Fluorophenol	25-121	81	----	63	46	54
2,4,6-Tribromophenol	19-122	88	----	106	21	20
PARAMETER: Units(ug/kg dry-weight)	SPQL					
Pentachlorobenzene	3300	<3300	<66000	<3300	<3300	<3300
Pentachloronitrobenzene	3300	<3300	<66000	<3300	<3300	<3300
Pentachlorophenol	3300	<3300	<66000	<3300	<3300	<3300
Phenacetin	3300	<3300	<66000	<3300	<3300	<3300
Phenanthrene	660	<660	<13200	<660	<660	<660
Phenol	660	<660	<13200	<660	<660	<660
2-Picoline	3300	<3300	<66000	<3300	<3300	<3300
Pronamide	3300	<3300	<66000	<3300	<3300	<3300
Pyrene	660	<660	<13200	<660	<660	<660
1,2,4,5-Tetrachlorobenzene	3300	<3300	<66000	<3300	<3300	<3300
2,3,4,6-Tetrachlorophenol	3300	<3300	<66000	<3300	<3300	<3300
1,2,4-Trichlorobenzene	660	<660	<13200	<660	<660	<660
2,4,5-Trichlorophenol	660	<660	<13200	<660	<660	<660
2,4,6-Trichlorophenol	660	<660	<13200	<660	<660	<660

RANGES = Surrogate spike recovery goals for water samples.

N-Nitrosodiphenylamine** cannot be separated from diphenylamine.

NOTE: 88-214-27 Original mistakenly not spiked and surrogates.

(re- for the duplicate or spike =0%

---- Diluted Out

FACILITY: Holloman, AFB, New Mexico

SAMPLE NUMBER		88-221-19	88-221-20	88-234-4	88-234-5	88-234-6
SAMPLE SITE		S50-B2-5	S50-B2-10	S50-B3-2.5	S50-B3-5	S50-B3-10
DATE COLLECTED		3-29-88	3-29-88	4-1-88	4-1-88	4-1-88
TIME COLLECTED		12:51	1:06	--	--	--
DATE RECEIVED		3-29-88	3-29-88	4-4-88	4-4-88	4-4-88
DATE EXTRACTED		4-4-88	4-4-88	4-4-88	4-4-88	4-4-88
DATE ANALYZED		4-12-88	4-14-88	4-15-88	4-8-88	4-8-88
SURROGATE: Units (Percent)	RANGE%					
2-Fluorobiphenyl	30-115	93	27	34	79	72
Nitrobenzene-d5	23-120	53	37	46	48	44
p-Terphenyl-d14	18-137	79	34	38	53	51
Phenol-d6	24-113	84	49	68	89	77
2-Fluorophenol	25-121	73	36	45	72	65
2,4,6-Tribromophenol	19-122	58	20	26	113	97
PARAMETER: Units(ug/kg dry-weight)	%PQL					
Acenaphthene	660	<660	<660	<660	<660	<660
Acenaphthylene	660	<660	<660	<660	<660	<660
Acetophenone	3300	<3300	<3300	<3300	<3300	<3300
Aniline	3300	<3300	<3300	<3300	<3300	<3300
Anthracene	660	<660	<660	<660	<660	<660
4-Aminobiphenyl	3300	<3300	<3300	<3300	<3300	<3300
Benzidine	3300	<3300	<3300	<3300	<3300	<3300
Benzoic acid	3300	<3300	<3300	<3300	<3300	<3300
Benzo(a)anthracene	660	<660	<660	<660	<660	<660
Benzo(b)fluoranthene	660	<660	<660	<660	<660	<660
Benzo(k)fluoranthene	660	<660	<660	<660	<660	<660
Benzo(g,h,i)perylene	660	<660	<660	<660	<660	<660
Benzo(a)pyrene	660	<660	<660	<660	<660	<660
Benzl alcohol	1300	<1300	<1300	<1300	<1300	<1300
Bis(2-chloroethoxy)methane	660	<660	<660	<660	<660	<660
Bis(2-chloroethyl)ether	660	<660	<660	<660	<660	<660
Bis(2-chloroisopropyl)ether	660	<660	<660	<660	<660	<660
Bis(2-ethylhexyl)phthalate	660	<660	<660	<660	<660	<660
4-Bromophenyl phenyl ether	660	<660	<660	<660	<660	<660
Butyl benzyl phthalate	660	<660	<660	<660	<660	<660
4-Chloroaniline	1300	<1300	<1300	<1300	<1300	<1300
1-Chloronaphthalene	3300	<3300	<3300	<3300	<3300	<3300
2-Chloronaphthalene	660	<660	<660	<660	<660	<660
4-Chloro-3-methylphenol	1300	<1300	<1300	<1300	<1300	<1300
2-Chlorophenol	660	<660	<660	<660	<660	<660
4-Chlorophenyl phenyl ether	660	<660	<660	<660	<660	<660
Chrysene	660	<660	<660	<660	<660	<660
Dibenz(a,j)acridine	3300	<3300	<3300	<3300	<3300	<3300
Dibenz(a,h)anthracene	660	<660	<660	<660	<660	<660
Dibenzofuran	660	<660	<660	<660	<660	<660
Di-N-Butylphthalate	660	<660	<660	<660	<660	<660
1,3-Dichlorobenzene	660	<660	<660	<660	<660	<660
1,4-Dichlorobenzene	660	<660	<660	<660	<660	<660
1,2-Dichlorobenzene	660	<660	<660	<660	<660	<660
3,3'-Dichlorobenzidine	1300	<1300	<1300	<1300	<1300	<1300
2,4-Dichlorophenol	660	<660	<660	<660	<660	<660
2,6-Dichlorophenol	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

FACILITY: Holloman, AFB, New Mexico

SAMPLE NUMBER		88-221-19	88-221-20	88-234-4	88-234-5	88-234-6
SAMPLE SITE		S50-B2-5	S50-B2-10	S50-B3-2.5	S50-B3-5	S50-B3-10
DATE COLLECTED		3-28-88	3-28-88	4-1-88	4-1-88	4-1-88
TIME COLLECTED		12:51	1:06	--	--	--
DATE RECEIVED		3-29-88	3-29-88	4-4-88	4-4-88	4-4-88
DATE EXTRACTED		4-4-88	4-4-88	4-4-88	4-4-88	4-4-88
DATE ANALYZED		4-12-88	4-14-88	4-15-88	4-8-88	4-8-88
SURROGATE: Units (Percent)	RANGE%					
2-Fluorobiphenyl	30-115	93	27	34	79	72
Nitrobenzene-d5	23-120	53	37	46	48	44
p-Terphenyl-d14	18-137	79	34	38	53	51
Phenol-d6	24-113	84	49	68	89	77
2-Fluorophenol	25-121	73	36	45	72	65
2,4,6-Tribromophenol	19-122	58	20	26	113	97
PARAMETER: Units(ug/kg dry-weight)	%PQL					
7,12-Dimethylbenz(a)anthracene	3300	<3300	<3300	<3300	<3300	<3300
alpha,alpha-Dimethylphenethylamine	3300	<3300	<3300	<3300	<3300	<3300
2,4-Dimethylphenol	660	<660	<660	<660	<660	<660
Dimethylphthalate	660	<660	<660	<660	<660	<660
4,6-Dinitro-2-methylphenol	3300	<3300	<3300	<3300	<3300	<3300
2,4-Dinitrophenol	3300	<3300	<3300	<3300	<3300	<3300
2,4-Dinitrotoluene	660	<660	<660	<660	<660	<660
2,6-Dinitrotoluene	660	<660	<660	<660	<660	<660
Diphenylamine	3300	<3300	<3300	<3300	<3300	<3300
1,2-Diphenylhydrazine	3300	<3300	<3300	<3300	<3300	<3300
Di-n-octylphthalate	660	<660	<660	<660	<660	<660
Ethyl methanesulfonate	3300	<3300	<3300	<3300	<3300	<3300
Fluoranthene	660	<660	<660	<660	<660	<660
Fluorene	660	<660	<660	<660	<660	<660
Hexachlorobenzene	660	<660	<660	<660	<660	<660
Hexachlorobutadiene	660	<660	<660	<660	<660	<660
Hexachlorocyclopentadiene	660	<660	<660	<660	<660	<660
Hexachloroethane	660	<660	<660	<660	<660	<660
Indeno(1,2,3-cd)pyrene	660	<660	<660	<660	<660	<660
Isophorone	660	<660	<660	<660	<660	<660
3-Methylcholanthrene	3300	<3300	<3300	<3300	<3300	<3300
Methyl Methanesulfonate	3300	<3300	<3300	<3300	<3300	<3300
2-Methylnaphthalene	660	<660	<660	<660	<660	<660
2-Methylphenol	660	<660	<660	<660	<660	<660
4-Methylphenol	660	<660	<660	<660	<660	<660
Naphthalene	660	<660	<660	<660	<660	<660
1-Naphthylamine	3300	<3300	<3300	<3300	<3300	<3300
2-Naphthylamine	3300	<3300	<3300	<3300	<3300	<3300
2-Nitroaniline	3300	<3300	<3300	<3300	<3300	<3300
3-Nitroaniline	3300	<3300	<3300	<3300	<3300	<3300
4-Nitroaniline	3300	<3300	<3300	<3300	<3300	<3300
Nitrobenzene	660	<660	<660	<660	<660	<660
2-Nitrophenol	3300	<3300	<3300	<3300	<3300	<3300
4-Nitrophenol	3300	<3300	<3300	<3300	<3300	<3300
N-Nitroso-di-N-Butylamine	660	<660	<660	<660	<660	<660
N-Nitrosodimethylamine	3300	<3300	<3300	<3300	<3300	<3300

FACILITY: Holloman, AFB, New Mexico

SAMPLE NUMBER		88-221-19	88-221-20	88-234-4	88-234-5	88-234-6
SAMPLE SITE		S30-B2-5	S30-B2-10	S30-B3-2.5	S30-B3-5	S30-B3-10
DATE COLLECTED		3-28-88	3-28-88	4-1-88	4-1-88	4-1-88
TIME COLLECTED		12:51	1:06	--	--	--
DATE RECEIVED		3-29-88	3-29-88	4-4-88	4-4-88	4-4-88
DATE EXTRACTED		4-4-88	4-4-88	4-4-88	4-4-88	4-4-88
DATE ANALYZED		4-12-88	4-14-88	4-15-88	4-8-88	4-8-88
SURROGATE: Units (Percent)	RANGES					
2-Fluorobiphenyl	30-115	93	27	34	79	72
Nitrobenzene-d5	23-120	53	37	46	48	44
p-Terphenyl-d14	18-137	79	34	38	53	51
Phenol-d6	24-113	84	49	68	89	77
2-Fluorophenol	25-121	73	36	45	72	65
2,4,6-Tribromophenol	19-122	58	28	26	113	97
PARAMETER: Units(ug/kg dry-weight)	SPQL					
Pentachlorobenzene	3300	<3300	<3300	<3300	<3300	<3300
Pentachloronitrobenzene	3300	<3300	<3300	<3300	<3300	<3300
Pentachlorophenol	3300	<3300	<3300	<3300	<3300	<3300
Phenacetin	3300	<3300	<3300	<3300	<3300	<3300
Phenanthrene	660	<660	<660	<660	<660	<660
Phenol	660	<660	<660	<660	<660	<660
2-Picoline	3300	<3300	<3300	<3300	<3300	<3300
Pronamide	3300	<3300	<3300	<3300	<3300	<3300
Pyrene	660	<660	<660	<660	<660	<660
1,2,4,5-Tetrachlorobenzene	3300	<3300	<3300	<3300	<3300	<3300
2,3,4,6-Tetrachlorophenol	3300	<3300	<3300	<3300	<3300	<3300
1,2,4-Trichlorobenzene	660	<660	<660	<660	<660	<660
2,4,5-Trichlorophenol	660	<660	<660	<660	<660	<660
2,4,6-Trichlorophenol	660	<660	<660	<660	<660	<660

FACILITY: Holloman, AFB, New Mexico

SAMPLE NUMBER		88-230-4	88-230-5	88-230-6	88-230-1	88-230-2
SAMPLE SITE		S50-B4-2.5	S50-B4-5	S50-B4-10	S50-B5-12.5	S50-B5-15
DATE COLLECTED		3-29-88	3-29-88	3-29-88	3-29-88	3-29-88
TIME COLLECTED		1:44	1:35	1:55	9:37	9:49
DATE RECEIVED		3-30-88	3-30-88	3-30-88	3-30-88	3-30-88
DATE EXTRACTED		5-12-88	5-12-88	5-12-88	5-12-88	5-12-88
DATE ANALYZED		5-13-88	5-13-88	5-13-88	5-13-88	5-13-88
SURROGATE: Units (Percent)	RANGE%					
2-Fluorobiphenyl	30-115	40	73	63	73	61
Nitrobenzene-d5	23-120	47	79	78	91	75
p-Terphenyl-d14	18-137	68	99	90	108	84
Phenol-d6	24-113	68	113	96	118	102
2-Fluorophenol	25-121	54	91	82	88	79
2,4,6-Tribromophenol	19-122	68	106	95	96	93
PARAMETER: Units(ug/kg dry-weight)	%POL					
Acenaphthene	660	<660	<660	<660	<660	<660
Acenaphthylene	660	<660	<660	<660	<660	<660
Acetophenone	3300	<3300	<3300	<3300	<3300	<3300
Aniline	3300	<3300	<3300	<3300	<3300	<3300
Anthracene	660	<660	<660	<660	<660	<660
4-Aminobiphenyl	3300	<3300	<3300	<3300	<3300	<3300
Benzidine	3300	<3300	<3300	<3300	<3300	<3300
Benzoic acid	3300	<3300	<3300	<3300	<3300	<3300
Benzo(a)anthracene	660	<660	<660	<660	<660	<660
Benzo(b)fluoranthene	660	<660	<660	<660	<660	<660
Benzo(k)fluoranthene	660	<660	<660	<660	<660	<660
Benzo(g,h,i)perylene	660	<660	<660	<660	<660	<660
Benzo(a)pyrene	660	<660	<660	<660	<660	<660
Benzl alcohol	1300	<1300	<1300	<1300	<1300	<1300
Bis(2-chloroethoxy)methane	660	<660	<660	<660	<660	<660
Bis(2-chloroethyl)ether	660	<660	<660	<660	<660	<660
Bis(2-chloroisopropyl)ether	660	<660	<660	<660	<660	<660
Bis(2-ethylhexyl)phthalate	660	<660	<660	<660	<660	<660
4-Bromophenyl phenyl ether	660	<660	<660	<660	<660	<660
Butyl benzyl phthalate	660	<660	<660	<660	<660	<660
4-Chloroaniline	1300	<1300	<1300	<1300	<1300	<1300
1-Chloronaphthalene	3300	<3300	<3300	<3300	<3300	<3300
2-Chloronaphthalene	660	<660	<660	<660	<660	<660
4-Chloro-3-methylphenol	1300	<1300	<1300	<1300	<1300	<1300
2-Chlorophenol	660	<660	<660	<660	<660	<660
4-Chlorophenyl phenyl ether	660	<660	<660	<660	<660	<660
Chrysene	660	<660	<660	<660	<660	<660
Dibenz(a,j)acridine	3300	<3300	<3300	<3300	<3300	<3300
Dibenz(a,h)anthracene	660	<660	<660	<660	<660	<660
Dibenzofuran	660	<660	<660	<660	<660	<660
Di-N-Butylphthalate	660	<660	<660	<660	<660	<660
1,3-Dichlorobenzene	660	<660	<660	<660	<660	<660
1,4-Dichlorobenzene	660	<660	<660	<660	<660	<660
1,2-Dichlorobenzene	660	<660	<660	<660	<660	<660
3,3'-Dichlorobenzidine	1300	<1300	<1300	<1300	<1300	<1300
2,4-Dichlorophenol	660	<660	<660	<660	<660	<660

FACILITY: Holloman, AFB, New Mexico

SAMPLE NUMBER		88-230-4	88-230-5	88-230-6	88-230-1	88-230-2
SAMPLE SITE		S50-B4-2.5	S50-B4-5	S50-B4-10	S50-B5-12.5	S50-B5-15
DATE COLLECTED		3-29-88	3-29-88	3-29-88	3-29-88	3-29-88
TIME COLLECTED		1:44	1:35	1:55	9:37	9:49
DATE RECEIVED		3-30-88	3-30-88	3-30-88	3-30-88	3-30-88
DATE EXTRACTED		5-12-88	5-12-88	5-12-88	5-12-88	5-12-88
DATE ANALYZED		5-13-88	5-13-88	5-13-88	5-13-88	5-13-88
SURROGATE: Units (Percent)	RANGES					
2-Fluorobiphenyl	30-115	40	73	63	73	61
Nitrobenzene-d5	23-120	47	79	78	91	75
p-Terphenyl-d14	18-137	60	99	90	108	84
Phenol-d6	24-113	68	113	96	118	102
2-Fluorophenol	25-121	54	91	82	88	79
2,4,6-Tribromophenol	19-122	68	106	95	96	93
PARAMETER: Units(ug/kg dry-weight)	SPQL					
7,12-Dimethylbenz(a)anthracene	3300	<3300	<3300	<3300	<3300	<3300
alpha,alpha-Dimethylphenethylamine	3300	<3300	<3300	<3300	<3300	<3300
2,4-Dimethylphenol	660	<660	<660	<660	<660	<660
Dimethylphthalate	660	<660	<660	<660	<660	<660
4,6-Dinitro-2-methylphenol	3300	<3300	<3300	<3300	<3300	<3300
2,4-Dinitrophenol	3300	<3300	<3300	<3300	<3300	<3300
2,4-Dinitrotoluene	660	<660	<660	<660	<660	<660
2,6-Dinitrotoluene	660	<660	<660	<660	<660	<660
Diphenylamine	3300	<3300	<3300	<3300	<3300	<3300
1,2-Diphenylhydrazine	3300	<3300	<3300	<3300	<3300	<3300
Di-n-octylphthalate	660	<660	<660	<660	<660	<660
Ethyl methanesulfonate	3300	<3300	<3300	<3300	<3300	<3300
Fluoranthene	660	<660	<660	<660	<660	<660
Fluorene	660	<660	<660	<660	<660	<660
Hexachlorobenzene	660	<660	<660	<660	<660	<660
Hexachlorobutadiene	660	<660	<660	<660	<660	<660
Hexachlorocyclopentadiene	660	<660	<660	<660	<660	<660
Hexachloroethane	660	<660	<660	<660	<660	<660
Indeno(1,2,3-cd)pyrene	660	<660	<660	<660	<660	<660
Isophorone	660	<660	<660	<660	<660	<660
3-Methylcholanthrene	3300	<3300	<3300	<3300	<3300	<3300
Methyl Methanesulfonate	3300	<3300	<3300	<3300	<3300	<3300
2-Methylnaphthalene	660	<660	<660	<660	<660	<660
2-Methylphenol	660	<660	<660	<660	<660	<660
4-Methylphenol	660	<660	<660	<660	<660	<660
Naphthalene	660	<660	<660	<660	<660	<660
1-Naphthylamine	3300	<3300	<3300	<3300	<3300	<3300
2-Naphthylamine	3300	<3300	<3300	<3300	<3300	<3300
2-Nitroaniline	3300	<3300	<3300	<3300	<3300	<3300
3-Nitroaniline	3300	<3300	<3300	<3300	<3300	<3300
4-Nitroaniline	3300	<3300	<3300	<3300	<3300	<3300
Nitrobenzene	660	<660	<660	<660	<660	<660
2-Nitrophenol	3300	<3300	<3300	<3300	<3300	<3300
4-Nitrophenol	3300	<3300	<3300	<3300	<3300	<3300
N-Nitroso-di-N-Butylamine	660	<660	<660	<660	<660	<660
N-Nitrosodimethylamine	3300	<3300	<3300	<3300	<3300	<3300

FACILITY: Holloman, AFB, New Mexico

SAMPLE NUMBER		88-230-4	88-230-5	88-230-6	88-230-1	88-230-2
SAMPLE SITE		S50-B4-2.5	S50-B4-5	S50-B4-10	S50-B5-12.5	S50-B5-15
DATE COLLECTED		3-29-88	3-29-88	3-29-88	3-29-88	3-29-88
TIME COLLECTED		1:44	1:35	1:55	9:37	9:49
DATE RECEIVED		3-30-88	3-30-88	3-30-88	3-30-88	3-30-88
DATE EXTRACTED		5-12-88	5-12-88	5-12-88	5-12-88	5-12-88
DATE ANALYZED		5-13-88	5-13-88	5-13-88	5-13-88	5-13-88
SURROGATE: Units (Percent)	RANGES					
2-Fluorobiphenyl	30-115	40	73	63	73	61
Nitrobenzene-d5	23-120	47	79	78	91	75
p-Terphenyl-d14	18-137	68	99	98	108	84
Phenol-d6	24-113	69	113	96	118	102
2-Fluorophenol	25-121	54	91	82	88	79
2,4,6-Tribromophenol	19-122	68	106	95	96	93
PARAMETER: Units(ug/kg dry-weight)	SPQL					
Pentachlorobenzene	3300	<3300	<3300	<3300	<3300	<3300
Pentachloronitrobenzene	3300	<3300	<3300	<3300	<3300	<3300
Pentachlorophenol	3300	<3300	<3300	<3300	<3300	<3300
Phenacetin	3300	<3300	<3300	<3300	<3300	<3300
Phenanthrene	660	<660	<660	<660	<660	<660
Phenol	660	<660	<660	<660	<660	<660
2-Picoline	3300	<3300	<3300	<3300	<3300	<3300
Pronamide	3300	<3300	<3300	<3300	<3300	<3300
Pyrene	660	<660	<660	<660	<660	<660
1,2,4,5-Tetrachlorobenzene	3300	<3300	<3300	<3300	<3300	<3300
2,3,4,6-Tetrachlorophenol	3300	<3300	<3300	<3300	<3300	<3300
1,2,4-Trichlorobenzene	660	<660	<660	<660	<660	<660
2,4,5-Trichlorophenol	660	<660	<660	<660	<660	<660
2,4,6-Trichlorophenol	660	<660	<660	<660	<660	<660

FACILITY: Holloman, AFB, New Mexico

SAMPLE NUMBER	88-230-3
SAMPLE SITE	S50-B5-17.5
DATE COLLECTED	3-29-88
TIME COLLECTED	10:07
DATE RECEIVED	3-30-88
DATE EXTRACTED	5-12-88
DATE ANALYZED	5-13-88

SURROGATE: Units (Percent)	RANGES	
2-Fluorobiphenyl	30-115	72
Nitrobenzene-d5	23-120	92
p-Terphenyl-d14	18-137	92
Phenol-d6	24-113	123
2-Fluorophenol	25-121	108
2,4,6-Tribromophenol	19-122	104

PARAMETER: Units(ug/kg dry-weight)	SPQL	
Acenaphthene	660	<660
Acenaphthylene	660	<660
Acetophenone	3300	<3300
Aniline	3300	<3300
Anthracene	660	<660
4-Aminobiphenyl	3300	<3300
Benzidine	3300	<3300
Benzoic acid	3300	<3300
Benzo(a)anthracene	660	<660
Benzo(b)fluoranthene	660	<660
Benzo(k)fluoranthene	660	<660
Benzo(g,h,i)perylene	660	<660
Benzo(a)pyrene	660	<660
Benzl alcohol	1300	<1300
Bis(2-chloroethoxy)methane	660	<660
Bis(2-chloroethyl)ether	660	<660
Bis(2-chloroisoprpyl)ether	660	<660
Bis(2-ethylhexyl)phthalate	660	<660
4-Bromophenyl phenyl ether	660	<660
Butyl benzyl phthalate	660	<660
4-Chloroaniline	1300	<1300
1-Chloronaphthalene	3300	<3300
2-Chloronaphthalene	660	<660
4-Chloro-3-methylphenol	1300	<1300
2-Chlorophenol	660	<660
4-Chlorophenyl phenyl ether	660	<660
Chrysene	660	<660
Dibenz(a,j)acridine	3300	<3300
Dibenz(a,h)anthracene	660	<660
Dibenzofuran	660	<660
Di-N-Butylphthalate	660	<660
1,3-Dichlorobenzene	660	<660
1,4-Dichlorobenzene	660	<660
1,2-Dichlorobenzene	660	<660
3,3'-Dichlorobenzidine	1300	<1300
2,4-Dichlorophenol	660	<660
2,6-Dichlorophenol	3300	<3300

FACILITY: Holloman, AFB, New Mexico

SAMPLE NUMBER	88-230-3
SAMPLE SITE	S50-B5-17.5
DATE COLLECTED	3-29-88
TIME COLLECTED	10:07
DATE RECEIVED	3-30-88
DATE EXTRACTED	5-12-88
DATE ANALYZED	5-13-88

SURROGATE: Units (Percent)	RANGES	
2-Fluorobiphenyl	30-115	72
Nitrobenzene-d5	23-120	92
p-Terphenyl-d14	18-137	92
Phenol-d6	24-113	123
2-Fluorophenol	25-121	100
2,4,6-Tribromophenol	19-122	104

PARAMETER: Units(ug/kg dry-weight)	#PQL	
7,12-Dimethylbenz(a)anthracene	3300	<3300
alpha,alpha-Dimethylphenethylamine	3300	<3300
2,4-Dimethylphenol	660	<660
Dimethylphthalate	660	<660
4,6-Dinitro-2-methylphenol	3300	<3300
2,4-Dinitrophenol	3300	<3300
2,4-Dinitrotoluene	660	<660
2,6-Dinitrotoluene	660	<660
Diphenylamine	3300	<3300
1,2-Diphenylhydrazine	3300	<3300
Di-n-octylphthalate	660	<660
Ethyl methanesulfonate	3300	<3300
Fluoranthene	660	<660
Fluorene	660	<660
Hexachlorobenzene	660	<660
Hexachlorobutadiene	660	<660
Hexachlorocyclopentadiene	660	<660
Hexachloroethane	660	<660
Indeno(1,2,3-cd)pyrene	660	<660
Isophorone	660	<660
3-Methylcholanthrene	3300	<3300
Methyl Methanesulfonate	3300	<3300
2-Methylnaphthalene	660	<660
2-Methylphenol	660	<660
4-Methylphenol	660	<660
Naphthalene	660	<660
1-Naphthylamine	3300	<3300
2-Naphthylamine	3300	<3300
2-Nitroaniline	3300	<3300
3-Nitroaniline	3300	<3300
4-Nitroaniline	3300	<3300
Nitrobenzene	660	<660
2-Nitrophenol	3300	<3300
4-Nitrophenol	3300	<3300
N-Nitroso-di-N-Butylamine	660	<660
N-Nitrosodimethylamine	3300	<3300
N-Nitrosodiphenylamine**	660	<660

FACILITY: Holloman, AFB, New Mexico

SAMPLE NUMBER	88-230-3
SAMPLE SITE	S50-B5-17.5
DATE COLLECTED	3-29-88
TIME COLLECTED	10:07
DATE RECEIVED	3-30-88
DATE EXTRACTED	5-12-88
DATE ANALYZED	5-13-88

SURROGATE: Units (Percent)	RANGES	
2-Fluorobiphenyl	30-115	72
Nitrobenzene-d5	23-120	92
p-Terphenyl-d14	18-137	92
Phenol-d6	24-113	123
2-Fluorophenol	25-121	100
2,4,6-Tribromophenol	19-122	184

PARAMETER: Units(ug/kg dry-weight)	SPQL	
Pentachlorobenzene	3300	<3300
Pentachloronitrobenzene	3300	<3300
Pentachlorophenol	3300	<3300
Phenacetin	3300	<3300
Phenanthrene	660	<660
Phenol	660	<660
2-Picoline	3300	<3300
Pronamide	3300	<3300
Pyrene	660	<660
1,2,4,5-Tetrachlorobenzene	3300	<3300
2,3,4,6-Tetrachlorophenol	3300	<3300
1,2,4-Trichlorobenzene	660	<660
2,4,5-Trichlorophenol	660	<660
2,4,6-Trichlorophenol	660	<660

FACILITY: Holloman, AFB		:	
SAMPLE NUMBER:		: 89-073-10	LAB BLANK
SAMPLE SITE:		: S50-86-20/21.5	--
DATE COLLECTED:		: 01-23-89	--
TIME COLLECTED:		: 10:38	--
DATE RECEIVED:		: 01-24-89	--
DATE EXTRACTED:		: 01-30-89	01-30-89
DATE ANALYZED:		: 02-27-89	02-27-89
SURROGATE: Units (Percent)	RANGE	:	
2-Fluorobiphenyl	30-115	: 61	60
Nitrobenzene-d5	23-120	: 40	74
p-Terphenyl-d14	18-137	: 167***	122
Phenol-d6	24-113	: 102	110
2-Fluorophenol	25-121	: 72	115
2,4,6-Tribromophenol	19-122	: 175***	105
PARAMETER: Units(ug/kg dry-wt)	PQL	:	
Acenaphthene	330	: <400	<330
Acenaphthylene	330	: <400	<330
Anthracene	330	: <400	<330
Benzoic acid	1600	: <2100	<1600
Benzo(a)anthracene	330	: <400	<330
Benzo(b)fluoranthene	330	: <400	<330
Benzo(k)fluoranthene	330	: <400	<330
Benzo(g,h,i)perylene	330	: <400	<330
Benzo(a)pyrene	330	: <400	<330
Benzl alcohol	660	: <900	<660
Bis(2-chloroethoxy)methane	330	: <400	<330
Bis(2-chloroethyl)ether	330	: <400	<330
Bis(2-chloroisopropyl)ether	330	: <400	<330
Bis(2-ethylhexyl)phthalate	330	: <400	<330
4-Bromophenyl phenyl ether	330	: <400	<330
Butyl benzyl phthalate	330	: <400	<330
4-Chloroaniline	660	: <900	<660
2-Chloronaphthalene	330	: <400	<330
4-Chloro-3-methylphenol	660	: <900	<660
2-Chlorophenol	330	: <400	<330
4-Chlorophenyl phenyl ether	330	: <400	<330
Chrysene	330	: <400	<330
Dibenz(a,h)anthracene	330	: <400	<330
Dibenzofuran	330	: <400	<330
Di-N-Butylphthalate	330	: <400	<330
1,2-Dichlorobenzene	330	: <400	<330
1,3-Dichlorobenzene	330	: <400	<330
1,4-Dichlorobenzene	330	: <400	<330
3,3'-Dichlorobenzidine	660	: <900	<660
2,4-Dichlorophenol	330	: <400	<330
Diethylphthalate	330	: <400	<330
2,4-Dimethylphenol	330	: <400	<330
Dimethylphthalate	330	: <400	<330
4,6-Dinitro-2-methylphenol	1650	: <2100	<1650
2,4-Dinitrophenol	1650	: <2100	<1650
2,4-Dinitrotoluene	330	: <400	<330
2,6-Dinitrotoluene	330	: <400	<330
Di-n-octylphthalate	330	: <400	<330
Fluoranthene	330	: <400	<330
Fluorene	330	: <400	<330

FACILITY: Holloman, AFB	:	
SAMPLE NUMBER:	: 89-073-10	LAB BLANK
SAMPLE SITE:	: S50-96-20/21.5	--
DATE COLLECTED:	: 01-23-89	--
TIME COLLECTED:	: 10:30	--
DATE RECEIVED:	: 01-24-89	--
DATE EXTRACTED:	: 01-30-89	01-30-89
DATE ANALYZED:	: 02-27-89	02-27-89

SURROGATE: Units (Percent)	RANGE	:	
2-Fluorobiphenyl	30-115	: 61	60
Nitrobenzene-d5	23-120	: 40	74
p-Terphenyl-d14	18-137	: 167***	122
Phenol-d6	24-113	: 102	110
2-Fluorophenol	25-121	: 72	115
2,4,6-Tribromophenol	19-122	: 175***	105

PARAMETER: Units(ug/kg dry-wt)	PQL	:	
Hexachlorobenzene	330	: <400	<330
Hexachlorobutadiene	330	: <400	<330
Hexachlorocyclopentadiene	330	: <400	<330
Hexachloroethane	330	: <400	<330
Indeno(1,2,3-cd)pyrene	330	: <400	<330
Isophorone	330	: <400	<330
2-Methylnaphthalene	330	: <400	<330
2-Methylphenol	330	: <400	<330
4-Methylphenol	330	: <400	<330
Naphthalene	330	: <400	<330
2-Nitroaniline	1650	: <2100	<1650
3-Nitroaniline	1650	: <2100	<1650
4-Nitroaniline	1650	: <2100	<1650
Nitrobenzene	330	: <400	<330
2-Nitrophenol	1650	: <2100	<1650
4-Nitrophenol	1650	: <2100	<1650
N-Nitrosodiphenylamine	1650	: <2100	<1650
N-Nitroso-di-N-propylamine	330	: <400	<330
Pentachlorophenol	1650	: <2100	<1650
Phenanthrene	330	: <400	<330
Phenol	330	: <400	<330
Pyrene	330	: <400	<330
1,2,4-Trichlorobenzene	330	: <400	<330
2,4,5-Trichlorophenol	330	: <400	<330
2,4,6-Trichlorophenol	330	: <400	<330

C83

ENVIRONMENTAL HEALTH RESEARCH AND TESTING, INC.
RESULT SHEET

CUSTOMER NAME: U.S. ARMY CORPS OF ENGINEERS

SAMPLE SOURCE: HOLLOMAN AFB, PHASE II - DR. JOE SOLSKY

WORK ORDER NO.: 275 PROJECT NO.: 10290

SAMPLE TYPE: SOIL SAMPLE METHOD NO.: EPA 8270

ANALYSIS PERFORMED: GC/MS Analysis for B/N/A

EXTRACTED: 01-26-89 ANALYZED: 02-28-89

ANALYST: K. Nusekabel LAB NOTEBOOK NO.: 99, pg. 57

CUSTOMER SAMPLE NO.: H-STE-50-B6-DUP (890124-021) EHRT NO.: 16003

RESULTS (mg/kg)

2-Picoline - BDL	Methyl Methanesulfonate - BDL
Ethyl Methanesulfonate - BDL	Aniline - BDL
Benzyl Alcohol - BDL	Bis(2-Chloroethyl)Ether - BDL
1,3-Dichlorobenzene - BDL	1,4-Dichlorobenzene - BDL
1,2-Dichlorobenzene - BDL	Bis(2-Chloroisopropyl)Ether - BDL
N-Nitrosodimethylamine - BDL	N(Nitrosodi-N-Propylamine) - BDL
Acetophenone - BDL	Hexachloroethane - BDL
Nitrobenzene - BDL	Isophorone - BDL
Bis(2-Chloroethoxy)Methane - BDL	Benzoic Acid - BDL
a-,a-Dimethylphenethylamine - BDL	1,2,4-Trichlorobenzene - BDL
Naphthalene - BDL	Hexachlorobutadiene - BDL
N-Nitroso-di-n-butylamine - BDL	2-Methylnaphthalene - BDL
Hexachlorocyclopentadiene - BDL	2-Chloronaphthalene - BDL
1-Chloronaphthalene - BDL	2-Nitroaniline - BDL
Dimethylphthalate - BDL	Acenaphthylene - BDL
Acenaphthene - BDL	Pentachloronitrobenzene - BDL
1,2,4,5-Tetrachlorobenzene - BDL	3-Nitroaniline - BDL
4-Nitroaniline - BDL	2,4-Dinitrotoluene - BDL

C8

ENVIRONMENTAL HEALTH RESEARCH AND TESTING, INC.
RESULT SHEET

CUSTOMER NAME: U.S. ARMY CORPS OF ENGINEERS

SAMPLE SOURCE: HOLLOMAN AFB, PHASE II - DR. JOE SOLSKY

WORK ORDER NO.: 275 PROJECT NO.: 10290

SAMPLE TYPE: SOIL SAMPLE METHOD NO.: EPA 8270

ANALYSIS PERFORMED: GC/MS Analysis for B/N/A

EXTRACTED: 01-26-89 ANALYZED: 02-28-89

ANALYST: K. Nusekabel LAB NOTEBOOK NO.: 99, pg. 57

CUSTOMER SAMPLE NO.: H-STE-50-B6-DUP (890124-021) EHRT NO.: 16003

RESULTS (mg/kg)

2,6-Dinitrotoluene - BDL	Dibenzofuran - BDL
Diethylphthalate - BDL	1-Naphthylamine - BDL
2-Naphthylamine - BDL	4-Chlorophenyl-Phenyl-Ether - BDL
Fluorene - BDL	N-Nitrosodiphenylamine - BDL
Diphenylamine - BDL	1,2-Diphenylhydrazine - BDL
N-Nitrosopiperidine - BDL	4-Bromophenyl-Phenyl-Ether - BDL
4-Aminobiphenyl - BDL	Hexachlorobenzene - BDL
Pentachlorobenzene - BDL	Phenacetin - BDL
Pronamide - BDL	Phenanthrene - BDL
Anthracene - BDL	Alpha-BHC - BDL
Beta-BHC - BDL	Gamma-BHC (Lindane) - BDL
Delta-BHC - BDL	Heptachlor - BDL
Aldrin - BDL	Di-n-Butylphthalate - 0.15
Heptachlor Epoxide - BDL	Endosulfan I - BDL
Fluoranthene - BDL	Dieldrin - BDL
4,4'-DDE - BDL	Benzidine -BDL
Pyrene - BDL	Endrin - BDL
Endosulfan II - BDL	4.4'-DDD - BDL

C85

ENVIRONMENTAL HEALTH RESEARCH AND TESTING, INC.
RESULT SHEET

CUSTOMER NAME: U.S. ARMY CORPS OF ENGINEERS

SAMPLE SOURCE: HOLLOMAN AFB, PHASE II - DR. JOE SOLSKY

WORK ORDER NO.: 275 PROJECT NO.: 10290

SAMPLE TYPE: SOIL SAMPLE METHOD NO.: EPA 8270

ANALYSIS PERFORMED: GC/MS Analysis for B/N/A

EXTRACTED: 01-26-89 ANALYZED: 02-28-89

ANALYST: K. Nusekabel LAB NOTEBOOK NO.: 99, pg. 57

CUSTOMER SAMPLE NO.: H-STE-50-B6-DUP (890124-021) EHRT NO.: 16003

RESULTS (mg/kg)

p-Dimethylaminoazobenzene - BDL	Butyl-Benzyl-Phthalate - BDL
3,3'-Dichlorobenzidine - BDL	Benzo(a)Anthracene - BDL
Bis(2-Ethyl-Hexyl)Phthalate - BDL	Chrysene - BDL
7,12-Dimethylbenz(a)anthracene - BDL	4,4'-DDD - BDL
Endosulfan Sulfate - BDL	Endrin Aldehyde - BDL
3-Methylcholanthrene - BDL	Di-n-Octylphthalate - BDL
Benzo(b)Fluoranthene - BDL	Benzo(k)Fluoranthene - BDL
Benzo(a)Pyrene - BDL	Dibenz(a,j)Acridine - BDL
Indeno(1,2,3-c,d)Pyrene - BDL	Dibenzo(a,h)Anthracene - BDL
Benzo(g,h,i)Perylene - BDL	

C86

ENVIRONMENTAL HEALTH RESEARCH AND TESTING, INC.
RESULT SHEET

CUSTOMER NAME: U.S. ARMY CORPS OF ENGINEERS

SAMPLE SOURCE: HOLLOMAN AFB, PHASE II - DR. JOE SOLSKY

WORK ORDER NO.: 275 PROJECT NO.: 10290

SAMPLE TYPE: SOIL SAMPLE METHOD NO.: EPA 8270

ANALYSIS PERFORMED: GC/MS Analysis for Acids

EXTRACTED: 01-26-89 ANALYZED: 02-28-89

ANALYST: K. Nusekabel LAB NOTEBOOK NO.: 99, pg. 57

CUSTOMER SAMPLE NO.: H-STE-50-B6-DUP (890124-021) EHRT NO.: 16003

RESULTS (mg/kg)

Phenol - BDL	2-Chlorophenol - BDL
2-Methylphenol - BDL	4-Methylphenol - BDL
2-Nitrophenol - BDL	2,4-Dimethylphenol - BDL
2,4-Dichlorophenol - BDL	2,6-Dichlorophenol - BDL
4-Chloro-3-Methyl Phenol - BDL	2,4,6-Trichlorophenol - BDL
2,4,5-Trichlorophenol - BDL	2,4-Dinitrophenol - BDL
4-Nitrophenol - BDL	2,3,4,6-Tetrachlorophenol - BDL
4,6-Dinitro-2-Methyl Phenol - BDL	Pentachlorophenol - BDL

SURROGATE COMPOUND	PERCENT RECOVERY
Nitrobenzene-d_5	82.06%
2-Fluorobiphenyl	65.70%
Terphenyl-d_{14}	66.73
Phenol-d_5	68.02%
2-Fluorophenol	63.44%
2,4,6-Tribromophenol	55.47%

QUALITY CONTROL OFFICER: [signature]

DATE: 3/7/89

13-JUN-88 SITE 50 TOTAL RECOVERABLE HYDROCARBONS

FACILITY Holloman, AFB, New Mexico

SAMPLE NUMBER		88-255-6	88-255-3	88-221-12	88-221-13	88-221-14
SAMPLE SITE		S50-B1	R-S50-B1	S50-B1-2.5	S50-B1-5	S50-B1-5-DUP
DATE COLLECTED		4-8-88	4-8-88	3-28-88	3-28-88	3-28-88
TIME COLLECTED		10:53	10:24	8:44	8:55	8:55
DATE RECEIVED		4-9-88	4-9-88	3-29-88	3-29-88	3-29-88
DATE ANALYZED		4-21-88	4-21-88	4-6-88	4-6-88	4-6-88
PARAMETER: UNITS (mg/kg)	+MDL					
Total Recov. Hydrocarbons	15	<1.0	<1.0	525.3	<20	<20

+MDL = Method detection limit.

13-JUN-88 SITE 50 TOTAL RECOVERABLE HYDROCARBONS

FACILITY: Holloman, AFB, New Mexico

SAMPLE NUMBER		88-221-15	88-221-17	88-221-18	88-221-19	88-221-20
SAMPLE SITE		R-S50-B1-5	S50-B1-10	S50-B2-2.5	S50-B2-5	S50-B2-10
DATE COLLECTED		3-28-88	3-28-88	3-28-88	3-28-88	3-28-88
TIME COLLECTED		8:18	9:07	12:42	12:51	1:06
DATE RECEIVED		3-29-88	3-29-88	3-29-88	3-29-88	3-29-88
DATE ANALYZED		4-6-88	4-6-88	4-6-88	4-6-88	4-6-88
PARAMETER: UNITS (mg/kg)	+MDL					
Total Recov. Hydrocarbons	15	<1.0	<20	<20	7946	<20

+MDL = Method detection limit.

13-Jun-88 SITE 50 TOTAL RECOVERABLE HYDROCARBONS

FACILITY: Holloman, AFB, New Mexico

SAMPLE NUMBER		88-230-6	88-230-1	88-230-3	88-230-2	88-234-4
SAMPLE SITE		S50-B4-10	S50-B5-12.5	S50-B5-17.5	S50-B5-15	S50-B3-2.5
DATE COLLECTED		3-29-88	3-29-88	3-29-88	3-29-88	4-1-88
TIME COLLECTED		1:55	9:37	10:07	9:49	--
DATE RECEIVED		3-30-88	3-30-88	3-30-88	3-30-88	4-4-88
DATE ANALYZED		4-7-88	4-7-88	4-7-88	4-7-88	4-12-88
PARAMETER: UNITS (mg/kg)	*MDL					
Total Recov. Hydrocarbons	15	<20	<20	<20	<20	<50

*MDL = Method detection limit.

	88-230-4	88-230-5
	S50-B4-7.5	S50-B4-5
	3-29-88	3-29-88
	1:44	1:35
	3-30-88	3-30-88
	4-7-88	4-7-88
	<20	<20

13-Jun-88

SITE 30 TOTAL RECOVERABLE HYDROCARBONS

FACILITY: Holloman, AFB, New Mexico

SAMPLE NUMBER		88-234-5	88-234-6
SAMPLE SITE		S30-B3-5	S30-B3-10
DATE COLLECTED		4-1-88	4-1-88
TIME COLLECTED		--	--
DATE RECEIVED		4-4-88	4-4-88
DATE ANALYZED		4-12-88	4-12-88
PARAMETER: UNITS (mg/kg)	+MDL		
Total Recov. Hydrocarbons	15	<50	<50

+MDL = Method detection limit.

FACILITY: Holloman, AFB					
SAMPLE NUMBER		89-073-08	89-073-09	89-073-09	89-073-10
SAMPLE SITE		S50-B6-2.5/4	S50-B6-5/6.5	S50-B6-5/6.5-FDUP	S50-B6-20/21.5
DATE COLLECTED		01-23-89	01-23-89	01-23-89	01-23-89
TIME COLLECTED		09:17	09:40	09:40	10:38
DATE RECEIVED		01-24-89	01-24-89	01-24-89	01-24-89
DATE ANALYZED		01-29-89	01-29-89	01-29-89	01-29-89
PARAMETER:	UNITS (mg/kg) +MDL				
Total Recov. Hydrocarbons	5.0	23.7	25.3	36.3	<5.0

WATER

FACILITY: Holloman, AFB, New Mexico

SAMPLE NUMBER	SS-221-14
SAMPLE SITE	R-553-B1-S
DATE COLLECTED	3-28-88
TIME COLLECTED	8:18
DATE RECEIVED	3-29-88
DATE ANALYZED	4-10-88

SURROGATE: Units (Percent)	BLANK RANGE	
1,2-Dichloroethane-d4	76-114	102
Toluene-d8	88-110	94
p-Bromofluorobenzene	86-115	70

PARAMETER: UNITS (ug/L)	%PQL	
Acetone	100	<100
Acrolein	100	<100
Acrylonitrile	5	<5
Benzene	5	<5
Bromodichloromethane	5	<5
Bromoform	5	<5
Bromomethane	10	<10
2-Butanone	100	<100
2-Butenoic Acid, ethyl Ester	5	<5
Carbon Disulfide	5	<5
Carbon Tetrachloride	5	<5
Chlorobenzene	5	<5
Chloroethane	10	<10
2-chloroethyl Vinyl Ether	10	<10
Chloroform	5	<5
Chloromethane	10	<10
cis-1,3-Dichloropropene	5	<5
cis-1,4-Dichlorobutene	5	<5
Dibromochloromethane	5	<5
Dibromomethane	5	<5
1,1-Dichloroethane	5	<5
1,2-Dichloroethane	5	<5
1,1-Dichloroethene	5	<5
1,2-Dichloroethene	5	<5
1,2-Dichloropropane	5	<5
Dichlorodifluoromethane	10	<10
Ethanol	100	<100
Ethyl Benzene	5	<5
2-Hexanone	50	<50
Iodomethane	5	<5
Methylene Chloride	5	<5
4-methyl-2-pentanone	50	<50
Styrene	5	<5
Tetrachloroethene	5	<5
Toluene	5	<5
Total Xylenes	5	<5
trans-1,4-Dichlorobutene	5	<5
trans-1,3-Dichloropropene	5	<5
1,1,1-Trichloroethane	5	<5

FACILITY: Holloman, AFB, New Mexico

SAMPLE NUMBER	88-221-14
SAMPLE SITE	R-550-81-5
DATE COLLECTED	3-28-88
TIME COLLECTED	8:18
DATE RECEIVED	3-29-88
DATE ANALYZED	4-10-88

SURROGATE: Units (Percent)	BLANK RANGE	
1,2-Dichloroethane-d4	76-114	102
Toluene-d8	88-110	94
p-Bromofluorobenzene	86-115	70

PARAMETER: UNITS (ug/L)	*PQL	
1,2,3-Trichloropropane	5	<5
Trichloroethene	5	<5
Trichlorofluoromethane	100	<100
Vinyl Acetate	50	<50
Vinyl Chloride	10	<10

*PQL= Practical Quantitation Limit

FACILITY: Holloman, AFB					
SAMPLE NUMBER:		89-073-11	89-073-12	LAB BLANK	89-090-05
SAMPLE DESCRIPTION:		R-S50-86-5/6.5	S50-TRIP BLK	012789	S50-81-MW1
DATE COLLECTED:		01-23-89	01-23-89	--	01-29-89
TIME COLLECTED:		09:30	--	--	01:03
DATE RECEIVED:		01-24-89	01-24-89	--	01-31-89
DATE ANALYZED:		01-27-89	01-27-89	01-27-89	02-09-89
SURROGATE:	RANGE				
1,2-Dichloroethane-d4	76-114	98	100	96	108
Toluene-d8	88-110	92	92	92	102
p-Bromofluorobenzene	86-115	102	104	96	112
PARAMETER: UNITS (ug/L)	PQL				
Acetone	100	<100	<100	<100	<100
Benzene	5	<5	<5	<5	<5
Bromodichloromethane	5	<5	<5	<5	<5
Bromoform	5	<5	<5	<5	<5
Bromomethane	10	<10	<10	<10	<10
2-Butanone	100	<100	<100	<100	<100
Carbon Disulfide	5	<5	<5	<5	<5
Carbon Tetrachloride	5	<5	<5	<5	<5
Chlorobenzene	5	<5	<5	<5	<5
Chloroethane	10	<10	<10	<10	<10
2-chloroethyl Vinyl Ether	10	<10	<10	<10	<10
Chloroform	5	<5	<5	<5	<5
Chloromethane	10	<10	<10	<10	<10
cis-1,3-Dichloropropene	5	<5	<5	<5	<5
Dibromochloromethane	5	<5	<5	<5	<5
1,1-Dichloroethane	5	<5	<5	<5	<5
1,2-Dichloroethane	5	<5	<5	<5	<5
1,1-Dichloroethene	5	<5	<5	<5	<5
1,2-Dichloroethene (Total)	5	<5	<5	<5	<5
1,2-Dichloropropane	5	<5	<5	<5	<5
Ethyl Benzene	5	<5	<5	<5	<5
2-Hexanone	50	<50	<50	<50	<50
Methylene Chloride	5	<5	<5	<5	<5
4-methyl-2-pentanone	50	<50	<50	<50	<50
Styrene	5	<5	<5	<5	<5
Tetrachloroethene	5	<5	<5	<5	<5
Toluene	5	<5	<5	<5	<5
Total Xylenes	5	<5	<5	<5	<5
trans-1,3-Dichloropropene	5	<5	<5	<5	<5
1,1,1-Trichloroethane	5	<5	<5	<5	<5
1,1,2,2-Tetrachloroethane	5	<5	<5	<5	<5
1,1,2-Trichloroethane	5	<5	<5	<5	<5
Trichloroethene	5	<5	<5	<5	16
Vinyl Acetate	50	<50	<50	<50	<50
Vinyl Chloride	10	<10	<10	<10	<10

FACILITY: Holloman, AFB					
SAMPLE NUMBER:		89-090-06	89-090-07	89-090-07	89-090-08
SAMPLE DESCRIPTION:		S50-B2-MW2	S50-B6-MW6	S50-B6-MW6-FDUP	R-S50-B6-MW6
DATE COLLECTED:		01-29-89	01-29-89	01-29-89	01-29-89
TIME COLLECTED:		01:33	09:23	09:23	09:05
DATE RECEIVED:		01-31-89	01-31-89	01-31-89	01-31-89
DATE ANALYZED:		02-09-89	02-09-89	02-09-89	02-09-89
SURROGATE:	RANGE				
1,2-Dichloroethane-d4	76-114	110	110	110	108
Toluene-d8	88-110	100	98	100	102
p-Bromofluorobenzene	86-115	114	114	114	114
PARAMETER: UNITS (ug/L)	PQL				
Acetone	100	<100	<100	<100	<100
Benzene	5	<5	<5	<5	<5
Bromodichloromethane	5	<5	<5	<5	<5
Bromoform	5	<5	<5	<5	<5
Bromomethane	10	<10	<10	<10	<10
2-Butanone	100	<100	<100	<100	<100
Carbon Disulfide	5	<5	<5	<5	<5
Carbon Tetrachloride	5	<5	<5	<5	<5
Chlorobenzene	5	<5	<5	<5	<5
Chloroethane	10	<10	<10	<10	<10
2-chloroethyl Vinyl Ether	10	<10	<10	<10	<10
Chloroform	5	<5	<5	<5	12
Chloromethane	10	<10	<10	<10	<10
cis-1,3-Dichloropropene	5	<5	<5	<5	<5
Dibromochloromethane	5	<5	<5	<5	<5
1,1-Dichloroethane	5	<5	<5	<5	<5
1,2-Dichloroethane	5	<5	<5	<5	<5
1,1-Dichloroethene	5	<5	<5	<5	<5
1,2-Dichloroethene (Total)	5	<5	<5	<5	<5
1,2-Dichloropropane	5	<5	<5	<5	<5
Ethyl Benzene	5	<5	<5	<5	<5
2-Hexanone	50	<50	<50	<50	<50
Methylene Chloride	5	<5	<5	<5	<5
4-methyl-2-pentanone	50	<50	<50	<50	<50
Styrene	5	<5	<5	<5	<5
Tetrachloroethene	5	<5	<5	<5	<5
Toluene	5	<5	<5	<5	<5
Total Xylenes	5	<5	<5	<5	<5
trans-1,3-Dichloropropene	5	<5	<5	<5	<5
1,1,1-Trichloroethane	5	<5	<5	<5	<5
1,1,2,2-Tetrachloroethane	5	<5	<5	<5	<5
1,1,2-Trichloroethane	5	<5	<5	<5	<5
Trichloroethene	5	9	<5	<5	<5
Vinyl Acetate	50	<50	<50	<50	<50
Vinyl Chloride	10	<10	<10	<10	<10

C116

WILSON LABORATORIES

525 NORTH EIGHTH STREET - P.O. BOX 1820 - SALINA, KANSAS 67402-1884 - (913)825-7186

LABORATORY REPORT PAGE

CLIENT: DEPT. OF THE ARMY
ATTN: R.K. SCHLENKER
P.O. BOX 103
OMAHA, NE 68101

DATE RPTD: 12/14/88
DATE RCVD: 04/15/88
PURCHASE AUTH:
FILE NO.: 88-9633
ORDER NO.: 776

LAB NUMBER: 88041557
SAMPLE DESCRIPTION: H-STE-50-B1/MW-1

DATE SAMPLED: 04/08/88

ANALYSIS	CONCENTRATION	UNITS	BOOK-PAG
HYDROCARBONS, TOTAL PETROLEUM, BY IR	ND(1)	MG/L	1147-2
LOW LEVEL VOLATILE COMPOUNDS			
1V. ACROLEIN	ND(25)	UG/L	1136-45
2V. ACRYLONITRILE	ND(25)	UG/L	1136-45
3V. BENZENE	ND(1.0)	UG/L	1136-45
4V. BISCHLOROMETHYLETHER	NOT ANALYZED	UG/L	1136-45
5V. BROMOFORM	ND(1.0)	UG/L	1136-45
6V. CARBON TETRACHLORIDE	ND(1.0)	UG/L	1136-45
7V. CHLOROBENZENE	ND(1.0)	UG/L	1136-45
8V. CHLORODIBROMOMETHANE	ND(1.0)	UG/L	1136-45
9V. CHLOROETHANE	ND(1.0)	UG/L	1136-45
10V. 2-CHLOROETHYLVINYL ETHER	ND(1.0)	UG/L	1136-45
11V. CHLOROFORM	ND(1.0)	UG/L	1136-45
12V. DICHLOROBROMOMETHANE	ND(1.0)	UG/L	1136-45
13V. DICHLORODIFLUOROMETHANE	NOT ANALYZED	UG/L	1136-45
14V. 1,1-DICHLOROETHANE	6.8	UG/L	1136-45
15V. 1,2-DICHLOROETHANE	ND(1.0)	UG/L	1136-45
16V. 1,1-DICHLOROETHYLENE	1.6	UG/L	1136-45
17V. 1,2-DICHLOROPROPANE	ND(1.0)	UG/L	1136-45
18V. 1,3-DICHLOROPROPYLENE	ND(1.0)	UG/L	1136-45
19V. ETHYLBENZENE	ND(1.0)	UG/L	1136-45
20V. METHYL BROMIDE	ND(1.0)	UG/L	1136-45
21V. METHYL CHLORIDE	ND(1.0)	UG/L	1136-45
22V. METHYLENE CHLORIDE	ND(1.0)	UG/L	1136-45
23V. 1,1,2,2-TETRACHLOROETHANE	ND(1.0)	UG/L	1136-45
24V. TETRACHLOROETHYLENE	ND(1.0)	UG/L	1136-45
25V. TOLUENE	ND(1.0)	UG/L	1136-45
26V. 1,2-TRANSDICHLOROETHYLENE	4.9++	UG/L	1136-45
27V. 1,1,1-TRICHLOROETHANE	22	UG/L	1136-45
28V. 1,1,2-TRICHLOROETHANE	ND(1.0)	UG/L	1136-45
29V. TRICHLOROETHYLENE	75	UG/L	1136-45
30V. TRICHLOROFLUOROMETHANE	NOT ANALYZED	UG/L	1136-45
31V. VINYL CHLORIDE	ND(1.0)	UG/L	1136-45
BASE NEUTRAL COMPOUNDS			
1B. ACENAPHTHENE	ND(5.0)	UG/L	1192-39

CLIENT: DEPT. OF THE ARMY

FILE NO.: 88-9633
ORDER NO.: 776

LAB NUMBER: 88041557 (CONT.)

ANALYSIS	CONCENTRATION	UNITS	BOOK/PAGE
2B. ACENAPHTHYLENE	ND(5.0)	UG/L	1192-39
3B. ANTHRACENE	ND(5.0)	UG/L	1192-39
4B. BENZIDINE	ND(50)	UG/L	1192-39
5B. BENZO(A)ANTHRACENE	ND(5.0)	UG/L	1192-39
6B. BENZO(A)PYRENE	ND(5.0)	UG/L	1192-39
7B. BENZO(B)FLUORANTHENE	ND(5.0)	UG/L	1192-39
8B. BENZO(GHI)PERYLENE	ND(5.0)	UG/L	1192-39
9B. BENZO(K)FLUORANTHENE	ND(5.0)	UG/L	1192-39
10B. BIS(2-CHLOROETHOXY)METHANE	ND(5.0)	UG/L	1192-39
11B. BIS(2-CHLOROETHYL)ETHER	ND(5.0)	UG/L	1192-39
12B. BIS(2-CHLOROISOPROPYL)ETHER	ND(5.0)	UG/L	1192-39
13B. BIS(2-ETHYLHEXYL)PHTHALATE	6.3	UG/L	1192-39
14B. 4-BROMOPHENYL PHENYL ETHER	ND(5.0)	UG/L	1192-39
15B. BUTYL BENZYL PHTHALATE	ND(5.0)	UG/L	1192-39
16B. 2-CHLORONAPHTHALENE	ND(5.0)	UG/L	1192-39
17B. 4-CHLOROPHENYL PHENYL ETHER	ND(5.0)	UG/L	1192-39
18B. CHRYSENE	ND(5.0)	UG/L	1192-39
19B. DIBENZO(A,H)ANTHRACENE	ND(5.0)	UG/L	1192-39
20B. 1,2-DICHLOROBENZENE	ND(5.0)	UG/L	1192-39
21B. 1,3-DICHLOROBENZENE	ND(5.0)	UG/L	1192-39
22B. 1,4-DICHLOROBENZENE	ND(5.0)	UG/L	1192-39
23B. 3,3-DICHLOROBENZIDINE	ND(50)	UG/L	1192-39
24B. DIETHYLPHTHALATE	ND(5.0)	UG/L	1192-39
25B. DIMETHYLPHTHALATE	ND(5.0)	UG/L	1192-39
26B. DI-N-BUTYLPHTHALATE	ND(5.0)	UG/L	1192-39
27B. 2,4-DINITROTOLUENE	ND(5.0)	UG/L	1192-39
28B. 2,6-DINITROTOLUENE	ND(5.0)	UG/L	1192-39
29B. DI-N-OCTYLPHTHALATE	ND(5.0)	UG/L	1192-39
30B. 1,2-DIPHENYLHYDRAZINE	ND(5.0)	UG/L	1192-39
31B. FLUORANTHENE	ND(5.0)	UG/L	1192-39
32B. FLUORENE	ND(5.0)	UG/L	1192-39
33B. HEXACHLOROBENZENE	ND(5.0)	UG/L	1192-39
34B. HEXACHLOROBUTADIENE	ND(5.0)	UG/L	1192-39
35B. HEXACHLOROCYCLOPENTADIENE	ND(5.0)	UG/L	1192-39
36B. HEXACHLOROETHANE	ND(5.0)	UG/L	1192-39
37B. INDENO(1,2,3-CD)PYRENE	ND(5.0)	UG/L	1192-39
38B. ISOPHORONE	ND(5.0)	UG/L	1192-39
39B. NAPHTHALENE	ND(5.0)	UG/L	1192-39
40B. NITROBENZENE	ND(5.0)	UG/L	1192-39
41B. N-NITROSODIMETHYLAMINE	ND(5.0)	UG/L	1192-39
42B. N-NITROSODI-N-PROPYLAMINE	ND(5.0)	UG/L	1192-39
43B. N-NITROSODIPHENYLAMINE	ND(5.0)	UG/L	1192-39

WILSON LABORATORIES

C118

LABORATORY REPORT

PAGE

CLIENT: DEPT. OF THE ARMY

FILE NO.: 88-9633
ORDER NO.: 776

LAB NUMBER: 88041557 (CONT.)

ANALYSIS	CONCENTRATION	UNITS	BOOK/PAGE
44B. PHENANTHRENE	ND(5.0)	UG/L	1192-39
45B. PYRENE	ND(5.0)	UG/L	1192-39
46B. 1,2,4-TRICHLOROBENZENE	ND(5.0)	UG/L	1192-39
ACID COMPOUNDS			
1A. 2-CHLOROPHENOL	ND(5.0)	UG/L	1125-13
2A. 2,4-DICHLOROPHENOL	ND(5.0)	UG/L	1125-13
3A. 2,4-DIMETHYLPHENOL	ND(5.0)	UG/L	1125-13
4A. 4,6-DINITRO-O-CRESOL	ND(50)	UG/L	1125-13
5A. 2,4-DINITROPHENOL	ND(50)	UG/L	1125-13
6A. 2-NITROPHENOL	ND(5.0)	UG/L	1125-13
7A. 4-NITROPHENOL	ND(5.0)	UG/L	1125-13
8A. P-CHLORO-M-CRESOL	ND(5.0)	UG/L	1125-13
9A. PENTACHLOROPHENOL	ND(5.0)	UG/L	1125-13
10A. PHENOL	ND(5.0)	UG/L	1125-13
11A. 2,4,6-TRICHLOROPHENOL	ND(5.0)	UG/L	1125-13
VOLATILE SURVEY SEARCH	SEE NARRATIVE	.	1085-56
EXTRACTABLE SURVEY SEARCH	SEE NARRATIVE	.	1138-44

—CONCLUSION—LAB NUMBER: 88041557 H-STE-50-B1/MW-1

FACILITY Holloman, AFB, New Mexico

SAMPLE NUMBER		88-221-16	88-255-6	88-255-6	88-255-9	89-255-10
SAMPLE SITE		R-S50-B1-5	S50-B1	S50-B1-DUP	R-S50-B1	S50-B2-MW2
DATE COLLECTED		3-23-88	4-9-88	4-8-88	4-8-88	4-8-88
TIME COLLECTED		8:13	10:53	10:53	10:24	12:41
DATE RECEIVED		3-29-88	4-9-88	4-9-88	4-9-88	4-9-88
DATE EXTRACTED		4-2-88	4-13-88	4-13-88	4-14-88	4-14-88
DATE ANALYZED		4-14-88	5-7-88	5-6-88	5-7-88	5-6-88
SURROGATE: Units (Percent)	RANGES					
2-Fluorobiphenyl	43-116	51	78	64	80	80
Nitrobenzene-d5	35-114	60	77	65	98	79
p-Terphenyl-d14	33-141	88	78	84	131	109
Phenol-d6	10-94	50	75	51	86	83
2-Fluorophenol	21-100	37	62	44	87	74
2,4,6-Tribromophenol	10-123	33	81	76	65	124
PARAMETER: Units (ug/L)	PQLs					
Acenaphthene	10	<10	<10	<10	<10	<10
Acenaphthylene	10	<10	<10	<10	<10	<10
Acetophenone	50	<50	<50	<50	<50	<50
Aniline	50	<50	<50	<50	<50	<50
Anthracene	10	<10	<10	<10	<10	<10
4-Aminobiphenyl	50	<50	<50	<50	<50	<50
Benzidine	50	<50	<50	<50	<50	<50
Benzoic acid	50	<50	<50	<50	<50	<50
Benzo(a)anthracene	10	<10	<10	<10	<10	<10
Benzo(b)fluoranthene	10	<10	<10	<10	<10	<10
Benzo(k)fluoranthene	10	<10	<10	<10	<10	<10
Benzo(g,h,i)perylene	10	<10	<10	<10	<10	<10
Benzo(a)pyrene	10	<10	<10	<10	<10	<10
Benzl alcohol	20	<20	<20	<20	<20	<20
Bis(2-chloroethoxy)methane	10	<10	<10	<10	<10	<10
Bis(2-chloroethyl)ether	10	<10	<10	<10	<10	<10
Bis(2-chloroisoprpyl)ether	10	<10	<10	<10	<10	<10
Bis(2-ethylhexyl)phthalate	10	<10	<10	<10	<10	<10
4-Bromophenyl phenyl ether	10	<10	<10	<10	<10	<10
Butyl benzyl phthalate	10	<10	<10	<10	<10	<10
4-Chloroaniline	20	<20	<20	<20	<20	<20
1-Chloronaphthalene	50	<50	<50	<50	<50	<50
2-Chloronaphthalene	10	<10	<10	<10	<10	<10
4-Chloro-3-methylphenol	20	<20	<20	<20	<20	<20
2-Chlorophenol	10	<10	<10	<10	<10	<10
4-Chlorophenyl phenyl ether	10	<10	<10	<10	<10	<10
Chrysene	10	<10	<10	<10	<10	<10
Dibenz(a,j)acridine	50	<50	<50	<50	<50	<50
Dibenz(a,h)anthracene	10	<10	<10	<10	<10	<10
Dibenzofuran	10	<10	<10	<10	<10	<10
Di-N-Butylphthalate	10	<10	<10	<10	<10	<10
1,3-Dichlorobenzene	10	<10	<10	<10	<10	<10
1,4-Dichlorobenzene	10	<10	<10	<10	<10	<10
1,2-Dichlorobenzene	10	<10	<10	<10	<10	<10
3,3'-Dichlorobenzidine	20	<20	<20	<20	<20	<20

FACILITY: Holloman, AFB, New Mexico

SAMPLE NUMBER		88-221-16	88-255-6	88-255-6	88-255-9	88-255-10
SAMPLE SITE		R-SSD-B1-5	SSD-B1	SSD-B1-DUP	R-SSD-B1	SSD-B2-MW2
DATE COLLECTED		3-28-88	4-8-88	4-8-88	4-8-88	4-8-88
TIME COLLECTED		8:18	10:53	10:53	10:24	12:41
DATE RECEIVED		3-29-88	4-9-88	4-9-88	4-9-88	4-9-88
DATE EXTRACTED		4-2-88	4-13-88	4-13-88	4-14-88	4-14-88
DATE ANALYZED		4-14-88	5-7-88	5-6-88	5-7-88	5-6-88
SURROGATE: Units (Percent)	RANGE%					
2-Fluorobiphenyl	43-116	51	70	64	80	80
Nitrobenzene-d5	35-114	60	77	65	98	79
p-Terphenyl-d14	33-141	88	78	84	131	109
Phenol-d6	10-94	50	75	51	80	83
2-Fluorophenol	21-100	37	62	44	87	74
2,4,6-Tribromophenol	10-123	33	81	76	65	124
PARAMETER: Units (ug/L)	PQL**					
p-Dimethylaminoazobenzene	50	<50	<50	<50	<50	<50
7,12-Dimethylbenz(a)anthracene	50	<50	<50	<50	<50	<50
alpha,alpha-Dimethylphenethylamine	50	<50	<50	<50	<50	<50
2,4-Dimethylphenol	10	<10	<10	<10	<10	<10
Dimethylphthalate	10	<10	<10	<10	<10	<10
4,6-Dinitro-2-methylphenol	50	<50	<50	<50	<50	<50
2,4-Dinitrophenol	50	<50	<50	<50	<50	<50
2,4-Dinitrotoluene	10	<10	<10	<10	<10	<10
2,6-Dinitrotoluene	10	<10	<10	<10	<10	<10
Diphenylamine	50	<50	<50	<50	<50	<50
1,2-Diphenylhydrazine	50	<50	<50	<50	<50	<50
Di-n-octylphthalate	10	<10	<10	<10	<10	<10
Ethyl methanesulfonate	50	<50	<50	<50	<50	<50
Fluoranthene	10	<10	<10	<10	<10	<10
Fluorene	10	<10	<10	<10	<10	<10
Hexachlorobenzene	10	<10	<10	<10	<10	<10
Hexachlorobutadiene	10	<10	<10	<10	<10	<10
Hexachlorocyclopentadiene	10	<10	<10	<10	<10	<10
Hexachloroethane	10	<10	<10	<10	<10	<10
Indeno(1,2,3-cd)pyrene	10	<10	<10	<10	<10	<10
Isophorone	10	<10	<10	<10	<10	<10
3-Methylcholanthrene	50	<50	<50	<50	<50	<50
Methyl Methanesulfonate	50	<50	<50	<50	<50	<50
2-Methylnaphthalene	10	<10	<10	<10	<10	<10
2-Methylphenol	10	<10	<10	<10	<10	<10
4-Methylphenol	10	<10	<10	<10	<10	<10
Naphthalene	10	<10	<10	<10	<10	<10
1-Naphthylamine	50	<50	<50	<50	<50	<50
2-Naphthylamine	50	<50	<50	<50	<50	<50
2-Nitroaniline	50	<50	<50	<50	<50	<50
3-Nitroaniline	50	<50	<50	<50	<50	<50
4-Nitroaniline	50	<50	<50	<50	<50	<50
Nitrobenzene	10	<10	<10	<10	<10	<10
2-Nitrophenol	50	<50	<50	<50	<50	<50
4-Nitrophenol	50	<50	<50	<50	<50	<50

FACILITY: Holloman, AFB, New Mexico

SAMPLE NUMBER		88-221-16	88-255-6	88-255-6	88-255-9	88-255-10
SAMPLE SITE		R-S50-B1-5	S50-B1	S50-B1-DUP	R-S50-B1	S50-B2-MW2
DATE COLLECTED		3-28-88	4-8-88	4-3-88	4-8-88	4-8-88
TIME COLLECTED		8:18	10:53	10:53	10:24	12:41
DATE RECEIVED		3-29-88	4-9-88	4-9-88	4-9-88	4-9-88
DATE EXTRACTED		4-2-88	4-13-88	4-13-88	4-14-88	4-14-88
DATE ANALYZED		4-14-88	5-7-88	5-6-88	5-7-88	5-6-88
SURROGATE: Units (Percent)	RANGE%					
2-Fluorobiphenyl	43-116	51	70	64	80	80
Nitrobenzene-d5	35-114	60	77	65	98	79
p-Terphenyl-d14	33-141	80	78	84	131	109
Phenol-d6	10-94	50	75	51	88	83
2-Fluorophenol	21-100	37	62	44	87	74
2,4,6-Tribromophenol	10-123	33	81	76	65	124
PARAMETER: Units (ug/L)	PQL**					
N-Nitroso-di-N-propylamine	10	<10	<10	<10	<10	<10
N-Nitrosopiperidine	50	<50	<50	<50	<50	<50
Pentachlorobenzene	50	<50	<50	<50	<50	<50
Pentachloronitrobenzene	50	<50	<50	<50	<50	<50
Pentachlorophenol	50	<50	<50	<50	<50	<50
Phenacetin	50	<50	<50	<50	<50	<50
Phenanthrene	10	<10	<10	<10	<10	<10
Phenol	10	<10	<10	<10	<10	<10
2-Picoline	50	<50	<50	<50	<50	<50
Pronamide	50	<50	<50	<50	<50	<50
Pyrene	10	<10	<10	<10	<10	<10
1,2,4,5-Tetrachlorobenzene	50	<50	<50	<50	<50	<50
2,3,4,6-Tetrachlorophenol	50	<50	<50	<50	<50	<50
1,2,4-Trichlorobenzene	10	<10	<10	<10	<10	<10
2,4,5-Trichlorophenol	10	<10	<10	<10	<10	<10
2,4,6-Trichlorophenol	10	<10	<10	<10	<10	<10

RANGE% = Surrogate spike recovery goals for water samples. soil samples.
N-Nitrosodiphenylamine** cannot be separated from diphenylamine.
---- Diluted Out

FACILITY: Holloman, AFB, New Mexico

SAMPLE NUMBER		88-255-11	88-255-12
SAMPLE SITE		S50-B3-MW3	S50-B4-MW4
DATE COLLECTED		4-8-88	4-8-88
TIME COLLECTED		1:14	1:53
DATE RECEIVED		4-9-88	4-9-88
DATE EXTRACTED		4-14-88	4-14-88
DATE ANALYZED		5-13-88	5-8-88
SURROGATE: Units (Percent)	RANGES		
2-Fluorobiphenyl	43-116	69	68
Nitrobenzene-d5	35-114	83	78
p-Terphenyl-d14	33-141	83	107
Phenol-d6	10-94	68	72
2-Fluorophenol	21-100	53	62
2,4,6-Tribromophenol	10-123	121	116
PARAMETER: Units (ug/L)	PQL**		
Acenaphthene	10	<10	<10
Acenaphthylene	10	<10	<10
Acetophenone	50	<50	<50
Aniline	50	<50	<50
Anthracene	10	<10	<10
4-Aminobiphenyl	50	<50	<50
Benzidine	50	<50	<50
Benzoic acid	50	<50	<50
Benzo(a)anthracene	10	<10	<10
Benzo(b)fluoranthene	10	<10	<10
Benzo(k)fluoranthene	10	<10	<10
Benzo(g,h,i)perylene	10	<10	<10
Benzo(a)pyrene	10	<10	<10
Benzl alcohol	20	<20	<20
Bis(2-chloroethoxy)methane	10	<10	<10
Bis(2-chloroethyl)ether	10	<10	<10
Bis(2-chloroisoprpyl)ether	10	<10	<10
Bis(2-ethylhexyl)phthalate	10	<10	<10
4-Bromophenyl phenyl ether	10	<10	<10
Butyl benzyl phthalate	10	<10	<10
4-Chloroaniline	20	<20	<20
1-Chloronaphthalene	50	<50	<50
2-Chloronaphthalene	10	<10	<10
4-Chloro-3-methylphenol	20	<20	<20
2-Chlorophenol	10	<10	<10
4-Chlorophenyl phenyl ether	10	<10	<10
Chrysene	10	<10	<10
Dibenz(a,j)acridine	50	<50	<50
Dibenz(a,h)anthracene	10	<10	<10
Dibenzofuran	10	<10	<10
Di-N-Butylphthalate	10	<10	<10
1,3-Dichlorobenzene	10	<10	<10
1,4-Dichlorobenzene	10	<10	<10
1,2-Dichlorobenzene	10	<10	<10
3,3'-Dichlorobenzidine	20	<20	<20

FACILITY: Holloman, AFB, New Mexico

SAMPLE NUMBER		89-253-11	89-253-12
SAMPLE SITE		S50-83-MW3	S50-84-MW4
DATE COLLECTED		4-8-88	4-8-88
TIME COLLECTED		1:14	1:53
DATE RECEIVED		4-9-88	4-9-88
DATE EXTRACTED		4-14-88	4-14-88
DATE ANALYZED		5-13-88	5-8-88
SURROGATE: Units (Percent)	RANGE:		
2-Fluorobiphenyl	43-116	69	68
Nitrobenzene-d5	35-114	83	78
p-Terphenyl-d14	33-141	83	107
Phenol-d6	10-94	60	72
2-Fluorophenol	21-100	53	62
2,4,6-Tribromophenol	10-123	121	116
PARAMETER: Units (ug/L)	PQL:		
p-Dimethylaminoazobenzene	50	<50	<50
7,12-Dimethylbenz(a)anthracene	50	<50	<50
alpha,alpha-Dimethylphenethylamine	50	<50	<50
2,4-Dimethylphenol	10	<10	<10
Dimethylphthalate	10	<10	<10
4,6-Dinitro-2-methylphenol	50	<50	<50
2,4-Dinitrophenol	50	<50	<50
2,4-Dinitrotoluene	10	<10	<10
2,6-Dinitrotoluene	10	<10	<10
Diphenylamine	50	<50	<50
1,2-Diphenylhydrazine	50	<50	<50
Di-n-octylphthalate	10	<10	<10
Ethyl methanesulfonate	50	<50	<50
Fluoranthene	10	<10	<10
Fluorene	10	<10	<10
Hexachlorobenzene	10	<10	<10
Hexachlorobutadiene	10	<10	<10
Hexachlorocyclopentadiene	10	<10	<10
Hexachloroethane	10	<10	<10
Indeno(1,2,3-cd)pyrene	10	<10	<10
Isophorone	10	<10	<10
3-Methylcholanthrene	50	<50	<50
Methyl Methanesulfonate	50	<50	<50
2-Methylnaphthalene	10	<10	<10
2-Methylphenol	10	<10	<10
4-Methylphenol	10	<10	<10
Naphthalene	10	<10	<10
1-Naphthylamine	50	<50	<50
2-Naphthylamine	50	<50	<50
2-Nitroaniline	50	<50	<50
3-Nitroaniline	50	<50	<50
4-Nitroaniline	50	<50	<50
Nitrobenzene	10	<10	<10
2-Nitrophenol	50	<50	<50
4-Nitrophenol	50	<50	<50
N-Nitrosodi-N-Butylamine	10	<10	<10

FACILITY: Holloman, AFB, New Mexico

SAMPLE NUMBER		88-255-11	88-255-12
SAMPLE SITE		S50-B3-MW3	S50-B4-MW4
DATE COLLECTED		4-8-88	4-8-88
TIME COLLECTED		1:14	1:53
DATE RECEIVED		4-9-88	4-9-88
DATE EXTRACTED		4-14-88	4-14-88
DATE ANALYZED		5-13-88	5-8-88
SURROGATE: Units (Percent)	RANGES		
2-Fluorobiphenyl	43-116	69	68
Nitrobenzene-d5	35-114	83	78
p-Terphenyl-d14	33-141	83	107
Phenol-d6	10-94	60	72
2-Fluorophenol	21-100	53	62
2,4,6-Tribromophenol	10-123	121	116
PARAMETER: Units (ug/L)	PQL**		
N-Nitroso-di-N-propylamine	10	<10	<10
N-Nitrosopiperidine	50	<50	<50
Pentachlorobenzene	50	<50	<50
Pentachloronitrobenzene	50	<50	<50
Pentachlorophenol	50	<50	<50
Phenacetin	50	<50	<50
Phenanthrene	10	<10	<10
Phenol	10	<10	<10
2-Picoline	50	<50	<50
Pronamide	50	<50	<50
Pyrene	10	<10	<10
1,2,4,5-Tetrachlorobenzene	50	<50	<50
2,3,4,6-Tetrachlorophenol	50	<50	<50
1,2,4-Trichlorobenzene	10	<10	<10
2,4,5-Trichlorophenol	10	<10	<10
2,4,6-Trichlorophenol	10	<10	<10

[illegible] 11 89 SITE 53 SEMI-VOLATILE DATA

FACILITY Holloman, AFB					
SAMPLE NUMBER:		89-073-11	89-090-07	89-090-07	89-[illegible]
SAMPLE DESCRIPTION:		R-550-86-5/6 5	550-86-MW6	550-86-MW6-FDUP	0-550-86-MW6
DATE COLLECTED:		01-23-89	01-29-89	01-29-89	01-[illegible]-89
DATE RECEIVED:		09-[illegible]	09-[illegible]	09-[illegible]	09-[illegible]
DATE EXTRACTED:		01-24-89	01-31-89	01-31-89	01-[illegible]-89
DATE ANALYZED:		02-19-89	02-20-89	02-22-89	02-20-89
SURROGATE:	RANGE				
2-Fluorobiphenyl	30-115	113	56	64	36
Nitrobenzene-d5	23-120	102	39	57	11***
p-Terphenyl-d14	18-137	116	68	55	129
Phenol-d6	24-113	154***	53	31	4***
2-Fluorophenol	25-121	172***	43	38	1***
2,4,6-Tribromophenol	19-122	168***	117	42	51
PARAMETER: Units (ug/L)	PQL				
Acenaphthene	10	<10	<10	<10	<10
Acenaphthylene	10	<10	<10	<10	<10
Anthracene	10	<10	<10	<10	<10
Benzoic acid	50	<50	<50	<50	<50
Benzo(a)anthracene	10	<10	<10	<10	<10
Benzo(b)fluoranthene	10	<10	<10	<10	<10
Benzo(k)fluoranthene	10	<10	<10	<10	<10
Benzo(g,h,i)perylene	10	<10	<10	<10	<10
Benzo(a)pyrene	10	<10	<10	<10	<10
Benzyl alcohol	20	<20	<20	<20	<20
Bis(2-chloroethoxy)methane	10	<10	<10	<10	<10
Bis(2-chloroethyl)ether	10	<10	<10	<10	<10
Bis(2-chloroisopropyl)ether	10	<10	<10	<10	<10
Bis(2-ethylhexyl)phthalate	10	<10	<10	<10	<10
4-Bromophenyl phenyl ether	10	<10	<10	<10	<10
Butyl benzyl phthalate	10	<10	<10	<10	<10
4-Chloroaniline	20	<20	<20	<20	<20
2-Chloronaphthalene	10	<10	<10	<10	<10
4-Chloro-3-methylphenol	20	<20	<20	<20	<20
2-Chlorophenol	10	<10	<10	<10	<10
4-Chlorophenyl phenyl ether	10	<10	<10	<10	<10
Chrysene	10	<10	<10	<10	<10
Dibenz(a,h)anthracene	10	<10	<10	<10	<10
Dibenzofuran	10	<10	<10	<10	<10
Di-N-Butylphthalate	10	<10	<10	<10	<10
1,2-Dichlorobenzene	10	<10	<10	<10	<10
1,3-Dichlorobenzene	10	<10	<10	<10	<10
1,4-Dichlorobenzene	10	<10	<10	<10	<10
3,3'-Dichlorobenzidine	20	<20	<20	<20	<20
2,4-Dichlorophenol	10	<10	<10	<10	<10
Diethylphthalate	10	<10	<10	<10	<10
2,4-Dimethylphenol	10	<10	<10	<10	<10
Dimethylphthalate	10	<10	<10	<10	<10
4,6-Dinitro-2-methylphenol	50	<50	<50	<50	<50
2,4-Dinitrophenol	50	<50	<50	<50	<50
2,4-Dinitrotoluene	10	<10	58	56	<10
2,6-Dinitrotoluene	10	<10	<10	<10	<10
Di-n-octylphthalate	10	18	<10	<10	<10
Fluoranthene	10	<10	<10	<10	<10
Fluorene	10	<10	<10	<10	<10
Hexachlorobenzene	10	<10	<10	<10	<10

FACILITY: Holloman, AFB					
SAMPLE NUMBER:		89-073-11	89-090-07	89-090-07	89-090-09
SAMPLE DESCRIPTION:		R-S50-86-5/6 S	S50-86-MW6	S50-86-MW6-FDUP	R-S50-86-MW6
DATE COLLECTED:		01-23-89	01-29-89	01-29-99	01-29-89
DATE RECEIVED:		09-30	09-23	09-23	09-05
DATE EXTRACTED:		01-24-89	01-31-89	01-31-89	01-31-89
DATE ANALYZED:		02-19-89	02-20-89	02-20-89	02-20-89
SURROGATE:	RANGE				
2-Fluorobiphenyl	30-115	113	56	64	36
Nitrobenzene-d5	23-120	102	39	57	11***
p-Terphenyl-d14	18-137	116	68	55	12
Phenol-d6	24-113	154***	53	31	4***
2-Fluorophenol	25-121	172***	43	38	1***
2,4,6-Tribromophenol	19-122	168***	117	42	51
PARAMETER: Units (ug/L)	PQL				
Hexachlorobutadiene	10	<10	<10	<10	<10
Hexachlorocyclopentadiene	10	<10	<10	<10	<10
Hexachloroethane	10	<10	<10	<10	<10
Indeno(1,2,3-cd)pyrene	10	<10	<10	<10	<10
Isophorone	10	<10	<10	<10	<10
2-Methylnaphthalene	10	<10	<10	<10	<10
2-Methylphenol	10	<10	<10	<10	<10
4-Methylphenol	10	<10	<10	<10	<10
Naphthalene	10	<10	<10	<10	<10
2-Nitroaniline	50	<50	<50	<50	<50
3-Nitroaniline	50	<50	<50	<50	<50
4-Nitroaniline	50	<50	<50	<50	<50
Nitrobenzene	10	<10	<10	<10	<10
2-Nitrophenol	50	<50	<50	<50	<50
4-Nitrophenol	50	<50	<50	<50	<50
N-Nitrosodiphenylamine	10	<10	<10	<10	<10
N-Nitroso-di-N-propylamine	10	<10	<10	<10	<10
Pentachlorophenol	50	<50	<50	<50	<50
Phenanthrene	10	<10	<10	<10	<10
Phenol	10	<10	<10	<10	<10
Pyrene	10	<10	<10	<10	<10
1,2,4-Trichlorobenzene	10	<10	<10	<10	<10
2,4,5-Trichlorophenol	10	<10	<10	<10	<10
2,4,6-Trichlorophenol	10	<10	<10	<10	<10

13-JUN-88 SITE 50 TOTAL RECOVERABLE HYDROCARBONS

FACILITY: Holloman, AFB, New Mexico

SAMPLE NUMBER		88-255-10	88-255-11	88-255-12	88-255-6	88-2
SAMPLE SITE		550-82-M2	550-83-MW3	550-84-MW4	550-51	R-55
DATE COLLECTED		4-9-88	4-8-88	4-9-88	4-9-88	4-
TIME COLLECTED		12:41	1:14	1:53	10:53	1
DATE RECEIVED		4-9-88	4-9-88	4-9-88	4-9-88	4-
DATE ANALYZED		4-21-88	4-21-88	4-21-88	4-21-88	4-2
PARAMETER: UNITS (mg/kg)	*MDL					
Total Recov. Hydrocarbons	15	16.9	<1.0	<1.0	<1.0	<

*MDL = Method detection limit.

FACILITY: Holloman, AFB						
SAMPLE NUMBER		89-073-11	89-090-05	89-090-06	89-090-07	89-090-07
SAMPLE SITE		R-S50-B6-5/6.5	S50-B1-MW1	S50-B2-MW2	S50-B6-MW6	S50-B6-MW6-FDUP
DATE COLLECTED		01-23-89	01-29-89	01-29-89	01-29-89	01-29-89
TIME COLLECTED		09:30	01:03	01:33	09:23	09:23
DATE RECEIVED		01-24-89	01-31-89	01-31-89	01-31-89	01-31-89
DATE ANALYZED		01-29-89	01-29-89	01-29-89	01-29-89	01-29-89
PARAMETER: UNITS (mg/L)	MDL					
Total Recov. Hydrocarbons	0.5	<0.5	<0.5	0.8	2.4	1.9

FACILITY: Holloman, AFB	
SAMPLE NUMBER	89-098-08
SAMPLE SITE	R-S50-B6-MW6
DATE COLLECTED	01-29-89
TIME COLLECTED	09:05
DATE RECEIVED	01-31-89
DATE ANALYZED	01-29-89

PARAMETER:	UNITS (mg/L)	+MDL	
Total Recov. Hydrocarbons		0.5	<0.5

ENVIRONMENTAL PROTECTION SYSTEMS
HOLLOMAN, AIR FORCE BASE
BASE NEUTRAL ACID MATRIX SPIKES
SOIL

SOIL MATRIX SPIKE		89-073-10	89-073-10	
SAMPLE IDENTIFICATION		850-86-20/21.5	850-86-20/21.5	
DESCRIPTION		SPIKE	SPK DUP	
ANALYSIS DATE		02-27-89	02-27-89	
COMPOUND	XRANGE	% REC	% REC	
SURROGATE COMPOUNDS				
2-Fluorobiphenyl	30-115	69	62	
Nitrobenzene-d5	23-120	94	23	
p-Terphenyl-d14	18-137	193***	162***	
Phenol-d6	24-113	159***	65	
2-Fluorophenol	25-121	159***	27	
2,4,6-Tribromophenol	19-122	212***	240***	
ACID COMPOUNDS				
Pentachlorophenol	17-109	145***	175***	
Phenol	26-90	74	29	
2-Chlorophenol	25-102	82	19	
4-Chloro-3-Methylphenol	26-103	85	94	
4-Nitrophenol	11-114	13	13	
BASE NEUTRAL COMPOUNDS				
1,2,4-Trichlorobenzene	38-107	14***	5***	
Acenaphthene	31-137	60	60	
2,4 Dinitrotoluene	28-89	103***	123***	
Di-n-Butylphthalate	29-135	117	127	
Pyrene	35-142	197***	169***	
N-Nitrosodi-n-Propylamine	41-126	67	39***,^	
1,4-Dichlorobenzene	28-104	3***	5***	

Phase II RFI

TABLE D.2 RESULTS OF ORGANIC ANALYSES FOR SOIL SAMPLES, HOLLOMAN TABLE 1 PHASE II RFI

PARAMETER	SITE ID	LOCATION ID	SAMPLE ID	BEG. DEPTH - END DEPTH (FT.)												
	44	44-B12	94-44-B12-01	1 - 3			44	44-B12	94-44-B12-02	3 - 5			45	45-B09	94-45-B09-01R	1 - 2.5			45	45-B09	94-45-B09-02R	3 - 4.25		
E418.1 - Total Recoverable Petroleum Hydrocarbons (mg/kg)																								
TRPH	70.3		(26.3)		[1]		169		(29.1)		[1]		NA						NA					
SW8015ME - Petroleum Hydrocarbons-Modified Extractable (mg/kg)																								
Diesel Range Organics	NA						NA						1.1	qrJ		(5.4)		[1]	2.4	qrJ		(5.7)		[1]
SW8015MP Petroleum Hydrocarbons-Modified Purgeable (mg/kg)																								
Benzene	NA						NA						ND	T		(0.034)		[1]	ND	T		(0.035)		[1]
Ethylbenzene	NA						NA						ND			(0.034)		[1]	ND			(0.035)		[1]
Gasoline Range Organics	NA						NA						0.39	qJ		(0.68)		[1]	0.42	qJ		(0.71)		[1]
Toluene	NA						NA						ND			(0.034)		[1]	ND			(0.035)		[1]
Total xylenes	NA						NA						ND			(0.034)		[1]	ND			(0.035)		[1]

Compiled: 19 April 1995 () = Detection Limit [] = Dilution Factor ND = Not Detected NA = Not Applicable * - Value considered suspect, Refer to QC Report

TABLE D.2 RESULTS OF ORGANIC ANALYSES FOR SOIL SAMPLES, HOLLOMAN TABLE 1 PHASE II RFI

	SITE ID											
	LOCATION ID											
	SAMPLE ID											
	BEG. DEPTH - END DEPTH (FT.)											
PARAMETER	44 44-B10 94-44-B10-02 3 - 5			44 44-B10 94-44-B10-22 Dup of 94-44-B10-02 3 - 5			44 44-B11 94-44-B11-01 1 - 3			44 44-B11 94-44-B11-02 3 - 5		
E418.1 - Total Recoverable Petroleum Hydrocarbons (mg/kg)												
TRPH	264	(27.9)	[1]	457	(27.9)	[1]	156	(26)	[1]	404	(24.9)	[1]

Compiled: 19 A[illegible] 1995 () = Detection Limit [] = Dilution Factor ND = Not [illegible]ted NA = Not Applicable * - Value considered suspect, Refer to Q[illegible]rt
[illegible]2-86

TABLE D.2 RESULTS OF ORGANIC ANALYSES FOR SOIL SAMPLES, HOLLOMAN TABLE 1 PHASE II RFI

PARAMETER	SITE ID LOCATION ID SAMPLE ID BEG. DEPTH - END DEPTH (FT.)											
	44 44-B09 94-44-B09-01 1 - 3			44 44-B09 94-44-B09-02 3 - 5			44 44-B09 94-44-B09-22 Dup of 94-44-B09-02 3 - 5			44 44-B10 94-44-B10-01 1 - 3		
E418.1 - Total Recoverable Petroleum Hydrocarbons (mg/kg)												
TRPH	ND	(29.3)	[1]	145	(29.2)	[1]	199	(28.2)	[1]	ND	(30.8)	[1]

Compiled: 19 April 1995 () = Detection Limit [] = Dilution Factor ND = Not Detected NA = Not Applicable * - Value considered suspect, Refer to QC Report

TABLE D.2 RESULTS OF ORGANIC ANALYSES FOR SOIL SAMPLES, HOLLOMAN TABLE 1 PHASE II RFI

PARAMETER	SITE ID LOCATION ID SAMPLE ID BEG. DEPTH - END DEPTH (FT.)											
	44 44-B07 94-44-B07-02 2.5 - 4.5			44 44-B07 94-44-B07-03 4.5 - 6.5			44 44-B08 94-44-B08-01 1 - 3			44 44-B08 94-44-B08-02 3 - 5		
E418.1 - Total Recoverable Petroleum Hydrocarbons (mg/kg)												
TRPH	30700	(791)	[1]	ND	(28.8)	[1]	ND	(28.7)	[1]	ND	(29)	[1]

Compiled: 19 A[illegible]l 1995 () = Detection Limit [] = Dilution Factor ND = Not [illegible]cted NA = Not Applicable * - Value considered suspect. Refer to [illegible]port

Additional Characteristics of POL Contaminated Sites

TABLE 6
SUMMARY OF SOIL ANALYTICAL RESULTS
OT-44 BUILDING 301 FUEL TANK
HOLLOMAN AFB, NM
Delivery Order 11 Work Authorization Directive 1
February, 1996

SAMPLE NO. AND DEPTH (FEET)	OT-44 DP-1-2 (2' TO 3')	OT-44 DP-1-4 (4' TO 5')	OT-44 DP-2-5 (5' TO 6')	OT-44 DP-2-6 & 7 (6' TO 8')	OT-44 DP-3-4 (4' TO 5')	OT-44 DP-3-2 & 3 (2' TO 4')
AMETER						
hod 8015 l as Gasoline /kg)	<10	<10	490	413	3.0J	42
hod 8015 l as Diesel /kg)	<10	<10	11000	11000	32	8200
hod 418.1 H /kg)	<20	<20	19100	12600	74	12600
hod 8020 kg)						
zene	<50	<50	<400	<400	<50	<50
ene	<100	<100	<400	<400	<100	<100
lbenzene	<100	<100	1360	790	<100	<100
nes	<200	<200	810	550J	<200	<200
l BTEX	--	--	2170	790	--	--

< = constituent not detected
J = Estimate value less than sample quantitation limit

GROUNDWATER TECHNOLOGY INC.
HOLLOMAN AIR FORCE BASE
ANALYTICAL RESULTS/CHRONOLOGY

Client Sample ID:		OT44-DP1-2'	OT44-DP1-4'	OT44-DP2-5'	OT44-DP2-6'+ 7'	OT44-DP3-(2+3)'
Job Number & Lab Sample ID:		E96-0006 E6000605	E96-0006 E6000606	E96-0006 E6000609	E96-0006 E6000610	E96-0006 E6000607
Sample Date:		02/01/96	02/01/96	02/01/96	02/01/96	02/01/96
TCLP Date/HT Met:		- -	- -	- -	- -	- -
Extraction Date/HT Met:		02/07/96 10:00 YES	02/07/96 10:00 YES	02/07/96 10:00 YES	02/07/96 10:00 YES	02/07/96 10:00 YES
Analysis Date/Ht Met:		02/08/96 14:20 YES	02/08/96 14:43 YES	02/08/96 11:47 YES	02/08/96 12:10 YES	02/08/96 15:37 YES
Dilution Factor:		1.0	1.0	50.0	50.0	100.0
Analyte (MG/KG)	RL	Result	Result	Result	Result	Result
ETHOD 8015D - DIESEL RANGE ORGANICS						
DIESEL COMPONENTS	10	10 U	10 U	11000	11000	8200

TCLP Date/HT Met:		- -	- -	- -	- -	- -
Extraction Date/HT Met:		- -	- -	- -	- -	- -
Analysis Date/Ht Met:		02/06/96 12:51 YES	02/06/96 13:10 YES	02/09/96 19:38 YES	02/09/96 19:57 YES	02/09/96 18:41 YES
Dilution Factor:		5.0	5.0	200.0	200.0	25.0
Analyte (UG/KG)	RL	Result	Result	Result	Result	Result
TEX						
BENZENE	50	50 U	50 U	400 U	400 U	50 U
ETHYLBENZENE	100	100 U	100 U	1360	790	100 U
TOLUENE	100	100 U	100 U	400 U	400 U	100 U
XYLENES,TOTAL	200	200 U	200 U	810	550 J	200 U
O-XYLENE (1,2-DIMETHYLBENZENE)	100	100 U	100 U	400 U	400 U	100 U
m/p-Xylenes	100	100 U	100 U	810	550	100 U
SURROGATES						
1,1,1-TRIFLUOROTOLUENE	70-130	100	96	96	98	108
1-BROMO-4-FLUOROBENZENE (4-BROMOFLUOROBE	70-130	102	102	87	90	83

TCLP Date/HT Met:		- -	- -	- -	- -	- -
Extraction Date/HT Met:		- -	- -	- -	- -	- -
Analysis Date/Ht Met:		02/06/96 12:51 YES	02/06/96 13:10 YES	02/09/96 19:38 YES	02/09/96 19:57 YES	02/09/96 18:41 YES
Dilution Factor:		5.0	5.0	200.0	200.0	25.0
Analyte (MG/KG)	RL	Result	Result	Result	Result	Result
ETHOD 8015G - GASOLINE RANGE ORGANICS						
GASOLINE COMPONENTS	10	10 U	10 U	490	413	42

Indicates Result Outside QC Limits
= Not Applicabl

Client Sample ID:		OT44-DP3-4'	SWMU 36-DP3-14'	SWMU 36-DP3-22'	SWMU 36-DP4-14'	SWMU 36-DP4-25'
Job Number & Lab Sample ID:		E96-0006 E6000608	E96-0006 E6000601	E96-0006 E6000602	E96-0006 E6000603	E96-0006 E6000604
Sample Date:		02/01/96	02/01/96	02/01/96	02/01/96	02/01/96
TCLP Date/HT Met:		- -	- -	- -	- -	- -
Extraction Date/HT Met:		02/07/96 10:00 YES	02/07/96 10:00 YES	02/07/96 10:00 YES	02/07/96 10:00 YES	02/07/96 10:00 YES
Analysis Date/Ht Met:		02/08/96 16:25 YES	02/08/96 11:03 YES	02/08/96 14:07 YES	02/08/96 13:36 YES	02/08/96 14:58 YES
Dilution Factor:		1.0	1.0	1.0	1.0	1.0
Analyte (MG/KG)	RL	Result	Result	Result	Result	Result
D 8015D - DIESEL RANGE ORGANICS						
SEL COMPONENTS	10	32	10 U	10 U	10 U	10 U

TCLP Date/HT Met:		- -				
Extraction Date/HT Met:		- -				
Analysis Date/Ht Met:		02/09/96 19:00 YES				
Dilution Factor:		25.0				
Analyte (UG/KG)	RL	Result	Result	Result	Result	Result
ZENE	50	50 U	NA	NA	NA	NA
YLBENZENE	100	100 U	NA	NA	NA	NA
JENE	100	100 U	NA	NA	NA	NA
ENES,TOTAL	200	200 U	NA	NA	NA	NA
YLENE (1,2-DIMETHYLBENZENE)	100	100 U	NA	NA	NA	NA
-Xylenes	100	100 U	NA	NA	NA	NA
SURROGATES						
,1-TRIFLUOROTOLUENE	70-130	110	NA	NA	NA	NA
ROMO-4-FLUOROBENZENE (4-BROMOFLUOROBE	70-130	109	NA	NA	NA	NA

TCLP Date/HT Met:		- -	- -	- -	- -	- -
Extraction Date/HT Met:		- -	- -	- -	- -	- -
Analysis Date/Ht Met:		02/09/96 19:00 YES	02/10/96 12:41 YES	02/10/96 13:00 YES	02/10/96 13:19 YES	02/10/96 13:39 YES
Dilution Factor:		25.0	25.0	25.0	25.0	25.0
Analyte (MG/KG)	RL	Result	Result	Result	Result	Result
8015G - GASOLINE RANGE ORGANICS						
LINE COMPONENTS	10	3.0 J	0.60 J	0.40 J	0.30 J	0.20 J

cates Result is Outside QC Limits
ot Applicable

GROUNDWATER TECHNOLOGY INC.
HOLLOMAN AIR FORCE BASE
ANALYTICAL RESULTS

		Client Sample ID:	OT44-DP1-2'	OT44-DP1-4'	OT44-DP2-5'	OT44-DP2-6'+ 7'	OT44-DP3-(2+3)'
		Job Number & Lab Sample ID:	E96-0006 E6000605	E96-0006 E6000606	E96-0006 E6000609	E96-0006 E6000610	E96-0006 E6000607
		Sample Date:	02/01/96	02/01/96	02/01/96	02/01/96	02/01/96
Analyte	UNITS OF MEASURE	PQL	Result	Result	Result	Result	Result
CHEMISTRY ANALYSIS							
TROLEUM HYDROCARBONS	MG/KG	20.0	20.0 U	20.0 U	19100	12600	12600

dicates Result is side QC Limits
Not Applicable

			Client Sample ID:	OT44-DP3-4'	SWMU 36-DP3-14'	SWMU 36-DP3-22'	SWMU 36-DP4-14'	SWMU 36-DP4-25'
			Job Number & Lab Sample ID:	E96-0006 E6000608	E96-0006 E6000601	E96-0006 E6000602	E96-0006 E6000603	E96-0006 E6000604
			Sample Date:	02/01/96	02/01/96	02/01/96	02/01/96	02/01/96
Analyte	UNITS OF MEASURE	PQL		Result	Result	Result	Result	Result
CHEMISTRY ANALYSIS								
TROLEUM HYDROCARBONS	MG/KG	20.0		74.0	40.0	20.0 U	20.0 U	16.0 B

This page was intentionally left blank.

Final Closure Addendum

ANALYTICAL RESULTS
Total Petroleum Hydrocarbons

NEI/GTEL Client ID: FWH03FWH03
Login Number: W7030277
Project ID (number): FWH03FWH03
Project ID (name): AFB/D08 WAD3/RV STORAGE/HOLLOMAN/NM

Method: EPA 418.1
Matrix: Solids

NEI/GTEL Sample Number	W7030277-01	W7030277-02	W7030277-03	W7030277-04
Client ID	OT44-01-03	OT44-010-03	OT44-02-03	OT44-020-03
Date Sampled	03/17/97	03/17/97	03/17/97	03/17/97
Date Prepared	03/20/97	03/20/97	03/20/97	03/20/97
Date Analyzed	03/21/97	03/21/97	03/21/97	03/21/97
Dilution Factor	1.00	1.00	1.00	1.00

Analyte	Reporting Limit	Units	Concentration.Dry Weight			
Total Petroleum Hydrocarbons	20	mg/kg	260	520	46.	49.
Percent Solids	--	%	75 0	75 5	64 6	94 7

Notes

Dilution Factor:

Dilution factor indicates the adjustments made for sample dilution

EPA 418 1

Extraction is modified for soils by using EPA Method 9071 (soxhlet extraction) "Methods for Chemical Analysis of Water and Wastes" EPA 600/4-79-(

USEPA EMSL Cincinnati OH Revised March 1983

ANALYTICAL RESULTS
Total Petroleum Hydrocarbons

NEI/GTEL Client ID: FWH03FWH03
Login Number: W7030277
Project ID (number): FWH03FWH03
Project ID (name): AFB/D08 WAD3/RV STORAGE/HOLLOMAN/NM

Method: EPA 418.1
Matrix: Solids

NEI/GTEL Sample Number	W7030277-05	W7030277-06	W7030277-07	W7030277-08
Client ID	OT44-03-03	OT44-030-03	OT44-04-03	OT44-040-03
Date Sampled	03/17/97	03/17/97	03/17/97	03/17/97
Date Prepared	03/20/97	03/20/97	03/20/97	03/20/97
Date Analyzed	03/21/97	03/21/97	03/21/97	03/21/97
Dilution Factor	1.00	1.00	1.00	1.00

Analyte	Reporting Limit	Units	Concentration Dry Weight			
Total Petroleum Hydrocarbons	20	mg/kg	< 20	27.	32.	25.
Percent Solids	--	%	79 3	80 6	72 2	73 6

Notes

Dilution Factor

Dilution factor indicates the adjustments made for sample dilution

EPA 418 1

Extraction is modified for soils by using EPA Method 9071 (soxhlet extraction) "Methods for Chemical Analysis of Water and Wastes EPA 600/4-79-02 USEPA EMSL Cincinnati OH Revised March 1983

LTM Monitoring Data

TABLE 3-16
SUMMARY OF GROUNDWATER ANALYTICAL RESULTS AT OT-44
BUILDING 301 AIRCRAFT MAINTENANCE HANGAR
HOLLOMAN AFB, NEW MEXICO
SEPTEMBER 1995

ANALYTES	COMPARATIVE CONCENTRATIONS		OT44-MW2-01/ OT44-MW2-02	OT44-MW6-01
	Background[1]	Risk-based Levels[2]		
Volatile Organic Compounds - EPA Method 8260 (ug/l)				
Carbon disulfide	NA	21	11/<5.0	<5.0

[1] *Basewide Background Study for Holloman AFB* (Radian, December 1993a).
[2] EPA Region III, Risk-Based Concentrations (R.L. Smith, March 7, 1995).
< = Indicates compound not detected at the stated reporting limit.
NA = Not applicable/not established
ug/l = Micrograms per Liter

Table 3-8b. Summary of Groundwater Analytical Results at OT-44 Building 301 Aircraft Maintenance Hangar

HOLLOMAN AFB, NEW MEXICO
September 1997

SAMPLE I. D.	S50-MW1		S50-MW2		S50-MW3		S50-MW6[1]	
Sampling Date	Sep-97	Aug-95	Sep-97	Aug-95	Sep-97	Aug-95	Sep-97	Aug-95
VOCs - EPA Method 8260A (µg/l)								
sec-butylbenzene	ND	NS	1.9 J	ND	ND	NS	ND	ND
benzene	ND	NS	1.2	ND	ND	NS	ND	ND
toluene	ND	NS	1.4	ND	ND	NS	ND	ND
carbon disulfide	ND	NS	2.6 J	11	ND	NS	1 8 J	ND
methylene chloride	ND	NS	7.2 UB	ND	7 6 UB	NS	7.1 UB	ND
chloroform	0.76 J	NS	ND	ND	ND	NS	ND	ND

[1] Upgradient monitoring well

µg/l = micrograms per liter
AFB = Air Force Base
EPA = U.S. Environmental Protection Agency
I.D. = identification
J = Value is estimated; value is above detection limit but below reporting limit
ND = Not detected above method reporting limits.
NS = Not sampled in the 1995 LTMP.
UB = Result qualified as non-detected due to presence of methylene chloride in associated laborator

Table 3-17. Summary of Analytical Results from the 1995, 1997, and 1999 Long-Term Monitoring Programs at OT-44

Well Number	S50-MW1			S50-MW2			S50-MW3			S50-MW6[2]		
Sampling Date	Aug-95	Sep-97	Sep-99	Aug-95	Sep-97	Sep-99	Aug-95	Sep-97	Sep-99	Aug-95	Sep-97	Sep-99
VOCs[1] (µg/L)												
Benzene	NS	ND	ND	ND	1 2	ND	NS	ND	ND	ND	ND	ND
sec-Butylbenzene[3]	NS	ND	NA	ND	1 9 J	NA	NS	ND	NA	ND	ND	NA
Carbon disulfide	NS	ND	ND	1 1	2 6 J	5	NS	ND	ND	ND	1 8 J	ND
Chloroform	NS	0 76 J	ND	ND	ND	ND	NS	ND	ND	ND	ND	ND
Methylene chloride	NS	ND	ND	ND	7 2 UB	ND	NS	7 6 UB	ND	ND	7 1 UB	ND
Toluene	NS	ND	ND	ND	1 4	ND	NS	ND	ND	ND	ND	ND
TCE	NS	ND	ND	ND	ND	1 J	NS	ND	ND	ND	ND	ND

Notes
[1] Unless otherwise reported, no VOCs were detected using EPA Method 8260B
(EPA Method 8260A was used to analyze for VOCs in the 1995 and 1997 programs)
[2] Upgradient monitoring well
[3] Organic analyte not included in EPA Method 8260B
CRDL - Contract Required Detection Limit
IDL - Instrument Detection Limit
NA - not analyzed
ND - not detected at or above method reporting limit
NS - not sampled
TCE - trichloroethylene
VOCs - volatile organic compounds
µg/L - micrograms per liter

Laboratory Qualifiers--assigned as a result of internal laboratory data assessment procedures
J - Estimated value, less than CRDL but greater than or equal to IDL
UB - Qualifies as non-detect due to presence of analyte in associated laboratory blank

EPA Qualifiers--assigned as a result of independent data validation
None

1197399

SAMPLE NO

OT44MW201

VOLATILE ORGANICS ANALYSIS DATA SHEET

Lab Name: Laucks Testing Lab

SDG No: FWH48

Matrix (soil/water): WATER

Lab Sample ID: 9909534-02

Sample wt/vol: 5.0 (g/ml) ML

Lab File ID: U0929011 D

Level. (low/med): LOW

Date Received: 09/22/99

% Moisture not dec.:

Date Analyzed: 09/29/99

GC Column: DB-624 ID: 0.45 (mm)

Dilution Factor: 1.0

Soil Extract Volume: (uL)

Soil Aliquot Volume: (uL)

CONCENTRATION UNITS. (ug/L or ug/Kg) UG/L

CAS NO.	COMPOUND		Q
74-87-3	Chloromethane	3	U
75-01-4	Vinyl chloride	3	U
74-83-9	Bromomethane	3	U
75-00-3	Chloroethane	3	U
75-35-4	1,1-Dichloroethene	3	U
67-64-1	Acetone	5	U
75-15-0	Carbon disulfide	5	
75-09-2	Methylene chloride	3	U
156-60-5	trans-1,2-Dichloroethene	3	U
75-34-3	1,1-Dichloroethane	3	U
156-59-2	cis-1,2-Dichloroethene	3	U
78-93-3	2-Butanone	5	U
67-66-3	Chloroform	3	U
71-55-6	1,1,1-Trichloroethane	3	U
56-23-5	Carbon tetrachloride	3	U
71-43-2	Benzene	3	U
107-06-2	1,2-Dichloroethane	3	U
79-01-6	Trichloroethene	1	J
78-87-5	1,2-Dichloropropane	3	U
75-27-4	Bromodichloromethane	3	U
10061-01-5	cis-1,3-Dichloropropene	3	U
108-10-1	4-Methyl-2-pentanone	5	U
108-88-3	Toluene	3	U
10061-02-6	trans-1,3-Dichloropropene	3	U
79-00-5	1,1,2-Trichloroethane	3	U
127-18-4	Tetrachloroethene	3	U
591-78-6	2-Hexanone	5	U
124-48-1	Dibromochloromethane	3	U
108-90-7	Chlorobenzene	3	U
100-41-4	Ethylbenzene	3	U
108-38-3	m,p-Xylene	3	U
95-47-6	o-Xylene	3	U
100-42-5	Styrene	3	U
75-25-2	Bromoform	3	U
79-34-5	1,1,2,2-Tetrachloroethane	3	U

SAMPLE NO 1197398

VOLATILE ORGANICS ANALYSIS DATA SHEET

OT44MW101

Lab Name. Laucks Testing Lab

SDG No FWH48

Matrix (soil/water) WATER

Lab Sample ID: 9909534-01

Sample wt/vol 5 0 (g/ml) ML

Lab File ID. U0929009 D

Level. (low/med) LOW

Date Received: 09/22/99

% Moisture not dec

Date Analyzed 09/29/99

GC Column: DB-624 ID: 0.45 (mm)

Dilution Factor: 1.0

Soil Extract Volume. (uL)

Soil Aliquot Volume. (uL)

CONCENTRATION UNITS:

CAS NO	COMPOUND	(ug/L or ug/Kg) UG/L	Q
74-87-3	Chloromethane	3	U
75-01-4	Vinyl chloride	3	U
74-83-9	Bromomethane	3	U
75-00-3	Chloroethane	3	U
75-35-4	1,1-Dichloroethene	3	U
67-64-1	Acetone	5	U
75-15-0	Carbon disulfide	3	U
75-09-2	Methylene chloride	3	U
156-60-5	trans-1,2-Dichloroethene	3	U
75-34-3	1,1-Dichloroethane	3	U
156-59-2	cis-1,2-Dichloroethene	3	U
78-93-3	2-Butanone	5	U
67-66-3	Chloroform	3	U
71-55-6	1,1,1-Trichloroethane	3	U
56-23-5	Carbon tetrachloride	3	U
71-43-2	Benzene	3	U
107-06-2	1,2-Dichloroethane	3	U
79-01-6	Trichloroethene	3	U
78-87-5	1,2-Dichloropropane	3	U
75-27-4	Bromodichloromethane	3	U
10061-01-5	cis-1,3-Dichloropropene	3	U
108-10-1	4-Methyl-2-pentanone	5	U
108-88-3	Toluene	3	U
10061-02-6	trans-1,3-Dichloropropene	3	U
79-00-5	1,1,2-Trichloroethane	3	U
127-18-4	Tetrachloroethene	3	U
591-78-6	2-Hexanone	5	U
124-48-1	Dibromochloromethane	3	U
108-90-7	Chlorobenzene	3	U
100-41-4	Ethylbenzene	3	U
108-38-3	m,p-Xylene	3	U
95-47-6	o-Xylene	3	U
100-42-5	Styrene	3	U
75-25-2	Bromoform	3	U
79-34-5	1,1,2,2-Tetrachloroethane	3	U

SAMPLE NO 1197100

VOLATILE ORGANICS ANALYSIS DATA SHEET

OT44MW301

Lab Name. Laucks Testing Lab

SDG No · FWH48

Matrix (soil/water) WATER

Lab Sample ID. 9909534-03

Sample wt/vol. 5 0 (g/ml) ML

Lab File ID: U0929012 D

Level· (low/med) LOW

Date Received· 09/22/99

% Moisture: not dec.

Date Analyzed: 09/29/99

GC Column: DB-624 ID. 0.45 (mm)

Dilution Factor: 1.0

Soil Extract Volume· (uL)

Soil Aliquot Volume. (uL)

CONCENTRATION UNITS·
(ug/L or ug/Kg) UG/L

CAS NO	COMPOUND		Q
74-87-3	Chloromethane	3	U
75-01-4	Vinyl chloride	3	U
74-83-9	Bromomethane	3	U
75-00-3	Chloroethane	3	U
75-35-4	1,1-Dichloroethene	3	U
67-64-1	Acetone	5	U
75-15-0	Carbon disulfide	3	U
75-09-2	Methylene chloride	3	U
156-60-5	trans-1,2-Dichloroethene	3	U
75-34-3	1,1-Dichloroethane	3	U
156-59-2	cis-1,2-Dichloroethene	3	U
78-93-3	2-Butanone	5	U
67-66-3	Chloroform	3	U
71-55-6	1,1,1-Trichloroethane	3	U
56-23-5	Carbon tetrachloride	3	U
71-43-2	Benzene	3	U
107-06-2	1,2-Dichloroethane	3	U
79-01-6	Trichloroethene	3	U
78-87-5	1,2-Dichloropropane	3	U
75-27-4	Bromodichloromethane	3	U
10061-01-5	cis-1,3-Dichloropropene	3	U
108-10-1	4-Methyl-2-pentanone	5	U
108-88-3	Toluene	3	U
10061-02-6	trans-1,3-Dichloropropene	3	U
79-00-5	1,1,2-Trichloroethane	3	U
127-18-4	Tetrachloroethene	3	U
591-78-6	2-Hexanone	5	U
124-48-1	Dibromochloromethane	3	U
108-90-7	Chlorobenzene	3	U
100-41-4	Ethylbenzene	3	U
108-38-3	m,p-Xylene	3	U
95-47-6	o-Xylene	3	U
100-42-5	Styrene	3	U
75-25-2	Bromoform	3	U
79-34-5	1,1,2,2-Tetrachloroethane	3	U

1197401

VOLATILE ORGANICS ANALYSIS DATA SHEET

SAMPLE NO

OT44MW601

Lab Name: Laucks Testing Lab

SDG No.: FWH48

Matrix (soil/water): WATER

Lab Sample ID: 9909534-04

Sample wt/vol: 5.0 (g/ml) ML

Lab File ID: U0929013.D

Level. (low/med): LOW

Date Received: 09/22/99

% Moisture. not dec.:

Date Analyzed: 09/29/99

GC Column: DB-624 ID: 0.45 (mm)

Dilution Factor: 1.0

Soil Extract Volume: (uL)

Soil Aliquot Volume: (uL)

CONCENTRATION UNITS. (ug/L or ug/Kg) UG/L

CAS NO.	COMPOUND		Q
74-87-3	Chloromethane	3	U
75-01-4	Vinyl chloride	3	U
74-83-9	Bromomethane	3	U
75-00-3	Chloroethane	3	U
75-35-4	1,1-Dichloroethene	3	U
67-64-1	Acetone	5	U
75-15-0	Carbon disulfide	3	U
75-09-2	Methylene chloride	3	U
156-60-5	trans-1,2-Dichloroethene	3	U
75-34-3	1,1-Dichloroethane	3	U
156-59-2	cis-1,2-Dichloroethene	3	U
78-93-3	2-Butanone	5	U
67-66-3	Chloroform	3	U
71-55-6	1,1,1-Trichloroethane	3	U
56-23-5	Carbon tetrachloride	3	U
71-43-2	Benzene	3	U
107-06-2	1,2-Dichloroethane	3	U
79-01-6	Trichloroethene	3	U
78-87-5	1,2-Dichloropropane	3	U
75-27-4	Bromodichloromethane	3	U
10061-01-5	cis-1,3-Dichloropropene	3	U
108-10-1	4-Methyl-2-pentanone	5	U
108-88-3	Toluene	3	U
10061-02-6	trans-1,3-Dichloropropene	3	U
79-00-5	1,1,2-Trichloroethane	3	U
127-18-4	Tetrachloroethene	3	U
591-78-6	2-Hexanone	5	U
124-48-1	Dibromochloromethane	3	U
108-90-7	Chlorobenzene	3	U
100-41-4	Ethylbenzene	3	U
108-38-3	m,p-Xylene	3	U
95-47-6	o-Xylene	3	U
100-42-5	Styrene	3	U
75-25-2	Bromoform	3	U
79-34-5	1,1,2,2-Tetrachloroethane	3	U

1197402

SAMPLE NO

OT44MW602

VOLATILE ORGANICS ANALYSIS DATA SHEET

Lab Name. Laucks Testing Lab

SDG No · FWH48

Matrix (soil/water) WATER

Lab Sample ID 9909534-05

Sample wt/vol· 5.0 (g/ml) ML

Lab File ID: U0929014 D

Level (low/med) LOW

Date Received: 09/22/99

% Moisture not dec. _____

Date Analyzed· 09/29/99

GC Column: DB-624 ID. 0.45 (mm)

Dilution Factor: 1.0

Soil Extract Volume: _____ (uL)

Soil Aliquot Volume: _____ (uL)

CONCENTRATION UNITS:

CAS NO	COMPOUND	(ug/L or ug/Kg) UG/L	Q
74-87-3	Chloromethane	3	U
75-01-4	Vinyl chloride	3	U
74-83-9	Bromomethane	3	U
75-00-3	Chloroethane	3	U
75-35-4	1,1-Dichloroethene	3	U
67-64-1	Acetone	5	U
75-15-0	Carbon disulfide	3	U
75-09-2	Methylene chloride	3	U
156-60-5	trans-1,2-Dichloroethene	3	U
75-34-3	1,1-Dichloroethane	3	U
156-59-2	cis-1,2-Dichloroethene	3	U
78-93-3	2-Butanone	5	U
67-66-3	Chloroform	3	U
71-55-6	1,1,1-Trichloroethane	3	U
56-23-5	Carbon tetrachloride	3	U
71-43-2	Benzene	3	U
107-06-2	1,2-Dichloroethane	3	U
79-01-6	Trichloroethene	3	U
78-87-5	1,2-Dichloropropane	3	U
75-27-4	Bromodichloromethane	3	U
10061-01-5	cis-1,3-Dichloropropene	3	U
108-10-1	4-Methyl-2-pentanone	5	U
108-88-3	Toluene	3	U
10061-02-6	trans-1,3-Dichloropropene	3	U
79-00-5	1,1,2-Trichloroethane	3	U
127-18-4	Tetrachloroethene	3	U
591-78-6	2-Hexanone	5	U
124-48-1	Dibromochloromethane	3	U
108-90-7	Chlorobenzene	3	U
100-41-4	Ethylbenzene	3	U
108-38-3	m,p-Xylene	3	U
95-47-6	o-Xylene	3	U
100-42-5	Styrene	3	U
75-25-2	Bromoform	3	U
79-34-5	1,1,2,2-Tetrachloroethane	3	U

Table 16-2. Summary of Analytical Results from the 1996, 1997, 1999, and 2001 Long-Term Monitoring Programs at OT-44

Well Number	S50-MW1				S50-MW2			
Sampling Date	Aug-95	Sep-97	Sep-99	Sep-01	Aug-95	Sep-97	Sep-99	Sep-01
VOCs[1] (µg/L)								
Benzene	NS	ND	<3	<5	ND	1 2	<3	<5
sec-Butylbenzene[3]	NS	ND	NA	<5	ND	1.9 J	NA	<5
Carbon disulfide	NS	ND	<3	<5	11	2.6 J	5	<5
Chloroform	NS	0.76 J	<3	<5	ND	ND	<3	<5
Methylene chloride	NS	ND	<3	<5	ND	7 2 UB	<3	<5
Toluene	NS	ND	<3	<5	ND	1.4	<3	<5
Trichloroethylene	NS	ND	<3	<5	ND	ND	1 J	<5

Notes

[1] Unless otherwise reported, no VOCs were detected using EPA Method 8260B
(EPA Method 8260A was used to analyze for VOCs in the 1995 and 1997 programs)
[2] Upgradient monitoring well
[3] Organic analyte not included in EPA Method 8260B
CRDL - Contract-required Detection Limit
IDL - Instrument Detection Limit
ND - not detected at or above method reporting limit
NS - not sampled
VOCs - volatile organic compounds
µg/L - micrograms per liter

Laboratory Qualifiers--assigned as a result of laboratory data assessment procedures
J - Estimated value, less than CRDL but greater than or equal to IDL
UB - Qualifies as nondetect due to presence of analyte in associated laboratory blank

EPA Qualifiers--assigned as a result of independent data validation
None

1169152

Table 16-2. Summary of Analytical Results from the 1996, 1997, 1999, and 2001 Long-Term Monitoring Programs at OT-44

Well Number	S50-MW3				S50-MW6 [2]			
Sampling Date	Aug-95	Sep-97	Sep-99	Sep-01	Aug-95	Sep-97	Sep-99	Sep-01
VOCs[1] (µg/L)								
Benzene	NS	ND	<3	<5	ND	ND	<3	<5
sec-Butylbenzene[3]	NS	ND	NA	<5	ND	ND	NA	<5
Carbon disulfide	NS	ND	<3	<5	ND	1 8 J	<3	<5
Chloroform	NS	ND	<3	<5	ND	ND	<3	<5
Methylene chloride	NS	7 6 UB	<3	<5	ND	7.1 UB	<3	<5
Toluene	NS	ND	<3	<5	ND	ND	<3	<5
TCE	NS	ND	<3	<5	ND	ND	<3	<5

Notes

[1] Unless otherwise reported, no VOCs were detected using EPA Method 8260B
(EPA Method 8260A was used to analyze for VOCs in the 1995 and 1997 programs)
[2] Upgradient monitoring well
[3] Organic analyte not included in EPA Method 8260B
CRDL - Contract-required Detection Limit
IDL - Instrument Detection Limit
ND - not detected at or above method reporting limit
NS - not sampled
VOCs - volatile organic compounds
µg/L - micrograms per liter

Laboratory Qualifiers--assigned as a result of laboratory data assessment procedures
J - Estimated value, less than CRDL but greater than or equal to IDL
UB - Qualifies as nondetect due to presence of analyte in associated laboratory blank

EPA Qualifiers--assigned as a result of independent data validation
None

116915

1169221

SW 5030B/8260B
VOLATILE ORGANICS BY GC/MS

Client : FOSTER WHEELER	Date Collected: 09/27/01
Project : HOLLOMAN AFB	Date Received: 09/28/01
Batch No. : 01I209	Date Extracted: 10/05/01 15:15
Sample ID: OT44MW101	Date Analyzed: 10/05/01 15:15
Lab Samp ID: 1209-10	Dilution Factor: 1
Lab File ID: RJQ167	Matrix : WATER
Ext Btch ID: VO05J15	% Moisture : NA
Calib. Ref.: RJQ156	Instrument ID : T-005

PARAMETERS	RESULTS (ug/L)	RL (ug/L)	MDL (ug/L)
1,1,1-TRICHLOROETHANE	ND	5	1.5
1,1,2,2-TETRACHLOROETHANE	ND	5	.44
1,1,2-TRICHLOROETHANE	ND	5	.55
1,1-DICHLOROETHANE	ND	5	1.2
1,1-DICHLOROETHENE	ND	5	1.6
1,2-DICHLOROETHANE	ND	5	.27
1,2-DICHLOROPROPANE	ND	5	.52
2-BUTANONE (MEK)	ND	5	2.3
2-HEXANONE	ND	5	1.2
4-METHYL-2-PENTANONE (MIBK)	ND	5	1
ACETONE	ND	5	1.2
BENZENE	ND	5	1
BROMOCHLOROMETHANE	ND	5	.62
BROMODICHLOROMETHANE	ND	5	.76
BROMOFORM	ND	5	.28
BROMOMETHANE	ND	5	2.7
CARBON DISULFIDE	ND	5	1.8
CARBON TETRACHLORIDE	ND	5	.75
CHLOROBENZENE	ND	5	.88
CHLOROETHANE	ND	5	1.5
CHLOROFORM	ND	5	1
CHLOROMETHANE	ND	5	2.5
CIS-1,2-DICHLOROETHENE	ND	5	1.1
CIS-1,3-DICHLOROPROPENE	ND	5	.6
DIBROMOCHLOROMETHANE	ND	5	.67
ETHYLBENZENE	ND	5	1.3
M,P-XYLENES	ND	10	2.6
MTBE	ND	5	.55
METHYLENE CHLORIDE	ND	5	.78
O-XYLENE	ND	5	1.1
STYRENE	ND	5	.89
TETRACHLOROETHENE	ND	5	1.8
TOLUENE	ND	5	1
TRANS-1,2-DICHLOROETHENE	ND	5	1.3
TRANS-1,3-DICHLOROPROPENE	ND	5	.55
TRICHLOROETHENE	ND	5	1.5
VINYL ACETATE	ND	5	.61
VINYL CHLORIDE	ND	5	1.9

SURROGATE PARAMETERS	% RECOVERY	QC LIMIT
1,2-DICHLOROETHANE-D4	99	63-132
BROMOFLUOROBENZENE	97	73-129
TOLUENE-D8	97	75-122

1169222

SW 5030B/8260B
VOLATILE ORGANICS BY GC/MS

Client : FOSTER WHEELER	Date Collected: 09/27/01
Project : HOLLOMAN AFB	Date Received: 09/28/01
Batch No. : 011209	Date Extracted: 10/05/01 15:52
Sample ID: OT44MW102	Date Analyzed: 10/05/01 15:52
Lab Samp ID: I209-11	Dilution Factor: 1
Lab File ID: RJ0168	Matrix : WATER
Ext Btch ID: V005J15	% Moisture : NA
Calib. Ref.: RJ0156	Instrument ID : T-005

PARAMETERS	RESULTS (ug/L)	RL (ug/L)	MDL (ug/L)
1,1,1-TRICHLOROETHANE	ND	5	1.5
1,1,2,2-TETRACHLOROETHANE	ND	5	.44
1,1,2-TRICHLOROETHANE	ND	5	.55
1,1-DICHLOROETHANE	ND	5	1.2
1,1-DICHLOROETHENE	ND	5	1.6
1,2-DICHLOROETHANE	ND	5	.27
1,2-DICHLOROPROPANE	ND	5	.52
2-BUTANONE (MEK)	ND	5	2.3
2-HEXANONE	ND	5	1.2
4-METHYL-2-PENTANONE (MIBK)	ND	5	1
ACETONE	ND	5	1.2
BENZENE	ND	5	1
BROMOCHLOROMETHANE	ND	5	.62
BROMODICHLOROMETHANE	ND	5	.76
BROMOFORM	ND	5	.28
BROMOMETHANE	ND	5	2.7
CARBON DISULFIDE	ND	5	1.8
CARBON TETRACHLORIDE	ND	5	.75
CHLOROBENZENE	ND	5	.88
CHLOROETHANE	ND	5	1.5
CHLOROFORM	ND	5	1
CHLOROMETHANE	ND	5	2.5
CIS-1,2-DICHLOROETHENE	ND	5	1.1
CIS-1,3-DICHLOROPROPENE	ND	5	.6
DIBROMOCHLOROMETHANE	ND	5	.67
ETHYLBENZENE	ND	5	1.3
M,P-XYLENES	ND	10	2.6
MTBE	ND	5	.55
METHYLENE CHLORIDE	ND	5	.78
O-XYLENE	ND	5	1.1
STYRENE	ND	5	.89
TETRACHLOROETHENE	ND	5	1.8
TOLUENE	ND	5	1
TRANS-1,2-DICHLOROETHENE	ND	5	1.3
TRANS-1,3-DICHLOROPROPENE	ND	5	.55
TRICHLOROETHENE	ND	5	1.5
VINYL ACETATE	ND	5	.61
VINYL CHLORIDE	ND	5	1.9

SURROGATE PARAMETERS	% RECOVERY	QC LIMIT
1,2-DICHLOROETHANE-D4	101	63-132
BROMOFLUOROBENZENE	96	73-129
TOLUENE-D8	98	75-122

SW 50308/8260B
VOLATILE ORGANICS BY GC/MS

Client : FOSTER WHEELER	Date Collected: 09/27/01
Project : HOLLOMAN AFB	Date Received: 09/28/01
Batch No. : 011209	Date Extracted: 10/06/01 18:22
Sample ID: OT44MW201	Date Analyzed: 10/06/01 18:22
Lab Samp ID: I209-12	Dilution Factor: 1
Lab File ID: RJ0212	Matrix : WATER
Ext Btch ID: V005J19	% Moisture : NA
Calib. Ref.: RJ0199	Instrument ID : T-005

PARAMETERS	RESULTS (ug/L)	RL (ug/L)	MDL (ug/L)
1,1,1-TRICHLOROETHANE	ND	5	1.5
1,1,2,2-TETRACHLOROETHANE	ND	5	.44
1,1,2-TRICHLOROETHANE	ND	5	.55
1,1-DICHLOROETHANE	ND	5	1.2
1,1-DICHLOROETHENE	ND	5	1.6
1,2-DICHLOROETHANE	ND	5	.27
1,2-DICHLOROPROPANE	ND	5	.52
2-BUTANONE (MEK)	ND	5	2.3
2-HEXANONE	ND	5	1.2
4-METHYL-2-PENTANONE (MIBK)	ND	5	1
ACETONE	ND	5	1.2
BENZENE	ND	5	1
BROMOCHLOROMETHANE	ND	5	.62
BROMODICHLOROMETHANE	ND	5	.76
BROMOFORM	ND	5	.28
BROMOMETHANE	ND	5	2.7
CARBON DISULFIDE	ND	5	1.8
CARBON TETRACHLORIDE	ND	5	.75
CHLOROBENZENE	ND	5	.88
CHLOROETHANE	ND	5	1.5
CHLOROFORM	ND	5	1
CHLOROMETHANE	ND	5	2.5
CIS-1,2-DICHLOROETHENE	ND	5	1.1
CIS-1,3-DICHLOROPROPENE	ND	5	.6
DIBROMOCHLOROMETHANE	ND	5	.67
ETHYLBENZENE	ND	5	1.3
M,P-XYLENES	ND	10	2.6
MTBE	ND	5	.55
METHYLENE CHLORIDE	ND	5	.78
O-XYLENE	ND	5	1.1
STYRENE	ND	5	.89
TETRACHLOROETHENE	ND	5	1.8
TOLUENE	ND	5	1
TRANS-1,2-DICHLOROETHENE	ND	5	1.3
TRANS-1,3-DICHLOROPROPENE	ND	5	.55
TRICHLOROETHENE	ND	5	1.5
VINYL ACETATE	ND	5	.61
VINYL CHLORIDE	ND	5	1.9

SURROGATE PARAMETERS	% RECOVERY	QC LIMIT
1,2-DICHLOROETHANE-D4	99	63-132
BROMOFLUOROBENZENE	93	73-129
TOLUENE-D8	99	75-122

1169224

SW 5030B/8260B
VOLATILE ORGANICS BY GC/MS

Client : FOSTER WHEELER	Date Collected: 09/27/01
Project : HOLLOMAN AFB	Date Received: 09/28/01
Batch No. : 011209	Date Extracted: 10/05/01 17:05
Sample ID: OT44MW301	Date Analyzed: 10/05/01 17:05
Lab Samp ID: I209-13	Dilution Factor: 1
Lab File ID: RJ0170	Matrix : WATER
Ext Btch ID: V005J15	% Moisture : NA
Calib. Ref.: RJ0156	Instrument ID : T-005

PARAMETERS	RESULTS (ug/L)	RL (ug/L)	MDL (ug/L)
1,1,1-TRICHLOROETHANE	ND	5	1.5
1,1,2,2-TETRACHLOROETHANE	ND	5	.44
1,1,2-TRICHLOROETHANE	ND	5	.55
1,1-DICHLOROETHANE	ND	5	1.2
1,1-DICHLOROETHENE	ND	5	1.6
1,2-DICHLOROETHANE	ND	5	.27
1,2-DICHLOROPROPANE	ND	5	.52
2-BUTANONE (MEK)	ND	5	2.3
2-HEXANONE	ND	5	1.2
4-METHYL-2-PENTANONE (MIBK)	ND	5	1
ACETONE	ND	5	1.2
BENZENE	ND	5	1
BROMOCHLOROMETHANE	ND	5	.62
BROMODICHLOROMETHANE	ND	5	.76
BROMOFORM	ND	5	.28
BROMOMETHANE	ND	5	2.7
CARBON DISULFIDE	ND	5	1.8
CARBON TETRACHLORIDE	ND	5	.75
CHLOROBENZENE	ND	5	.88
CHLOROETHANE	ND	5	1.5
CHLOROFORM	ND	5	1
CHLOROMETHANE	ND	5	2.5
CIS-1,2-DICHLOROETHENE	ND	5	1.1
CIS-1,3-DICHLOROPROPENE	ND	5	.6
DIBROMOCHLOROMETHANE	ND	5	.67
ETHYLBENZENE	ND	5	1.3
M,P-XYLENES	ND	10	2.6
MTBE	ND	5	.55
METHYLENE CHLORIDE	ND	5	.78
O-XYLENE	ND	5	1.1
STYRENE	ND	5	.89
TETRACHLOROETHENE	ND	5	1.8
TOLUENE	ND	5	1
TRANS-1,2-DICHLOROETHENE	ND	5	1.3
TRANS-1,3-DICHLOROPROPENE	ND	5	.55
TRICHLOROETHENE	ND	5	1.5
VINYL ACETATE	ND	5	.61
VINYL CHLORIDE	ND	5	1.9

SURROGATE PARAMETERS	% RECOVERY	QC LIMIT
1,2-DICHLOROETHANE-D4	99	63-132
BROMOFLUOROBENZENE	97	73-129
TOLUENE-D8	97	75-122

SW 5030B/8260B
VOLATILE ORGANICS BY GC/MS

ient : FOSTER WHEELER	Date Collected: 09/27/01
oject : HOLLOMAN AFB	Date Received: 09/28/01
tch No. : 011209	Date Extracted: 10/05/01 17:42
Sample ID: OT44MW601	Date Analyzed: 10/05/01 17:42
Lab Samp ID: I209-14	Dilution Factor: 1
Lab File ID: RJQ171	Matrix : WATER
Ext Btch ID: V005J15	% Moisture : NA
Calib. Ref.: RJQ156	Instrument ID : T-005

PARAMETERS	RESULTS (ug/L)	RL (ug/L)	MDL (ug/L)
1,1,1-TRICHLOROETHANE	ND	5	1.5
1,1,2,2-TETRACHLOROETHANE	ND	5	.44
1,1,2-TRICHLOROETHANE	ND	5	.55
1,1-DICHLOROETHANE	ND	5	1.2
1,1-DICHLOROETHENE	ND	5	1.6
1,2-DICHLOROETHANE	ND	5	.27
1,2-DICHLOROPROPANE	ND	5	.52
2-BUTANONE (MEK)	ND	5	2.3
2-HEXANONE	ND	5	1.2
4-METHYL-2-PENTANONE (MIBK)	ND	5	1
ACETONE	ND	5	1.2
BENZENE	ND	5	1
BROMOCHLOROMETHANE	ND	5	.62
BROMODICHLOROMETHANE	ND	5	.76
BROMOFORM	ND	5	.28
BROMOMETHANE	ND	5	2.7
BON DISULFIDE	ND	5	1.8
BON TETRACHLORIDE	ND	5	.75
CHLOROBENZENE	ND	5	.88
OROETHANE	ND	5	1.5
OROFORM	ND	5	1
CHLOROMETHANE	ND	5	2.5
CIS-1,2-DICHLOROETHENE	ND	5	1.1
CIS-1,3-DICHLOROPROPENE	ND	5	.6
DIBROMOCHLOROMETHANE	ND	5	.67
ETHYLBENZENE	ND	5	1.3
M,P-XYLENES	ND	10	2.6
MTBE	ND	5	.55
METHYLENE CHLORIDE	ND	5	.78
O-XYLENE	ND	5	1.1
STYRENE	ND	5	.89
TETRACHLOROETHENE	ND	5	1.8
TOLUENE	ND	5	1
TRANS-1,2-DICHLOROETHENE	ND	5	1.3
TRANS-1,3-DICHLOROPROPENE	ND	5	.55
TRICHLOROETHENE	ND	5	1.5
VINYL ACETATE	ND	5	.61
VINYL CHLORIDE	ND	5	1.9

SURROGATE PARAMETERS	% RECOVERY	QC LIMIT
1,2-DICHLOROETHANE-D4	99	63-132
BROMOFLUOROBENZENE	96	73-129
TOLUENE-D8	97	75-122

This page was intentionally left blank.

APPENDIX C

SUPPORTING INFORMATION

BLG 301

TANK No 301

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS 833D COMBAT SUPPORT GROUP (TAC)
HOLLOMAN AIR FORCE BASE NM 88330-5000

22 SEP

REPLY TO ATTN OF: DEV

SUBJECT: Underground Storage Tank Class

TO: 49 CRS/MAAM

1. MR SEHORN, who is assigned to your shop/unit, has been scheduled for an Underground Storage Tank Class. Individual will report to Bldg. 29, large conference room, at 0900 on OCT 10, 89.

2. It is imperative that all facility managers be trained in requirements necessary for compliance with New Mexico underground storage tank regulations.

3. All training classes should be considered mandatory. Request you advise 833 CSG/DEV by return indorsement not later than OCT 4, 89 whether or not the individual will be able to meet this appointment. If an indorsement is not received, it will be assumed that the individual named above will attend. A No-Show letter will be issued upon non-attendance.

WILLIAM W. KOELM, Colonel, USAF
Commander

1st Ind, _____

TO: 833 CSG/DEV

Individual will/will not be able to make this appointment. If no, state reason and sign below:

_____

_____

_____
Typed Supervisor's Signature Block

_____
Typed Individual's Signature Block

Readiness is our Profession

INDEX

PAGE 1.....INDEX, TANK DESCRIPTION, COMPLIANCE REQUIREMENTS, REGISTRATION CERTIFICATE

PAGE 2.....CORROSION PROTECTION RECORDS
- a.) RESULTS OF LAST THREE INSPECTION
- b.) RESULTS OF TESTING FROM THE LAST TWO TEST
- c.) REPAIRS TO SYSTEM

PAGE 3.....RELEASE DETECTION RECORDS
- a.) WRITTEN PERFORMANCE CLAIM AND MANNER JUSTIFIED
- b.) RESULTS OF SAMPLING, TESTING OR MONTORING
- c.) DOCUMENTATION OF CALIBRATION, MAINTENANCE, REPAIR TO SYSTEM, AND EQUIPMENT

PAGE 4.....CLOSURE REQUIREMENTS AND DOCUMENTATION
- a.) NOTIFICATION DOCUMENT AND ASSESSING PLAN
- b.) RESULTS OF THE EXCAVATION AREA AND TANK PIT
- c.) NMEID-UST SAMPLE RESULTS AND VERIFICATION TO PROCEDE
- d.) CLOSURE REQUIREMENTS AND HOW THEY WERE SATISFIED

PAGE 5.....RELEASE REPORTING AND INVESTIGATION
- a.) NOTIFICATION OF SUSPECTED RELEASES
- b.) SITE SPECIFIC INVESTIGATION
- c.) TANK TIGHTNESS TEST RESULTS

PAGE 6.....MISC.
- a.) TRAINING
- b.) DEV INSPECTIONS

FAC NBR: 301 Heating Fuel Tank

Status: ~~In use~~ REMOVED

Estimated age: 10

Tank size: 25000 gal

Tank Material: Fiberglass reinforced plastic

Internal protection: none

External protection: none

Piping material: Fiberglass reinforced plastic

Substance stored or last stored: Diesel

General Requirements:

1. LEAK DETECTION (Compliance Date: June 1, 1991)

   Existing Tanks.....Monthly Monitoring

   a.) Vapor monitoring- initially funded by TAC. Possibly responsible for monitoring the tanks ourself.

2. CORROSION PROTECTION

   Existing Tanks.....In Compliance.....Fiberglass

   Existing Piping.....In Compliance Fiberglass

3. SPILL/OVERFILL PREVENTION (Compliance Date: June 1, 1998)

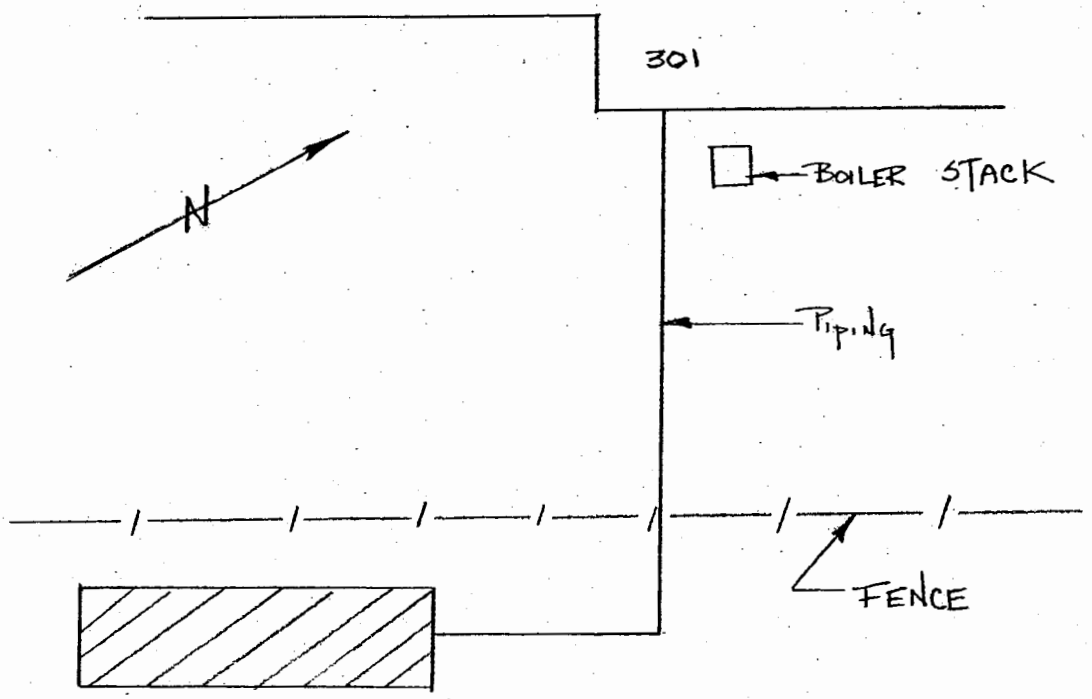
   All Tanks.....Catchment Basins and...Auto shutoff device

   or ...Overfill Alarms or Ball Float Valves.

ALTERNATE RECOMMENDATIONS:

1.) If Tank is left underground spill/overfill prevention will be required to acheive compliance with regulations.

BLD 301



25,000 GALLON DIESEL

2'-0" MIN COVER

DIAMETER 10'
LENGTH 40'

Removed

NATIONAL 42-381 50 SHEETS 5 SQUARE 42-382 100 SHEETS 5 SQUARE 42-389 200 SHEETS 5 SQUARE

REMOVED

FAC NBR: 301 Heating Fuel Tank

Status: In use

Estimated age: 10

Tank size: 25000 gal

Tank Material: Fiberglass reinforced plastic

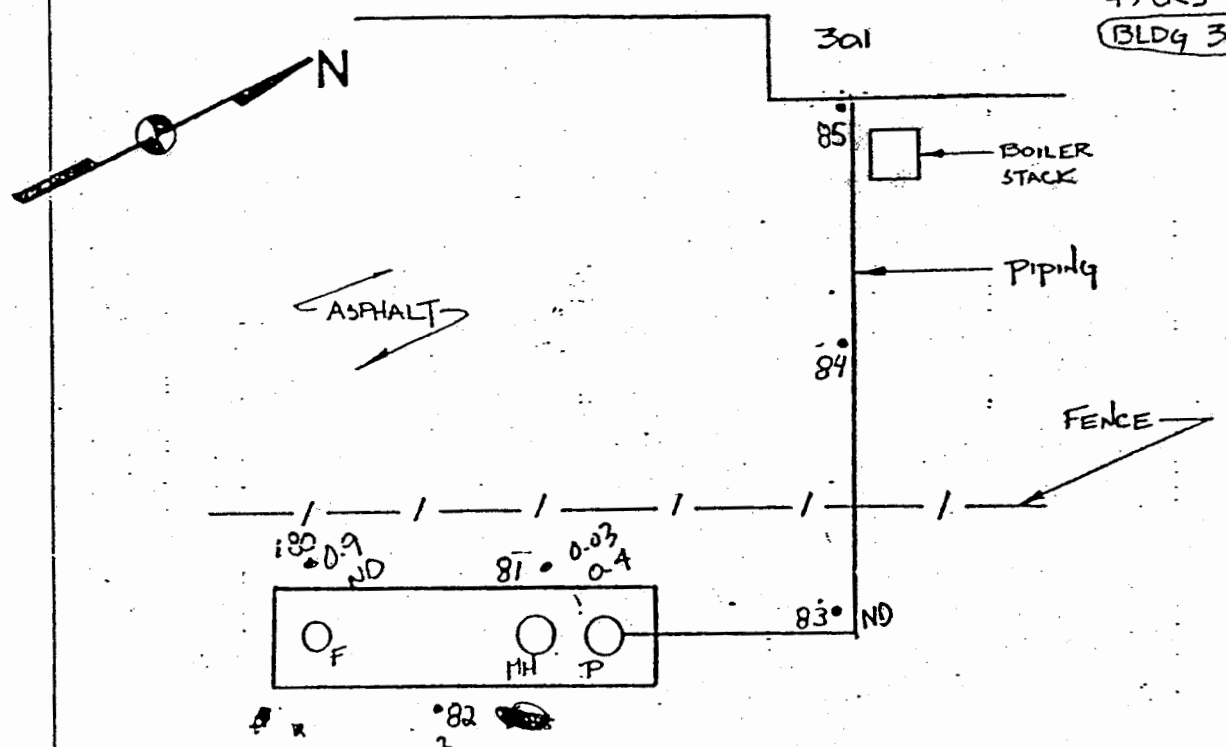
Internal protection: none

External protection: none

Piping material: Fiberglass reinforced plastic

Substance stored or last stored: Diesel

21 FEB 90
49 CRS
BLDG 301 HD



25,000 GALLON DIESEL
DIAMETER 10'
LENGTH 40'

LEGEND

F FILL
P PIPE
MH MANHOLE

0 10 20
SCALE 1" = 20'

TOTAL PROBES: 4

BLG 301

25,000 GAL
DIA 10'
LEN 40'

CAN NOT FIND TANK
EVEN FROM IRP
SEARCH

NATIONAL
42-381 50 SHEETS 5 SQUARE
42-382 100 SHEETS 5 SQUARE
42-389 200 SHEETS 5 SQUARE

.ANK CLOSURE WORKSHEET
(COMPLETE AFTER CLOSURE)

Tank Owner Holloman AFB Phone 505-479-5491
Mailing Address BLDG 55 HAFB N.M. 88330
Tank Address BLDG 301
Contractor Name CST Phone 1-800-445-0187
Address P.O. Box 2124 Las Cruces N.M. 88004
Contractor Name _____ Phone _____
Address _____

Tank Closure Date 2/91 # of Tanks Closed 1

****

I. Tank Closure Initial Procedures (check measures complied with):
- ✓ Obtain recommended safety equipment for all personnel
- ✓ Contact Fire Marshall or other fire officials
- ✓ Bond or ground equipment
- ✓ Drain product from piping and tank
- ✓ Disconnect, then cap or remove piping
- ___ Remove all residual product from tank
- ✓ Excavate to tank top
- ✓ Remove all tank fixtures
- ✓ Properly purge or inert tank of all flammable vapors using approved method
- ✓ Continually monitor for explosive vapors while tank is being removed

II. Tank Removal
- ✓ Create vent hole
- ✓ Excavate tank using all safety precautions
- ✓ Clean and inspect tank
- ✓ Check excavation for evidence of leaks and notify EID and other proper authorities if leak is found
- ✓ Check vapor levels in tank before transporting
- ✓ Dispose of tank in approved manner

Tank disposal location Estancia (City) N.M. (State)

How did you assess site for leakage? T.P.H. Lab Test
Closure report kept at _____
NOTE: Immediately report any evidence of leakage to EID at 827-0188

I hereby state that the above information is correct

Beth L [illegible]
Signature of owner or contractor performing work

****

FOR EID USE ONLY
Notification Received _____ Approved By _____
Inspection Date _____ Inspector _____

RPR UNDERGROUND STORAGE TANKS

Location: Holloman AFB N.M.

FIELD DATA SHEET REMOVAL OF UNDERGROUND STORAGE TANKS

Date:

Tank number: 5 RM

Location: BLDG 301

Size: 10' X 40'

Product: Diesal

Condition of Tank: Good, Fiberglass

Condition of Piping: Good, Fiberglass

Soil Analysis

	Location	PPM	%LEL	Visual
Sample #1	—	—	—	
Sample #2				
Sample #3				
Sample #4				

Comments: Base Personell Took Water Samples
Tank Below Water Table

QC Signature: Butt LU

28F-4

Environmental Improvement Division
Underground Storage Tank Bureau
Prevention/Inspection Section
1190 St. Francis Drive
Santa Fe, New Mexico 87503

(505) 827-0216

INSPECTION REPORT

DATE	CASE NUMBER	OPENING CONFERENCE TIME
2-4-90	031	11:35 am

INSPECTION TYPE: ☐ COMPLIANCE ☒ TANK CLOSURE ☐ REPAIR ☐ MODIFICATION ☐ REINSPECTION ☐ INSTALLATION ☐ COMPLAINT

Facility Name 1. Holloman AFB	Facility No.	Phone No.
Address Hwy 70		ZIP Code
Owner Name 2. Contact Person Roger Wilkson	Owner No.	Phone No. 479-3931
Address		ZIP Code
Facility Operator 3.		Phone No.
Address		ZIP Code
Contractor Name 4. Bret - Corrosion control Services		Phone No.
Address Las Cruces		ZIP Code

TANK NO.	SIZE	CONTENTS	INSTALLATION DATE	TANK CONSTRUCTION	PIPING CONSTRUCTION	TANK RELEASE DETECTION	PIPING RELEASE DETECTION	TANK STATUS
898	500 gal	Des	unk	steel	steel	vapor	vapor	closed
802	2000 gal	Doe	unk	steel	steel	"	"	"
585	2000	"	"	"	"	"	"	"
587	2000	"	"	"	"	"	"	"
2395	1000	"	"	"	"	"	"	"
221	500	"	"	"	"	"	"	"
222	3000	"	"	"		"	"	"
30	30 000	"	"	Fiber.	Fiber	"	"	"
1097	500	"	"	Steel	Steel	"	"	"
1098	500	"	"	"	"	"	"	"

SITE MAP

28F-4

New Mexico Underground Storage .k Bureau **INSPECTION REPORT**

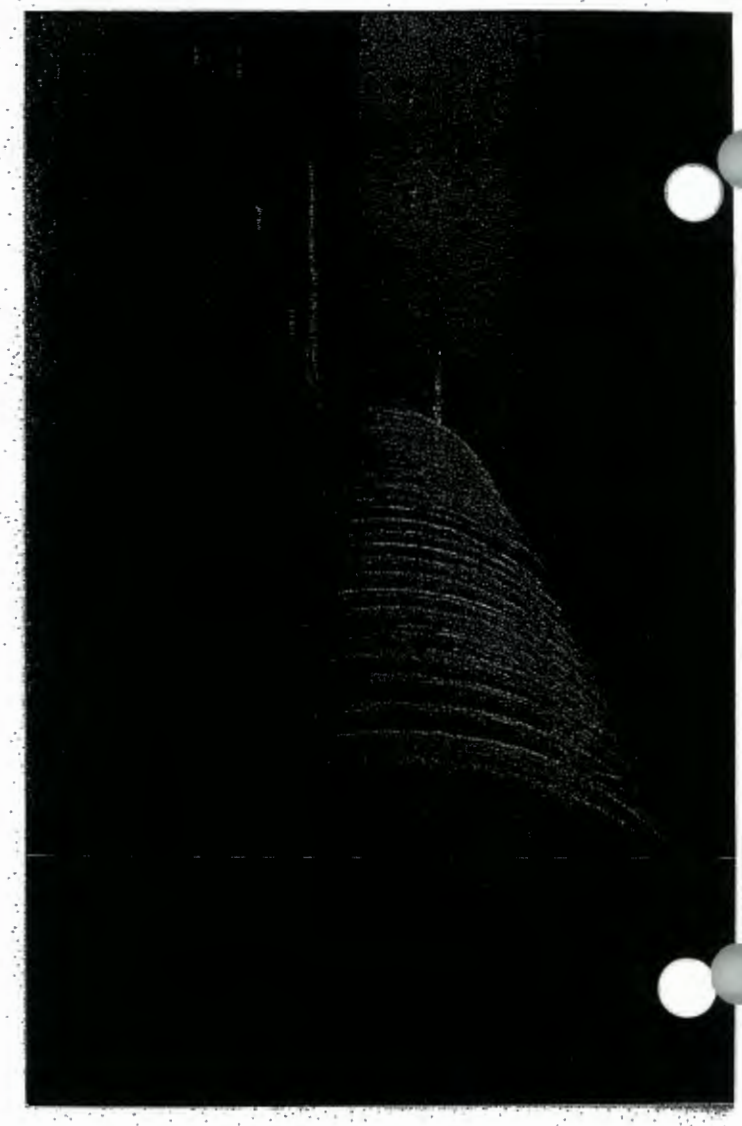
		Yes	No	Unk.	N/A
1. All applicable tanks on site are registered.	1.	X			
2. Proper notification was made for the following:	2.				
a. Closure	a.	X			
b. Installation	b.				X
c. Modification	c.				X
d. Repair	d.				X
3. Tanks closed properly.	3.	X			
4. Tanks installed properly.	4.				X
5. Tanks repaired/modified properly.	5.				X
6. Release detection — tanks:	6.				
a. Inventory records combined with annual tank tightness testing	a.				
b. Manual tank gauging	b.				
c. Automatic tank gauging	c.				
d. Vapor monitoring	d.	X			
e. Ground water monitoring	e.				
f. Interstitial monitoring	f.				
Release detection — piping.	7.	X			
8. Certified tank installers.	8.				X
9. All required records are maintained.	9.	X			
10. Evidence of release/spill.	10.	X			

COMMENTS:

tanks 898, 802, 2395, 221?, ~~90,000~~ 301, 1097
all showed signs of leaking. samples
are being taking.
Taint 301 in ground water

CLOSING CONFERENCE:	DATE 2-4-91	TIME 2:15 pm
Compliance Officer's Signature: Michael Osborne	Date 2-4-91	

On-site Representative's Signature	Date
[signature]	2/4/91



This page was intentionally left blank.

SUPPLEMENTAL RCRA FACILITY INVESTIGATION LF-19 (SWMU 105), LF-21 (SWMU 116), LF-22 (SWMU 115), AND LF-23 (SWMU 108) HOLLOMAN AIR FORCE BASE ALAMOGORDO, NEW MEXICO

Prepared for

Air Force Center for Environmental Excellence
3300 Sidney Brooks
Brooks City-Base, Texas 78235-5344

Prepared by

HydroGeoLogic, Inc.
1155 Herndon Parkway, Suite 900
Herndon, Virginia 20170-5545

Contract No. F41624-03-D-8602
Task Order No. 037

RECEIVED
FEB 2007
NMED Hazardous Waste Bureau

February 2007

REPORT DOCUMENTATION PAGE

Form Approved

QMB No. 0704-0188

Public reporting for this collection of information is estimated to average 1 hour per response, including the time for reviewing instruction, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1024, Arlington, VA 22202ll302, and to the Office of Management and Budget, Paperwork Reduction Project (070400188), Washington, DC 20503.

1. AGENCY USE ONLY *(Leave blank)*	2. REPORT DATE February 2007	3.REPORT TYPE AND DATES COVERED
4. TITLE AND SUBTITLE Supplemental RCRA Facility Investigation (RFI); LF-19, LF-21, LF-22, and LF-23; Holloman AFB, New Mexico		4. FUNDING NUMBERS F41624-03-D-8602 Task Order No. 037
6. AUTHOR(S) HydroGeoLogic, Inc.		
7. PERFORMANCE ORGANIZATION NAMES(S) AND ADDRESS(S) HydroGeoLogic, Inc. 1155 Herndon Parkway, Suite 900 Herndon, Virginia 20170-5545		8. PERFORMANCE ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(S) Air Force Center For Environmental Excellence 3300 Sidney Brooks Brooks City-Base, Texas 78235-5344		10.SPONSORING/MONITORING AGENCY REPORT NUMBER
11. SUPPLEMENTARY NOTES		
12a. DISTRIBUTION/AVAILABILITY STATEMENT Unlimited		12b. DISTRIBUTION CODE

13. ABSTRACT (Maximum 200 words)

This Supplemental Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) report was prepared by HydroGeoLogic, Inc. on behalf of Holloman Air Force Base (AFB) for the New Mexico Environment Department under contract to the Air Force Center for Environmental Excellence, Contract No. F41624-03-D-8602, Task Order No. 037. This Supplemental RFI report details the field activities conducted and associated results for the following Environmental Restoration Program sites / Solid Waste Management Units (SWMUs) at Holloman AFB, Alamogordo, New Mexico: LF-21 (SWMU 116) West Area Landfill No. 2; LF-22 (SWMU 115) West Area Landfill No. 1; LF-23 (SWMU 108) MOBSS Landfill.

14. SUBJECT TERMS			15. NUMBER OF PAGES 16. PRICE CODE
17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE.	19.SECURITY CLASSIFICATION OF ABSTRACT.	20.LIMITATIONOF ABSTRACT

TABLE OF CONTENTS

Page

1.0 INTRODUCTION 1-1
1.1 INVESTIGATION PURPOSE 1-1
1.2 REPORT ORGANIZATION 1-2

2.0 HOLLOMAN AFB ENVIRONMENTAL SETTING 2-1
2.1 CLIMATE 2-1
2.2 GEOLOGY 2-2
2.3 SOILS 2-4
2.4 SURFACE WATER 2-4
2.5 HYDROGEOLOGY 2-5

3.0 INVESTIGATION ACTIVITIES 3-1
3.1 GEOPHYSICAL SURVEYING 3-1
3.1.1 Terrain Conductivity Surveying 3-1
3.1.2 Magnetometer Surveying 3-2
3.1.3 Global Positioning 3-2
3.1.4 Geophysical Survey Data Processing 3-2
3.2 TRENCHING ACTIVITIES 3-3
3.2.1 Trenching 3-3
3.2.2 Decontamination 3-3
3.3 TRENCH SOIL SAMPLING 3-4
3.4 INVESTIGATION DERIVED WASTE 3-4

4.0 LF-19 (SWMU 105) - GOLF COURSE LANDFILL 4-1
4.1 LOCATION 4-1
4.2 SITE DESCRIPTION 4-1
4.3 WASTE HISTORY 4-2
4.4 ENVIRONMENTAL SETTING 4-2
4.4.1 Topography 4-2
4.4.2 Geology 4-2
4.4.3 Soils 4-3
4.4.4 Surface Water 4-3
4.4.5 Hydrogeology 4-4
4.5 PREVIOUS INVESTIGATIONS 4-4
4.5.1 LF-19 Remedial Investigation 4-4
4.5.2 Long Term Groundwater Monitoring 4-5
4.5.3 Statement of Basis 4-6
4.6 SUPPLEMENTAL RFI INVESTIGATION ACTIVITIES 4-6
4.6.1 Geophysical Surveying 4-6
4.6.2 Landfill Trenching 4-7
4.6.3 Trench Soil Sampling 4-8

TABLE OF CONTENTS (Continued)

Page

4.7 ASSESSMENT OF DATA RESULTS 4-8
4.7.1 Precision and Accuracy 4-8
4.7.2 Comparability 4-9
4.7.3 Representativeness 4-9
4.7.4 Completeness 4-10
4.7.5 Usability 4-10
4.8 SUPPLEMENT RFI INVESTIGATION RESULTS 4-10
4.8.1 Geophysical Surveying Results 4-10
4.8.1.1 Terrain Conductivity Survey Results 4-10
4.8.1.2 Magnetic Survey Results 4-10
4.8.1.3 Geophysical Survey Conclusions 4-11
4.8.2 Trenching Results 4-11
4.8.3 Trench Soil Sampling Results 4-11
4.9 CONCLUSIONS 4-12
4.10 RECOMMENDATIONS 4-13

5.0 LF-21 (SWMU 116) - WEST AREA LANDFILL NO. 2 5-1
5.1 LOCATION 5-1
5.2 SITE DESCRIPTION 5-1
5.3 WASTE HISTORY 5-1
5.4 ENVIRONMENTAL SETTING 5-1
5.4.1 Topography 5-1
5.4.2 Geology 5-2
5.4.3 Soils 5-2
5.4.4 Surface Water 5-3
5.4.5 Hydrogeology 5-3
5.5 PREVIOUS INVESTIGATIONS 5-3
5.5.1 LF-21 Remedial Investigation 5-3
5.5.2 Long Term Groundwater Monitoring 5-4
5.5.3 Statement of Basis 5-4
5.6 INVESTIGATION ACTIVITIES 5-4
5.6.1 Geophysical Surveying 5-5
5.6.2 Trenching 5-5
5.6.3 Trench Soil Sampling 5-6
5.7 SUPPLEMENT RFI INVESTIGATION RESULTS 5-6
5.7.1 Geophysical Surveying Results 5-6
5.7.1.1 Terrain Conductivity Survey Results 5-6
5.7.1.2 Magnetic Survey Results 5-6
5.7.1.3 Geophysical Survey Conclusions 5-6
5.7.2 Trenching Results 5-7
5.8 CONCLUSIONS 5-7

TABLE OF CONTENTS (Continued)

Page

5.9 RECOMMENDATIONS 5-8

6.0 LF-22 (SWMU 115) - WEST AREA LANDFILL NO. 1 6-1
6.1 LOCATION 6-1
6.2 SITE DESCRIPTION 6-1
6.3 WASTE HISTORY 6-1
6.4 ENVIRONMENTAL SETTING 6-1
6.4.1 Topography 6-1
6.4.2 Geology 6-1
6.4.3 Soils 6-2
6.4.4 Surface Water 6-2
6.4.5 Hydrogeology 6-3
6.5 PREVIOUS INVESTIGATIONS 6-3
6.5.1 LF-22 Remedial Investigation 6-3
6.5.2 Long Term Groundwater Monitoring 6-3
6.5.3 Statement of Basis 6-4
6.6 SUPPLEMENTAL RFI INVESTIGATION ACTIVITIES 6-4
6.6.1 Geophysical Surveying 6-4
6.6.2 Landfill Trenching 6-4
6.6.3 Trench Soil Sampling 6-5
6.7 SUPPLEMENT RFI INVESTIGATION RESULTS 6-5
6.7.1 Geophysical Surveying Results 6-5
6.7.1.1 Terrain Conductivity Survey Results 6-5
6.7.1.2 Magnetic Survey Results 6-5
6.7.1.3 Geophysical Survey Conclusions 6-5
6.7.2 Trenching Results 6-6
6.8 CONCLUSIONS 6-6
6.9 RECOMMENDATIONS 6-6

7.0 LF-23 (SWMU 108) - MOBSS LANDFILL 7-1
7.1 LOCATION 7-1
7.2 SITE DESCRIPTION 7-1
7.3 WASTE HISTORY 7-1
7.4 ENVIRONMENTAL SETTING 7-1
7.4.1 Topography 7-1
7.4.2 Geology 7-2
7.4.3 Soils 7-2
7.4.4 Surface Water 7-3
7.4.5 Hydrogeology 7-3
7.5 PREVIOUS INVESTIGATIONS 7-3
7.5.1 LF-22 Remedial Investigation 7-3

TABLE OF CONTENTS (Continued)

Page

7.5.2 Long Term Groundwater Monitoring 7-4
7.5.3 Statement of Basis 7-4
7.6 SUPPLEMENTAL RFI INVESTIGATION ACTIVITIES 7-4
7.6.1 Geophysical Surveying 7-4
7.6.2 Landfill Trenching 7-5
7.6.3 Trench Soil Sampling 7-5
7.7 SUPPLEMENT RFI INVESTIGATION RESULTS 7-5
7.7.1 Geophysical Surveying Results 7-5
7.7.1.1 Terrain Conductivity Survey Results 7-5
7.7.1.2 Magnetic Survey Results 7-6
7.7.1.3 Geophysical Survey Conclusions 7-6
7.7.2 Trenching Results 7-6
7.8 CONCLUSIONS 7-7
7.9 RECOMMENDATIONS 7-7

8.0 REFERENCES 8-1

LIST OF APPENDICES

APPENDIX A GEOPHYSICAL SURVEY REPORT
APPENDIX B PHOTOGRAPHIC RECORD
B.1 LF-19 Photographic Log
B.2 LF-21 Photographic Log
B.3 LF-22 Photographic Log
B.4 LF-23 Photographic Log
APPENDIX C TRENCH LOGS
C.1 LF-19 Trench Logs and Soil Sample Field Forms
C.2 LF-21 Trench Logs
C.3 LF-22 Trench Logs
C.4 LF-23 Trench Logs
APPENDIX D ANALYTICAL DATA

LIST OF TABLES

Table 4.1 Remedial Investigation Groundwater Analytical Results, LF-19 (SWMU 105)
Table 4.2 Long Term Groundwater Monitoring Analytical Results, LF-19 (SWMU 105)
Table 4.3 Soil Sample Analytical Scheme LF-19 (SWMU 105)
Table 4.4 Soil Analytical Results LF-19 (SWMU 105)
Table 5.1 Remedial Investigation Groundwater Analytical Results, LF-21 (SWMU 116)
Table 5.2 Long Term Groundwater Monitoring Analytical Results, LF-21 (SWMU 116)
Table 6.1 Remedial Investigation Groundwater Analytical Results, LF-22 (SWMU 115)
Table 6.2 Long Term Groundwater Monitoring Analytical Results, LF-22 (SWMU 115)
Table 7.1 Remedial Investigation Groundwater Analytical Results, LF-23 (SWMU 108)
Table 7.2 Long Term Groundwater Analytical Results, LF-23 (SWMU 108)

LIST OF FIGURES

Figure 1.1 Facility Location Map, Holloman AFB
Figure 1.2 Site Location Map, Holloman AFB
Figure 2.1 Facility Topographic Map, Holloman AFB
Figure 2.2 Surface Drainage, Holloman AFB
Figure 2.3 Geologic Map of the Tularosa Basin
Figure 2.4 Centralized Cross Section Tularosa Basin
Figure 2.5 Generalized Near-Surface Geologic Cross Section, Holloman AFB
Figure 2.6 Distribution of Soils, Holloman AFB
Figure 2.7 Groundwater Elevation Contour Map, Holloman AFB
Figure 4.1 LF-19 Site Map, Holloman AFB
Figure 4.2 LF-19 Geologic Cross Section, Holloman AFB
Figure 4.3 LF-19 Terrain Conductivity Survey, Holloman AFB
Figure 4.4 LF-19 Magnetic Survey, Holloman AFB
Figure 4.5 LF-19 Trench, Test Pit, and Sample Locations, Holloman AFB
Figure 5.1 LF-21 Site Map, Holloman AFB
Figure 5.2 LF-21 Geologic Cross Section, Holloman AFB
Figure 5.3 LF-21 Terrain Conductivity Survey, Holloman AFB
Figure 5.4 LF-21 Magnetic Survey, Holloman AFB
Figure 5.5 LF-21 Trench and Test Pit Locations, Holloman AFB
Figure 6.1 LF-22 Site Map, Holloman AFB
Figure 6.2 LF-22 Geologic Cross Section, Holloman AFB
Figure 6.3 LF-22 Terrain Conductivity Survey, Holloman AFB
Figure 6.4 LF-22 Magnetic Survey, Holloman AFB
Figure 6.5 LF-22 Trench Locations, Holloman AFB
Figure 7.1 LF-23 Site Map, Holloman AFB
Figure 7.2 LF-23 Geologic Cross Section, Holloman AFB
Figure 7.3 LF-23 Terrain Conductivity Survey, Holloman AFB
Figure 7.4 LF-23 Magnetic Survey, Holloman AFB
Figure 7.5 LF-23 Trench Locations, Holloman AFB

This page was intentionally left blank.

LIST OF ACRONYMS, SYMBOLS AND ABBREVIATIONS

%	percent
%D	percent difference
%R	percent recovery
μg/L	micrograms per liter
AFB	Air Force Base
AFCEE	Air Force Center for Environmental Excellence
bgs	below ground surface
Bhate	Bhate Environmental Associates
CLP	Contract Laboratory Procedure
cm/sec	centimeters per second
CCV	continuing calibration verification
EQ	environmental quotient
ERP	Environmental Restoration Program
ft/day	feet per day
ft/ft	feet per foot
ft/yr	feet per year
GPS	Global Positioning System
HGL	HydroGeoLogic, Inc.
HI	hazard index
LCS	laboratory control sample
LTM	long-term monitoring
mg/L	milligrams per liter
MOBSS	Mobilization Support System
NFA	no further action
NMED	New Mexico Environment Department
NMGWQ	New Mexico Groundwater Quality
NOD	notice of deficiency
PCB	polychlorinated biphenyl
PID	photoionization detector
PVC	polyvinyl chloride

QAPP	Quality Assurance Project Plan
QC	quality control
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
RFI	RCRA Facility Investigation
SDG	sample delivery group
SOB	Statement of Basis
SSL	soil screening level
SWMU	Solid Waste Management Unit
TAL	target analyte list
TDS	total dissolved solids
USAF	U.S. Air Force
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
WRRI	New Mexico Water Resources Research Institute
VOC	volatile organic compound

SUPPLEMENTAL RCRA FACILITY INVESTIGATION
LF-19 (SWMU 105), LF-21 (SWMU 116),
LF-22 (SWMU 115), and LF-23 (SWMU 108)
HOLLOMAN AIR FORCE BASE
ALAMOGORDO, NEW MEXICO

1.0 INTRODUCTION

This Supplemental Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) report was prepared by HydroGeoLogic, Inc. (HGL) on behalf of Holloman Air Force Base (AFB) for the New Mexico Environment Department (NMED) under contract to the Air Force Center for Environmental Excellence (AFCEE), Contract No.F41624-03-D-8602, Task Order No. 037. This report presents the results of supplemental RFI field investigation activities conducted at the following Environmental Restoration Program (ERP) sites / Solid Waste Management Units (SWMUs) located at Holloman AFB, Alamogordo, New Mexico:

LF-19 (SWMU 105)	Golf Course Landfill
LF-21 (SWMU 116)	West Area Landfill No. 2
LF-22 (SWMU 115)	West Area Landfill No. 1
LF-23 (SWMU 108)	Mobilization Support System (MOBSS) Landfill

Holloman AFB is situated in south central New Mexico, in the northwest central part of Otero County. Holloman AFB and occupies about 50,000 acres in the northeast quarter of Section 1 Township 17 South, Range 8 East. A facility location map is provided as Figure 1.1. A site location map, identifying the locations of the four landfills with respect to the surrounding facility, is presented as Figure 1.2.

1.1 INVESTIGATION PURPOSE

The four landfill sites, LF-19, LF-21, LF-22, and LF-23 are listed in Appendix 4-A Table A of the facility's RCRA permit (permit NM6572124422-2), which requires the sites to be investigated and, if warranted, undergo corrective action. A remedial investigation (RI) focusing on the groundwater quality emanating from the landfills was conducted on the four sites in 1992. This investigation approach is consistent with U.S. Environmental Protection Agency (USEPA) guidance on landfill characterization, since soils comprising landfills are inherently heterogeneous and prevent representative sampling for adequate characterization.

Since completion of the RIs, 10 years of biennial long-term monitoring (LTM) was performed at the sites, satisfying conditional closure requirements described in their respective decision documents (Radian, 1995). Based on the RI and biennial LTM analytical results, all four sites were recommended for closure in the 2003 groundwater LTM report (Bhate, 2003). In an August 10, 2004 letter (NMED, 2004), NMED concurred with the suspension of LTM activities at LF-19, LF-22, and LF-23, but directed that additional characterization of the sites

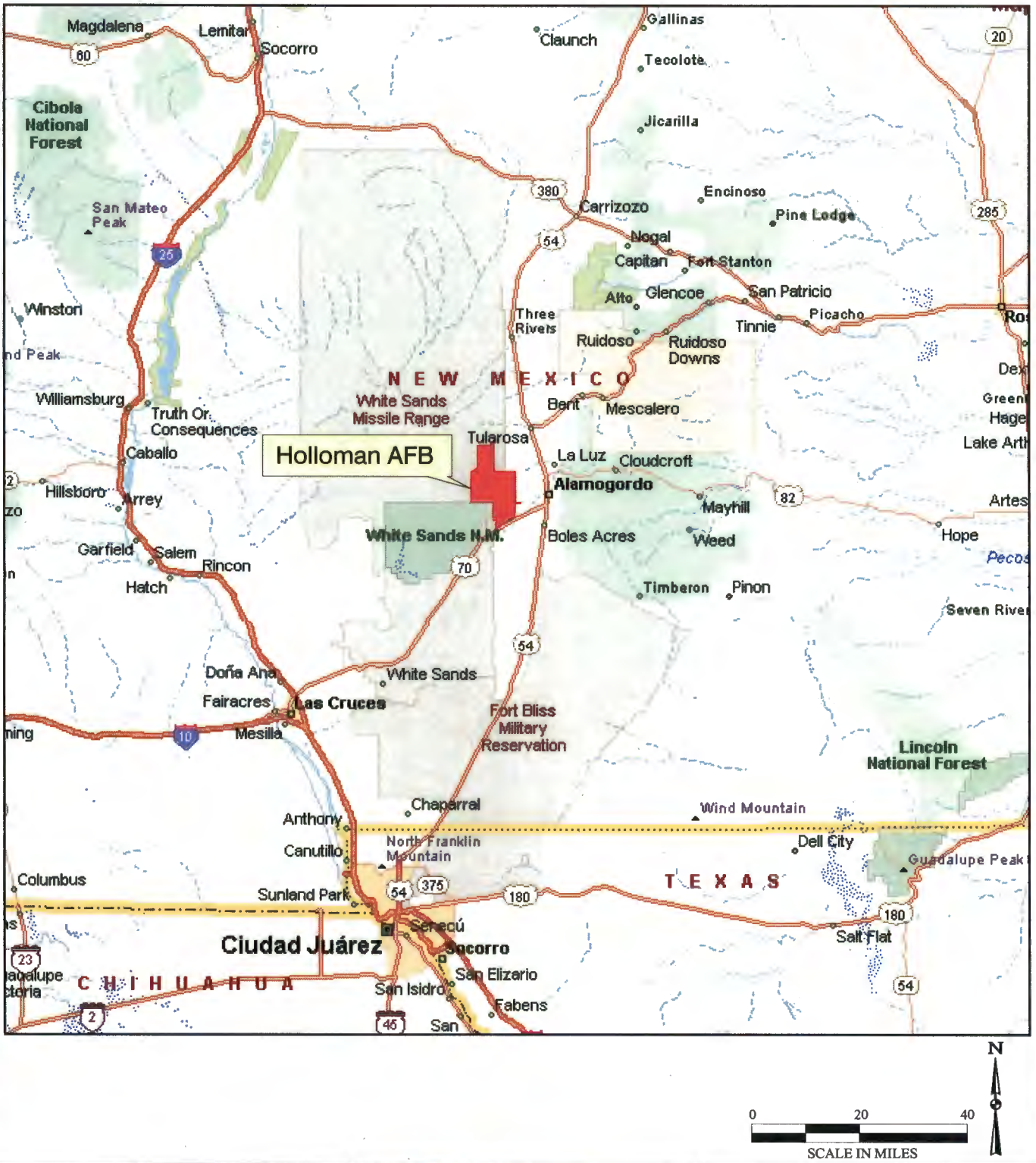
was required before closure could be considered. NMED required LTM to continue in 2005 at LF-21 in order to monitor an upgradient halogenated volatile organic compound (VOC) plume. Following review of the 2005 LTM report, NMED concurred in correspondence dated October 4, 2006, that LTM at LF-21 could also be suspended.

As stated previously, NMED responded that the four sites could not be closed without additional investigation (NMED, 2004). Specifically, NMED was concerned with the type of waste material present within the landfills and the soil quality beneath the landfill material if hazardous materials were present in the landfill. HGL submitted a workplan in July 2005 summarizing site histories and previous investigations for these four sites. NMED provided comments in correspondence dated January 2006. HGL responded to these comments in March 2006 and conducted a site visit with NMED in April 2006 to obtain final concurrence on the scope of the field investigation. This report documents the results of these supplemental RFI activities in order to satisfy NMED site-closure requirements.

1.2 REPORT ORGANIZATION

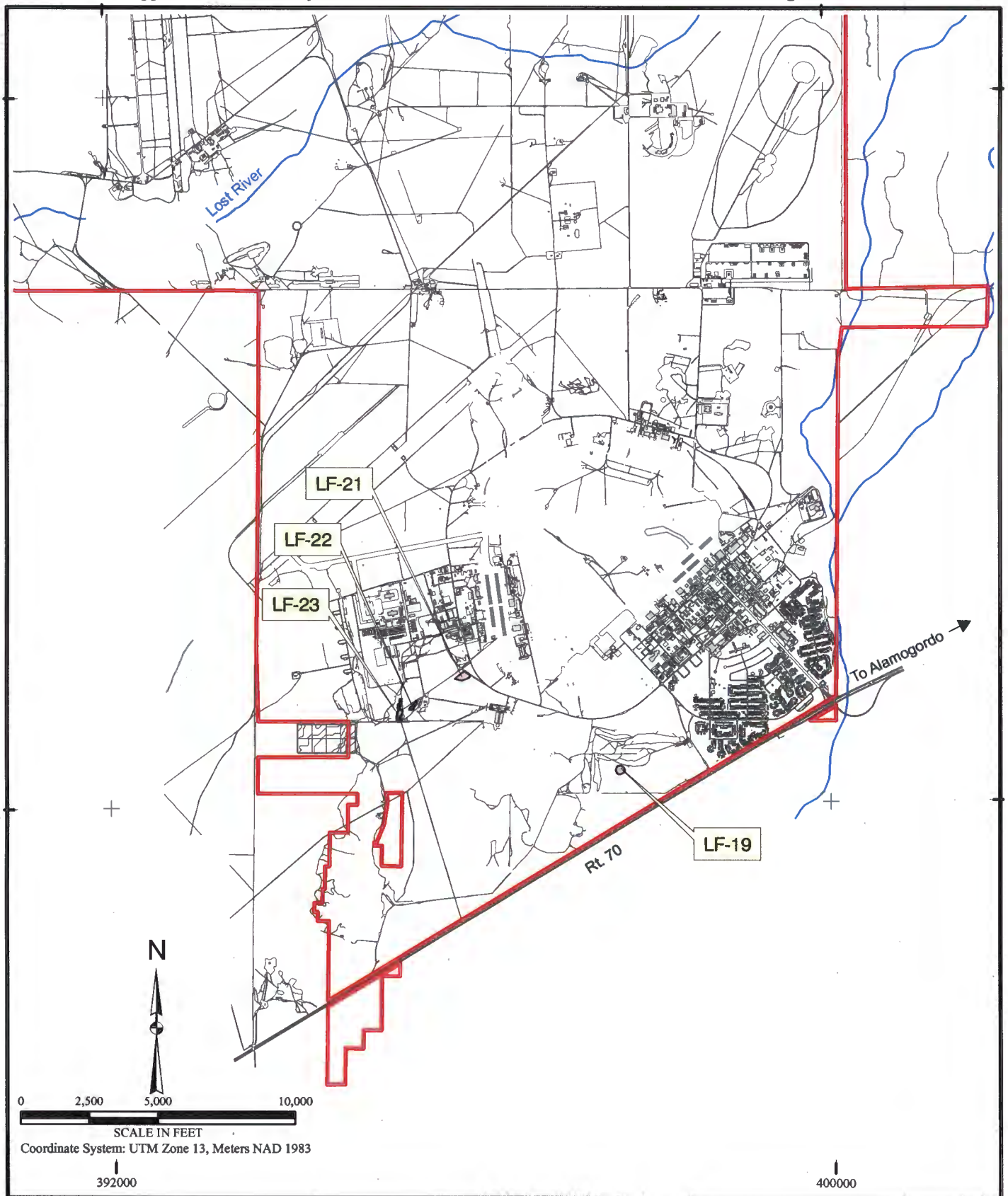
This supplemental RFI report is organized into eight sections. Section 1 is this introduction. Sections 2 presents the facility environmental setting. Section 3 describes the field activities performed for the supplemental RFI. Sections 4 through 7 present background and environmental setting information, documents supplemental RFI field activities, and presents the results of the investigations on a site-specific basis for LF-19 (Section 4), LF-21 (Section 5), LF-22 (Section 6), and LF-23 (Section 7). Section 8 presents the references cited in this report. Supporting information is included in Appendices A through D.

FIGURES



Filename: X:\AFC002\Holloman_AFB\Maps
\TO37\LF_19_21_22_23_Supp_RFI\Site_location.cdr
Project: AFC002-037-04-04-03
Revised: 09/26/06 BF
Source: MapPoint

Figure 1.1
Facility Location Map
Holloman AFB



File X:\AFC002\Holloman_AFB\TO37\Maps\LF_19_21_22_23_Supp_RFI\site_location.mxd
Project: AFC002-037-04-04-05
Revised: 09/25/06 BF
Map Source: Holloman AFB

Legend

- Holloman AFB Boundary
- Building/Structure
- Operable Unit Boundary (Approx.)

Figure 1.2
Site Location Map
Holloman AFB

2.0 HOLLOMAN AFB ENVIRONMENTAL SETTING

The environmental setting information in the following subsections is reproduced primarily from the HGL RFI Workplan (HGL, 2005), from the Radian 29-site RI report (Radian, 1992a), unless otherwise cited.

Holloman AFB is situated in south-central New Mexico, in the northwest-central part of Otero County. The Base occupies about 50,000 acres in the northeast quarter of section T.17S., R.8E. Additional land extending northward is occupied by the White Sands Missile Range testing facilities.

The Base is located about 75 miles northeast of El Paso, Texas and about seven miles west of Alamogordo, New Mexico. Alamogordo is the county seat of Otero County, and the only town of appreciable size within 30 to 50 miles of the Base. The population of Alamogordo was 23,535 in 1975 and has since grown to about 31,000. The economy of Alamogordo depends largely upon Holloman AFB and other military installations in the area. Approximately 5,500 people live at Holloman AFB.

Privately owned, public, and federally owned lands border the Base. The major highway serving the Base is Highway 70, which runs southwest from Alamogordo and forms the boundary between the Base and public lands.

The Base is located in the Tularosa Basin, which is part of a 170-mile-long structural depression. It is bounded on the south by a low topographic divide near the state line; on the west by the uplifted Organ, San Andres, and Oscura Mountains; on the north by Chupadera Mesa; and on the east by the uplifted Jicarilla and Sacramento Mountains. The interior plain has low relief with altitudes ranging from about 4,000 feet in the southwestern portion of the basin to about 4,400 feet in the northeastern portion. The surrounding mountains rise abruptly to altitudes of 7,000 to 12,000 feet.

Surface runoff from the mountains bordering the basin has deposited extensive alluvial fans on the interior plain. The Tularosa Basin is a closed basin from which no surface water drains. Near the Base, the ground surface is gently undulating and is composed of alluvial fan deposits, eolian dunes, and flat-bottomed playas (pan-shaped depressions carved by wind erosion). To the west of the Base lie the gypsum sand dune fields of White Sands National Monument. A regional topographic map is provided as Figure 2.1.

2.1 CLIMATE

The climate in the Tularosa Basin is arid, with low annual rainfall and low relative humidity. The surrounding mountain ranges greatly influence the local weather. They modify approaching weather systems and provide orographic lifting, which produces summer thunderstorms.

Holloman AFB receives most of its total annual rainfall from thunderstorm activity from May through October. Winter is generally dry and is characterized by clear skies and erratic snowfall. The period from March through May is characterized by strong southerly wind flow and periods of blowing dust and sand. Mean annual precipitation is 7.9 inches. The mean annual lake evaporation rate, commonly used as an estimate of the mean annual evapotranspiration rate, is approximately 67 inches per year. As presented by Huff in the 49th Annual New Mexico Water Conference Proceedings (WRRI, 2005), approximately 30,000 acre-feet/year of groundwater left the Tularosa basin through evapotranspiration under 1995 conditions.

2.2 GEOLOGY

The Tularosa Basin is the easternmost extension of the Basin and Range Province of the western United States. It was created by Cenozoic extensional, or normal, faulting of a sequence of Precambrian- through Tertiary-age sedimentary and igneous rocks. These rocks are exposed in the fault scarps bounding the basin floor. The basin is a graben, or downthrown block, bounded by the upthrown fault blocks of the San Andres and Sacramento Mountains. A geologic map of the Tularosa Basin is provided as Figure 2.2; a generalized cross-section of the Basin is provided as Figure 2.3.

During the Permian period of the Paleozoic era (approximately 270 million years ago), southern New Mexico was covered by a shallow sea. Limestone and sandstone were deposited, forming thick sedimentary units. Toward the end of the Mesozoic era (approximately 70 million years ago), major mountain building activities formed the Rocky Mountains. During these events, southern New Mexico emerged from the ocean as the earth's crust upwarped gently in that area. During the Cenozoic era (beginning approximately 70 million years ago), basin and range formation was initiated in what is now the southwestern United States. Approximately 10 million years ago, Cenozoic faulting formed the graben structure known as the Tularosa Basin. During this process, arched portions of rock collapsed between large-scale, north-south trending faults. The Tularosa Basin is a central downthrown area, bounded on the east and west by fault block mountains. Bedded Permian strata can be seen along the faces of the Sacramento and San Andres Mountains. Permian limestones also occur west of the Base in a low bedrock outcrop near Hurtz Spring. Sediments have been filling the basin continuously since its formation.

Recently (less than 10 million years ago), lava flows erupted along existing fault planes created during active basin development. The Carrizozo lava flow north of the Base is an example of such an eruption.

Permian Huew and Yeso Limestones are exposed in a north-south bedrock high beginning south of Holloman AFB in the Jarilla Mountains and trending north through Tres Hermanos and Twin Buttes. The bedrock high extends through a small outcrop near Hurtz Spring west of the Base and through Tularosa Peak on the Base north of the test track. A schematic east-west cross-sectional view of the southern basin is shown in Figure 2.3. The bedrock outcrops represent a large, buried, down-faulted block. The fault block is tilted to the east

slightly and plunges to the north. The fault is en-echelon to the basin-forming fault at the base of the Sacramento Mountains. The fault is buried by sedimentary deposits in the Holloman area, but is suspected to trend north-south in line with the bedrock outcrops described. This tilted fault block divides the larger Tularosa Basin/White Sands area from the Alamogordo sub-basin. The schematic cross-section shows the relationship between the Tularosa Basin and Alamogordo sub-basin. West of Holloman AFB (near Hurtz Spring), the main Tularosa Basin begins. It is bounded on the east by the near-vertical fault associated with the bedrock high between the Alamogordo sub-basin and the main Tularosa Basin, and on the west by the fault at the foot of the San Andres Mountains. Fault scarps and aligned springs are the predominant physical expression of this faulting. Shallow Permian rocks, including the Yeso and Hueco Formations, are the groundwater source for these springs. The Yeso Formation outcrops several hundred feet south of Hurtz Spring.

The Tularosa Basin is a bolson, or a basin that has no surface drainage outlet. Bolson deposits refer to sediments carried by water into a closed basin. The bolson fill in the Tularosa Basin is derived from the erosion of limestone, dolomite, and gypsum in the surrounding mountains. Coarser material is deposited at the base of the mountains while finer material is carried to the basin's interior. The bolson fill deposits thin out from Alamogordo toward the western edge of the sub-basin, ranging in thickness from 4,000 feet near Alamogordo to less than 100 feet near Hurtz Spring. Bolson fill deposits are 8,000 feet thick or more in the central portion of the Tularosa Basin.

Near-surface geologic conditions at Holloman AFB have been established during previous investigations. The near-surface bolson deposits consist of sediments that are of alluvial, eolian, and lacustrine or playa origin. Alluvial fan deposits are characteristically laterally discontinuous units of interbedded sands, silts, and clays. The eolian deposits consist of gypsum sands. The eolian and alluvial fan deposits are often indistinguishable, because the wind simultaneously reworks alluvial fan sediments and deposits gypsum sands, resulting in an intermingling of the two. Lacustrine or playa deposits in the area consist of medium to high plasticity clays containing gypsum crystals and other salts. Lacustrine deposits are juxtaposed with alluvial fan and eolian deposits throughout the Base. A generalized cross section across the Base is provided as Figure 2.4. The uppermost deposits (generally top 15 feet) at the Base are typically silty sands, grading vertically and laterally into silts and small lenses of clay and sand. These are typical alluvial fan sediments, which commonly exhibit lateral variability because they are deposited as lobes. A 5 to 8-foot thick clay unit grades laterally into silty, clayey sand, which underlies the alluvial sediments. These are lacustrine or playa deposits, which typically display less vertical variability than alluvial deposits but are also laterally discontinuous. These lacustrine clays are almost always highly plastic and contain abundant gypsum crystals. Below the lacustrine clays, sands grade into silty sands and are underlain by silts. Lenses/beds of lacustrine clay underlie these sediments.

2.3 SOILS

The United States Department of Agriculture (USDA) Soil Conservation Service has identified two soil associations in the vicinity of Holloman AFB: the Holloman-Gypsum Land-Yesum complex and the Mead silty clay loam. The permeability of these soil horizons ranges from 4×10^{-4} to 1×10^{-3} centimeters per second (cm/sec). Figure 2.5 shows the distribution of the soil types in the vicinity of Holloman AFB, according to the USDA Soil Conservation Service Soil Survey of Otero Area, New Mexico (USDA, 1981).

Most of the surficial soils at the Base are the well-drained, sandy loam and gypsum of the Holloman-Gypsum Land-Yesum complex. The soils of this association are formed from alluvial and eolian gypsiferous sediments. The Holloman unit makes up about 35 percent (%) of the complex. It is a light brown to pink, very fine, sandy loam with a high gypsum content. The soil is moderately permeable, calcareous, and mildly to moderately alkaline. The Gypsum Land unit makes up about 30% of the complex. It is soft to hard, white gypsum, typically overlain by less than one inch of very fine, sandy loam. The Yesum unit, which makes up 20% of the complex, is light brown to pinkish-white, very fine sandy loam that is also high in gypsum. It is moderately permeable, calcareous, and mildly alkaline (USDA, 1981).

The Mead silty clay loam soil occurs over a small area of the Base. This soil consists of reddish-brown, silty clay loam, clay loam, and clay with a high salt content. It is derived from fine grained alluvium deposited over lacustrine sediments. The soil has low permeability and available water capacity is low. It is moderately calcareous and moderately to strongly alkaline. The soil has a layer of salt that is more soluble than gypsum (USDA, 1981).

2.4 SURFACE WATER

The Tularosa Basin is a closed basin with no surface water drainage. Water is lost to evaporation, transpiration, and infiltration, or collects in Lake Lucero, the lowest point in the basin located approximately 20 miles southwest of Holloman AFB.

The Base is crossed by several southwest-trending arroyos as shown in Figure 2.6, which control surface drainage in the undeveloped part of the Base. These arroyos are: Hay Draw, in the far northern part of the Base; Malone Draw and Ritas Draw, which drain into Lost River; and Dillard Draw to the east, which runs in a southwesterly direction near the southern boundary of the Base toward the sewage lagoons. Lost River, the largest arroyo, is dammed near the western boundary of the Base to prevent runoff from the Base from entering White Sands National Monument. Runoff from Lost River, Malone Draw, and Ritas Draw collects in the dammed area and either evaporates or infiltrates.

2.5 HYDROGEOLOGY

Groundwater occurs in unconfined conditions in the unconsolidated bolson deposits beneath Holloman AFB. The primary source of recharge for groundwater in the bolson aquifer is percolation of rainfall and stream infiltration through the coarse, unconsolidated alluvial fan deposits along the western flank of the Sacramento Mountains. Water migrates downward into the bolson fill aquifer and flows downgradient through progressively finer-grained sediments into the basin. The depth to groundwater decreases from 270 feet (or more) near the mountains to less than 5 feet to 50 feet below the ground surface (bgs) at Holloman AFB. The hydraulic gradient is steep in the recharge zones at the base of the mountains, but then flattens out as groundwater migrates into the valley. Results of the 1992 RI indicated that groundwater gradients at the Base are very low, ranging from about 9×10^{-4} to 7×10^{-3} feet per foot (ft/ft). Groundwater discharge occurs through evapotranspiration, springs or seeps along steep-sided arroyos, or into closed playa lakes such as Lake Lucero, the regional groundwater discharge area.

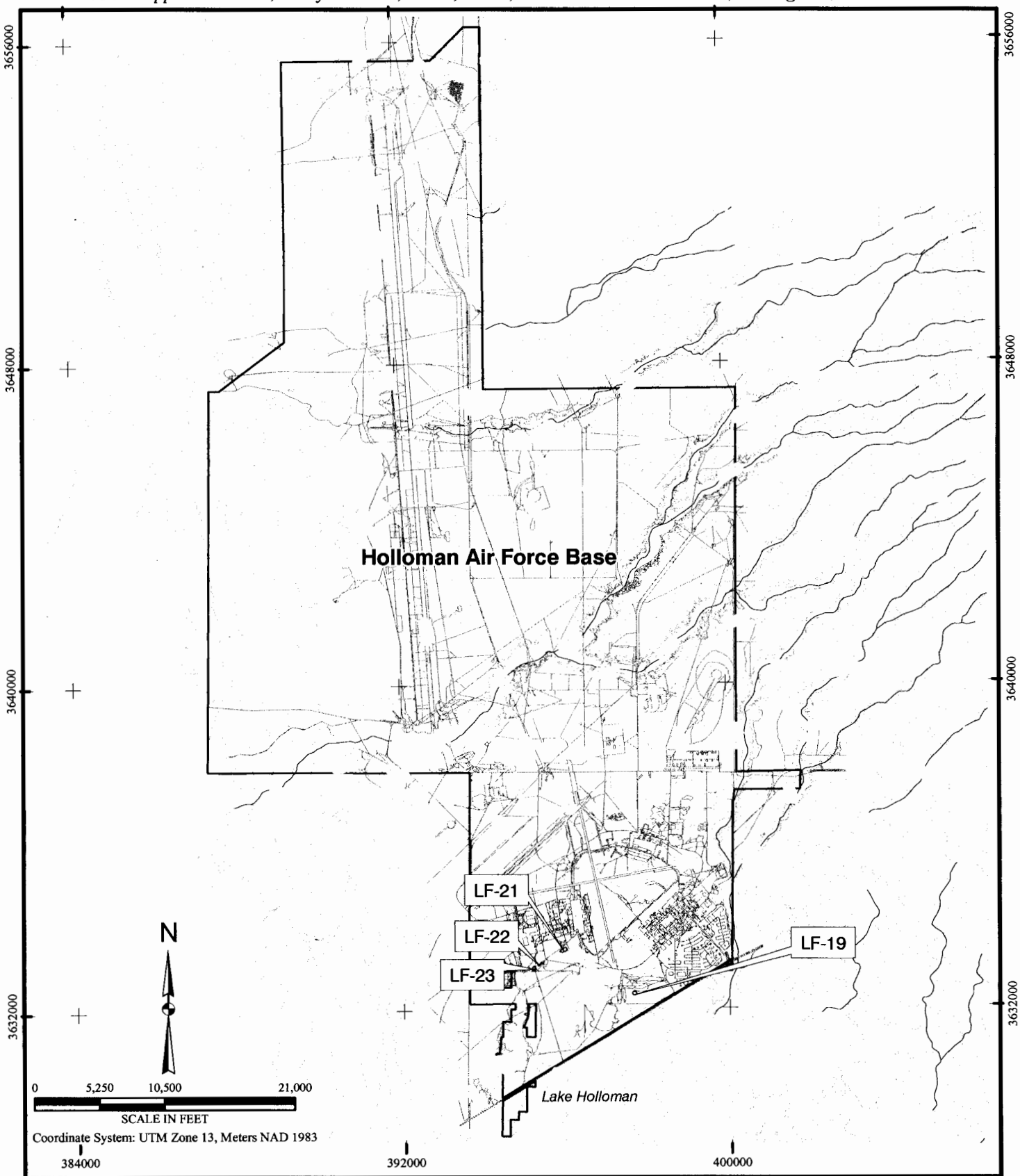
Groundwater flow direction at Holloman AFB is influenced by the surface water flow along southwest trending arroyos. In general, groundwater flow direction is west and southwest depending upon the immediate proximity of these drainage features; a basewide regional groundwater elevation contour map is provided as Figure 2.7. In the southeastern portion of the Base, regional groundwater flows southwest, following the Dillard Draw surficial drainage system. In the northern portion of the Base, groundwater flows to the west, following the Ritas Draw, Malone Draw, and Lost River drainages. An apparent groundwater divide exists between these two drainage subsystems. The greatest local effects on groundwater flow direction occur at sites located closest to the arroyos.

Hydraulic conductivity estimates were derived from slug tests performed during previous investigations. These estimates and estimates of seepage velocity are presented on a site by site basis in the site-specific sections of this report.

Groundwater in the Tularosa Basin is of potable quality at the recharge areas in close proximity to the Sacramento Mountains, but becomes increasingly mineralized as it flows downgradient toward the interior of the basin. This natural degradation of water quality can be attributed to slow groundwater migration from recharge to discharge areas and the presence of readily soluble minerals in the bolson sediments. The groundwater beneath Holloman AFB is considered unfit for human consumption because it naturally exceeds total dissolved solids (TDS) and sulfate thresholds. TDS values presented in the 1992 RI report ranged from 1,600 milligrams per liter (mg/L) to 66,000 mg/L, averaging over 17,000 mg/L (Radian, 1992a). Sulfate and chloride average concentrations were on the order of 4,000 mg/L and 6,000 mg/L, respectively (Radian, 1992a). Using the *Guidelines for Groundwater Classification Under the EPA Groundwater Protection Strategy* (USEPA, 1986), the groundwater at Holloman AFB can be classified as IIIB, i.e. not a source or a potential source of drinking water. Class III groundwater is characterized as having a TDS concentration greater than 10,000 mg/L and a low degree of interconnection to adjacent surface waters or groundwaters of a higher class.

This page was intentionally left blank.

FIGURES

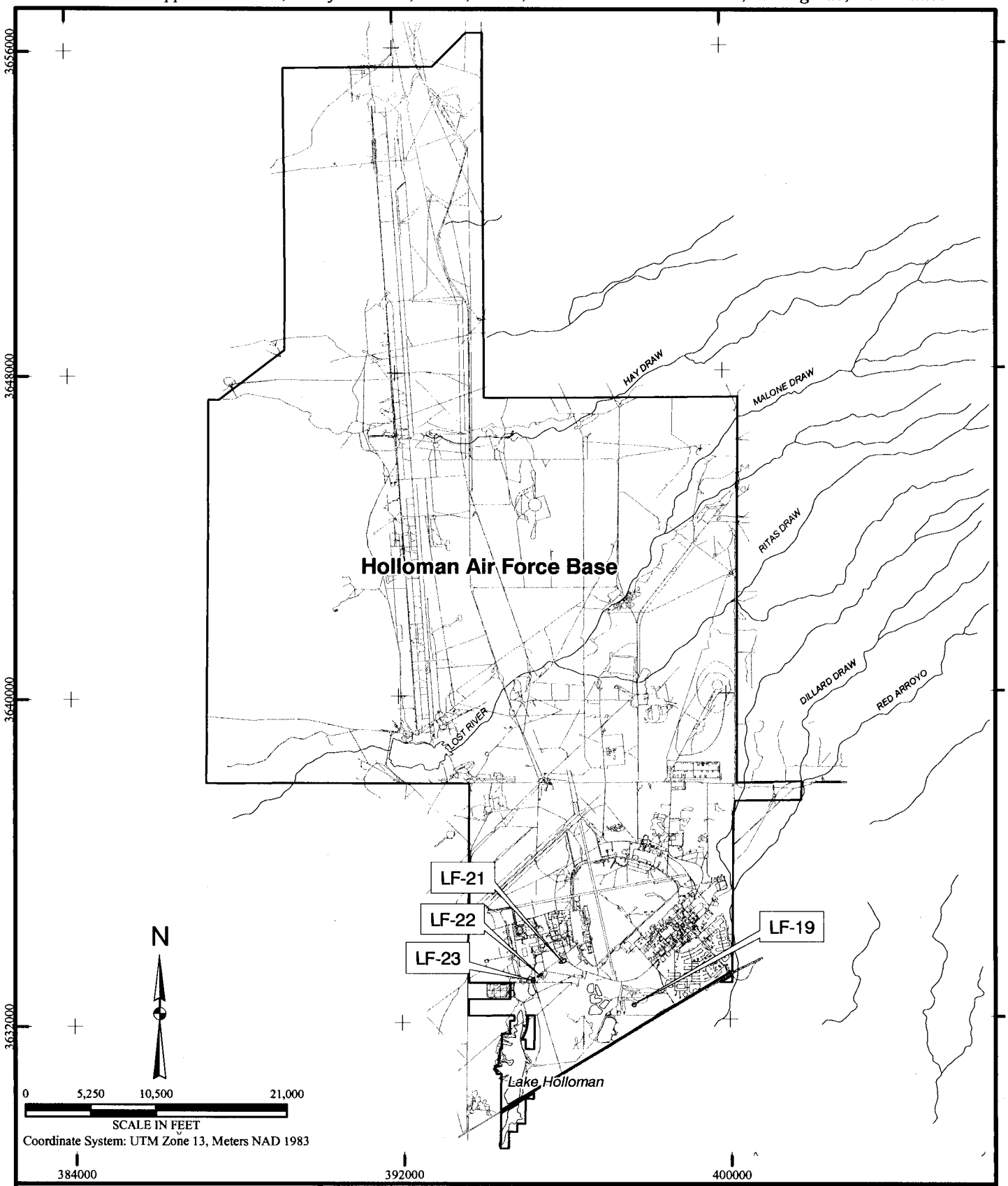


Filename: X:/AFC002/Holloman_AFB/Maps/TO37/LF_19_21_22_23_Supp_RFI/Site_topo.mxd
Project: AFC002-037-04-09-05
Revised: 09/25/06 BF
Map Source: Holloman AFB

Legend

- Holloman AFB Boundary
- Drainage Feature
- Facility Road
- Building/Structure
- Operable Unit Boundary (Approx.)
- Topographic Contour

Figure 2.1
Facility
Topographic Map
Holloman AFB

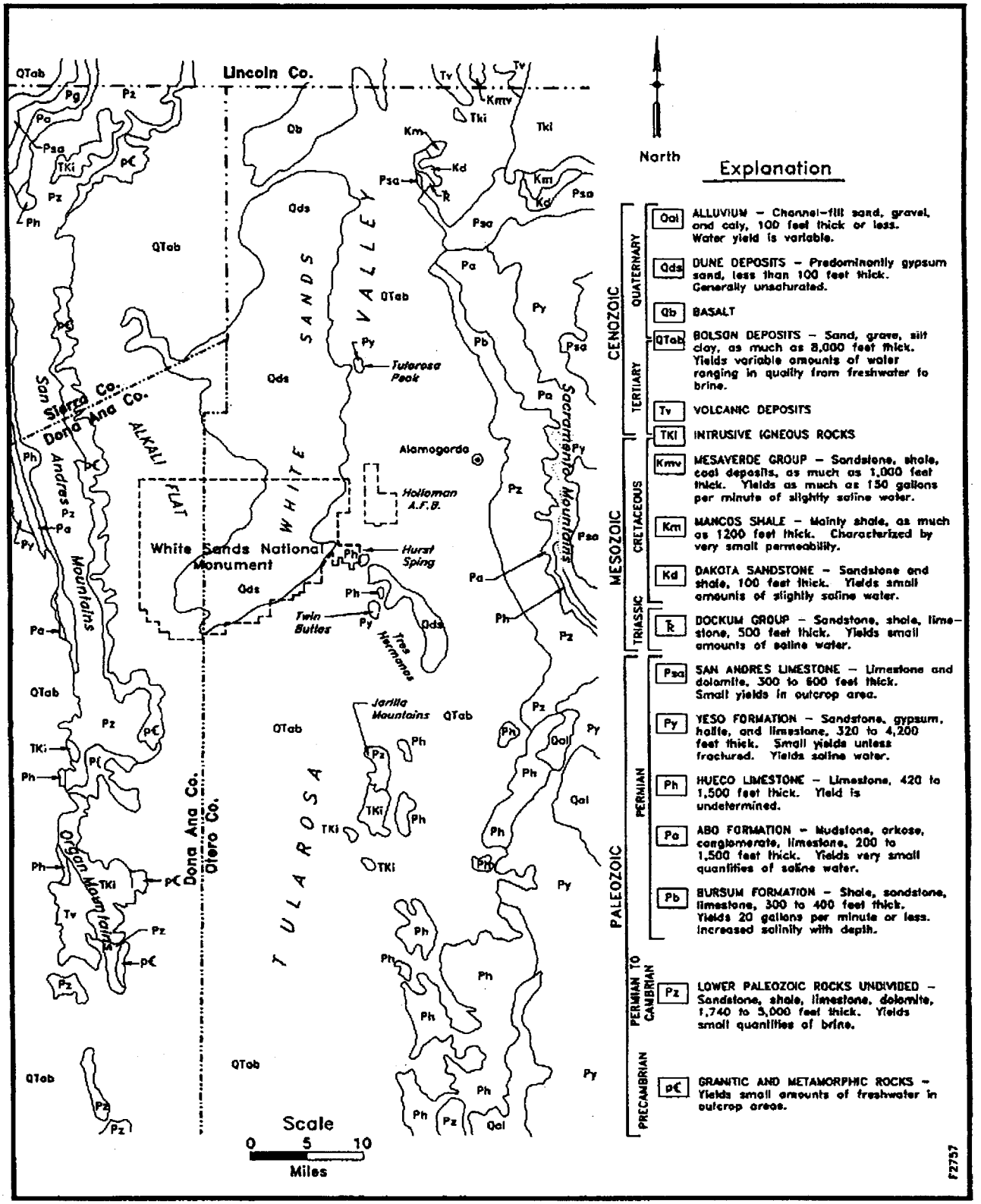


Filename: X:/AFC002/Holloman_AFB/Maps/TO37/LF_19_21_22_23_Supp_RFI/Surface_Drainage.mxd
Project: AFC002-037-04-09-05
Revised: 09/25/06 BF
Map Source: Holloman AFB

Legend

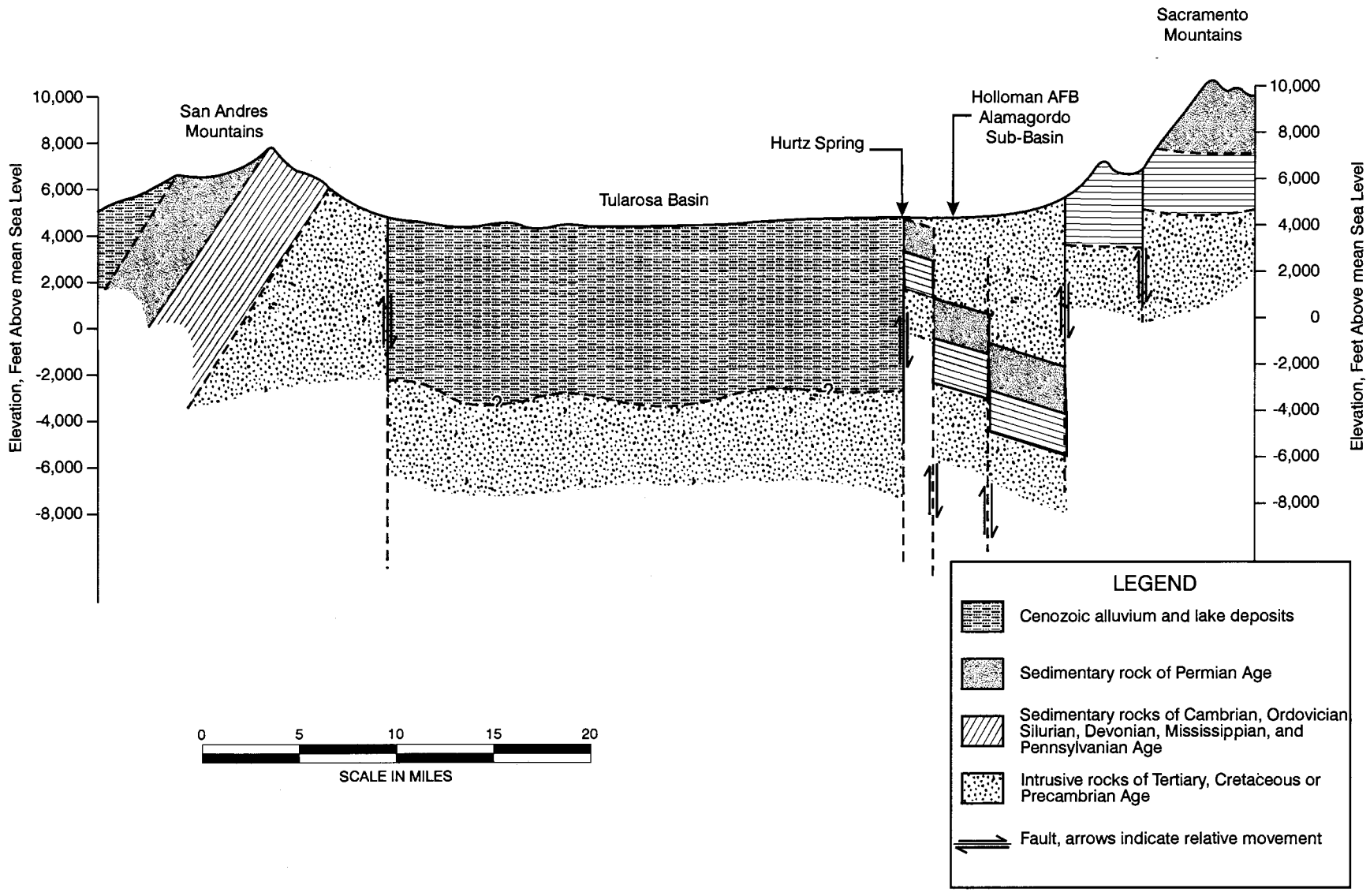
- Holloman AFB Boundary
- Drainage Feature
- Facility Road
- Building/Structure
- Operable Unit Boundary (Approx.)

Figure 2.2
Surface Drainage
Holloman AFB



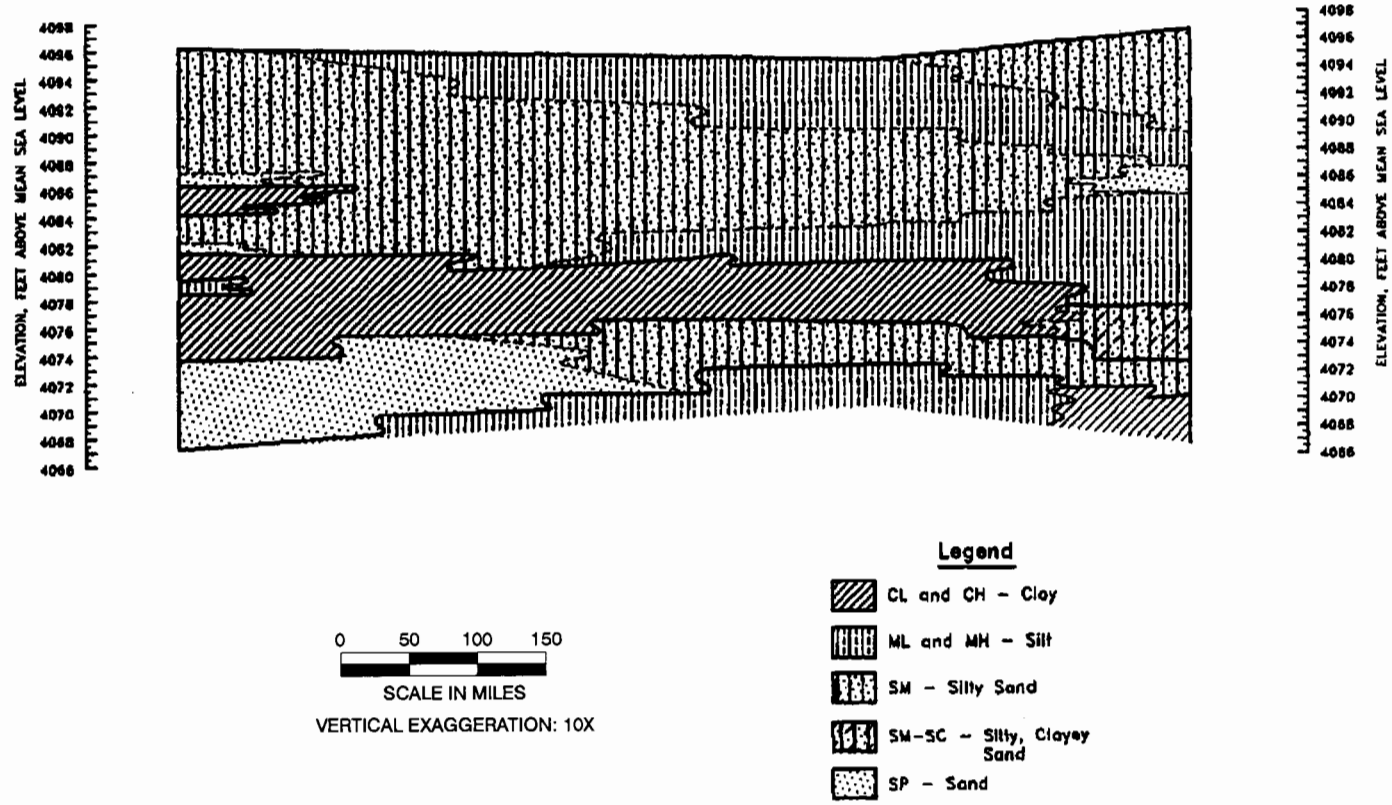
Filename: X:/AFC002/Holloman_AFB/Maps/TO37/LF_19_21_22_23_Supp_RFI/geo_site-map
Project: AFC002-037-04-09-05
Revised: 09/25/06 BF
Source: Orr and Myers, 1986

Figure 2.3
Geologic Map of the Tularosa Basin



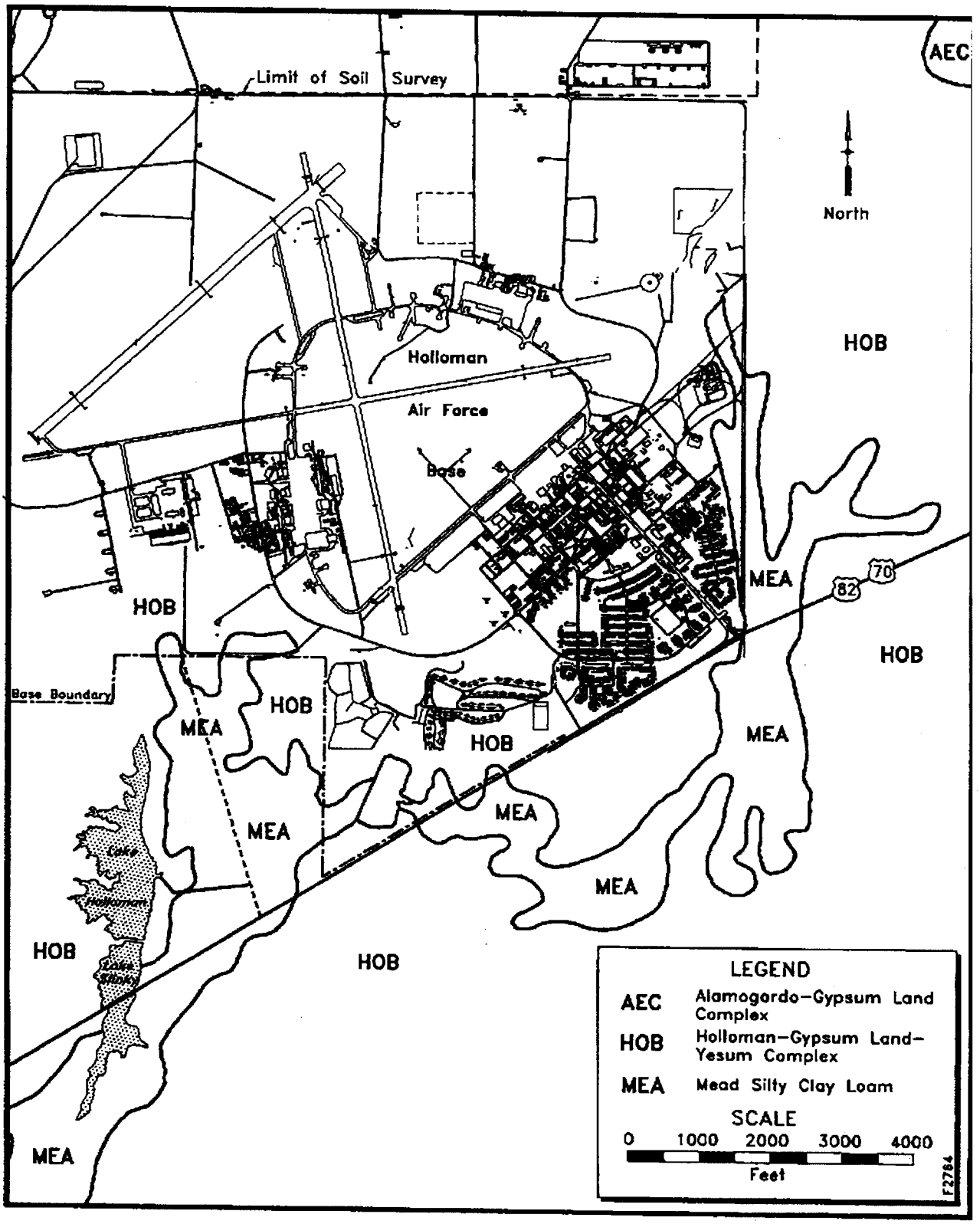
Filename: X:/AFC002/Holloman_AFB/Maps/TO37/LF_19_21_22_23_Supp_RFI/general_xsection.cdr
Project: AFC002-037-04-09-05
Revised: 09/25/06 BF
Source: Radian, 1992

Figure 2.4
Generalized Cross Section
Tularosa Basin



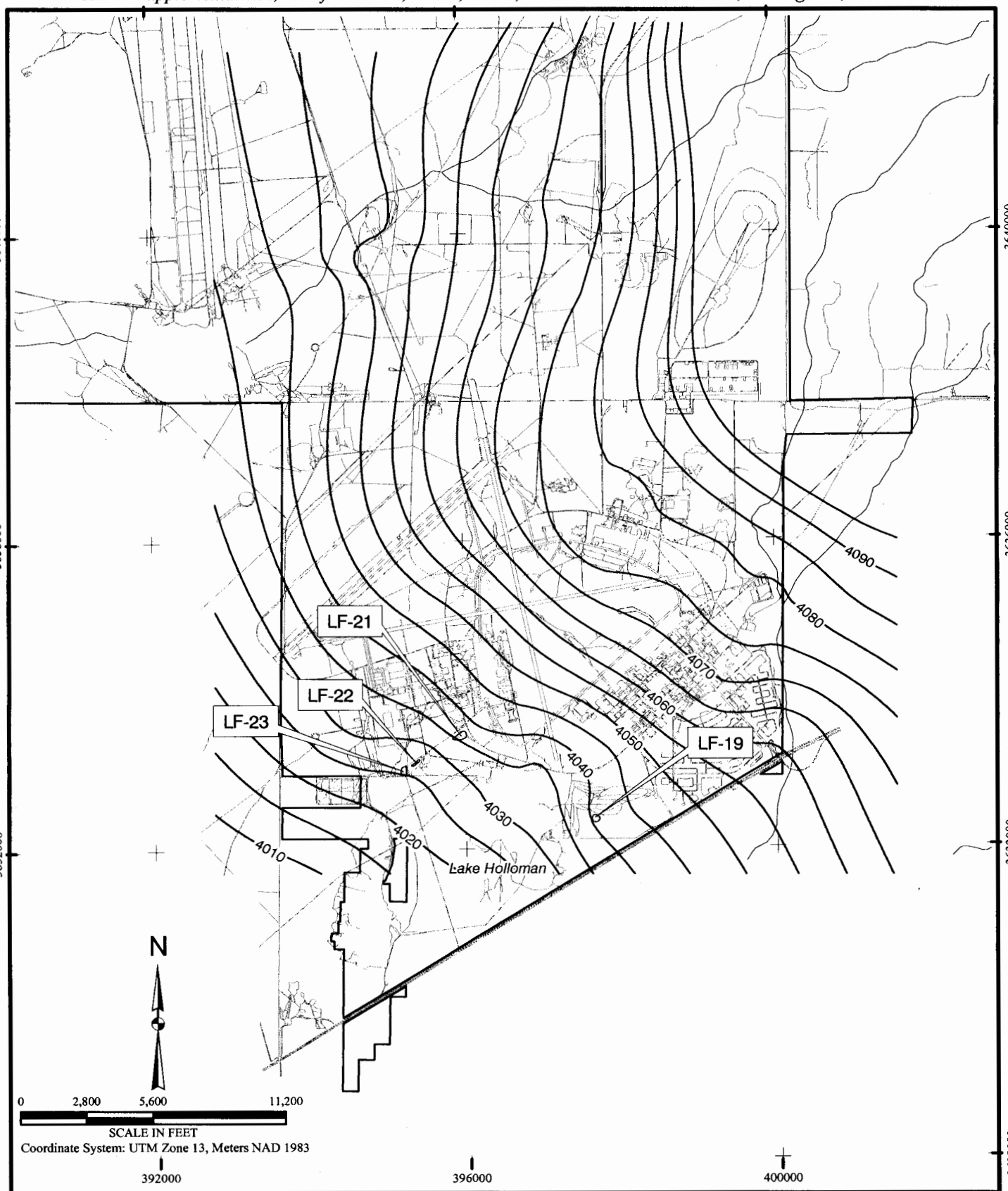
Filename: X:/AFC002/Holloman_AFB/Maps/TO37/ LF_19_21_22_23_Supp_RFI/near-surface_xsection.cdr
Project: AFC002-037-04-09-01
Revised: 09/25/06 BF
Source: Radian, 1992

Figure 2.5
Generalized Near-Surface Geologic Cross Section
Holloman AFB



Filename: X:/AFC002/Holloman_AFB/Maps/TO37/LF_19_21_22_23_Supp_RFI/Site_Soils.cdr
Project: AFC002-037-04-09-05
Revised: 09/25/06 BF
Source: USDA, 1981

Figure 2.6
Distribution of Soils
Holloman AFB



Filename: X:/AFC002/Holloman_AFB/Maps/TO37/LF_19_21_22_23_Supp_RFI/Regional_GW.mxd
Project: AFC002-037-04-09-05
Revised: 09/25/06 BF
Map Source: Holloman AFB

Legend

- Holloman AFB Boundary
- Building/Structure
- Operable Unit Boundary (Approx.)
- –4010– Groundwater Contour 1993 (ft MSL)

Figure 2.7
Groundwater Elevation Contour Map
Holloman AFB

3.0 INVESTIGATION ACTIVITIES

The supplemental RFI field activities conducted at LF-19, LF-21, LF-22, and LF-23 were designed to satisfy NMED's requirements for additional characterization prior to approving No Further Action under NMED Criterion 5, namely that the site has been adequately characterized and the available data indicate that contaminants pose an acceptable level of risk under current and projected future land use. Specifically, NMED requested that the additional characterization activities include the following:

- Further refine the landfill boundaries;
- Characterize the landfill waste material (if present); and
- Quantitatively evaluate the soil quality beneath the landfill if hazardous materials were found in the landfill.

To satisfy the above investigation requirements, a two phased supplemental RFI was conducted at the four landfills. The Supplemental RFI for the landfills consisted of a geophysical survey (Phase I) followed by trenching and soil sampling, if warranted (Phase II). The geophysical survey results (Phase I) were used to refine landfill boundaries, locate potential disposal areas within the landfills, and potential contaminant hotspots that would then be targeted for trenching and, if applicable, soil sampling. All field activities were conducted according to the project work plans (HGL, 2005a 2005b, and 2006b) as refined during a NMED site visit (HGL, 2006c). Minor deviations to the proposed work occurred and are described in detail below and in the site-specific sections of this report.

3.1 GEOPHYSICAL SURVEYING

Non-invasive geophysical surveying, consisting of a terrain conductivity survey and magnetic survey, was conducted at the four landfills in late September and early October 2005 to delineate the landfill boundaries, identify potential waste disposal locations within the landfill boundaries, and determine the presence/absence of subsurface magnetic anomalies that would be targeted for investigation during the trenching phase of the investigation.

The geophysical survey results were presented in a technical memorandum (HGL, 2006b), submitted to NMED in January 2006 as Appendix A of the Response to Notice of Deficiency (NOD), Supplemental RFI Work Plan (HGL, 2006a). The technical memorandum described the geophysical survey field activities, discussed the results of the surveys, and presented conclusions and recommendations based on the data.

The information, results, and conclusions provided in the technical memorandum are included below and in the associated site-specific sections of this report. In addition, a copy of the geophysical survey report is included in this report as Appendix A.

3.1.1 Terrain Conductivity Surveying

A Geonics Limited Model EM-31 Mark2 terrain conductivity instrument was utilized to measure lateral soil conductivity changes at the sites. Due to the high naturally conductive

soils encountered at Holloman AFB, the metal-detection (in-phase) component of the electromagnetic survey was adversely and significantly compromised and could not be used as proposed in the RFI work plan. Consequently, the electromagnetic survey strategy was modified to utilize only the quadrature (conductivity) component of the electromagnetic method. A magnetometer was used to detect buried metallic debris as described in the next section.

The EM-31 Mark2 system operates on magnetic induction and Maxwell's Law, whereby an electromagnetic field is transmitted through the soil, and the associated electrical field current is ultimately picked up by the receiver and correlated directly to soil conductivity. The Mark2's fixed intercoil spacing of 3.66 meters (12 feet) produces an ellipsoidal electromagnetic field that is approximately 20 feet wide and 40 feet high and typically penetrates subsurface soils to a depth of 20 feet and laterally 10 feet.

At LF-23, the electromagnetic survey was conducted on 10-foot line spacing. At LF-19, LF-21, and LF-22, the electromagnetic surveys were conducted utilizing a 20-foot line spacing. A 2 reading per second sampling rate was employed for all seven electromagnetic surveys, which translates to a station spacing of every 1.5 feet along each line.

3.1.2 Magnetometer Surveying

Geometrics, Inc. Model G-858 and Model G-856 total-field magnetometers were utilized for magnetic surveying at the sites. The G-858 magnetometer with a single sensor total-field configuration was utilized for surveying activities. The G-856 unit was employed strictly as a site-specific fixed based station, recording changes in the Earth's daily (diurnal) magnetic field when magnetic surveys were being conducted. Readings from the fixed base station surveys were subsequently used to correct the total-field magnetic survey data for diurnal changes, yielding true residual data.

Calibration testing of the G-858 magnetometer at Holloman AFB indicated that a 2-meter line spacing provided 100% survey coverage. Therefore, a 2-meter line spacing was employed. A 10 reading per second sampling rate, translating to a station spacing of 0.3 feet, was selected for the magnetic surveys.

3.1.3 Global Positioning

A Trimble ApGPS 132, a high-performance Global Positioning System (GPS) receiver was utilized to provide precision guidance of the survey lines during the magnetometer and terrain conductivity surveys. GPS surveys typically have an accuracy of $\pm$ 0.5 meters.

3.1.4 Geophysical Survey Data Processing

No post-survey data processing was performed on the EM-31 data. Post-survey processing of the magnetic data included: global dropout removal, global duplicate time removal, global spike removal, custom range despiking, GPS offset, correction for diurnal magnetic field changes, and heading error removal.

3.2 TRENCHING ACTIVITIES

3.2.1 Trenching

Trenching activities were initially proposed in Section 3.2 of the project workplan (HGL, 2005a) and refined in Section 5 of the Technical Memorandum provided with HGL's response to the NOD (HGL, 2006b). Proposed trench locations targeted magnetic anomalies and landfill boundaries identified from the geophysical surveys. Three trenches were proposed at LF-19, 7 at LF-21, 3 at LF-22, and 4 at LF-23. During an April 24, 2006 site visit, NMED requested several additional trenches and "spot trenches" (herein referred to as "test pits") at LF-19 and LF-21 (HGL, 2006c). Specifically, the total number of trenches at LF-19 was increased from 3 to 4, and 1 test pit was added. The total number of trenches at LF-21 was decreased from 7 to 3, with addition of 4 test pits to replace the trenches. NMED requested no changes to the number of trenches proposed for LF-22 or LF-23. In addition, NMED requested trench lengths be increased from the proposed 30 feet to range between 30 and 100 feet and test pits to be 20 feet in length.

Trenching was conducted at the four landfills between May 17 and May 22, 2006. All trenches and test pits were completed using a track-mounted excavator fitted with a 3 foot wide, toothed bucket. An additional test pit was completed at LF-19 based on the presence of surface debris observed during a visual inspection of the site prior to initiating trenching activities. Trench lengths ranged from 40 to 117 feet, while test pit lengths ranged from 20 to 45 feet. Specific information on individual trenches and test pits completed at the landfills is included in the site-specific sections of this report.

During propagation of the trenches/test pits, excavated soils and trench/test pit side walls were visually inspected for evidence of stained soils, non-native soils (i.e., fill), leachate, landfill material, and containers potentially used for the storage and/or disposal of hazardous materials. In addition, a photoionization detector (PID) was used to field screen the excavated soils to detect the presence of organic vapors. All trenches and test pits were completed to maximum depths corresponding to one to two feet below the base of landfill material (if present) observed within the associated trench/test pit. After completion of a trench/test pit, the excavated soils were backfilled into the trench/test pit in the same sequence as removed. The excavator was then used to compact the backfill in the trench.

3.2.2 Decontamination

Decontamination of the excavator bucket and all trenching equipment potentially coming into contact with excavated soils was conducted prior to and after each sample and between trenches. Decontamination activities consisted of brushing off loose soil followed by scraping soil that may have become adhered to the excavator bucket. The soil removal was conducted over the associated trench. After the soil was removed from the bucket, the bucket was washed with a potable water and detergent rinse followed by a potable water rinse. Decontamination activities were conducted over temporary decontamination pads set up at each site. The generated decontamination wash water was allowed to evaporate. Once the

contained water had evaporated, the temporary decontamination pads were deconstructed and disposed as municipal waste in a facility-approved waste receptacle.

3.3 TRENCH SOIL SAMPLING

Per the work plan (HGL, 2005a) as modified by the associated trenching plan (HGL, 2006b) and with NMED concurrence, trench soil sampling would be conducted only if hazardous materials were encountered. Hazardous materials included stained soils, unusual solids or fluids leaking from containers (e.g., drums, buckets, etc.) or free phase hydrocarbons. In a January 17, 2006 NOD letter, NMED specified that if soil samples were collected, samples should be collected immediately beneath the fill material and at the top of the underlying water table (NMED, 2006).

Soil samples were collected from only one trench completed at LF-19. The soil samples were retrieved from the trench using the excavator bucket; soil samples submitted for laboratory analysis were collected from the undisturbed soil contained within the bucket to minimize the potential for cross contamination. Information on LF-19 soil sampling is presented in Section 4 of this report.

In accordance with NMED requirements specified in the NMED January 2006 NOD (NMED, 2006), NMED was notified of the collected LF-19 soil samples and consulted to determine the appropriate analyses. After a review of the site data and inspection of the associated trench, the collected samples where submitted for NMED required analyses. Site-specific sampling activities are discussed in Section 4.

3.4 INVESTIGATION DERIVED WASTE

No investigation derived waste was generated during the Supplemental RFIs. All excavated soils were used to backfill the respective trenches. All decontamination water was allowed to evaporate.

4.0 LF-19 (SWMU 105) - GOLF COURSE LANDFILL

4.1 LOCATION

LF-19, the Golf Course Landfill, is located due south of Fairway 7 of the Holloman AFB golf course and approximately 800 feet north of the southern Base boundary. Access to the site is obtained via a partially asphalt-paved golf cart path and several unpaved service roads emanating from the golf cart path. The location of LF-19 with respect to the surrounding facility is shown on Figure 1.2. An aerial photograph of LF-19 is provided as Figure 4.1.

4.2 SITE DESCRIPTION

Landfill LF-19 is approximately two acres in size and encompasses two disposal units (herein designated as the "northern" and "southern" disposal units). The two disposal units are separated by a narrow, shallow, man-made drainage ditch that trends northeast to southwest. Both disposal units are unpaved, primarily undeveloped, and partially vegetated.

The largest portion of LF-19 is comprised of the northern disposal unit, which lies immediately south of the golf course. This unit is bounded to the north and northeast by the asphalt-paved golf cart path; to the east by a fenced-in cactus garden, a small salt cedar grove, and an aggregate (i.e., sand) stockpile; to the south by the shallow, man-made drainage ditch; and to the west by undeveloped, moderately vegetated land. The majority of the northern disposal unit is open, unpaved, and primarily clear of vegetation. Vegetation consisting of salt cedars, shrubs, and grasses is located primarily along the periphery of the northern disposal unit. The golf course historically and currently uses the northern disposal unit for the exterior storage of golf course materials and supplies. At the time of the supplemental RFI field investigation, sand and mulch piles, slashed vegetation, and grass clippings were observed. Minor amounts of concrete rubble were present in the southwestern portion of the disposal area while scrap metal and degraded metallic corrugated piping was present southeast of the unit. The slashed vegetation and grass clippings were present in the southern portion of the disposal unit.

The southern disposal unit is located immediately south of the northern disposal unit, across the narrow, shallow, man-made drainage ditch. This disposal unit is characterized primarily by a long, linear, east-west trending mound ranging approximately 2 feet above the surrounding topography, approximately 150 feet south of the man-made drainage ditch. The area between the mound and the drainage ditch is relatively flat, moderately vegetated with shrubs, and criss-crossed by several unpaved service roads. Sporadic amounts of scrap metal were observed on the surface of the mound. North of the mound, the ground was also sporadically littered with scrap metal. To the south of the debris mound, little to no debris was observed.

Photographs of LF-19 are included in Appendix B.

4.3 WASTE HISTORY

LF-19 was in operation for approximately 10 years between 1968 and 1978. The landfill was used primarily as a disposal site for golf course grass clippings; however the RFA indicated that unused rodenticides may have been disposed at the landfill. No other information has supported the potential disposal of unused rodenticides at LF-19.

4.4 ENVIRONMENTAL SETTING

4.4.1 Topography

The northern disposal unit of LF-19 is situated on a south facing slope. The upper portion of the northern disposal unit is relatively flat with a slight southerly dip, having been partially improved by golf course maintenance activities. Further south, the slope of the northern disposal area becomes more pronounced and terminates at the man-made drainage ditch which runs the entire length of the unit's southern boundary.

The topography of the southern disposal unit, with the exception of the linear mound, is relatively flat. The mound reaches approximately 2 feet above the surrounding grade. South of the mound, the topography is relatively flat and appears to be less disturbed as the distance from the site increases.

4.4.2 Geology

Site-specific LF-19 geologic information provided herein has been compiled from subsurface lithologic data obtained during the 1992 RFI (Radian, 1992a) as well as from this supplemental RFI. In 1992, one upgradient, MW-19-01, and two downgradient monitoring wells, MW-19-02 and MW-19-03, were installed, providing subsurface lithology information north and south of the landfill. During this supplemental RFI, four trenches and two test pits were completed, yielding shallow subsurface soil data within and immediately below the landfill.

The subsurface soils beneath LF-19 appear to be highly heterogeneous, ranging from silty sand, sand, silt, and clay. The northern disposal unit is underlain primarily by silty sand to at least 5.5 feet bgs. The silty sand unit is underlain by discontinuous sand and clay lenses that thin to the south. Beneath the southern disposal unit, the area is underlain by a thin silty sand unit, ranging from one to several feet in thickness. In the vicinity of MW-19-02, the silty sand unit is underlain by a 2.5 foot thick discontinuous clay lens from approximately 1 to 3.5 feet bgs. Beneath the clay lens, silty sand was encountered to the maximum investigated depth of 14 feet bgs. To the southeast, the silty sand unit grades into a silt, sand, silt layered unit.

Within the northern disposal unit, no landfill material was encountered in the shallow subsurface. Three trenches (HGLTR19-02 through HGLTR19-04) and one test pit (HGLTP19-02) were completed to a maximum depth of 5 feet bgs. Trench HGLTR19-02 was completed through the area used to stockpile sand and mulch, while trench HGLTR19-04 and test pit HGLTP19-02 were completed in the area covered with grass clippings and a few pieces

of concrete rubble. Beneath the stockpiles of mulch, sand and grass clippings, a brown to beige, loose, silty sand containing pea-gravel was encountered at the surface to approximately 1 to 2 feet bgs. This silty sand unit was underlain by a light gray brown to orangish-brown, silty sand to the maximum trench depth of 4 feet bgs. These soils appeared to be completely undisturbed, and no landfill debris, including organic detritus, was encountered in any of the trenches or test pit. In addition, no organic vapors were noted during field screening activities conducted with a PID on the excavated soil.

One trench (HGLTR19-01) and one test pit (HGLTP19-01) was completed in the southern portion of LF-19. The soils observed in the southern portion of LF-19 were similar to the soils observed in the northern disposal area except in the linear mound. Within the mound, the soil was composed of brown to dark brown, silty sand with debris consisting of organic detritus, heavily corroded piping, plastic sheeting, and minor amounts of scrap metal. The debris was present from the surface to approximately 2 feet bgs, the depth associated with the grade of the surrounding topography. Beneath the fill material, light gray brown to orangish-brown, silty sand was observed. No organic vapors were detected with a PID.

Groundwater was not encountered in any of the trenches or test pits completed at LF-19. A cross section of LF-19 is included as Figure 4.2. Trench and test pit logs are included in Appendix C.

4.4.3 Soils

The USDA Soil Conservation Service has identified two soil associations in the vicinity of Holloman AFB: the Holloman-Gypsum Land-Yesum complex and the Mead silty clay loam. The permeability of these soil horizons ranges from $4x10^{-4}$ to $1x10^{-3}$ cm/sec (USDA, 1981).

Based on the Soil Conservation Service Soil Survey of Otero Area, New Mexico, LF-19 is underlain by the Holloman-Gypsum Land-Yesum complex. The soils are formed from alluvial and eolian gypsiferous sediments. The Holloman unit makes up approximately 35% of the complex. The unit is light brown to pink, very fine, sandy loam with high gypsum content, moderately permeable, calcareous, and mildly to moderately alkaline. The Gypsum Land unit makes up to 30% of the complex and is soft to hard white gypsum typically overlain by less than one inch of very fine, sandy loam. The Yesum unit, comprising approximately 20% of the complex is light brown to pinkish-white, very fine sandy loam that is also high in gypsum. The unit is moderately permeable, calcareous, and mildly alkaline (USDA, 1981).

4.4.4 Surface Water

As stated in Section 4.2, a narrow, shallow, man-made drainage ditch separates the LF-19 northern and southern disposal units. The drainage ditch trends northeast to southwest and extends into and receives runoff from the Holloman AFB golf course. During supplemental RFI activities, the channel was dry and heavily vegetated with shrubs. No other surface water drainage features (e.g., ponds, creeks, channels) were observed crossing, emanating from, or lying adjacent to LF-19. Due to the unpaved condition of the site, precipitation falling onto

LF-19 would evaporate, infiltrate into the shallow subsurface, or discharge to the man-made drainage ditch.

4.4.5 Hydrogeology

Depth to groundwater at LF-19 has been observed in the site monitoring wells to range between 7 and 11 feet bgs. Based on the LTM sampling event conducted in 2003, groundwater flows in a south-southwesterly direction with a gradient of 0.005 ft/ft. Field slug tests conducted during the RI investigation yielded an average hydraulic conductivity of 1.34 feet per day (ft/day). Assuming a porosity of 30%, the groundwater velocity across LF-19 was estimated to be 0.022 ft/day or 8.15 feet per year (ft/yr) (Radian, 1992a). TDS at the site is greater than 10,000 mg/L.

Groundwater was not encountered in any of the trenches or test pits completed at LF-19.

4.5 PREVIOUS INVESTIGATIONS

A detailed discussion of the previous investigations conducted at LF-19 (i.e., the 1992 RI and five rounds of biennial LTM) is presented within the project work plan (HGL, 2005a). For completeness, a brief discussion of the previous investigations is presented below. Previous investigation analytical results are summarized on Table 4.1 (RI results) and Table 4.2 (LTM results).

4.5.1 LF-19 Remedial Investigation

The 1992 LF-19 RI consisted of the installation and sampling of three monitoring wells, MW19-01, MW19-02 and MW19-03. MW19-01 was installed upgradient of LF-19 in order to assess the local background groundwater quality. Monitoring wells MW19-02 and MW19-03 were installed downgradient of the northern and southern disposal units, respectively, to evaluate the groundwater quality emanating from the individual disposal units. Groundwater samples collected from the site monitoring wells were analyzed for VOCs, organochlorine pesticides, organophosphorus pesticides, polychlorinated biphenyls (PCBs), chlorinated herbicides, total metals, anions, and TDS.

No organochlorine pesticides, organophosphorus pesticides, PCBs, or chlorinated herbicides were detected in the groundwater samples. Methylene chloride, a common laboratory contaminant, was the only VOC detected; however, due to its detection in other non-site related wells, the VOC detection was considered representative of laboratory blank contamination. With respect to groundwater quality parameters and total metals, only chloride and cadmium were detected at concentrations exceeding New Mexico Groundwater Quality (NMGWQ) standards when compared to upgradient/background concentrations.

RI groundwater analytical results are presented in Table 4.1. Chloride, at a concentration of 20,000 mg/L, only slightly exceeded the background limit of 19,600 mg/L and is likely resultant from the high TDS (42,000 mg/L)) naturally present in the groundwater at this well.

The total concentration of cadmium in MW19-03, 11 micrograms per liter (μg/L), slightly exceeded the background limit of 8.3 μg/L and the NMGWQ standard for cadmium of 10 μg/L. It is important to note that the NMGWQ standard is based on dissolved, not total concentrations. Therefore, it is unlikely that chloride and cadmium concentrations reflect a release to groundwater from LF-19. The RI concluded that suspected wastes at LF-19 have not impacted the underlying groundwater.

A risk assessment was conducted to estimate the potential consequences to human health and the environment that could result if contamination at this site is not remediated. The risk assessment consisted for four basic steps: data analysis and selection of chemicals of concern; identification of exposure pathways and receptors (i.e., skin, ingestion, or inhalation); toxicity assessment or discussion of hazards and dose-response relationships associated with each contaminant; and quantification of potential carcinogenic and noncarcinogenic risks. A detailed description of the risk assessment is contained in the *Draft Final Risk Assessment Report for the Remedial Investigation-Investigation, Study and Recommendation for 29 Waste Sites* (Radian, 1992a).

The human health risks evaluated for this site were based on the possible exposure of off-base residents to contaminants in the groundwater reaching an agricultural well. This exposure does not currently exist; however, the hypothetical scenario was evaluated to ensure a conservative assessment of potential risks associated with this site. The only contaminants present at LF-19 that cause potential concern are antimony, cadmium, and lead. Since the contaminants of potential concern do not have any cancer factors, the carcinogenic risks are unable to be calculated. Carcinogenic risk characterization of the site indicates that adverse human health effects are unlikely.

For noncarcinogenic risk to be acceptable, the sum of the Hazard Index (HI) may not exceed a value of 1. The HI is the ratio of the chemical intake to a reference dose (the acceptable dose). The HI for the site is well below the value of 1, making the noncarcinogenic risk for off-base residential exposure within the acceptable range. Therefore, adverse health effects are not expected to result from exposure.

Environmental risk was evaluated using an environmental quotient (EQ). The EQ calculates the potential ecological risks associated with the contaminants of concern through the ingestion of soil and/or contaminated plants. EQs above a value of 1 represent the possibility of adverse environmental effects occurring from the intake of contaminants. No adverse ecological effects are expected to occur at sites with an EQ of less than 1. The EQ for the site was calculated at a value of 1.2×10^{-3} (or 0.0012), which indicates adverse environmental effects are unlikely to occur.

4.5.2 Long Term Groundwater Monitoring

Based on the results of the RI, Holloman AFB submitted a Decision Document (Radian, 1995) concluding a no action remedy was appropriate for LF-19. As part of the no action remedy, surface debris would be removed, a plat of survey would be produced, and LTM would be

conducted at the site at the request of NMED and USEPA. LTM activities would consist of the biennial collection and analysis of groundwater samples from the three onsite wells for 10 years to ensure any potential future release from the site would be detected. The collected groundwater samples were to be analyzed for VOCs, organochlorine pesticides, organophosphorus pesticides, chlorinated herbicides, and metals. The decision document was signed by the Holloman AFB base commander and NMED in September 1994.

LTM activities were initiated in 1995. A summary of the groundwater positive detections since LTM was initiated in 1995 is provided as Table 4.2. Modification of the required analyte list was conducted over the course of the LTM program due to lack of analyte detections. After the 1997 LTM event, NMED approved to discontinue monitoring of pesticides and herbicides. Subsequent analyte reductions reduced the requited analyte list to include only barium, iron, and manganese. With the exception of lead in the first round of sampling, no constituents in the downgradient wells were detected above background (i.e., upgradient) concentrations and NMGWQ standards. The 2003 LTM event marked the fifth biennial sampling event for LF-19. Consequently, within the 2003 LTM report, cessation of LTM and site closeout was recommended (Bhate, 2003).

4.5.3 Statement of Basis

In February 2004, Holloman AFB submitted a Statement of Basis (SOB) to NMED requesting no further action (NFA) status and a permit modification for the site. After an April 21, 2004 site visit, NMED informed Holloman AFB that LTM could be suspended; however, NFA for LF-19 would only be considered after additional characterization was performed at the site. Additional characterization requirements were discussed at the April 21, 2004 meeting and summarized in U.S. Air Force (USAF) correspondence dated May 21, 2004 (USAF, 2004) and NMED correspondence dated August 10, 2004 (NMED, 2004).

4.6 SUPPLEMENTAL RFI INVESTIGATION ACTIVITIES

4.6.1 Geophysical Surveying

A geophysical survey of LF-19 was conducted in September and October 2005. The geophysical survey of LF-19 included both a terrain conductivity survey and magnetic survey. Approximately six acres were surveyed, completely covering the 2 acre site. Prior to conducting the surveys, both disposal units were visually inspected. Within the northern disposal unit, a barbwire fence encloses a cactus garden, stockpiles of sand, soil, and slashed vegetation were present, and sections of drainage culvert and metal piping were observed in the southeastern portion of the northern disposal area. Within the southern disposal area, a few scattered pieces of metallic debris were observed on the surface of the shallow soil mounds.

The area included within the LF-19 geophysical survey is shown on Figures 4.3 (terrain conductivity survey map) and 4.4 (magnetic survey map). The results of the geophysical

survey and proposed trenching locations were presented to NMED in the response to NOD and finalized during the April 2006 NMED site visit.

4.6.2 Landfill Trenching

On May 22, 2006, four trenches (designated as HGLTR19-01 through HGLTR19-04) and two test pits (designated as HGLTP19-01 through HGLTP19-02) were completed at LF-19 as directed by NMED. Trench HGLTR19-01 was completed across the linear trending mound in the southern disposal area, an area containing multiple, small, and dispersed magnetic anomalies. Trenches HGLTR19-02 and HGLTR19-03 were completed in the northern disposal unit in the area used currently and historically for stockpiling sand, mulch, and gravel. Trench HGLTR19-04 was completed in an area of the northern disposal unit containing no magnetic anomalies but emitting high conductivity readings. During a visual inspection of this area, grass clippings, the primary waste reportedly disposed at LF-19, was observed covering the HGLTR19-04 area. Test pit HGLTP19-01 was completed adjacent to one robust magnetic anomaly, resulting from the presence of two metal pipes and one corrugated pipe, while test pit HGLTP19-02 was completed in an area covered with grass clippings. Test pit HGLTP19-02 was neither proposed in the project workplan nor requested by NMED during the April 24, 2006 site visit attended by NMED, Holloman AFB, AFCEE, and HGL. Rather, test pit HGLTP19-02 was conducted at the request of the HGL field geologist when during a visual inspection of the site, conducted immediately prior to initiating trenching activities, a stockpile of grass clippings and several concrete fragments were observed. This area represented one of a few locations within the landfill where visual evidence of the predominant waste material (i.e., grass clippings) reportedly disposed of at the landfill and possibly containing unused canisters of rodenticides was encountered. Test pit HGLTP19-02 was therefore completed to evaluate the contents of the grass clippings as well as allow for a visual and potential analytical assessment of the soil beneath the grass clippings. The locations of the completed trenches and test pits are presented on Figure 4.5.

The trenches ranged from 32 feet (HGLTR19-03) to 114 feet in length (HGLTR19-02), while the test pits ranged from 23 feet (HGLTP19-01) to 10 feet (HGLTP19-02) in length. The trench and test pit lengths were completed to adequately evaluate identified geophysical anomalies and areas of interest (i.e., areas littered with surface debris and areas historically used for material storage). The trenches were completed to maximum depths corresponding to 1 to 2 feet below observed subsurface debris (HGLTR19-01) or to depths sufficient to determine the absence of buried debris. The maximum investigated depths of the trenches and test pits completed at LF-19 ranged from 3 to 6 feet bgs.

Upon completion of a trench/test pit and lithologic logging and waste characterization activities, each trench/test pit was backfilled to grade with the excavated soils. LF-19 trench and test pit logs are included in Appendix C.

4.6.3 Trench Soil Sampling

During propagation of trench HGLTR19-01, a substance composed of small bluish crystals was observed around several corroded copper pipe fragments. The bluish crystals were observed coating the inside of the copper pipe fragments and in the soil immediately adjacent, within 2 inches, of the corroded copper pipe fragments. The pipe fragments were grouped approximately 1 to 2 feet below the surface of the mound, in the southern half of the linear trending mound dissected by the trench. No bluish crystals were observed anywhere else in the debris/fill material removed from the trench or in the soil underlying the fill material. Given the association of the bluish crystals to the corroded copper pipe fragments, the crystals were considered to most likely be copper salts derived from the corrosion of the copper pipe fragments.

Mr. David Strasser of NMED visually inspected the LF-19 trenches on May 22, 2006. During the NMED inspection, Mr. Strasser was notified of the bluish crystals (Strasser, 2006). After inspecting the trench, the bluish crystals, and the copper pipe fragments, Mr. Strasser approved the collection of two soil samples, one from the area containing the bluish crystals and one from the soil immediately beneath the fill material.

Both soil samples were collected from a decontaminated excavator bucket (HGL, 2005a). The sample of the bluish crystals and surrounding soil, obtained from 1 to 2 feet bgs, was designated as HGLTR19-01-0102. The undisturbed soil immediately beneath the fill material, approximately 2 to 3 feet bgs, was collected and designated as HGLTR19-01-0203. The collected soil samples were submitted to an offsite laboratory and analyzed, as approved by NMED (Strasser, 2006), for organochlorine pesticides, organophosphorous pesticides, herbicides, and target analyte list (TAL) metals.

After completion of the trench and soil sampling activities, the trench was backfilled making sure the soil from the area containing the bluish crystals was kept in the same location and depth as originally encountered. The analyte sampling scheme is presented as Table 4.3. Soil sample data sheets are included in Appendix C.

4.7 ASSESSMENT OF DATA RESULTS

4.7.1 Precision and Accuracy

Quality control (QC) data, including matrix spike/matrix spike duplicates, surrogates, and laboratory control sample (LCS) recoveries were used to assess the precision and accuracy for the two LF-19 soil samples. Results from both samples are located within sample delivery group 6052408. The following minor issues were identified and resolved during data validation:

- All percent recoveries (%R) for the LCS associated with batch 6152231 met the control limits with the exception of a low %R for dinoseb (14%), a herbicide.

Consequently, the associated non-detect dinoseb results are non-detect and should be rejected (R-flagged).

- The samples were initially extracted and analyzed within the required holding time for soil samples. Due to failure to meet QC criteria in the LCS, the samples were re-extracted one day outside of the holding time and re-analyzed. The re-analysis results should be considered the definitive results. Consequently, all associated results in both samples are non-detect and are therefore UJ qualified.

- All second source %Rs met the QC criteria with the exception of a high percent difference (%D) for dichlovos, mevinphos, dimethoate, fensulfothion, and famphur. Therefore, all associated results of these organophosphorus pesticides have been UJ qualified.

- Two bracketing continuing calibration verifications (CCVs) are associated with the samples in this sample delivery group (SDG). The CCV %Ds were within the control limits with the exceptions of mevinphos, naled, dimentoate, methyl parathion, malathion, tetrachlovinphos, EPN, azinphos-methyl, and coumaphos. Several analytes were out of control in the confirmation runs. However, the Contract Laboratory Procedure (CLP) does not specify flagging criteria for failure to meet QC criteria in the confirmation run. All associated results for the above organophosphorus pesticides are non-detect and have been UJ qualified.

- All %R results for the LCS associated with batch 6157599 met the control limits with the exception of a high %R for dementon-S, dimethoate, chloropyrifos, fenthion, malathion, parathion, azinos-methyl, and coumaphos. Consequently, all associated organophosphorus pesticide results are non-detect and should be UJ qualified.

4.7.2 Comparability

Comparability represents the confidence with which one data set can be compared to another. In accordance with the approved Quality Assurance Project Plan (QAPP) (HGL, 2005b), data are comparable when collection techniques, measurement methods, and reporting procedures are equivalent for the samples within a sample set. Implementation of appropriate procedures for sampling and shipping, as specified in the QAPP (HGL, 2005b), were performed. Within the data sets, it was concluded that results were comparable to each other.

4.7.3 Representativeness

Representativeness was assessed by the use of field duplicate and blank samples. Method and field blank samples were analyzed to determine potential contamination from laboratory or shipping procedures. Overall, representativeness was considered satisfactory.

4.7.4 Completeness

Completeness is defined as the percentage of the total number of analytical results requested that are judged to be valid, including estimated (J-flagged) values, in accordance with the QAPP (HGL, 2005b). Completeness of the laboratory analysis for the two LF-19 samples was determined to be 99.9% within acceptable data quality objective limits.

4.7.5 Usability

Based on the data review and validation, the analytical data were determined to be useable for their intended purpose.

4.8 SUPPLEMENT RFI INVESTIGATION RESULTS

4.8.1 Geophysical Surveying Results

4.8.1.1 Terrain Conductivity Survey Results

The results of the LF-19 terrain conductivity survey are depicted on Figure 4.3. Three very localized high-conductivity anomalies and one low conductivity anomaly were identified in the northern portion of the survey. These anomalies correspond to the barbwire fence present around the cactus garden.

Three large high-conductivity anomalies where identified in the southwestern and southern portions of the survey area. Two of these anomalies overlap the previously defined northern and southern landfill boundaries of LF-19. The third anomaly was located between the northern and southern landfills. These conductivity anomalies are relatively amorphous in shape and were not consistent with soil mound trends. In addition, the boundaries of the high conductivity anomalies exhibited diffuse borders, indicating that the anomalies reflected either highly conductive saturated soils or buried non-magnetic waste, such as grass clippings, the primary waste reportedly disposed at LF-19.

4.8.1.2 Magnetic Survey Results

Multiple magnetic anomalies were identified within and around LF-19 as shown on Figure 4.4. Excluding the magnetic anomalies associated with LF-19 monitoring wells and the barbwire fence surrounding the cactus garden, several discrete magnetic anomalies were observed primarily in the southeast corner of the northern landfill and dotting the southern disposal area and the area east of the southern disposal area. The majority of the identified magnetic anomalies corresponded to observed metallic or magnetically susceptible debris on the surface, including several sections of corrugated pipe, metal pipe, and scrap metal. However, not all of the anomalies present in the southern disposal unit area were observed to be associated with surface debris.

4.8.1.3 Geophysical Survey Conclusions

Geophysical surveying of LF-19 confirmed the absence of subsurface metallic anomalies. Magnetic surveying identified a few discrete magnetic anomalies associated with areas containing metallic or magnetically susceptible surficial debris. The lack of magnetic anomalies within the two landfills supports Base records indicating that LF-19 received almost exclusively non-metallic waste. Terrain conductivity results did not imply the presence of a landfill. These results were used to select the trenching locations.

4.8.2 Trenching Results

Shallow subsurface geologic information regarding the soils and sediments underlying LF-19 obtained during the trenching investigation is presented in the Section 4.4.2.

The soils encountered within the trenches (HGLTR19-02 through HGLTR19-04) and test pit (HGLTP19-02) appeared to be completely undisturbed and showed no evidence of subsurface disposal activities. No landfill material, debris, or waste materials were observed buried in the northern disposal unit. Grass clippings, the primary waste reportedly disposed at LF-19, were observed solely in the southwestern corner of the northern disposal unit. The grass clippings were present only on the surface and did not extend into or mix with subsurface soils. The lack of waste material in the subsurface soils is consistent with the lack of conductivity and magnetic anomalies at LF-19.

With respect to the southern disposal unit, fill material was observed only in the northeast-southwest linear trending mound. The fill material consisted of reworked soils, organic detritus, over-the-counter bags of topsoil, plastic sheeting, minor amounts of scrap metal and pipe fragments. Examination of the mound indicated the fill material never extended below the grade of the surrounding topography, meaning no subsurface burial of waste/fill material occurred. Rather the waste was either placed within a mound, or the surrounding soil was scraped and the recovered debris pushed into a long linear mound. No landfill material was observed in the soil north or south of the linear trending mound or beneath the mound at approximately two feet bgs. No canisters or drums potentially used for the storage or disposal of hazardous materials were observed. No soil staining, unusual odors or leachate was observed. As discussed previously, a substance composed of bluish crystals was encountered immediately adjacent to several small copper pipe fragments. Based on the occurrence of the bluish crystals only around the copper pipe fragments and the elevated salt content of the surrounding soil, as evident from the terrain conductivity survey, the bluish crystals are an insoluble copper salt derived from the corrosion of the pipe fragments.

4.8.3 Trench Soil Sampling Results

Positive analytical results obtained from the two LF-19 soil samples are summarized on Table 4.4. No organochlorine pesticides or herbicides were detected in the two soil samples collected from the debris mound. Several organophosphorous pesticides were detected in both soil samples with concentrations typically higher in the near surface soil sample

(HGLTR19-01-0102). None of the organophosphorous pesticides concentrations detected in the soil samples exceeded respective NMED residential soil screening levels (SSLs).

Eighteen metals were detected in the two soil samples, with the majority of the metals detected at concentrations one to two orders of magnitude higher in the shallow surface soil sample HGLTR19-01-0102. Elevated copper, aluminum, chromium, and manganese concentrations were detected in HGLTR19-01-0102, the soil sample containing the bluish crystals. The reported copper concentration exceeded the NMED residential SSL for copper. None of the metals detected in sample HGLTR19-01-0203, collected within one foot below sample HGLTR19-01-0102, were detected at concentrations above NMED SSLs. The presence of the bluish crystals only immediately around the copper pipe fragments, the elevated copper and associated metal concentrations in shallow soil sample HGLTR19-01-0102, and the lack of elevated metal concentrations in the deeper soil sample (HGLTR19-01-0203) support the conclusion that the observed bluish crystals are a copper salt formed from the corrosion of copper pipe fragments.

Analytical data sheets are included as Appendix D.

4.9 CONCLUSIONS

LF-19 is a two acre disposal area that, according to the RFA, received golf course grass clippings from 1968 to 1978. Two disposal units are present, a northern disposal unit, located immediately adjacent to the golf course and a southern disposal unit, located south of the northern disposal unit across a narrow, man-made drainage ditch. Unsubstantiated information obtained from the RFA indicated that the site may have received unused rodenticides. Supplemental RFI activities included a geophysical survey and the completion of four trenches and two test pits.

Investigation of the northern disposal unit identified no buried waste or waste disposal features. No evidence of hazardous materials storage or disposal at the unit was obtained. All subsurface soils appeared to be completely undisturbed. Groundwater was not encountered in any of the trenches or test pits.

Investigation of the southern disposal unit identified waste in a 2-foot high, northeast-southwest linear-trending mound located near the southern boundary of the southern disposal unit. The mound consisted of reworked soil, one bag of topsoil, organic detritus, a few pieces of scrap metal, copper piping fragments, plastic sheeting, and polyvinyl chloride (PVC) piping. This material was limited solely to the linear mound to a depth corresponding to the grade of the surrounding topography. Based on distribution of the waste, it appears the mound was created from the accumulation of surface debris scraped from the surrounding area.

During propagation of a trench through the soil mound, an unusual bluish solid (crystalline) substance was observed on and immediately adjacent to several copper pipe fragments buried between 1 and 2 feet below the top of the mound. Because the bluish substance occurred only on and immediately around corroded copper pipe fragments, the substance was considered to

be a copper salt derived from the corrosion of the pipe fragments. Analysis of the bluish substance and surrounding soil (HGLTR19-01-0102), further supported the presence of copper salts from pipe corrosion. None of the elevated metals were detected above NMED SSLs in the soil sample collected below the fill sample (HGLTR19-01-0102) and immediately, within 0.5 feet, of the disposal area base. No organophosphorus pesticides, organochlorine pesticides, or chlorinated herbicides were detected above NMED SSLs in either soil sample.

4.10 RECOMMENDATIONS

Debris is present only in a small area of LF-19 and consists primarily of golf course materials. Given the type of debris, the lack of contamination and hazardous materials within and beneath the disposal area soils, and groundwater sampling results obtained over the last 10 years, NFA status is recommended for LF-19 under NMED Criterion 3 (no release to the environment has occurred or is likely to occur in the future from the SWMU), and a class III permit modification is requested to remove the site from the active corrective action portion of the RCRA permit.

This page was intentionally left blank.

TABLES

Table 4.1
Remedial Investigation Groundwater Analytical Results
LF-19 (SWMU 105)
Holloman AFB, NM

Analyses	Background[1]	USEPA MCL	NMGWQ Standard	Detection Limit	MW-19-01 (upgradient)	MW-19-02	MW-19-03
Inorganic Results (mg/L)							
EPA 160.1- Total Dissolved Solids	43,600	--	1,000	10	*17,000*	*21,000*	*42,000*
EPA 300.0- Chloride	19,600	--	250	26	*7,200*	*8,200*	***20,000***
EPA 300.0- Sulfate	7,470	--	600	5.0	*3,400*	*4,600*	*7,100*
EPA 340.2- Fluoride	4.7	4	1.6	0.10	*1.7*	*3.2*	*1.8*
EPA 353.1- Nitrate-Nitrite	98	--	--	0.022	1.2	8.6	5.7
EPA 365.2- Total Phosphorous	0.75	--	--	0.020	0.26	0.5	0.18
SW6010 - Metals (μg/L)							
Antimony	89.6	6	--	100	*140*	***140***	*100*
Cadmium	8.3	5	10	5	*6.3*	*5.4*	*10*
Chromium	234	100	50	10	12	17	ND
Nickel	43.6	--	200^	20	32	33	29
Zinc	253.4	--	10,000	20	33	41	< 0.020
SW7421- Lead (μg/L)	19.9	15	50	3	< 0.0030		***21***
Organic Results							
SW8240 - Volatile Organics (μg/L)							
Methylene Chloride	--	--	100	5.0	3.8 J	< 5.0	22

Note: Table presents only constituents detected in ground water at this site.

USEPA = U.S. Environmental Protection Agency
MCL = Maximum Contaminant Level
NMGWQ = New Mexico Groundwater Quality
mg/L = milligrams per liter
μg/L = micrograms per liter
-- = No value or standard was found
J = Detected below the detection limit.
< = less than associated concentration

SWMU = solid waste management unit
AFB = Air Force Base
NM = New Mexico
ND = not detected at or above method reporting limit

Results in **BOLD** and *italics* exceed USEPA Primary Drinking Water MCLs and are greater than the background and upgradient values.
Results shaded in **BOLD** and *italics* exceed NMGWQ Standards for Human Health and are greater than the background and upgradient values.
Results in italics exceed USEPA or NMGWQ standards but are below background and/or upgradient levels.
^ NMGWQ Standard for Irrigation Use

[1] Source for Inorganics Values: Radian (1992b). Source for Metals: Radian (1993).

Table 4.2
Long Term Groundwater Monitoring
Analytical Results LF-19 (SWMU 105)
Holloman AFB, NM

Well Number				MW-19-01[4]					MW-19-02				
Sampling Date	Background	USEPA MCL (µg/L)	NMGWQ Standard (µg/L)	Aug-95	Sep-97	Sep-99	Sep-01	Apr-03	Aug-95	Sep-97	Sep-99	Sep-01	Apr-03
VOCs[1] (µg/L)													
1,2,3- Trichlorobenzene[6]	--	--	--	NA	ND	NA	NA	NA	NA	1.7 J	NA	NA	NA
1,2,4- Trichlorobenzene[6]	--	70	--	NA	ND	NA	NA	NA	NA	0.9 J	NA	NA	NA
Metals[2] (µg/L)													
Arsenic	35.4	10	100	ND	ND	< 3	NA	NA	ND	ND	3.9 B (J)	NA	NA
Barium	85.2	2000	1000	ND	19	14.5 B (J)	11.3	7.18 J	ND	ND	21.6 B (J)	15.2	11.9
Cadmium	7.4	5	10	ND	ND	.03 B	NA	NA	ND	ND	0.5 B	NA	NA
Iron	--	--	1000	ND	ND	< 21	89.3	< 200	ND	ND	132	< 1000	146 J
Lead	5.6	15	50	*54*^	ND	< 1.5	< 10 (UJ)	NA	*540*	ND	< 1.5	< 10 (UJ)	NA
Manganese	--	--	200	ND	*230*	*284 (J)*	*597 (J)*	*514*	ND	ND	*246 (J)*	77.5 (J)	79.6
Mercury	0.03	2	2	ND	ND	< 0.2	< 0.5	NA	ND	ND	0.56 (J)	< 0.5	NA
Selenium	85.3	50	50	ND	ND	2.9 B (J)	NA	NA	ND	ND	2.7 B (J)	NA	NA
Silver	6.7	--	50	ND	ND	< 0.5	NA	NA	ND	ND	< 0.5	NA	NA
Organochlorine Pesticides[3] (µg/L)													
all	--	--	--	ND	ND	NA	NA	NA	ND	ND	NA	NA	NA
Chlorinated Herbicides[4] (µg/L)													
all	--	--	--	ND	ND	NA	NA	NA	ND	ND	NA	NA	NA

Notes:

[1] Unless otherwise reported, no VOCs were detected prior to 2001 using USEPA Method 8260B.
(USEPA Method 8260A was used to analyze for VOCs in the 1995 and 1997 programs.)

[2] Unless otherwise reported, no metals were detected using USEPA Methods 6010B Trace & 7470A.
(USEPA Method 8080A was used to analyze for organochlorine pesticides in the 1995 and 1997 programs.)

[3] Unless otherwise reported, no organochlorine pesticides were detected prior to 1999 using USEPA Method
(USEPA Method 8080A was used to analyze for organochlorine pesticides in the 1995 and 1997 programs.)

[4] Upgradient monitoring well

CRDL = Contract-required Detection Limit
IDL = Instrument Detection Limit
NA = not analyzed
ND = not detected at or above method reporting limit
VOCs = volatile organic compounds
µg/L = micrograms per liter
-- = No value or standard was found
SWMU = solid waste management unit
AFB = Air Force Base
NM = New Mexico
USEPA = U.S. Environmental Protection Agency
NMGWQ = New Mexico Groundwater Quality
< = less than associated concentration

Results in **BOLD** and *italics* exceed USEPA Primary Drinking Water MCLs and are greater than the background and upgradient values.
Results shaded in **BOLD** and *italics* exceed NMGWQ Standards for Human Health and are greater than the background and upgradient values.
Results in *italics* exceed USEPA or NMGWQ standards but are below background and/or upgradient levels.

^ Radian (1993)

Laboratory qualifiers--assigned as a result of internal laboratory data assessment procedures.
B - Value less than CRDL but greater than or equal to IDL.
J - Estimated value less than CRDL but greater than or equal to IDL.
UB - Qualifies as non-detect due to presence of analyte in associated laboratory blank.
USEPA Qualifiers--assigned as a result of independent data validation.
(J) - Estimated value
(UJ) - Estimated value below the reporting limit.
(U) Compound was analyzed for but not detected.
2003 Validation Qualifiers
J - Estimated value detected less than the CRDL but greater than the reporting limit.
U - Compound was analyzed for but not detected. Analyte result was below the CRDL.
UJ - Estimated as a non-detect at the detection limit.

Table 4.2
Long Term Groundwater Monitoring
Analytical Results LF-19 (SWMU 105)
Holloman AFB, NM

Well Number				MW-19-03*				
Sampling Date	Background[2]	USEPA MCL (µg/L)	NMGWQ Standard (µg/L)	Aug-95	Sep-97	Sep-99	Sep-01	Apr-03
VOCs[1] (µg/L)								
1,2,3- Trichlorobenzene[6]	--	--	--	NA	ND	NA	NA	NA
1,2,4- Trichlorobenzene[6]	--	70	--	NA	ND	NA	NA	NA
Metals[2] (µg/L)								
Arsenic	35.4	10	100	ND	ND	< 3	NA	NA
Barium	85.2	2000	1000	ND	ND	17.8 B (J)	18.8 B	10.6 J
Cadmium	7.4	5	10	ND	ND	< 0.3	NA	NA
Iron	--	--	1000	ND	ND	< 110	*< 10,000*	< 200
Lead	5.6	15	50	*420*	ND	< 1.5	< 10 (UJ)	NA
Manganese	--	--	200	ND	ND	1.1 B (J)	1.5 B (J)	< 100
Mercury	0.03	2	2	ND	ND	< 0.2	< 0.5	NA
Selenium	85.3	50	50	ND	ND	4.1 B (J)	NA	NA
Silver	6.7	--	50	ND	ND	1.3 B (J)	NA	NA
Organochlorine Pesticides[3] (µg/L)								
all	--	--	--	ND	ND	NA	NA	NA
Chlorinated Herbicides[4] (µg/L)								
all	--	--	--	ND	ND	NA	NA	NA

Notes:

[1] Unless otherwise reported, no VOCs were detected prior to 2001 using USEPA Method 8260B.
(USEPA Method 8260A was used to analyze for VOCs in the 1995 and 1997 programs.)

[2] Unless otherwise reported, no metals were detected using USEPA Methods 6010B Trace & 7470A.
(USEPA Method 8080A was used to analyze for organochlorine pesticides in the 1995 and 1997 programs.)

[3] Unless otherwise reported, no organochlorine pesticides were detected prior to 1999 using USEPA Method 8081A.
(USEPA Method 8080A was used to analyze for organochlorine pesticides in the 1995 and 1997 programs.)

[4] Upgradient monitoring well

CRDL = Contract-required Detection Limit
IDL = Instrument Detection Limit
NA = not analyzed
ND = not detected at or above method reporting limit
VOCs = volatile organic compounds
µg/L = micrograms per liter
-- = No value or standard was found
SWMU = solid waste management unit
AFB = Air Force Base
NM = New Mexico
USEPA = U.S. Environmental Protection Agency
NMGWQ = New Mexico Groundwater Quality
< = less than associated concentration

Results in **BOLD** and *italics* exceed USEPA Primary Drinking Water MCLs and are greater than the background and upgradient values.
Results shaded in **BOLD** and *italics* exceed NMGWQ Standards for Human Health and are greater than the background and upgradient values.
Results in *italics* exceed USEPA or NMGWQ standards but are below background and/or upgradient levels.

* Radian (1993)

Laboratory qualifiers--assigned as a result of internal laboratory data assessment procedures.
B - Value less than CRDL but greater than or equal to IDL.
J - Estimated value less than CRDL but greater than or equal to IDL.
UB - Qualifies as non-detect due to presence of analyte in associated laboratory blank
USEPA Qualifiers--assigned as a result of independent data validation.
(J) - Estimated value
(UJ) - Estimated value below the reporting limit.
(U) Compound was analyzed for but not detected.
2003 Validation Qualifiers
J - Estimated value detected less than the CRDL but greater than the reporting limit.
U - Compound was analyzed for but not detected. Analyte result was below the CRDL.
UJ - Estimated as a non-detect at the detection limit.

Table 4.3
Soil Sample Analytical Scheme
LF-19 (SWMU 105)
Holloman AFB, NM

Sample	Description	TAL Metals	Organophosphorus Pesticides	Organochlorine Pesticides	Chlorinated Herbicides
HGLTR19-01-0102	Soil sample of landfill material containing bluish crystals associated with copper piping	X	X	X	X
HGLTR19-01-0203	Soil sample of undisturbed soil directly beneath landfill material	X	X	X	X

Notes:
SWMU = solid waste mangement unit
AFB = Air Force Base
NM = New Mexico
TAL = target analyte list

Table 4.4
Soil Analytical Results
LF-19 (SWMU 105)
Holloman AFB, NM

Analyte	NMED SOIL SCREENING LEVELS, [illegible] 2006		[illegible]	[illegible]
	Residential Soil	Industrial Soil	[illegible]	[illegible]
Chlorinated Herbicides (μg/kg)			ND	ND
Organophosphorous Pesticides (μg/kg)			ND	ND
Organochlorine Pesticides (μg/kg)				
alpha-Chlordane	16,200[1]	71,900[1]	119	2.90
gamma-Chlordane	16,200[1]	71,900[1]	144	2.00
p,p-DDE	17,200	78,100	51.6	--
p,p-DDT	17,200	78,100	7.00	1.90
Endosulfan I	367,000[2]	4,100,000[2]	93.2	--
Endosulfan sulfate	367,000[2]	4,100,000[2]	6.10	--
Endrin aldehyde	18,300[3]	205,000[3]	105	1.00
Metals (mg/kg)				
Aluminum	77,800	100,000	58,300	1,200
Antimony	31.3	454	3.64 J	--
Arsenic	3.9	17.7	3.17	1.88
Barium	15,600	100,000	16.4	17.4
Calcium	NA	NA	28,700	156,000
Chromium	234[4]	3,400[4]	78.6	0.976 J
Cobalt	1,520	20,500	3.47	0.695 J
Copper	**3,130**	45,400	[illegible]	20
Iron	23,500	100,000	4,060	1,240
Lead	400	800	367	7.37
Magnesium	NA	NA	8,640	2,250
Manganese	3,590	48,400	480	17.5
Nickel	1,560	22,700	310	1.21 J
Potassium	NA	NA	1,240	619
Silver	391	5,680	4.26	--
Sodium	NA	NA	9,280	3,020
Vanadium	78.2	1,140	15.4	2.19 J
Zinc	23,500	100,000	2,040	5.16

Notes:
[1] Chlordane NMED SSL value used as surrogate for alpha-chlordane and gamma-chlordane.
[2] Endosulfan NMED SSL value used as surrogate for endosulfan I and endosulfan sulfate.
[3] Endrin NMED SSL value used as a surrogate for endrin aldehyde.
[4] Hexavalent chromium NMED SSL value used as a surrogate for chromium.

μg/kg = micrograms per kilogram
mg/kg= milligrams per kilogram
NMED = New Mexico Environment Department
SSL = soil screening level
ND = not detected at or above method reporting limit
AFB = Air Force Base
SWMU = solid waste management unit
NM = New Mexico
NA = not analyzed
J = positive detection below reporting limit but above method detection limit

Gray shaded and **bolded** analyte concentrations indicate analyte concentrations above one or more screening criteria values shown.
Bolded screening criteria values are those values exceeded by an analyte concentration.

This page was intentionally left blank.

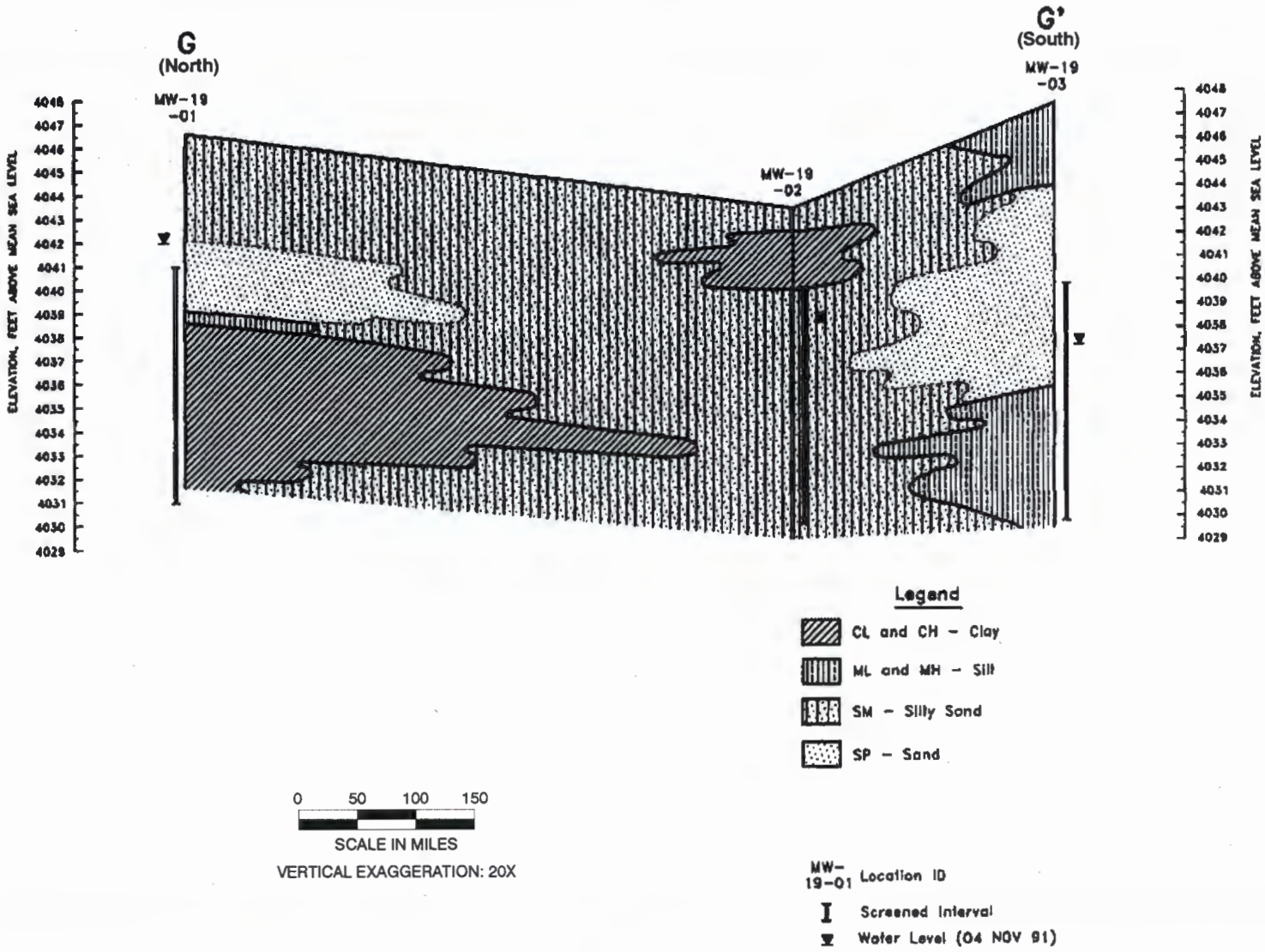
FIGURES

File X:\AFC002\Holloman_AFB\TO37\Maps\LF_19_21_22_23_Supp_RFI\LF-19.mxd
Project: AFC002-037-04-03-05
Revised: 09/25/06 BF
Map Source: Holloman AFB

Legend

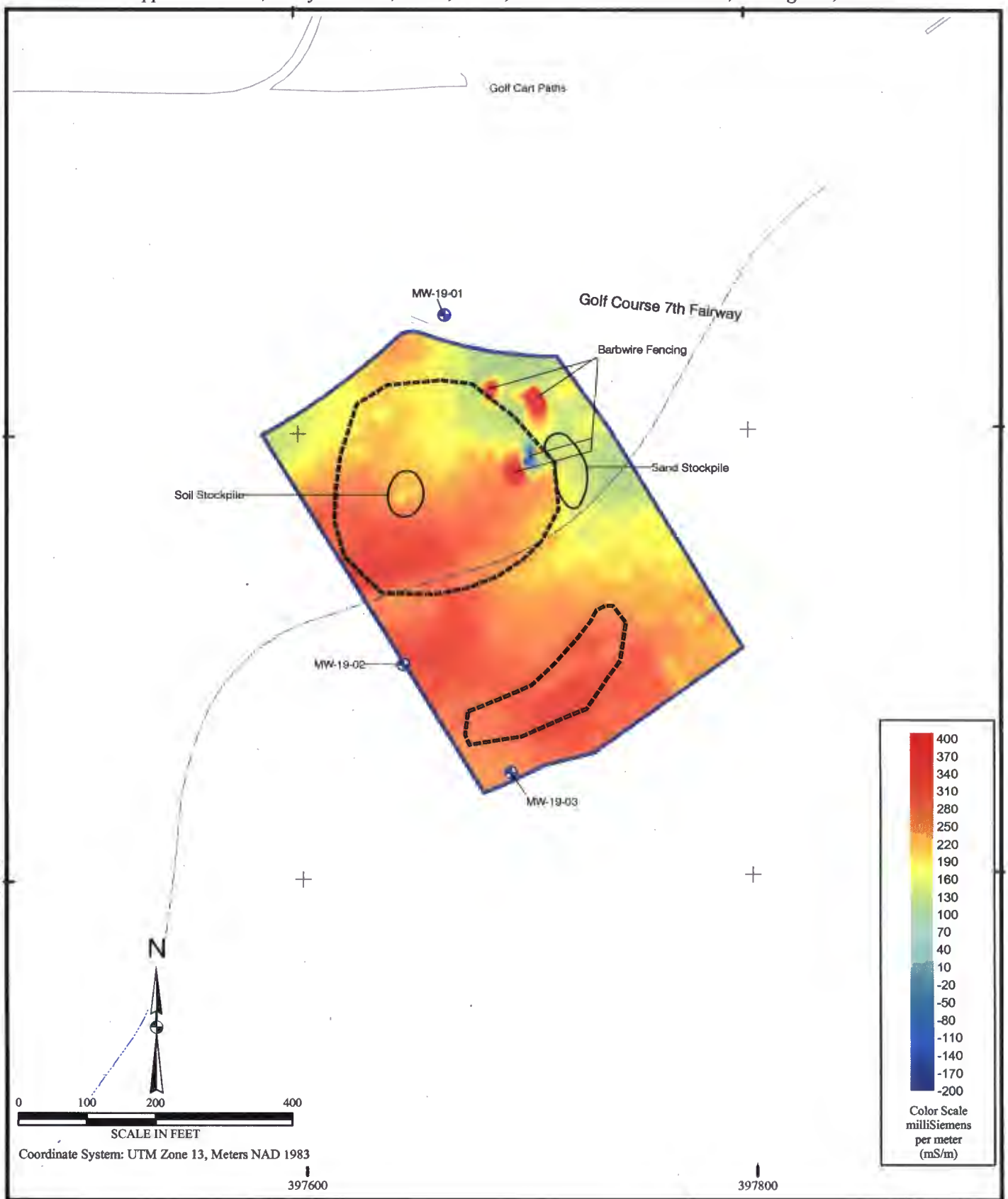
- Operable Unit Boundary (Base GIS)
- G——G' Line of Section
- Monitoring Well

Figure 4.1
LF-19 Site Map
Holloman AFB



X:\AFC002\Holloman_AFB\TO37\Maps
LF_19_21_22_23_Supp_RFI\site19_xsection.cdr
Project: AFC002-037-04-03-03
Revised: 09/25/06 BF
Source: Radian, 1992

Figure 4.2
LF-19 Geologic Cross Section
Holloman AFB

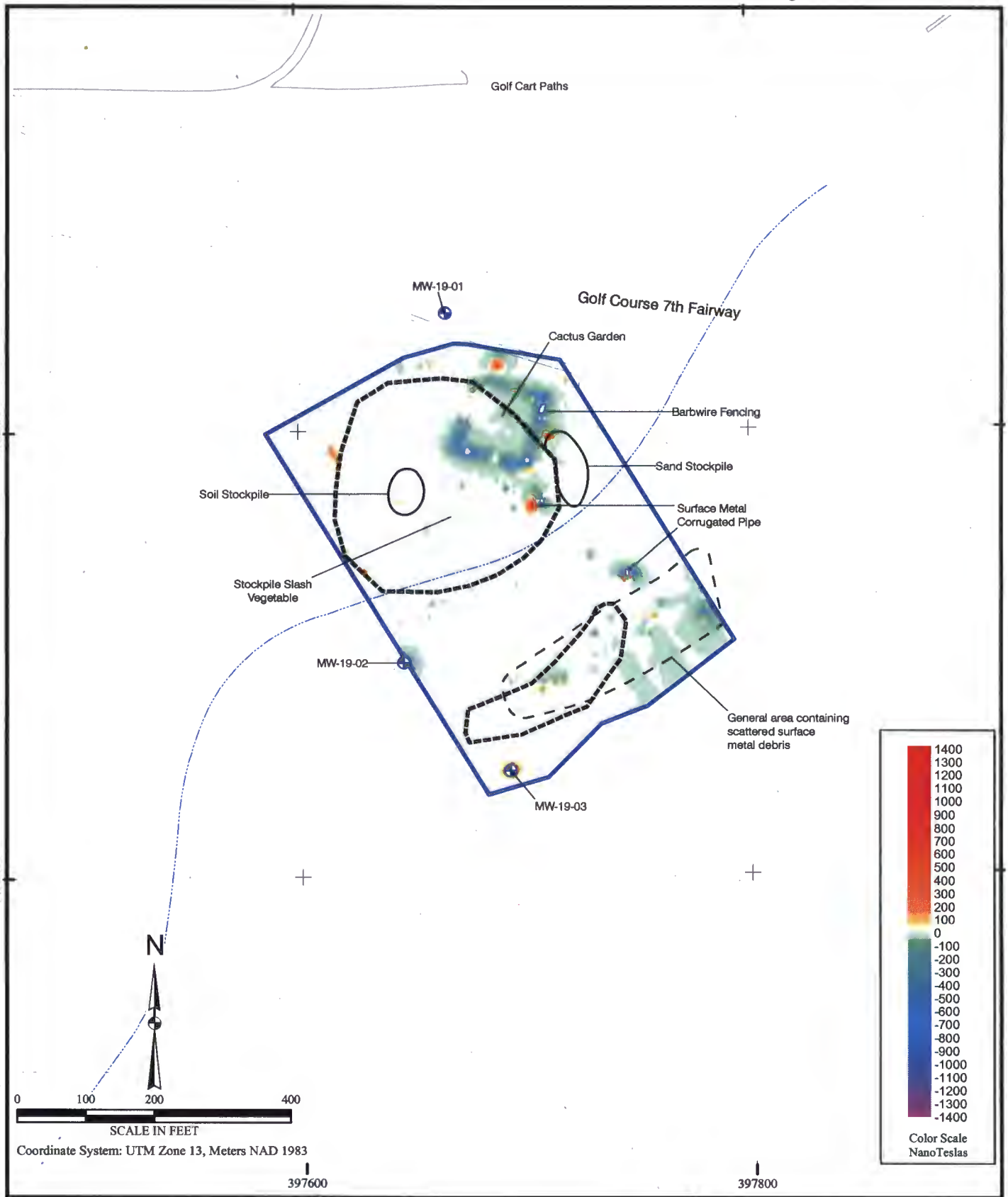


File X:\AFC002\Holloman_AFB\TO37\Maps\LF_19_21_22_23_Supp_RFI\LF-19_Geo.mxd
Project: AFC002-037-04-03-03
Revised: 09/25/06 BF
Map Source: Holloman AFB

Legend

- Monitoring Well
- Operable Unit Boundary (Base GIS)
- Terrain Conductivity Survey Boundary
- Drainage Swale

Figure 4.3
LF-19 Terrain Conductivity Survey
Holloman AFB

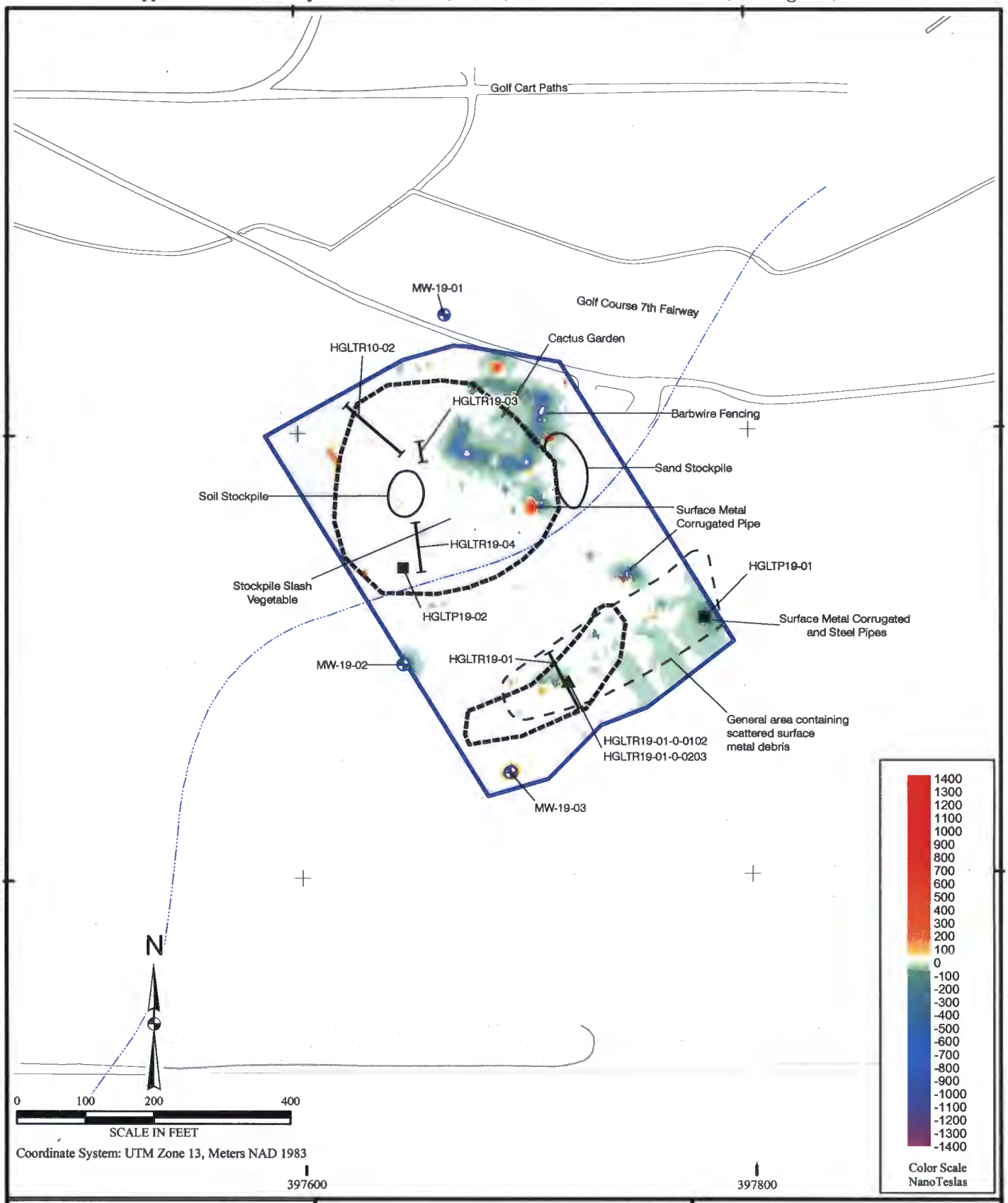


File X:\AFC002\Holloman_AFB\TO37\Maps\LF_19_21_22_23_Supp_RFI\LF-19_Mag.mxd
Project: AFC002-037-04-03-03
Revised: 09/25/06 BF
Map Source: Holloman AFB

Legend

- Monitoring Well
- Operable Unit Boundary (Base GIS)
- Magnetic Survey Boundary
- Drainage Swale

Figure 4.4
LF-19 Magnetic Survey
Holloman AFB



File X:\AFC002\Holloman_AFB\TO37\Maps\LF_19_21_22_23_Supp_RFI\LF-19_Trench.mxd
Project: AFC002-037-04-03-05
Revised: 09/25/06 BF
Map Source: Holloman AFB

Legend

- Monitoring Well
- Test Pit
- Soil Sample
- Operable Unit Boundary (Base GIS)
- Magnetic Survey Boundary
- Drainage Swale
- Trench

Figure 4.5
LF-19 Trench, Test Pit, and Sample Locations
Holloman AFB

5.0 LF-21 (SWMU 116) - WEST AREA LANDFILL NO. 2

5.1 LOCATION

LF-21, West Area Landfill No. 2, is located east of the Solar Observatory (Building 910), in the southwestern corner of the intersection of Observatory Road and Forty-Niner Avenue. The location of LF-21 with respect to the surrounding facility and the other landfills is shown on Figure 1.2. An aerial photograph of LF-21 is provided as Figure 5.1.

5.2 SITE DESCRIPTION

LF-21 is an undeveloped, slight to moderately vegetated parcel of land approximately three acres in size. The site is unpaved, and vegetation, consisting primarily of salt cedars and shrubs, is present in shallow depressions and around/within small debris mounds. The thickest concentration of vegetation is present along the northern and eastern unit boundaries.

The site is bounded to the north by Observatory Road, to the west by Forty-Niner Avenue, and to the south and east by undeveloped land. Access to LF-21 is unrestricted. A large, green-painted, metallic storage box and several fox holes, constructed of sand bags, are present in the western portion of LF-21. The presence of the storage box and the fox holes indicates LF-21 has been used and possibly continues to be used for military training exercises. Although the north-central portion of the unit is clear of vegetation, no defined service roads (paved or unpaved) have been observed at the site.

Debris, consisting of a mixture of concrete and asphalt rubble, terra cotta pipe fragments, metal piping, green and white colored PVC pipes, a wood door, metal cables, and rebar is present on the surface in discrete piles located throughout LF-21. The debris occurs primarily in distinct mounds that are typically less than one foot above the grade of the surrounding topography.

Photographs of LF-21 are included in Appendix B.

5.3 WASTE HISTORY

LF-21 was reportedly used for the disposal of paper bags, food, cans, boxes, boards, and tree limbs from the early 1970s (assumed) to 1977. According to one interviewee, some 55-gallon drums were also observed during the active period of the landfill. Disposal operations were stopped after the site was identified as an unapproved landfill.

5.4 ENVIRONMENTAL SETTING

5.4.1 Topography

The topography of LF-21 is relatively flat with a slight overall southwesterly dip. A slight hummocky topographic appearance is present in some areas of LF-21, reflecting the scattered presence of discrete debris mounds typically less than one foot above the surrounding grade.

Along the central northern boundary, a 2 to 3 foot high rise is present prior to reaching Observatory Road. The height of the rise decreases, disappearing to the east at the intersection of Observatory Road and Forty-Niner Avenue and decreasing to approximately 1 to 1.5 feet above the surrounding topography to the west. The remaining landfill boundaries blend into the surrounding topography and are not visually discernable. Shallow depressions, less than 1 to 2 feet deep, are present but typically only occur along the northern site boundary.

5.4.2 Geology

Site-specific LF-21 geologic information provided herein has been compiled from subsurface lithologic data obtained during the 1992 RFI (Radian, 1992a) as well as from this supplemental RFI. In 1992, one upgradient, MW-21-01, and three downgradient, MW-21-02 through MW-21-04, monitoring wells were installed, providing a subsurface lithology north and south of the landfill. During this supplemental RFI, 3 trenches and 4 test pits were completed yielding shallow subsurface soil data within and immediately below the landfill.

According to the 1992 RI, the upper 15 feet of LF-21 is composed of interfingered units of silts, sands, silty sands, and clayey sands. A geologic cross-section of LF-21, obtained from the 1992 RFI (Radian, 1992a), is included as Figure 5.2. According to the cross section, the surface soil of LF-21 is composed of a 2 to 4 foot thick silt unit. The silt unit is underlain by a thick sequence of silty sands to the maximum investigated depth of 15 feet bgs. Lenses of sand, clayey sand, and silt were observed interfingering the silty sand unit in the central and northern portions of the cross-section.

Within the confines of the landfill unit, fill material consisting primarily of construction debris (e.g., concrete and asphalt rubble, pipe fragments, rebar, etc.) was present sporadically from the surface to 2 to 5 feet bgs. The soil surrounding the debris consisted of light brown, dry, silt in the northern portion of LF-21 and a light brown, dry to damp, silty sand in the central and southern portions of LF-21. Beneath the fill material, a brown to orangish-brown, damp to moist, silty sand was observed to 6 feet bgs, the maximum depth trenched. Groundwater was not encountered in any of the trenches or test pits completed at LF-21. Trench and test pit logs are included in Appendix B.

5.4.3 Soils

The USDA Soil Conservation Service has identified two soil associations in the vicinity of Holloman AFB: the Holloman-Gypsum Land-Yesum complex and the Mead silty clay loam. The permeability of these soil horizons ranges from $4x10^{-4}$ to $1x10^{-3}$ cm/sec (USDA, 1981).

Based on the Soil Conservation Service Soil Survey of Otero Area, New Mexico, LF-21 is underlain by the Holloman-Gypsum Land-Yesum complex. The soils are formed from alluvial and eolian gypsiferous sediments. The Holloman unit makes up approximately 35% of the complex. The unit is light brown to pink, very fine, sandy loam with high gypsum content, moderately permeable, calcareous, and mildly to moderately alkaline. The Gypsum Land unit makes up to 30% of the complex and is soft to hard white gypsum typically overlain by less

than one inch of very fine, sandy loam. The Yesum unit, comprising approximately 20% of the complex is light brown to pinkish-white, very fine sandy loam that is also high in gypsum. The unit is moderately permeable, calcareous, and mildly alkaline (USDA, 1981).

5.4.4 Surface Water

No surface water drainage channels or features (e.g., drainage swales) are presented adjacent to or dissect LF-21. Very shallow depressions are present along the northern boundary of the unit adjacent to Observatory Road. The presence of the depressions is most likely attributable to former road grading activities associated with Observatory Road.

Given the unpaved condition of LF-21, precipitation falling onto LF-21 will either evaporate or infiltrate into the shallow subsurface.

5.4.5 Hydrogeology

Depth to groundwater at LF-21 was observed to range from 6.5 to 9 feet bgs (Bhate, 2003). Based on the LTM sampling event conducted in 2003, groundwater flows in a southwesterly direction with a gradient of 0.005 ft/ft (Bhate, 2003). Field slug tests conducted during the RI investigation yielded an average hydraulic conductivity of 2.79 ft/day. Assuming a porosity of 30%, the groundwater velocity across LF-21 was estimated to be 0.047 ft/day or 17.16 ft/yr. TDS at the site is greater than 10,000 mg/L.

Groundwater was not encountered in any of the trenches or test pits completed at LF-21.

5.5 PREVIOUS INVESTIGATIONS

Previous investigations conducted at LF-21 included the 1992 RI (Radian, 1992a) and five LTM sampling events. A detailed discussion of the RI and LTM sampling results is presented in Section 2.2.4 of the supplemental work plan (HGL, 2005a). For report completeness, a brief discussion of the previous investigations and associated sample results is provided below.

5.5.1 LF-21 Remedial Investigation

The 1992 LF-21 RI consisted of the installation and sampling of four monitoring wells, MW21-01, MW21-02, MW21-03, and MW21-04. MW21-01 was installed upgradient of LF-21 in order to assess the local background groundwater quality. Monitoring wells MW21-02 through MW21-04 were installed downgradient of the landfill to evaluate the groundwater quality emanating from the individual disposal units. Groundwater samples collected from the site monitoring wells were analyzed for VOCs, organochlorine pesticides, organophosphorus pesticides, PCBs, chlorinated herbicides, total metals, anions, and TDS.

RI groundwater analytical results are presented in Table 5.1. Organochlorine and organophosphorus pesticides, PCBs, and chlorinated herbicides were not detected in any of the samples. With the exception of methylene chloride, attributable to laboratory contamination due to its presence in blanks, no VOCS were detected in MW21-01, MW21-02, and

MW21-04. Benzene, ethylbenzene, styrene, toluene, and xylenes were detected at estimated concentrations below detection limits in MW21-03, well below standards. Only cadmium (24 μg/L in MW21-02) was detected at a concentration above background and NMGWQ standard (10 μg/L). The 24 μg/L cadmium concentration reported for monitoring well MW21-02 represents a total cadmium concentration, NMGWQ standards are based on dissolved metals concentrations. A direct comparison of the total cadmium concentration against a dissolved metal groundwater quality standard is not applicable. Risk characterization of the LF-21 data concluded that the site does not present an unacceptable risk even under worst-case exposure conditions.

5.5.2 Long Term Groundwater Monitoring

Based on the results of the RI, Holloman AFB submitted a Decision Document (Radian, 1995) concluding a no action remedy was appropriate for LF-21. As part of the no action remedy, surface debris would be removed, a plat of survey would be produced, and LTM would be conducted at the site at the request of NMED and USEPA. LTM activities would consist of the biennial collection and analysis of groundwater samples from the three onsite wells for 10 years to ensure any potential future release from the site would be detected. The decision document was signed by the Holloman AFB base commander and NMED in September 1994.

LTM activities were initiated in 1995. A summary of the groundwater positive detections since LTM was initiated in 1995 is provided as Table 5.2. Modification of the required analyte list was conducted over the course of the LTM program due to lack of analyte detections. After the 1997 LTM event, NMED approved to discontinue monitoring of pesticides and herbicides. Subsequent analyte reductions reduced the requited analyte list to include only barium, iron, and manganese. As shown on Table 5.2, over the history of the LTM program, with the exception of iron at MW21-04 in September 2001 and flagging of non-detects at elevated detection limits, no constituents in downgradient wells were detected above background concentrations and NMGWQ standards. The 2003 LTM event marked the fifth biennial sampling event for LF-21. Consequently, within the 2003 LTM report, cessation of LTM and site closeout was recommended (Bhate, 2003). One additional round of LTM was performed in 2005; after this round NMED concurred in correspondence dated October 4, 2006, that LTM could cease.

5.5.3 Statement of Basis

In February 2004, Holloman AFB submitted a SOB to NMED requesting NFA status and a permit modification for the site. After an April 21, 2004 site visit, NMED informed Holloman AFB that NFA for LF-21 would only be considered after additional characterization was performed at the site. Additional characterization requirements were discussed at the April 21, 2004 meeting and summarized in USAF correspondence dated May 21, 2004 (USAF, 2004) and NMED correspondence dated August 10, 2004 (NMED, 2004).

5.6 INVESTIGATION ACTIVITIES

5.6.1 Geophysical Surveying

A geophysical survey of LF-21 was conducted in September and October 2005. The geophysical survey of LF-21 included both a terrain conductivity survey and magnetic survey. Approximately five acres were surveyed, completely covering the three acre site. Prior to conducting the surveys, the site was visually inspected. Debris consisting of asphalt, concrete, metal piping, wiring, sheet metal, and a wood door was observed scattered in small piles throughout the entire unit. One large green, metallic storage box and several military foxholes were also observed. Based on the presence of surficial debris, the geophysical survey was extended westward and southward beyond the previously defined limits of LF-21 to encompass five acres.

The area included within the LF-21 geophysical survey is shown on Figures 5.3 (terrain conductivity survey map) and 4.4 (magnetic survey map). The results were used to determine trenching locations.

5.6.2 Trenching

On May 18 and 19, 2006, three trenches (designated as HGLTR21-01 through HGLTR21-03) and four test pits (designated as HGLTP21-01 through HGLTP21-04) were completed at LF-21 as directed by NMED to maximum depths ranging from 4 and 6 feet bgs. The three trenches were located next to three distinct grouping of robust magnetic anomalies. During a visual inspection of the sites proposed for trenching, construction debris (i.e., concrete and asphalt rubble, scrap metal, plastic piping, and a wooden door) was observed scattered across the surface of all three areas to be trenched. The trenches ranged from 50 feet (HGLTR21-01) to 114 feet in length (HGLTR21-03). The four test pits were completed in areas containing essentially one robust magnetic anomaly. Each trench/test pit was backfilled to grade with excavated soils upon characterization of the excavated soils and waste materials, if present.

Based on a visual inspection of the test pit locations, test pit lengths were lengthened longer than the NMED requested 10 foot length if surficial debris deposits (i.e., asphalt, concrete, piping fragments, etc.) suggested a disposal pit or disposal mound greater than 10 feet in length. Surficial construction debris was observed at test pit locations HGLTP21-01, HGLTP21-03, and HGLTP21-04. Therefore, test pits HGLTP21-01, HGLTP21-03, and HGLTP21-04 were lengthened to 45 feet, 20 feet, and 29 feet, respectively. No construction debris was observed at test pit location HGLTP21-02.

The locations of the completed trenches and test pits are presented on Figure 5.5. Photographs of the trenching activities are included in Appendix A.

5.6.3 Trench Soil Sampling

No hazardous materials, contaminated soils, non-native soils (i.e., fill), landfill leachate, or hazardous material storage containers were observed during LF-21 trenching activities based on visual inspection and PID field screening results. Consequently, no soil samples were collected for laboratory analysis.

5.7 SUPPLEMENT RFI INVESTIGATION RESULTS

5.7.1 Geophysical Surveying Results

5.7.1.1 Terrain Conductivity Survey Results

The results of the LF-21 terrain conductivity survey are depicted on Figure 5.3. LF-21 soils were identified as being moderately to highly conductive during the terrain conductivity survey (Figure 5.3). Conductivities were generally higher along the southeastern, southern, western, and northwestern portions of the survey area. No distinct conductivity patterns suggestive of landfill boundaries were discerned from the survey data.

Several high conductive anomalies were identified; two were within the southeastern portion, near Forty-Niner Avenue; two were in the north-central portion of the survey area, adjacent to Observatory Road; and the one associated with a green metal shed. With the exception of the green metal shed anomaly, the remaining high conductivity anomalies exhibited diffuse borders suggesting either saturated soil conditions or buried non-metallic debris. Several small, localized low conductivity anomalies were detected onsite. These anomalies typically occurred in the northeastern corner of the survey area.

5.7.1.2 Magnetic Survey Results

Magnetic surveying of LF-21 identified multiple magnetic anomalies that generally occurred within four distinct groupings across the survey area (Figure 5.4). The largest magnetic anomaly grouping occurred in the southeast portion of the landfill in an area littered with surface metal debris. However, based on the visual inspection of the site, surface metal debris was observed scattered in piles across the entire survey area.

Two of the magnetic groupings occurred in areas corresponding to two of the high conductivity anomalies, one in the southeast corner of the survey area and one in the north-central portion of the survey area. A third metal grouping was identified in the immediate vicinity of the low conductivity anomaly.

5.7.1.3 Geophysical Survey Conclusions

Neither the terrain conductivity nor the magnetic survey data indicates the presence of one large distinct landfill. However, based on historic documents, LF-21 reportedly received waste consisting of paper bags, food, cans, boxes, boards, and tree limbs. Therefore, landfill material may be present with or without exhibiting a magnetic anomaly signature. Several

conductivity anomalies were identified but exhibited diffuse boundaries suggesting either the presence of highly conductive soils or buried non-metallic waste. Terrain conductivity results do not imply the presence of a landfill.

5.7.2 Trenching Results

The landfill material was observed in all of the LF-21 trenches and test pits, ranging in thickness from 2 to 5 feet and varying in type and composition of debris. Debris observed at LF-21 included primarily concrete rubble up to 3 feet by 4 feet by 0.5 feet in size; degraded asphalt rubble; scrap metal; metal, terra cotta, blue PVC, and green PVC piping; plastic sheeting; 3/8-inch rebar; and metal wire/cable. In addition, a section of an old engine, fabric, a wood door, and one over-the-counter, 1-gallon, shredded antifreeze plastic container was also observed. Typically, the soils surrounding the debris consisted of loose, light brown, silty sand; however, in the vicinity of test pit HGLTP21-04, the soil intermixed with the fill material was composed primarily of silt. Groundwater was not encountered within the trenches and no evidence of leachate was observed within the fill material.

Beneath the fill unit, undisturbed soils composed primarily of moderately loose, light brown, silty sand was encountered to the maximum excavated trench depth. The contact boundary between the fill material and underlying soils was distinct and rather uniform within an individual trench/test pit but varied vertically between trenches/test pits. Groundwater was not encountered in any of the trenches/test pits. No organic vapors, stained soils, or unusual solids and liquids were observed in the soils underlying the fill.

No canisters, buckets, or drums potentially used for the storage or disposal of hazardous materials were encountered at LF-21. A 1-gallon, over-the-counter, antifreeze plastic bottle was uncovered in trench HGLTR21-01; however, based on the bottle's appearance, the bottle was rinsed and shredded prior to burial. No stained soils, petroleum odors, or leachate were observed or detected with a PID in the soils comprising and underlying the LF-21 landfill. In accordance with the approved trenching plan (HGL, 2006b); no soil samples were collected due to the obvious lack of potential contamination within or beneath the LF-21 landfill.

Photographs of the trenching activities are presented in Appendix B. LF-21 trench and test pit logs are included in Appendix C.

5.8 CONCLUSIONS

Supplemental RFI activities, including a geophysical survey and trenching, were completed at the requested of NMED for the purpose of obtaining NFA status for LF-21.

Based on supplemental RFI activities, LF-21 was used for the disposal of construction debris, consisting primarily of concrete rubble, asphalt debris, and reworked soil to a maximum depth of 5 feet bgs, but also received some municipal waste. Scrap metal; metal and plastic piping; a wood door; portion of an old engine; fabric; and one empty over-the-counter, shredded 1-gallon plastic container were observed at the site. The presence of debris in all 3 trenches and

all 4 test pits indicates the area of disposal is slightly larger than historically reported; however, the results of the magnetic survey indicate the distribution of magnetically susceptible debris occurs sporadically and generally within the previously defined site limits.

Neither groundwater nor landfill leachate was encountered in the trenches and test pits. No evidence of soil contamination was observed within or beneath the discarded material and no canisters, buckets, or drums potentially used to store or dispose hazardous materials were observed at the site.

5.9 RECOMMENDATIONS

Given the type of debris comprising LF-21, the lack of contamination and hazardous materials within and beneath the disposal area, and groundwater sampling results over the last 10 years, NFA status under NMED Criterion 5 is recommended, and a class III permit modification is requested to remove the site from the active corrective action portion of the RCRA permit.

TABLES

Table 5.1
Remedial Investigation Groundwater Analytical Results
LF-21 (SWMU 116)
Holloman AFB, NM

Analyses	Background[1]	USEPA MCL	NMGWQ Standard	Detection Limit	MW-21-01 (upgradient)	MW-21-02	MW-21-03	MW-21-04
Inorganic Results (mg/L)								
EPA 160.1- Total Dissolved Solids	43,600	--	1,000	10	*12,000*	*26,000*	*27,000*	*27,000*
EPA 300.0- Chloride	19,600	--	250	26	*1,900*	*4,700*	*7,400*	*2,500*
EPA 300.0- Sulfate	7,470	--	600	5.0	*3,000*	*2,500*	*2,600*	*2,400*
EPA 340.2- Fluoride	4.7	4	1.6	0.10	*2.8*	*1.7*	*1.5*	*1.6*
EPA 353.1- Nitrate-Nitrite	98	--	--	0.22	18	18	14	10
EPA 365.2- Total Phosphorous	0.75	--	--	0.020	0.13	0.24	0.15	0.2
SW6010 - Metals (μg/L)								
Arsenic	72.3	10	100	8	*110*	*<8*	*<8*	*<8*
Cadmium	8.3	5	10	20	*<20*	*24*	*<20*	*<20*
Lead	19.9	15	50	6	<6	6.8	7.2	13
Organic Results								
SW8240 - Volatile Organics (μg/L)								
Benzene	--	5	10	5	<5.0	<5.0	1.4 J	<5.0
Ethylbenzene	--	700	750	5	<5.0	<5.0	1.5 J	<5.0
Methylene chloride	--	--	100	5	4.2 JB	11 B	3.7 JB	1.7 JB
Styrene	--	100	--	5	<5.0	<5.0	2.4 J	<5.0
Toluene	--	1,000	750	5	<5.0	<5.0	4.4 J	<5.0
Xylenes	--	10,000	620	5.0	<5.0	<5.0	2.9 J	<5.0

Notes:

Note: Table presents only constituents detected in ground water at this site.

USEPA = U.S. Environmental Protection Agency
MCL = Maximum Contaminant Level
NMGWQ = New Mexico Groundwater Quality
SWMU = solid waste management unit
AFB = Air Force Base
NM = New Mexico
mg/L = milligrams per liter
μg/L = micrograms per liter
-- = No value or standard was found.
J = Positive detected below the detection limit.
B = Postivitive detection considered a result of laboratory blank contamination.
JB = Positive detection below the method dection limit and considered a result of laboratory blank contamination.
< = less than associated concentration
Results in **BOLD** and *italics* exceed USEPA Primary Drinking Water MCLs and are greater than the background and upgradient values.
Results shaded in **BOLD** and *italics* exceed NMGWQ Standards for Human Health and are greater than the background and upgradient values.
Results in italics exceed USEPA or NMGWQ standards but are below background and/or upgradient levels.
^ NMGWQ Standard for Irrigation Use

[1] Source for Inorganics Values: Radian (1992b). Source for Metals: Radian (1993).

Table 5.2
Long Term Groundwater Monitoring Analytical Results
LF-21 (SWMU 116)
Holloman AFB, NM

Well Number		USEPA MCL	NMGWQ Standards	MW-21-01*					MW-21-02				
Sampling Data	Background	(µg/L)	(µg/L)	Aug-95	Sep-97	Sep-99	Sep-01	Apr-03	Aug-95	Sep-97	Sep-99	Sep-01	Apr-03
VOCs[1] (µg/L)													
Chloroform	--	--	100	ND	ND	ND	ND	NA	ND	ND	ND	ND	NA
cis-1,2-dichloroethene	--	70	--	ND	ND	ND	ND	NA	ND	ND	ND	ND	NA
Methylene chloride	--	--	100	ND	5.1 UB	< 3	NA	NA	ND	5 UB	< 3	NA	NA
Trichlorethylene	--	5	100	ND	*5.4*	*11*	*13*	*15*	ND	ND	< 3	< 5	< 1
Metals[2] (µg/L)													
Arsenic	35.4	10	100	ND	ND	*16.2 B (J)*	*11.8 (J)*	*21.2*	ND	ND	*13.0 B (J)*	7.2 B (J)	***< 100***
Barium	85.2	2,000	1,000	ND	17	18.6 B (J)	NA	15.7	ND	40	32.1 B (J)	NA	19.5 J
Cadmium	7.4	5	10	ND	ND	< 0.3	NA	NA	ND	ND	0.3 B	NA	NA
Chromium	7.2	100	50	ND	ND	9.3 B (J)	< 20	NA	ND	ND	< 0.6	< 20	NA
Iron	--	--	1,000	ND	ND	< 21	< 1000	< 200	ND	ND	< 21	< 1000	< 200
Manganese	--	--	200	ND	ND	2.1 B (J)	139 (J)	12.3	ND	ND	0.6 B (J)	< 10 (UJ)	< 100
Selenium	85.3	50	50	ND	ND	6.2 B (J)	NA	<10	ND	ND	11.3 B (J)	NA	***<100***
Organochlorine Pesticides[3] (µg/L)													
all	--	--	--	ND	ND	NA	NA	NA	ND	ND	NA	NA	NA
Chlorinated Herbicides[4] (µg/L)													
all	--	--	--	ND	ND	NA	NA	NA	ND	ND	NA	NA	NA

Notes:
[1] Unless otherwise reported, no VOCs were detected prior to 2001 using USEPA Method 8260B.
(USEPA Method 8260A was used to analyze for VOCs in the 1995 and 1997 programs.)
[2] Unless otherwise reported, no metals were detected using USEPA Methods 6010B Trace & 7470A.
(USEPA Method 8080A was used to analyze for organochlorine pesticides in the 1995 and 1997 programs.)
[3] Unless otherwise reported, no organochlorine pesticides were detected prior to 1999 using USEPA Method 8081A.
(USEPA Method 8080A was used to analyze for organochlorine pesticides in the 1995 and 1997 programs.)
[4] Upgradient monitoring well

CRDL = Contract-required Detection Limit
IDL = Instrument Detection Limit
NA = not analyzed
ND = not detected at or above method reporting limit
VOCs = volatile organic compounds
µg/L = micrograms per liter
-- = No value or standard was found
SWMU = solid waste management unit
AFB = Air Force Base
NM = New Mexico
USEPA = U.S. Environmental Protection Agency
MCL = Maximum Contaminant Level
NMGWQ = New Mexico Groundwater Quality
< = less than associated concentration
Results in **BOLD** and *italics* exceed USEPA Primary Drinking Water MCLs and are greater than the background and upgradient values.
Results shaded in **BOLD** and *italics* exceed NMGWQ Standards for Human Health and are greater than the background and upgradient values.
Results in *italics* exceed USEPA or NMGWQ standards but are below background and/or upgradient levels.

* Radian (1993)b

Laboratory qualifiers–assigned as a result of internal laboratory data assessment procedures.
B - Value less than CRDL but greater than or equal to IDL.
J - Estimated value less than CRDL but greater than or equal to IDL.
UB - Qualifies as non-detect due to presence of analyte in associated laboratory blank.
USEPA Qualifiers–assigned as a result of independent data validation.
(J) - Estimated value.
(UJ) - Estimated value below the reporting limit.
(U) Compound was analyzed for but not detected.
2003 Validation Qualifiers
J - Estimated value detected less than the CRDL but greater than the reporting limit.
U - Compound was analyzed for but not detected. Analyte result was below the CRDL.
UJ - Estimated as a non-detect at the detection limit.

Table 5.2
Long Term Groundwater Monitoring Analytical Results
LF-21 (SWMU 116)
Holloman AFB, NM

Well Number		USEPA MCL	NMGWQ	MW-21-03					MW-21-04				
Sampling Data	Background*	(µg/L)	(µg/L)	Aug-95	Sep-97	Sep-99	Sep-01	Apr-03	Aug-95	Sep-97	Sep-99	Sep-01	Apr-03
VOCs[1] (µg/L)													
Chloroform	--	--	100	ND	ND	ND	ND	NA	ND	ND	ND	ND	NA
cis-1,2-dichloroethene	--	70	--	ND	ND	ND	ND	NA	ND	ND	ND	ND	NA
Methylene chloride	--	--	100	ND	5.4 UB	< 3	NA	NA	ND	4.7 UB	< 3	NA	NA
Trichlorethylene	--	5	--	ND	ND	< 3	< 5	< 1	ND	ND	< 3	< 5	< 1
Metals[2] (µg/L)													
Arsenic	35.4	10	100	ND	ND	*11.6 B (J)*	*12 (J)*	*16.1*	ND	ND	4.6 B (J)	6.7 B (J)	*11.8*
Barium	85.2	2000	1000	ND	36	36.1 B (J)	NA	26.8	ND	38	37.1 B (J)	NA	24.7
Cadmium	7.4	5	10	ND	ND	0.6 B	NA	NA	ND	ND	0.7 B	NA	NA
Chromium	7.2	100	50	ND	ND	< 0.6	< 20	NA	ND	ND	< 0.6	*< 200*	NA
Iron	--	--	1000	ND	ND	< 21	< 1000	67.4 J	ND	600	936	*3440 B*	89.2 J
Manganese	--	--	200	ND	50	34.8 (J)	42.1 (J)	19.2	ND	ND	78.5 (J)	62.5 (J)	18.6
Selenium	85.3	50	50	ND	ND	12.4 B (J)	NA	13.4 J	ND	ND	11.5 B (J)	NA	12.6 J
Organochlorine Pesticides[3] (µg/L)													
all	--	--	--	ND	ND	NA	NA	NA	ND	ND	NA	NA	NA
Chlorinated Herbicides[4] (µg/L)													
all	--	--	--	ND	ND	NA	NA	NA	ND	ND	NA	NA	NA

Notes:

[1] Unless otherwise reported, no VOCs were detected prior to 2001 using USEPA Method 8260B.
(USEPA Method 8260A was used to analyze for VOCs in the 1995 and 1997 programs.)

[2] Unless otherwise reported, no metals were detected using USEPA Methods 6010B Trace & 7470A.
(USEPA Method 8080A was used to analyze for organochlorine pesticides in the 1995 and 1997 programs.)

[3] Unless otherwise reported, no organochlorine pesticides were detected prior to 1999 using USEPA Method 8081A.
(USEPA Method 8080A was used to analyze for organochlorine pesticides in the 1995 and 1997 programs.)

[4] Upgradient monitoring well

CRDL = Contract-required Detection Limit
IDL = Instrument Detection Limit
NA = not analyzed
ND = not detected at or above method reporting limit
VOCs = volatile organic compounds
µg/L = micrograms per liter
-- = No value or standard was found
SWMU = solid waste management unit
AFB = Air Force Base
NM = New Mexico
USEPA = U.S. Environmental Protection Agency
MCL = Maximum Contaminant Level
NMGWQ = New Mexico Groundwater Quality
< = less than associated concentration

Results in **BOLD** and *italics* exceed USEPA Primary Drinking Water MCLs and are greater than the background and upgradient values.
Results shaded in **BOLD** and *italics* exceed NMGWQ Standards for Human Health and are greater than the background and upgradient values.
Results in *italics* exceed USEPA or NMGWQ standards but are below background and/or upgradient levels.

* Radian (1993)b

Laboratory qualifiers--assigned as a result of internal laboratory data assessment procedures.
B - Value less than CRDL but greater than or equal to IDL.
J - Estimated value less than CRDL but greater than or equal to IDL.
UB - Qualifies as non-detct due to presence of analyte in associated laboratory blank.
EPA Qualifiers--assigned as a result of independent data validation.
(J) - Estimated value.
(UJ) - Estimated value blow the reporting limit.
(U) Compound was analyzed for but not detected.
2003 Validation Qualifiers
J - Estimated value detected less than the CRDL but greater than the reporting limit.
U - Compound was analyzed for but not detected. Analyte result was below the CRDL.
UJ - Estimated as a non-detect at the detection limit.

This page was intentionally left blank.

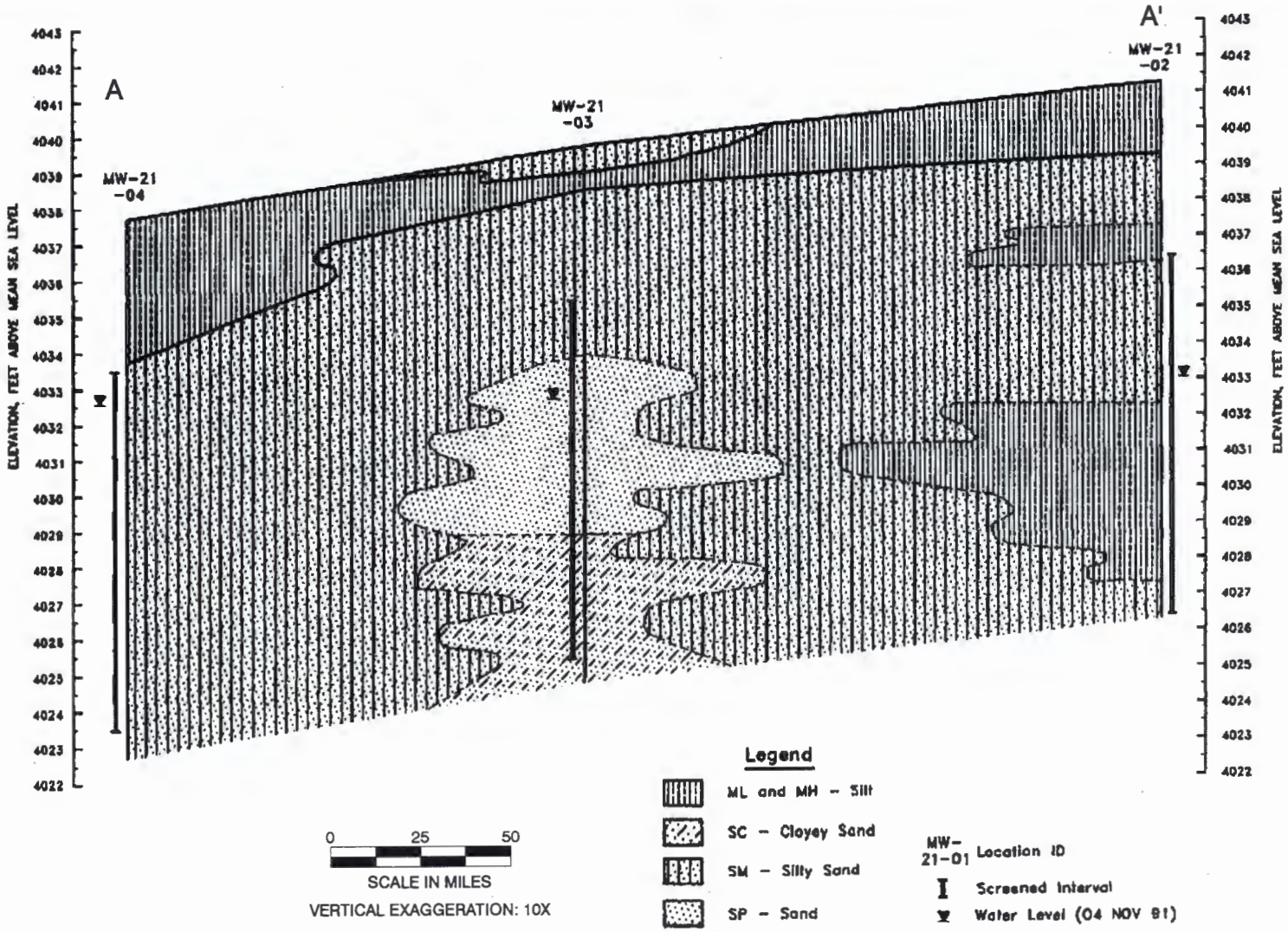
FIGURES

File X:\AFC002\Holloman_AFB\TO37\Maps\LF_19_21_22_23_Supp_RFI\LF-21.mxd
Project: AFC002-037-04-04-03
Revised: 09/25/06 BF
Map Source: Holloman AFB

Legend

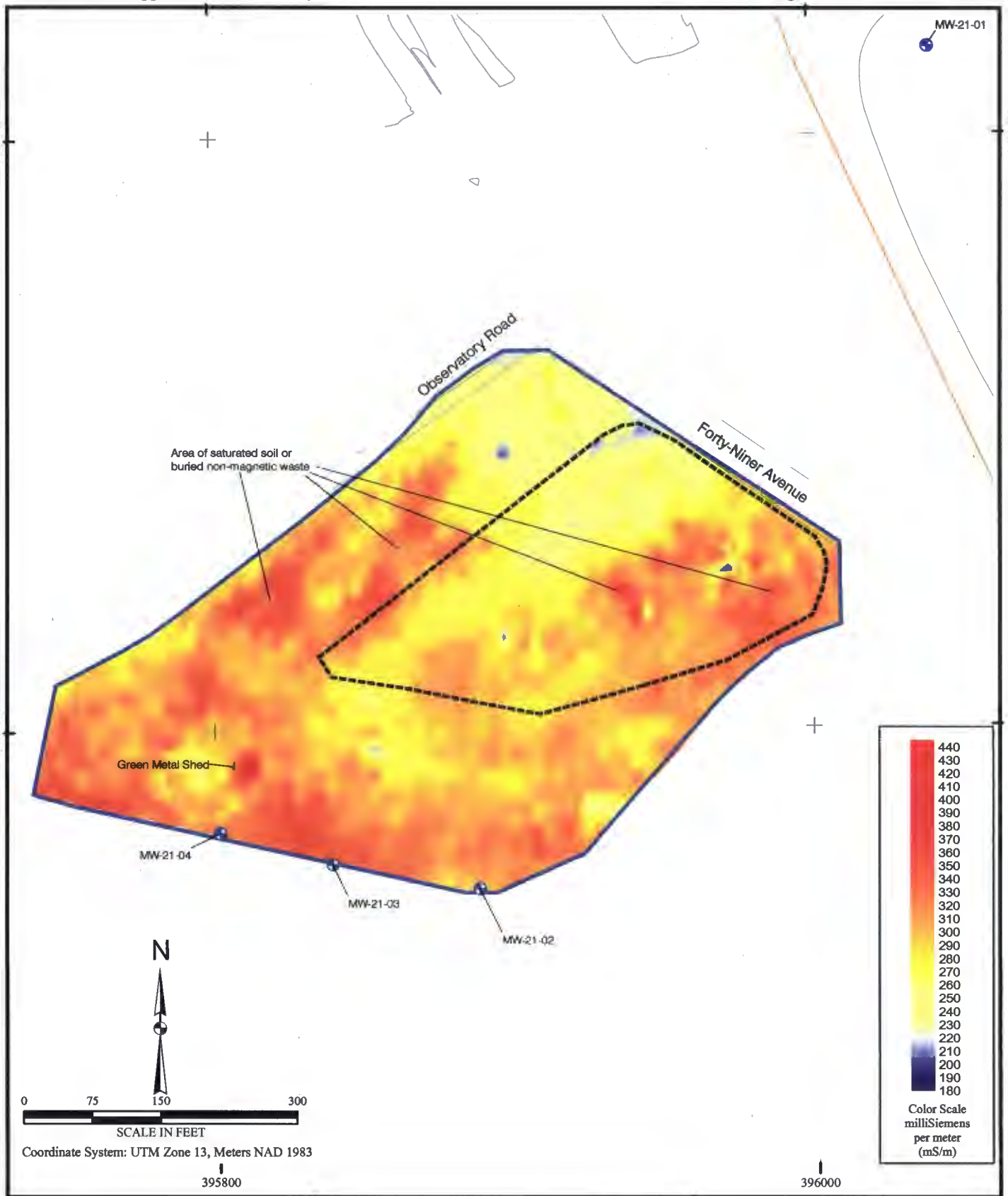
- Operable Unit Boundary (Base GIS)
- A — A' Cross Section
- Communication
- Electric
- Monitoring Well

Figure 5.1
LF-21 Site Map
Holloman AFB



X:\AFC002\Holloman_AFB\TO37\Maps\LF_19_21_22_23_Supp_RFII\LF_21_xsection.cdr
Project: AFC002-037-04-05-05
Revised: 09/25/06 BF
Source: Radian, 1992

Figure 5.2
LF-21 Geologic Cross Section
Holloman AFB

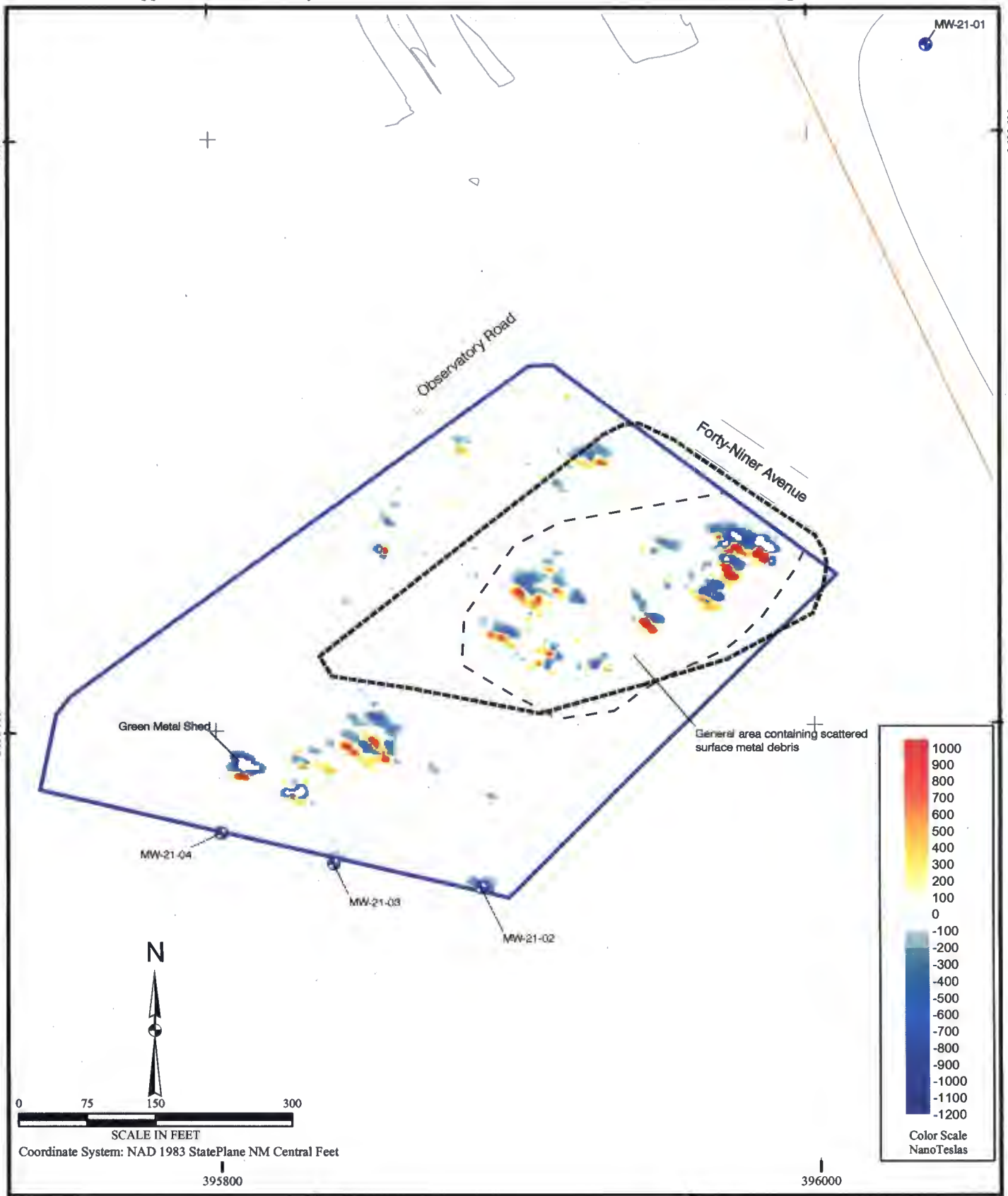


File X:\AFC002\Holloman_AFB\TO37\Maps\LF_19_21_22_23_Supp_RFI\LF-21_Geo.mxd
Project: AFC002-037-04-04-05
Revised: 11/20/06 TH
Map Source: Holloman AFB

Legend

- Monitoring Well
- Communication Line
- Operable Unit Boundary (Base GIS)
- Terrain Conductivity Survey Boundary

Figure 5.3
LF-21 Terrain Conductivity Survey
Holloman AFB

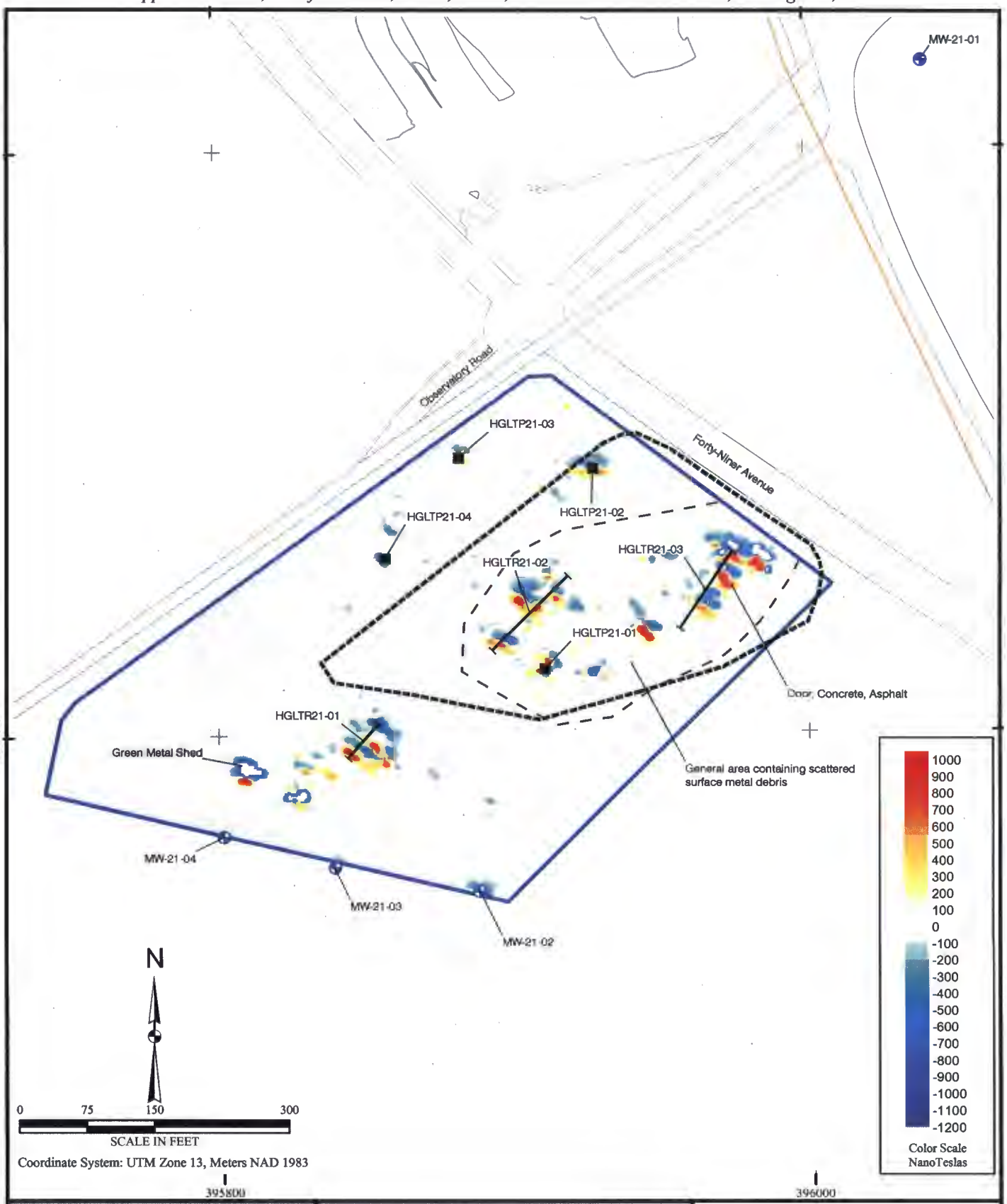


File X:\AFC002\Holloman_AFB\TO37\Maps\LF_19_21_22_23_Supp_RFI\LF-21_Mag.mxd
Project: AFC002-037-04-04-05
Revised: 11/20/06 TH
Map Source: Holloman AFB

Legend

- Monitoring Well
- Communication Line
- Operable Unit Boundary (Base GIS)
- Magnetic Survey Boundary

Figure 5.4
LF-21 Magnetic Survey
Holloman AFB



File X:\AFC002\Holloman_AFB\TO37\Maps\LF_19_21_22_23_Supp_RFI\LF-21_Trench.mxd
Project: AFC002-037-04-04-05
Revised: 09/26/06 BF
Map Source: Holloman AFB

Legend

- Monitoring Well
- Communication Line
- Operable Unit Boundary (Base GIS)
- Magnetic Survey Boundary
- Trench
- Test Pit

Figure 5.5
LF-21 Trench and Test Pit Locations
Holloman AFB

6.0 LF-22 (SWMU 115) - WEST AREA LANDFILL NO. 1

6.1 LOCATION

LF-22, West Area Landfill No. 1, is located in an arroyo west of the Solar Observatory (Building 910) and Observatory Road. LF-22 is approximately 350 feet northeast of landfill LF-23. The location of LF-22 with respect to the surrounding facility and the other landfills is shown on Figure 1.2. An aerial photograph of LF-22 is provided as Figure 6.1.

6.2 SITE DESCRIPTION

LF-22 is an undeveloped, moderately vegetated, rectangular-shaped portion of land, approximately three acres in size surrounding a former arroyo. The landfill trends in a northeast-southwest direction and is bordered to the east and southeast by an unpaved segment of Observatory Road and to the south, northwest and north by undeveloped land. Vegetation consists of salt cedars, shrubs, cactus, and grasses. Primarily, the salt cedars are located within and immediately around the former arroyo. Access to LF-22 is unrestricted; however, the site is located in a secluded portion of the base.

Debris, consisting almost exclusively of concrete rubble, is present within the former arroyo. Several former metal sign posts and a few metal pipes are also present. Photographs of LF-22 are provided in Appendix B.

6.3 WASTE HISTORY

LF-22 was a former landfill active between 1974 and 1978. The landfill was reportedly used for the disposal of plastic sheeting, boxes, and empty cans. Disposal operations were stopped after the site was identified as an unapproved landfill. During a records search of the unit, one interviewee indicated that some 55 gallon drums were observed during the active period of the landfill (HGL, 2005a).

6.4 ENVIRONMENTAL SETTING

6.4.1 Topography

With exception of the arroyo and several concrete rubble piles, LF-22 is flat with a very slight west to southwesterly dip. In the northern portion of the unit, a ramp constructed of concrete rubble and soil is present, while several small mounds of concrete rubble are present near the southern limit of the unit. The arroyo is located along the western edge of the site and filled-in with large concrete rubble blocks. The depth of the arroyo ranges from less than 0.5 feet to 3 feet; however, former landfilling activities have most likely modified the site and arroyo topography.

6.4.2 Geology

Site-specific LF-22 geologic information provided herein has been compiled from subsurface lithologic data obtained during the 1992 RFI (Radian, 1992a) as well as from this supplemental

RFI. In 1992, one upgradient, MW-22-01, and two downgradient, MW-22-02 and MW-22-03, monitoring wells were installed, providing a subsurface lithology north and south of the landfill. During this supplemental RFI, three trenches were completed yielding shallow subsurface soil data within and immediately below the landfill.

According to the 1992 RI, the upper 20 feet of LF-22 is composed of a silty sand unit interfingered with lenses of clayey sand, sand, and silt and underlain by clay. A geologic cross-section of LF-22, obtained from the 1992 RFI (Radian, 1992a) is included as Figure 6.2. Based on the cross section, the soils immediately south of LF-22 are primarily silty sands with lenses of sand and silt present from 5 to 15 feet deep to the east and a clayey sand lens from 5 to 9 feet bgs to the west. Clayey sand was also observed at the surface to 5 feet bgs in the south-central portion of LF-22. The silty sand unit is underlain by an interfingered clay unit along the western and eastern edges of the sites.

Within the trenches, a fill unit, composed of concrete rubble and a whitish brown to light brown, dry, silt, was observed across LF-22 from the surface to a maximum depth of 2 feet bgs in trench HGLTR22-01, 7 feet bgs in trench HGLTR22-02, and 4 feet bgs in trench HGLTR22-03. In some portions of the fill unit, the unit was composed almost entirely of concrete rubble with the size ranging from pea gravel to boulders (i.e., 6 feet by 3 feet by 0.5 feet). Beneath the fill layer, a reddish-brown to light beige brown, damp to moist, silty sand was present to the maximum depths trenched. LF-22 trench logs are included in Appendix B.

6.4.3 Soils

The USDA Soil Conservation Service has identified two soil associations in the vicinity of Holloman AFB: the Holloman-Gypsum Land-Yesum complex and the Mead silty clay loam. The permeability of these soil horizons ranges from $4x10^{-4}$ to $1x10^{-3}$ cm/sec (USDA, 1981).

Based on the Soil Conservation Service Soil Survey of Otero Area, New Mexico, LF-22 is underlain by the Holloman-Gypsum Land-Yesum complex. The soils are formed from alluvial and eolian gypsiferous sediments. The Holloman unit makes up approximately 35% of the complex. The unit is light brown to pink, very fine, sandy loam with high gypsum content, moderately permeable, calcareous, and mildly to moderately alkaline. The Gypsum Land unit makes up to 30% of the complex and is soft to hard white gypsum typically overlain by less than one inch of very fine, sandy loam. The Yesum unit, comprising approximately 20% of the complex is light brown to pinkish-white, very fine sandy loam that is also high in gypsum. The unit is moderately permeable, calcareous, and mildly alkaline (USDA, 1981).

6.4.4 Surface Water

Excluding the former arroyo, no surface water drainage features were observed adjacent to or crossing LF-22. Due to former landfilling and grading activities, the former arroyo at LF-22 is no longer an arroyo but appears to be more of a shallow basin. No surface water was observed within the former arroyo. Given the unpaved condition of LF-22, rainwater falling onto LF-22 will either evaporate or infiltrate into the shallow subsurface.

6.4.5 Hydrogeology

Depth to groundwater at LF-22 was observed to range from 9 to 12 feet bgs (HGL, 2005a). Based on the 2003 LTM sampling event, groundwater flows in a southwesterly direction with a gradient of 0.004 ft/ft (Bhate, 2003). Field slug tests conducted during the RI investigation yielded an average hydraulic conductivity of 1.50 ft/day. Assuming a porosity of 30%, the groundwater velocity across LF-21 was estimated to be 0.02 ft/day or 7.3 ft/yr. TDS at the site is greater than 10,000 mg/L.

Groundwater was not encountered in any of the trenches or test pits completed at LF-22.

6.5 PREVIOUS INVESTIGATIONS

Previous investigations conducted at LF-22 included a 1992 RI (Radian, 1992a) and five LTM sampling events. A detailed discussion of the RI and LTM sampling results is presented in Section 2.2.5 of the supplemental work plan (HGL, 2005a). For report completeness, a brief discussion of the previous investigations and associated sample results is provided below.

6.5.1 LF-22 Remedial Investigation

The 1992 LF-22 RI consisted of the installation and sampling of four monitoring wells, MW22-01, MW22-02, MW22-03, and MW22-04. MW22-01 was installed upgradient of LF-22 in order to assess the local background groundwater quality. Monitoring wells MW22-02 through MW22-04 were installed downgradient of the landfill to evaluate the groundwater quality emanating from the individual disposal units. Groundwater samples collected from the site monitoring wells were analyzed for VOCs, organochlorine pesticides, organophosphorus pesticides, PCBs, chlorinated herbicides, total metals, anions, and TDS. Similar to other landfill sites, soil sampling was not proposed because of the inherent heterogeneity of landfills.

RI groundwater analytical results are presented in Table 6.1. Only cadmium (11 μg/L in MW22-02) was detected at a concentration above background and NMGWQ standard of 10 μg/L. It is important to note that the total cadmium concentration is being compared to a standard for dissolved cadmium. The pesticides 4,4'-DDE and alpha-BHC were detected at low concentrations in downgradient monitoring well MW22-04. No pesticides were detected in the other monitoring wells. With the exception of methylene chloride attributable to blank contamination, no VOCs were detected in MW22-03 or MW22-04. Some halogenated VOCs were detected at estimated low levels in the upgradient well MW22-01, and several non-halogenated VOCS were present at estimated low levels in MW22-02. The risk characterization of LF-22 concluded that the site does not present an unacceptable risk even under worst-case exposure conditions.

6.5.2 Long Term Groundwater Monitoring

Based on the results of the RI, Holloman AFB submitted a Decision Document (Radian, 1995) concluding a no action remedy was appropriate for LF-22. As part of the no action remedy,

surface debris would be removed, a plat of survey would be produced, and LTM would be conducted at the site at the request of NMED and USEPA. LTM activities would consist of the biennial collection and analysis of groundwater samples from the three onsite wells for 10 years to ensure any potential future release from the site would be detected. The decision document was signed by the Holloman AFB base commander and NMED in September 1994.

LTM activities were initiated in 1995. A summary of the groundwater positive detections since LTM was initiated in 1995 is provided as Table 6.2. Modification of the required analyte list was conducted over the course of the LTM program due to lack of analyte detections. After the 1999 LTM event, NMED approved to discontinue monitoring PCBs, pesticides and herbicides. Subsequent analyte reductions reduced the required analyte list to include only arsenic, barium, iron, manganese, and selenium. As shown on Table 6.2, over the history of the LTM program, no constituents in downgradient wells were detected above background concentrations and NMGWQ standards.

6.5.3 Statement of Basis

In February 2004, Holloman AFB submitted a SOB to NMED requesting NFA status and a permit modification for the site. After an April 21, 2004 site, visit NMED informed Holloman AFB that LTM could be suspended, but NFA for LF-22 would only be considered after additional characterization was performed at the site. Additional characterization requirements were discussed at the April 21, 2004 meeting and summarized in USAF correspondence dated May 21, 2004 (USAF, 2004) and NMED correspondence dated August 10, 2004 (NMED, 2004).

6.6 SUPPLEMENTAL RFI INVESTIGATION ACTIVITIES

6.6.1 Geophysical Surveying

A geophysical survey of LF-22 was conducted in September and October 2005. The geophysical survey of LF-22 included both a terrain conductivity survey and magnetic survey. Approximately 3.5 acres were geophysical surveyed, completely covering the site. A visual inspection of LF-22 (SWMU 115) was conducted immediately prior to implementing geophysical surveying activities. The unit was observed to be a construction debris rubble pile within a former drainage swale. Several trees bordered the debris laden drainage swale. The area surrounding the debris pile was flat, sparsely vegetated with small shrubs, and contained minor amounts of surface metallic debris.

The area included within the LF-22 geophysical survey is shown on Figures 6.3 (terrain conductivity survey map) and 6.4 (magnetic survey map). The results were used to select trench locations.

6.6.2 Landfill Trenching

On May 18, 2006, three trenches (designated as HGLTR22-01 through HGLTR22-03) were completed at LF-22 as directed by NMED to maximum depths ranging from 4 (HGLTR22-01)

and 8 feet bgs (HGLTR22-02). Trenches HGLTR22-01 and HGLTR22-03 were completed adjacent to identified magnetic anomalies within the waste unit. Trench HGLTR22-02 was completed across the landfill unit. The maximum trench depths correspond to 1 to 2 feet below the base of the landfill material. The trenches ranged from 44 feet (HGLTR22-03) to 117 feet in length (HGLTR22-02). The locations of the completed trenches are presented on Figure 3.3. Photographs of the trenching activities are included in Appendix A.

Upon completion of a trench/test pit and lithologic logging and waste characterization activities, each trench was backfilled to grade with the excavated soils.

6.6.3 Trench Soil Sampling

No hazardous materials, contaminated soils, unusual solids or fluids, or hazardous material storage containers were observed during LF-22 trenching activities based on visual inspection and PID field screening results. Consequently, no soil samples were collected for laboratory analysis.

6.7 SUPPLEMENT RFI INVESTIGATION RESULTS

6.7.1 Geophysical Surveying Results

6.7.1.1 Terrain Conductivity Survey Results

One large low conductivity anomaly was identified at LF-22 (Figure 6.3). The anomaly was fairly well defined, roughly oblong in shape, approximately 400 feet long, and averaged 80 feet in width. The anomaly encompassed the concrete debris laden arroyo observed on site. No other anomalies were identified from the survey data.

6.7.1.2 Magnetic Survey Results

Numerous magnetic anomalies were identified at LF-22 (Figure 6.4). The majority of the magnetic anomalies correspond with the low conductivity anomaly (i.e., the concrete debris laden drainage channel). Few metallic objects were observed within and around the concrete rubble. This suggests metallic or magnetically susceptible objects may be buried beneath the concrete rubble.

The remaining anomalies outside of the concrete rubble laden arroyo were associated with onsite structures (i.e., fencing and monitoring wells) and surface metal debris scattered across the survey area.

6.7.1.3 Geophysical Survey Conclusions

According to base records, LF-22 received waste in the form of plastic sheeting, boxes, and empty cans. Geophysical surveying identified one conductivity anomaly and multiple magnetic anomalies. The conductivity anomaly and most of the magnetic anomalies were associated with a concrete rubble pile located within a former arroyo.

6.7.2 Trenching Results

Fill material, consisting almost exclusively of concrete rubble, was observed on the surface and within the shallow subsurface of LF-22 to maximum depths ranging between 2 and 7 feet bgs. Several metal sign posts, pieces of metal piping, and rebar were also observed on the surface and in the shallow subsurface of LF-22. In addition, fragments of plastic sheeting and fabric were also observed in the far western portion of trench HGLTR22-02 at 2 to 3 feet bgs. Soils surrounding the concrete rubble were typically composed of brown, loose, and dry to damp, silty sand (SM). The presence of concrete rubble in the subsurface corresponded well to the terrain conductivity anomaly identified at LF-22 during the geophysical survey. Groundwater was not encountered within the trenches and no evidence of leachate was observed within the fill material.

Beneath the fill material, undisturbed reddish brown to light beige, moderately soft, damp to moist, silty sand containing calcite crystals was observed. No visual or field screening evidence was obtained indicating the soil underlying the debris laden fill unit had been impacted from hazardous material disposal activities.

No containers, buckets, or drums used for the storage or disposal of hazardous materials were observed in the LF-22. In addition, no soil staining, non-native soils (i.e., fill), landfill leachate, or petroleum odors were observed or detected in the soils comprising and underlying the LF-22 landfill. In accordance with the approved trenching plan (HGL, 2006b), no soil samples were collected due to the obvious lack of potential contamination within or beneath the LF-22 landfill.

Photographs of the trenching activities are presented in Appendix B. LF-22 trench logs are included in Appendix C.

6.8 CONCLUSIONS

Supplemental RFI activities, including a geophysical survey and trenching, were completed at the request of NMED for the purpose of obtaining NFA status for LF-22.

Based on supplemental RFI data, LF-22 is a construction debris disposal area used primarily for the disposal of concrete rubble. Neither groundwater nor landfill leachate was encountered in the completed trenches. No evidence of contamination was observed within the disposed material or beneath the LF-22 landfill, and no canisters, buckets, or drums potentially used to store or dispose hazardous materials were observed at the site.

6.9 RECOMMENDATIONS

Given the type of debris comprising LF-22, the lack of contamination and hazardous materials within and beneath the disposed material, and groundwater sampling results over the last 10 years, NFA status under NMED Criterion 5 is recommended and a class III permit modification is requested to remove the site from the active corrective action portion of the RCRA permit.

TABLES

Table 6.1
Remedial Investigation Groundwater Analytical Results
LF-22 (SWMU 115)
Holloman AFB, NM

Location:	Background[1]	USEPA MCL	NMGWQ Standard	Detection Limit	MW-22-01 (upgradient)	MW-22-02	MW-22-03	MW-22-04
Analyses								
EPA 160.1- Total Dissolved Solids (mg/L)	43,600	--	1,000	10	*18,000*	*27,000*	*18,000*	*10,000*
EPA 300.0- Chloride (mg/L)	19,600	--	250	26	*6,200*	*11,000*	*8,200*	*3,900*
EPA 300.0- Sulfate (mg/L)	7,470	--	600	5.0	*3,500*	*3,300*	*2,800*	*2,900*
EPA 340.2- Fluoride (mg/L)	4.7	4	1.6	0.10	*2.4*	*1.9*	*2.5*	*3*
EPA 353.1- Nitrate-Nitrite (mg/L)	98	--	--	0.11	4.3	7.7	7.1	4.3
EPA 365.2- Total Phosphorous (mg/L)	0.75	--	--	0.0020	0.057	0.13	0.22	0.18
SW6010 - Metals (μg/L)								
Cadmium	8.3	5	10	5	*7.7*	*11*	< 5	< 5
Chromium	234	100	10	10	< 10	< 10	< 10	*13*
Nickel	43.6	--	200^	20	23	44	ND	29
Zinc	253.4	--	10,000	20	< 20	< 20	< 20	28
SW7421- Lead (μg/L)	19.9	15	50	3	< 3	< 3	7.9	4.9
SW8080 - Organochlorine Pesticides and PCBs (μg/L)								
4,4'- DDE	--	--	--	0.0094	< 0.0094	< 0.0094	< 0.0094	0.010 C
alpha - BHC	--	--	--	0.0094	< 0.0094	< 0.0094	< 0.0094	0.015 C
SW8240 - Volatile Organics (μg/L)								
1,1,2,2- Tetrachloroethane	--	--	10	5.0	0.098 J	< 5.0	< 5.0	< 5.0
1,1- Dichloroethane	--	--	25	5.0	1.9 J	< 5.0	< 5.0	< 5.0
Acetone	--	--	--	100	< 100	16 J	< 100	< 100
Benzene	--	5	10	5.0	< 5.0	0.14 J	< 5.0	< 5.0
Carbon disulfide	--	--	--	5.0	4.4 J	< 5.0	< 5.0	< 5.0
Chlorobenzene	--	100	--	5.0	< 5.0	0.33 J	< 5.0	< 5.0
Methylene chloride	--	--	100	5.0	0.76 JB	10 B	3.9 J	26 B
Tetrachloroethene	--	5	20	5.0	1.5 J	< 5.0	< 5.0	< 5.0
Toluene	--	1,000	750	5.0	< 5.0	0.23 J	< 5.0	< 5.0
Trichloroethene	--	5	100	5.0	1.2 J	< 5.0	< 5.0	< 5.0

Note: Table presents only constituents detected in groundwater at this site.
C = Presence and quantitation of analyte confirmed by second column analysis.
J = Detected below the detection limit.
B = Analyte detected in laboratory blank analysis, no blank subtraction performed.
ND = Not Detected, at the reported detection limit.
-- No value or standard was found.
SWMU = solid waste management unit
AFB = Air Force Base
NM = New Mexico
mg/L = milligrams per liter
μg/L = micrograms per liter
USEPA = U.S. Environmental Protection Agency
MCL = Maximum Contaminant Level
NMGWQ = New Mexico Groundwater Quality
< = less than associated concentration
^ NMGWQ Ground Water Standard for Irrigation Use

Results in **BOLD** and *italics* exceed USEPA Primary Drinking Water MCLs and are greater than the background and upgradient values.
Results shaded in **BOLD** and *italics* exceed NMGWQ Ground Water Standards for Human Health and are greater than the background and upgradient values.
Results in italics exceed USEPA or NMGWQ standards but are below background and/or upgradient levels.

[1] Source for metals background values: Radian (1993). Source for all other background values: Radian (1992b).

Table 6.2
Long Term Groundwater Monitoring Analytical Results
LF-22 (SWMU 115)
Holloman AFB, NM

Well Number		USEPA MCL	NMGWQ Standard	MW-22-01[4]					MW-22-02				
Sampling Data	Background[*]	(µg/L)	(µg/L)	Aug-95	Sep-97	Sep-99	Sep-01	Apr-03	Aug-95	Sep-97	Sep-99	Sep-01	Apr-03
VOCs[1] (µg/L)													
Chloroform	--	--	100	ND	ND	< 3	NA	NA	ND	ND	1 J	NA	NA
Methylene chloride	--	--	100	ND	4.1 UB	< 3	NA	NA	ND	ND	< 3	NA	NA
Tetrachloroethylene	--	5	20	ND	2.6 J	< 3	NA	NA	ND	ND	< 3	NA	NA
Trichlorethylene	--	5	100	ND	1.7 J	1 J	NA	NA	ND	ND	< 3	NA	NA
Metals[2] (µg/L)													
Arsenic	35.4	10	100	ND	ND	*11.8 B (J)*	*11.5 (J)*	*23.7*	ND	ND	*12 B (J)*	6.8 B (J)	*16.1*
Barium	85.2	2000	1000	ND	27	23.6 B (J)	20.7	14.2	ND	29	29.5 B (J)	17.6	19.8
Chromium	7.2	100	50	ND	ND	< 0.6	NA	NA	ND	ND	< 0.6	NA	NA
Iron	--	--	1000	ND	ND	< 21	< 1000	< 200	ND	ND	< 21	< 1000	123 J
Lead	5.6	15	50	ND	ND	< 1.5	< 10 (UJ)	NA	ND	ND	< 1.5	< 10 (UJ)	NA
Manganese	--	--	200	ND	ND	54	8.9 B (J)	65.7	ND	ND	0.7 B	< 10 (UJ)	< 10
Selenium	85.3	50	50	ND	ND	4.1 B (J)	< 10 (UJ)	<10	ND	ND	13.7 B (J)	3.3 B (J)	17.2
Organochlorine Pesticides[3] (µg/L)													
all	--	--	--	ND	ND	ND	NA	NA	ND	ND	NA	NA	NA
Polychlorinated Biphenyls (µg/L)													
all	--	--	--	ND	ND	ND	NA	NA	ND	ND	NA	NA	NA
Chlorinated Herbicides[5] (µg/L)													
2,4-D	--	--	--	ND	ND	< 0.08	NA	NA	ND	ND	< 0.8	NA	NA
MCPP	--	--	--	ND	ND	34 P (J)	< 0.5	NA	ND	ND	< 20	NA	NA
Picloram	--	500	--	ND	ND	0.046 P (J)	< 0.5	NA	ND	ND	< 0.04	NA	NA

Notes:
[1] Unless otherwise reported, no VOCs were detected prior to 2001 using USEPA Method 8260B.
(USEPA Method 8260A was used to analyze for VOCs in the 1995 and 1997 programs.)
[2] Unless otherwise reported, no metals were detected using USEPA Methods 6010B Trace & 7470A.
(USEPA Method 8080A was used to analyze for organochlorine pesticides in the 1995 and 1997 programs.)
[3] Unless otherwise reported, no organochlorine pesticides were detected prior to 1999 using USEPA Method 8081A.
(USEPA Method 8080A was used to analyze for organochlorine pesticides in the 1995 and 1997 programs.)
[4] Upgradient monitoring well
CRDL = Contract-required Detection Limit
IDL = Instrument Detection Limit
NA = not analyzed
ND = not detected at or above method reporting limit
VOCs = volatile organic compounds
µg/L = micrograms per liter
-- = No value or standard was found
SWMU = solid waste management unit
AFB = Air Force Base
NM = New Mexico
USEPA = U.S. Environmental Protection Agency
NMGWQ = New Mexico Groundwater Quality
< = less than associated concentration
Results in BOLD and *italics* exceed USEPA Primary Drinking Water MCLs and are greater than the background and upgradient values.
Results shaded in BOLD and *italics* exceed NMGWQ Standards for Human Health and are greater than the background and upgradient values.
Results in *italics* exceed USEPA or NMGWQ standards but are below background and/or upgradient levels.

[*] Radian (1993)

Laboratory qualifiers--assigned as a result of internal laboratory data assessment procedures.
B - Value less than CRDL but greater than or equal to IDL.
J - estimated value; less than CRDL but greater than or equal to IDL.
UB - Qualifies as non-detct due to presence of analyte in associated laboratory blank.
USEPA Qualifiers--assigned as a result of independent data validation.
(J) - Estimated value.
(UJ) - Estimated value below the reporting limit.
(U) Compound was analyzed for but not detected.
2003 Validation Qualifiers
J - Estimated value detected less than the CRDL but greater than the reporting limit.
U - Compound was analyzed for but not detected. Analyte result was below the CRDL.
UJ - Estimated as a non-detect at the detection limit.

Table 6.2
Long Term Groundwater Monitoring Analytical Results
LF-22 (SWMU 115)
Holloman AFB, NM

Well Number		USEPA MCL	NMED	MW-22-03					MW-22-04				
Sampling Data	Background[4]	(µg/L)	(µg/L)	Aug-95	Sep-97	Sep-99	Sep-01	Apr-03	Aug-95	Sep-97	Sep-99	Sep-01	Apr-03
VOCs[1] (µg/L)													
Chloroform	--	--	100	ND	ND	< 3	NA	NA	ND	ND	< 3	NA	NA
Methylen chloride	--	--	100	ND	ND	< 3	NA	NA	ND	ND	< 3	NA	NA
Tetrachloroethylene	--	5	20	ND	ND	< 3	NA	NA	ND	ND	< 3	NA	NA
TCE	--	5	100	ND	ND	< 3	NA	NA	ND	ND	< 3	NA	NA
Metals[2] (µg/L)													
Arsenic	35.4	10	100	ND	ND	6.4 B (J)	8.8 B (J)	*14.2*	ND	ND	5.3 B (J)	5.2 B (J)	*18.6*
Barium	85.2	2000	1000	ND	27	30.2 B (J)	47.8 B	17.5	ND	10	16.8 B (J)	16.1	12.7
Chromium	7.2	100	50	ND	ND	< 0.6	NA	NA	ND	ND	1.6 B	NA	NA
Iron	--	--	1000	ND	ND	< 21	*< 10,000*	33.8 J	ND	86	51.2 B	< 1000	123 J
Lead	5.6	15		ND	ND	< 1.5	< 10 (UJ)	NA	ND	ND	< 1.5	< 10 (UJ)	NA
Manganese	--	--	200	ND	ND	38.7	44.4 (J)	39.8	ND	29	52.1	38.6 (J)	62.2
Selenium	85.3	50	50	ND	ND	17.2 B (J)	10.2 (J)	12.3	ND	ND	4.6 B (J)	< 10 (UJ)	< 10
Organochlorine Pesticides[3] (µg/L)													
all	--	--	--	ND	ND	ND	NA	NA	ND	ND	ND	NA	NA
Polychlorinated Biphenyls (µg/L)													
all	--	--	--	ND	ND	ND	NA	NA	ND	ND	ND	NA	NA
Chlorinated Herbicides[5] (µg/L)													
2,4-D	--	--	--	ND	ND	< 0.08	NA	NA	ND	ND	0.51 P (J)	NA	NA
MCPP	--	--	--	ND	ND	< 20	NA	NA	ND	ND	< 20	NA	NA
Picloram	--	500	--	ND	ND	< 0.04	NA	NA	ND	ND	< 0.04	NA	NA

Notes:
[1] Unless otherwise reported, no VOCs were detected prior to 2001 using USEPA Method 8260B.
(USEPA Method 8260A was used to analyze for VOCs in the 1995 and 1997 programs.)
[2] Unless otherwise reported, no metals were detected using USEPA Methods 6010B Trace & 7470A.
(USEPA Method 8080A was used to analyze for organochlorine pesticides in the 1995 and 1997 programs.)
[3] Unless otherwise reported, no organochlorine pesticides were detected prior to 1999 using USEPA Method 8081A.
(USEPA Method 8080A was used to analyze for organochlorine pesticides in the 1995 and 1997 programs.)
[4] Upgradient monitoring well
CRDL = Contract-required Detection Limit
IDL = Instrument Detection Limit
NA = not analyzed
ND = not detected at or above method reporting limit
VOCs = volatile organic compounds
µg/L = micrograms per liter
– = No value or standard was found
SWMU = solid waste management unit
AFB = Air Force Base
NM = New Mexico
USEPA = U.S. Environmental Protection Agency
NMGWQ = New Mexico Groundwater Quality
< = less than associated concentration
Results in BOLD and *italics* exceed USEPA Primary Drinking Water MCLs and are greater than the background and upgradient values.
Results shaded in BOLD and *italics* exceed NMGWQ Standards for Human Health and are greater than the background and upgradient values.
Results in *italics* exceed USEPA or NMGWQ standards but are below background and/or upgradient levels.

[5] Radian (1993)

Laboratory qualifiers--assigned as a result of internal laboratory data assessment procedures.
B - Value less than CRDL but greater than or equal to IDL.
J - Estimated value less than CRDL but greater than or equal to IDL.
UB - Qualifies as non-detct due to presence of analyte in associated laboratory blank.
P - Results of dual-column GC technique differ by more than 25%; value is lower of the two.
USEPA Qualifiers--assigned as a result of independent data validation.
(J) - Estimated value.
(UJ) - Estimated value below the reporting limit.
(U) Compound was analyzed for but not detected.
2003 Validation Qualifiers
J - Estimated value detected less than the CRDL but greater than the reporting limit.
U - Compound was analyzed for but not detected. Analyte result was below the CRDL.
UJ - Estimated as a non-detect at the detection limit.

This page was intentionally left blank.

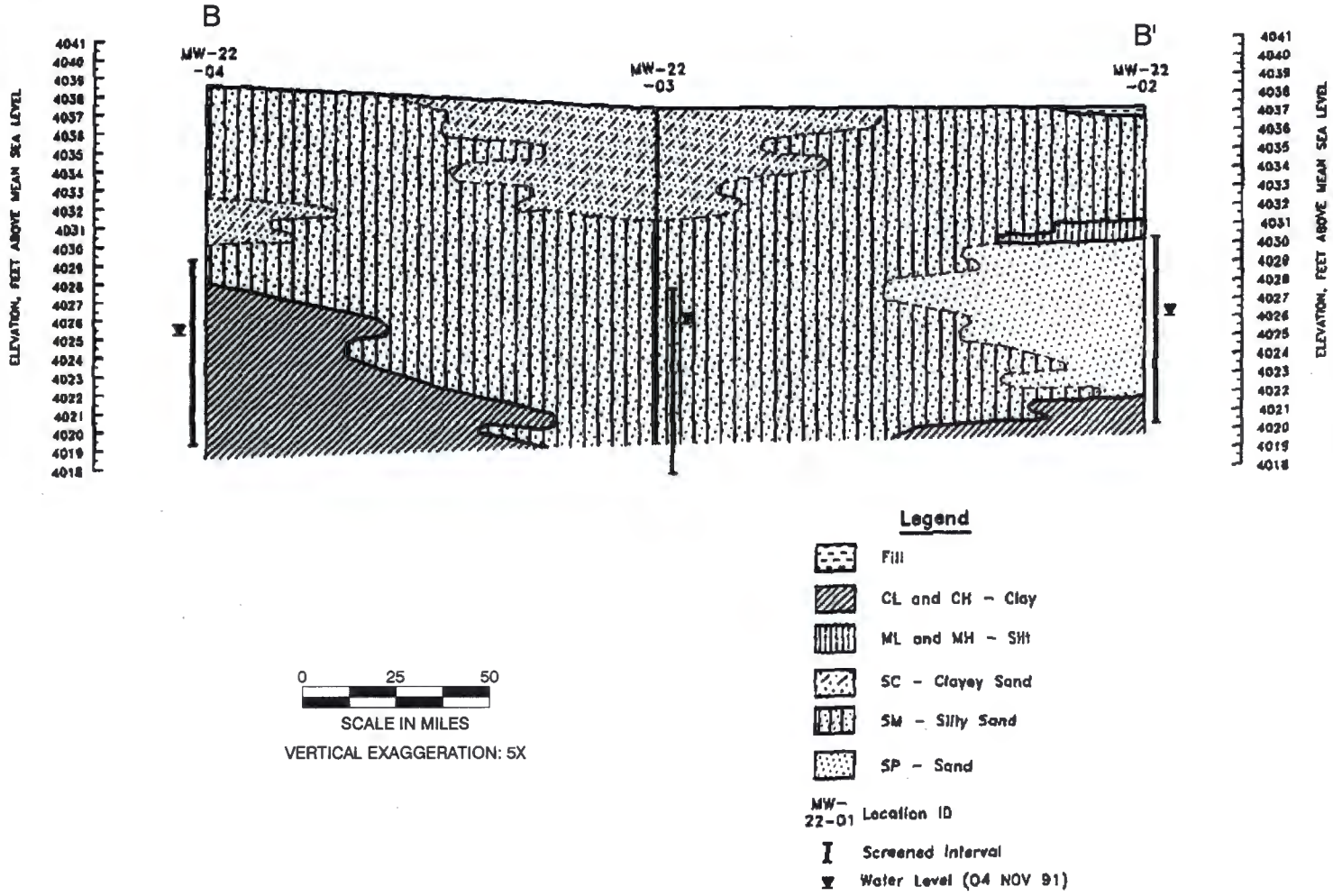
FIGURES

File X:\AFC002\Holloman_AFB\TO37\Maps\LF_19_21_22_23_Supp_RFI\LF-22.mxd
Project: AFC002-037-04-05-03
Revised: 09/25/06 BF
Map Source: Holloman AFB

Legend

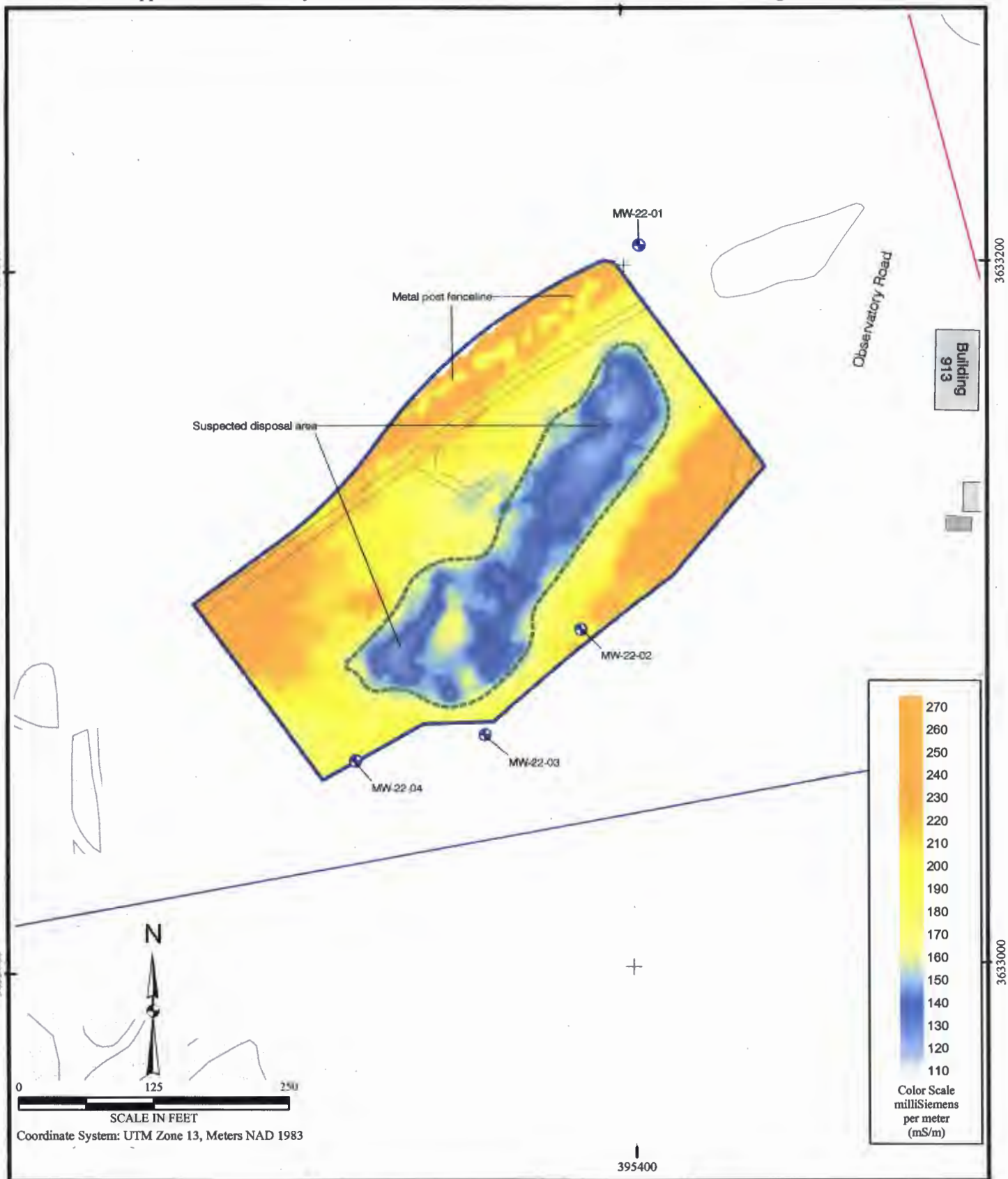
- Unit Boundary Implied by Geophysics
- B—B' Cross Section
- Water Line
- Below-Ground Electric
- Monitoring Well

Figure 6.1
LF-22 Site Map
Holloman AFB



X:\AFC002\Holloman_AFB\TO37\Maps\LF_19_21_22_23_Supp_RFI\LF_22_xsection.cdr
Project: AFC002-037-04-05-03
Revised: 09/25/06 BF
Source: Radian, 1992

Figure 6.2
LF-22 Geologic Cross Section
Holloman AFB

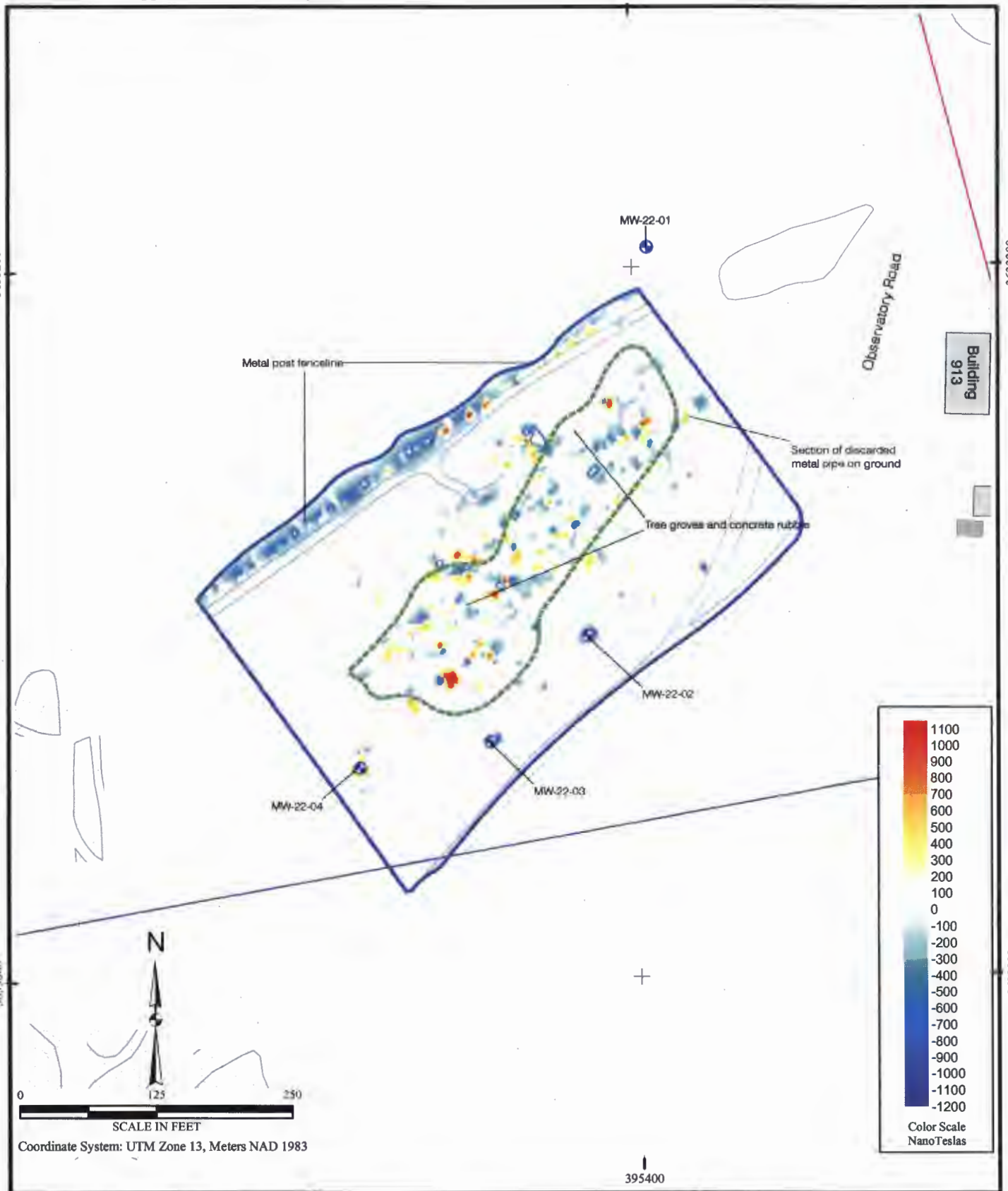


File X:\AFC002\Holloman_AFB\TO37\Maps\LF_19_21_22_23_Supp_RFI\LF-22_Geo.mxd
Project: AFC002-037-04-05-03
Revised: 09/25/06 BF
Map Source: Holloman AFB

Legend

- Monitoring Well
- Water Line
- Electric Line (Below Ground)
- Unit Boundary Implied by Geophysics
- Terrain Conductivity Survey Boundary

Figure 6.3
LF-22 Terrain Conductivity Survey
Holloman AFB

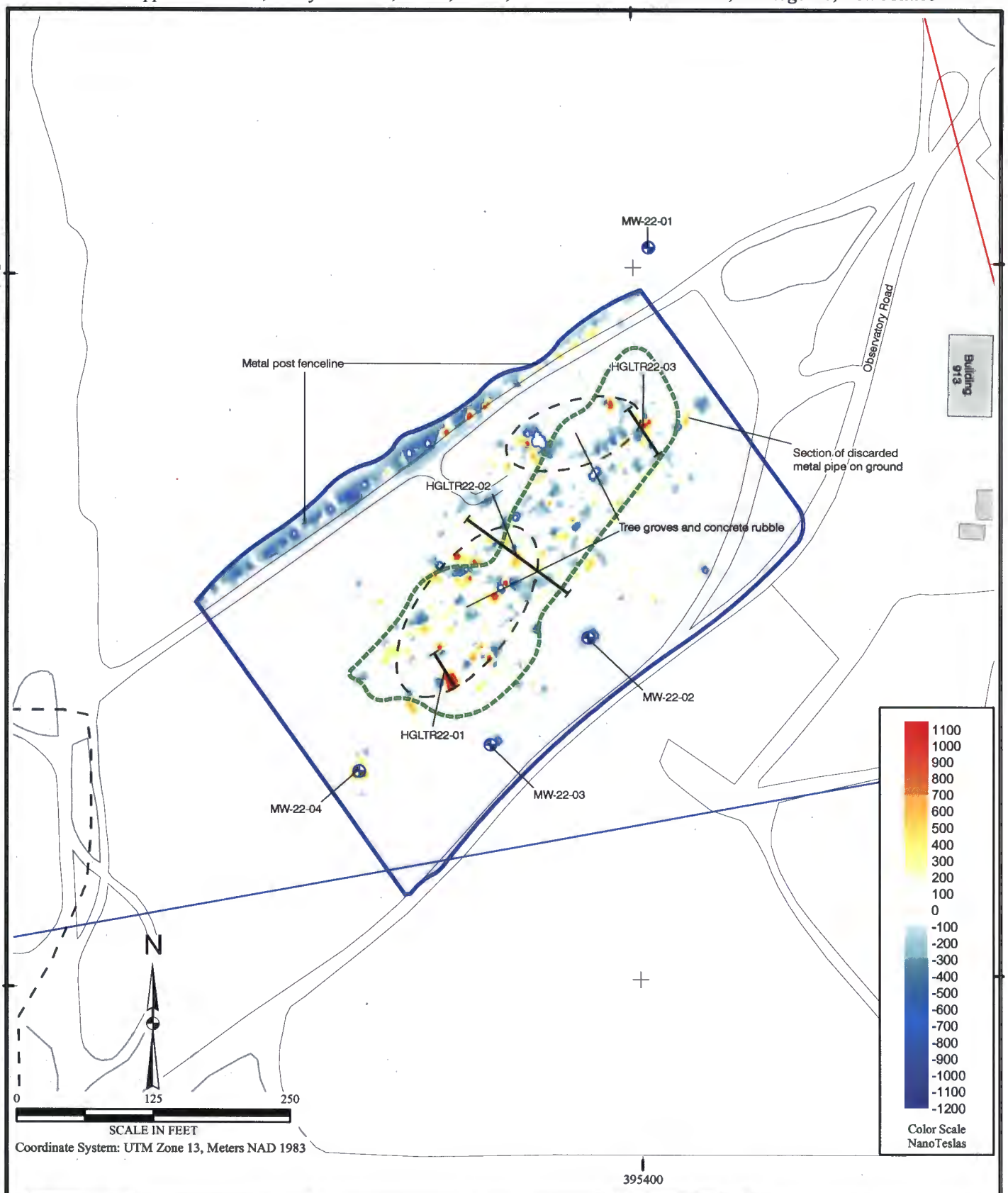


File X:\AFC002\Holloman_AFB\TO37\Maps\LF_19_21_22_23_Supp_RFI\LF-22_Mag.mxd
Project: AFC002-037-04-05-05
Revised: 09/25/06 BF
Map Source: Holloman AFB

Legend

- Monitoring Well
- Water Line
- Electric Line (Below Ground)
- Unit Boundary Implied by Geophysics
- Magnetic Survey Boundary

Figure 6.4
LF-22 Magnetic Survey
Holloman AFB



File X:\AFC002\Holloman_AFB\TO37\Maps\LF_19_21_22_23_Supp_RFI\LF-22_Trench.mxd
Project: AFC002-037-04-05-05
Revised: 09/26/06 BF
Map Source: Holloman AFB

Legend

- Monitoring Well
- Water Line
- Electric Line (Below Ground)
- Unit Boundary Implied by Geophysics
- Magnetic Survey Boundary
- Trench

Figure 6.5
LF-22 Trench Locations
Holloman AFB

7.0 LF-23 (SWMU 108) - MOBSS LANDFILL

7.1 LOCATION

LF-23, MOBSS Landfill, is located southwest of the Solar Observatory (Building 910), west of Observatory Road, and approximately 350 feet southwest of LF-22. The location of LF-23 with respect to the surrounding facility and the other landfills is shown on Figure 1.2. An aerial photograph of LF-23 is provided as Figure 7.1.

7.2 SITE DESCRIPTION

LF-23 is an undeveloped, rectangular-shaped parcel of land, trending in a north-south orientation, approximately 3 acres in size. The former landfill is moderately vegetated with shrubs, salt cedars (southwestern corner), and cactus. Construction debris consisting of concrete and asphalt rubble, metal sign posts, and metal cables was observed throughout LF-23 but primarily in the southern portion of the unit. To the north, the landfill appears to be composed primarily of concrete rubble. Two partially crushed, 1-gallon cans were observed along with a hardened black substance in a cement block located in the eastern south-central portion of the landfill. In addition, three rusted and fragmented 5-gallon cans were also observed in the southwestern corner of LF-23 during the 2005 geophysical survey. Photographs of LF-23 are included in Appendix B.

Several sand bag constructed fox holes and barb wire fencing are present in the southern portion of LF-23. The presence of the fox holes indicates the use of LF-23 for military training exercises. Numerous unpaved service roads lie adjacent to and cross LF-23 along the eastern and southern site boundaries and through the central portion of LF-23.

7.3 WASTE HISTORY

LF-23 was a former landfill that received waste disposal items from 1976 to 1979. During a records search of the site, cans of diazinon, dibromochloromethane, and 55-gallon drums of unknown contents were reportedly observed at the site.

7.4 ENVIRONMENTAL SETTING

7.4.1 Topography

LF-23 forms the northeastern slope of a borrow pit. The majority of the landfill is relatively flat, but minor variations associated with unpaved service roads, drainage rills and swales pockmark the surface of the landfill. Excluding the area immediately adjacent to the borrow pit slope, the overall dip of the topography is to the west-central portion of the site. In the southern portion of LF-23, the elevation difference between the top of the landfill unit and the base of the borrow pit is approximately 5 feet. Further north, the elevation difference between the top of the landfill unit and the borrow pit decreases and becomes non-existent in the central and northern portions of the landfill. The base of the borrow pit, in the vicinity of LF-23, is flat with an overall gentle, south-dipping slope.

7.4.2 Geology

Site-specific LF-23 geologic information provided herein has been compiled from subsurface lithologic data obtained during the 1992 RFI (Radian, 1992a) as well as from this supplemental RFI. In 1992, one upgradient, MW-23-01, and three downgradient, MW-23-02 through MW-23-04, monitoring wells were installed, providing a subsurface lithology north and south of the landfill. During this supplemental RFI, four trenches were completed yielding shallow subsurface soil data within and immediately below the landfill.

According to the 1992 RI, the upper 15 feet of soil immediately west and southwest of LF-23 is composed of interfingered units of clay, silt, and silty sand. A geologic cross-section of LF-23 obtained from the supplemental RFI work plan is included as Figure 7.2. Immediately west of the landfill, within the former borrow pit, clay was observed at the surface to 5 to 10 feet bgs. The clay unit vertically interfingered with a silt unit from 5 to 10 feet bgs to the northwest, and the unit horizontally and vertically interfingered with a silty sand unit to the south-southwest. A sand unit was present at the surface south of LF-23.

During the supplemental RFI, trenches were completed within the limits of LF-23 to a maximum depth of 3 to 6 feet bgs. A fill unit, ranging from 1 to 4.5 feet thick was observed at LF-23, with the thickest portion observed in trench HGLTR23-02. The fill unit contained construction debris within a light brown, loose, gravelly silty sand matrix. Beneath the fill unit, an undisturbed light brown, loose to moderately loose, silty sand was observed to the maximum depth of the trenches. Groundwater was not encountered within any of the trenches. No evidence of soil impacts, based on a visual inspection and field screening results, was obtained indicating former disposal or a release of hazardous materials to the underlying soils. Trench logs of the trenches completed at LF-23 are included in Appendix C.

7.4.3 Soils

The USDA Soil Conservation Service has identified two soil associations in the vicinity of Holloman AFB: the Holloman-Gypsum Land-Yesum complex and the Mead silty clay loam. The permeability of these soil horizons ranges from $4x10^{-4}$ to $1x10^{-3}$ cm/sec (USDA, 1981).

Based on the Soil Conservation Service Soil Survey of Otero Area, New Mexico, LF-23 is underlain by the Holloman-Gypsum Land-Yesum complex. The soils are formed from alluvial and eolian gypsiferous sediments. The Holloman unit makes up approximately 35% of the complex. The unit is light brown to pink, very fine, sandy loam with high gypsum content, moderately permeable, calcareous, and mildly to moderately alkaline. The Gypsum Land unit makes up to 30% of the complex and is soft to hard white gypsum typically overlain by less than one inch of very fine, sandy loam. The Yesum unit, comprising approximately 20% of the complex is light brown to pinkish-white, very fine sandy loam that is also high in gypsum. The unit is moderately permeable, calcareous, and mildly alkaline (USDA, 1981).

7.4.4 Surface Water

No surface water was observed in the vicinity of LF-23. Several rills and swales cross LF-23, running primarily from east to west into the borrow pit. These rills and swales occur primarily near the edge of the landfill/borrow pit and within the unpaved service roads crossing and running parallel to the site.

7.4.5 Hydrogeology

Depth to groundwater at LF-23 was observed to range from 4.5 to 9 feet bgs. Based on the LTM sampling event conducted in 2003, groundwater flows in a southwesterly direction with a gradient of 0.004 ft/ft. Field slug tests conducted during the RI investigation yielded an average hydraulic conductivity of 1.57 ft/day. Assuming a porosity of 30%, the groundwater velocity across LF-23 was estimated to be 0.02 ft/day or 7.3 ft/yr. TDS at the site is greater than 10,000 mg/L.

Although the soil encountered at the base of the LF-23 trenches were moist, groundwater was not encountered in any of the trenches or test pits completed at LF-23.

7.5 PREVIOUS INVESTIGATIONS

Previous investigations conducted at LF-23 included a RI completed in 1992 (Radian, 1992a) and five LTM sampling events. A detailed discussion of the RI and LTM sampling results is presented in Section 2.2.6 of the supplemental work plan (HGL, 2005a). For report completeness, a brief discussion of the previous investigations and associated sample results is provided below.

7.5.1 LF-22 Remedial Investigation

The 1992 LF-23 RI consisted of the installation and sampling of four monitoring wells, MW23-01, MW23-02, MW23-03, and MW23-04. MW23-01 was installed upgradient of LF-22 in order to assess the local background groundwater quality. Monitoring wells MW22-02 through MW22-04 were installed downgradient of the landfill to evaluate the groundwater quality emanating from the individual disposal units. Groundwater samples collected from the site monitoring wells were analyzed for VOCs, organochlorine pesticides, organophosphorus pesticides, PCBs, chlorinated herbicides, total metals, anions, and TDS. Similar to other landfill sites, soil sampling was not proposed because of the inherent heterogeneity of landfills.

RI groundwater analytical results are presented in Table 7.1. With the exception of methylene chloride, which can be attributed to blank contamination, no VOCs were detected in the groundwater. Organophosphorus pesticides, chlorinated herbicides, and PCBs were also not detected in the groundwater. Organochlorine pesticide delta-BHC was detected at low levels in MW32-02 and MW23-04. Since these two wells are located in a borrow pit that fills with run-off water from the Base during rainfall events, the RI suggested that the presence of delta-BHC may be attributable to runoff given the lack of detected constituents for the other parameters,

particularly for other pesticides and herbicides, and further suggested that the VSI conclusions with respect to former disposal practices may have been in error. The RI concluded that the MOBSS Landfill had little impact on the local groundwater. The risk characterization of LF-23 concluded that the site does not present an unacceptable risk even under worst-case exposure conditions.

7.5.2 Long Term Groundwater Monitoring

Based on the results of the RI, Holloman AFB submitted a Decision Document (Radian, 1995) concluding a no action remedy was appropriate for LF-23. The decision document was signed by both the Holloman AFB base commander and NMED in September 2004.

LTM activities were initiated in 1995. A summary of the groundwater positive detections since LTM was initiated in 1995 is provided as Table 7.2. Modification of the required analyte list was conducted over the course of the LTM program due to lack of analyte detections. After the 1999 LTM event, NMED approved to discontinue monitoring of VOCs, PCBs, pesticides and herbicides. Subsequent analyte reductions reduced the required analyte list to include only barium, iron, manganese, and selenium. As shown on Table 7.2, over the history of the LTM program, no constituents in downgradient wells were detected above background concentrations and NMGWQ standards, with the exception of selenium during the 2003 sampling event. The 2003 LTM selenium concentration in MW23-03, at 96.9 μg/L, only slightly exceeded the background limit of 85.3 μg/L.

7.5.3 Statement of Basis

In February 2004, Holloman AFB submitted a SOB to NMED requesting NFA status and a permit modification for the site. After an April 21, 2004 site visit, NMED informed Holloman AFB that LTM could be suspended, but NFA for LF-23 would only be considered after additional characterization was performed at the site. Additional characterization requirements were discussed at the April 21, 2004 meeting and summarized in USAF correspondence dated May 21, 2004 (USAF, 2004) and NMED correspondence dated August 10, 2004 (NMED, 2004).

7.6 SUPPLEMENTAL RFI INVESTIGATION ACTIVITIES

7.6.1 Geophysical Surveying

A geophysical survey of LF-23 was conducted in September and October 2005. The geophysical survey of LF-23 included both a terrain conductivity survey and magnetic survey. Approximately 2.5 acres were geophysical surveyed, completely covering the entire site. Prior to conducting the surveys, LF-23 was visually inspected. LF-23 was observed to be comprised primarily of concrete rubble placed on the northwestern slope of a former borrow pit. In addition, pipes, cables, a former utility vault, several rusted canisters, asphalt, and gravel were observed at LF-23 intermixed with the concrete rubble. The canisters, approximately 30 gallons in capacity, were unlabeled, heavily rusted and each contained several corrosion holes. No stained soils or stressed vegetation were observed around the canisters. According to

facility records, the unit was approximately 0.5 acres in size; however, during the visual inspection of the landfill, concrete debris was observed north of the landfill's defined boundary. Consequently, the geophysical survey was extended northward.

The area included within the LF-23 geophysical survey is shown on Figures 7.3 (terrain conductivity survey map) and 7.4 (magnetic survey map). These results were used to select trench locations.

7.6.2 Landfill Trenching

On May 17 and 18, 2006, four trenches (designated as HGLTR23-01 through HGLTR21-04) were completed at LF-23 as directed by NMED to maximum depths ranging from 3 to 6 feet bgs. Based on geophysical surveying results, LF-23 contains multiple, non-robust magnetic anomalies. Trenches HGLTR23-01, HGLTR23-02, and HGLTR23-04 were located adjacent to or across several of the magnetic anomalies across LF-23. Trench HGLTR23-03 was located across an area formerly containing several corroded containers. The trenches ranged from 30 feet in length (HGLTR21-01) to 42 feet in length (HGLTR21-03). The locations of the completed trenches are presented on Figure 7.5.

Upon completion of a trench and the characterization of the excavated soils and debris, each trench was backfilled to grade with the excavated soils.

7.6.3 Trench Soil Sampling

No hazardous materials, contaminated soils, unusual solids or fluids, or hazardous material storage containers were observed during LF-23 trenching activities based on visual inspection and PID field screening results. Consequently, no soil samples were collected for laboratory analysis.

7.7 SUPPLEMENT RFI INVESTIGATION RESULTS

7.7.1 Geophysical Surveying Results

7.7.1.1 Terrain Conductivity Survey Results

Two conductivity anomalies were identified at LF-23 (Figure 7.3). One was associated with the chain-link fence located along the survey's northern boundary. The second was located along the western edge of the survey within the former borrow pit. Given the diffused condition of the anomaly's borders and water observed ponded on the borrow pit soils during the geophysical survey, the anomaly is attributable to highly conductive saturated soils. No conductive anomalies were observed within the concrete disposal areas of LF-23.

7.7.1.2 Magnetic Survey Results

Magnetic anomalies were observed at LF-23 (Figure 7.4). The anomalies were associated with onsite surface structures and the concrete debris observed along the northwestern slope of the former borrow pit.

7.7.1.3 Geophysical Survey Conclusions

Based on the geophysical survey results and visual observations, LF-23 appears to be little more than a concrete debris pile located along the northeastern slope of a former borrow pit. Terrain conductivity anomalies are related to saturated soils. Magnetic anomalies were observed throughout the concrete rubble pile but generally clustered in small groupings. Debris observed included concrete rubble, piping, cables, asphalt, gravel, a concrete utility vault, several rusted cans, and several open, approximately 30-gallon empty and unlabeled drums, possibly used as part of training exercises since they were gone at the time of trenching. Based on the association between the magnetic anomalies and the presence of the concrete rubble, the boundaries of LF-23 were modified to reflect the rubble pile. The modified landfill boundaries are depicted on Figures 7.3 through 7.5.

7.7.2 Trenching Results

Fill material, consisting primarily of construction debris, was observed in all four trenches. The fill material ranges in thickness from 1 foot (HGLTR23-04) to 4.5 feet (HGLTR23-02). Debris encountered included concrete rubble (including a concrete utility box and drainage culvert), former communication line, asphalt, wiring, cording, a tarp, metal piping, metal sign posts, metal railing, rubber bands, and a partially crushed 5-gallon water can. No visual evidence or field screening result was obtained indicating the presence of or a release of hazardous materials. Groundwater was not encountered within the trenches and no evidence of leachate was observed within the fill material.

Beneath the fill material, undisturbed soils composed primarily of moderately loose, light brown to reddish brown, silty sand were encountered to the maximum excavated trench depth. Although groundwater was not encountered, moist soils were encountered 2 to 4 feet bgs depending on the trench and proximity to the borrow pit. PID field screening and visual inspection of these underlying soils suggests the soils have not been impacted due to former disposal activities.

No canisters, buckets, or drums potentially used to store or dispose hazardous materials were encountered in the landfill trenches. In addition, no soil staining, unusual solids or fluids, or petroleum odors were encountered in the soils comprising and underlying LF-23. In accordance with the approved trenching plan (HGL, 2006b), no soil samples were collected due to the obvious lack of potential contamination within or beneath the LF-23 landfill.

Photographs of the trenching activities are presented in Appendix B. LF-23 trench logs are included in Appendix C.

7.8 CONCLUSIONS

Supplemental RFI activities, including a geophysical survey and trenching, were completed at the requested of NMED for the purpose of obtaining NFA status for LF-23.

LF-23 consists primarily of construction debris (i.e., concrete rubble, asphalt, gravel, metal piping, and cables) deposited on a west facing slope of a former borrow pit. A visual inspection of the site, prior to the geophysical survey, determined the site to extend further northward than previously reported. Multiple magnetic anomalies were identified and clustered primarily in the southern and central portions of the site. The magnetic anomalies were generally non-robust, discrete anomalies and typically associated with observed concrete rubble present on the surface. Trenching revealed buried debris to be consistent with observed surface debris and extending into the subsurface from 1 to 4.5 feet bgs. Neither groundwater nor landfill leachate was encountered in the trenches. No evidence of contamination was observed within the disposed material or beneath it, and no canisters, buckets, or drums potentially used to store or dispose hazardous materials were observed in the subsurface soils.

7.9 RECOMMENDATIONS

Given the type of debris comprising LF-23, the lack of contamination and hazardous materials within and beneath the debris, and groundwater sampling results over the last 10 years, NFA status under NMED Criterion 5 is recommended and a class III permit modification is requested to remove the site from the active corrective action portion of the RCRA permit.

This page intentionally left blank.

TABLES

Table 7.1
Remedial Investigation Groundwater Analytical Results
LF-23 (SWMU 108)
Holloman AFB, NM

Location	Background[1]	USEPA MCL	NMGWQ Standard	Detection Limit	MW-23-01 (upgradient)	MW-23-02	MW-23-03	MW-23-04
Analyses								
Inorganic Results								
EPA 160.1- Total Dissolved Solids (mg/L)	43,600	--	1,000	10	*37,000*	*40,000*	*31,000*	*23,000*
EPA 300.0- Chloride (mg/L)	19,600	--	250	26	*13,000*	***20,000***	*16,000*	*11,000*
EPA 300.0- Sulfate (mg/L)	7,470	--	600	10	*5,900*	*5,800*	*4,600*	*3,700*
EPA 340.2- Fluoride (mg/L)	4.7	4	1.6	0.10	1.5	1.0	1.1	1.4
EPA 353.1- Nitrate-Nitrite (mg/L)	98	--	--	0.022	0.74	13	9.8	13
EPA 365.2- Total Phosphorous (mg/L)	0.75	--	--	0.020	0.091	0.73	0.16	0.16
SW6010 - Metals (μg/L)								
Cadmium	8.3	5	10	5	< 5	*5.9*	< 5	< 5
Chromium	234	100	10	10	< 10	10	< 10	< 10
Copper	38.6	--	1,000	20	< 20	31	< 20	< 20
Nickel	43.6	--	200^	20	< 20	36	22	< 20
SW7421- Lead (μg/L)	19.9	15	50	6	< 6	15	< 6	< 6
Organic Results								
SW8080 - Organochlorine Pesticides and PCBs (μg/L)								
delta - BHC	--	--	--	0.0095	< 0.0095	0.17 X	< 0.0095	0.014 X
SW8240 - Volatile Organics (μg/L)								
Methylene Chloride	--	--	100	5	< 5.0	9.6	4.6 J	9.3

Note: Table presents only constituents detected in ground water at this site.

X = SW8080-- Presence of analyte confirmed by second column analysis, but quantitation was not confirmed.

J = Detected below the detection limit.

SWMU = solid waste management unit

AFB = Air Force Base

NM = New Mexico

mg/L = milligrams per liter

μg/L = micrograms per liter

USEPA = U.S. Environmental Protection Agency

MCL = Maximum Contaminant Level

NMGWQ = New Mexico Groundwater Quality

-- = No value or standard was found

^ NMGWQ Standard for Irrigation Use

< = less than associated concentration

Results in **BOLD** and *italics* exceed USEPA Primary Drinking Water MCLs and are greater than the background and upgradient values.

Results shaded in **BOLD** and *italics* exceed NMGWQ Standards for Human Health and are greater than the background and upgradient values.

Results in *italics* exceed USEPA or NMGWQ standards but are below background and/or upgradient levels.

[1] Source for metals background values: Radian (1993). Source for all other background values: Radian (1992b).

Table 7.2
Long Term Groundwater Analytical Results
LF-23 (SWMU 108)
Holloman AFB, NM

Well Number		USEPA MCL	NMGWQ Standard	MW-23-01					MW-23-02				
Sampling Date	Background	(µg/L)	(µg/L)	Aug-95	Sep-97	Sep-99	Sep-01	Apr-03	Aug-95	Sep-97	Sep-99	Sep-01	Apr-03
VOCs[1] (µg/L)													
Acetone	--	--	--	ND	ND	1 J	NA	NA	ND	ND	< 5	NA	NA
Bromoform	--	--	--	ND	ND	< 3	NA	NA	ND	ND	< 3	NA	NA
Methylene chloride	--	--	100	ND	20	< 3	NA	NA	ND	ND	< 3	NA	NA
Metals[2] (µg/L)													
Arsenic	35.4	10	100	ND	ND	7.9 B (J)	NA	NA	ND	ND	6.2 B (J)	NA	NA
Barium	85.2	2000	1000	ND	ND	21.5 B (J)	22.9	< 10	ND	21	29.1 B (J)	32.3 B	10.1 J
Cadmium	7.4	5	10	ND	ND	< 0.3	NA	NA	ND	ND	0.7 B	NA	NA
Iron	--	--	1000	ND	ND	646	*< 10,000*	*< 2000*	ND	ND	< 110	*< 10000*	*< 2000*
Manganese	--	--	200	ND	ND	*348*	*223 (J)*	13.6 J	ND	ND	12.6 B	9.9 B (J)	< 100
Selenium	85.3	50	50	ND	ND	16.4 B (J)	9.5 B (J)	44 J	ND	13	*57.4 B (J)*	24.2 (J)	*< 100*
Silver	6.7	--	50	ND	ND	< 0.5	NA	NA	ND	ND	5.2 B (J)	NA	NA
Organochlorine Pesticides[3] (µg/L)													
all	--	--	--	ND	ND	ND	NA	NA	ND	ND	ND	NA	NA
Polychlorinated Biphenyls[4] (µg/L)													
all	--	0.5	1	ND	ND	ND	NA	NA	ND	ND	ND	NA	NA
Chlorinated Herbicides[5] (µg/L)													
4-Nitrophenol	--	--	--	ND	ND	0.085 P (J)	< 0.5	NA	ND	ND	< 0.08	NA	NA

Notes:

[1] Unless otherwise reported, no VOCs were detected prior to 2001 using USEPA Method 8260B.
(USEPA Method 8260A was used to analyze for VOCs in the 1995 and 1997 programs.)

[2] Unless otherwise reported, no metals were detected using USEPA Methods 6010B Trace & 7470A.
(USEPA Method 8080A was used to analyze for organochlorine pesticides in the 1995 and 1997 programs.)

[3] Unless otherwise reported, no organochlorine pesticides were detected prior to 1999 using USEPA Method 8081A.
(USEPA Method 8080A was used to analyze for organochlorine pesticides in the 1995 and 1997 programs.)

[4] Upgradient monitoring well

CRDL = Contract-required Detection Limit
IDL = Instrument Detection Limit
NA = not analyzed
ND = not detected at or above method reporting limit
VOCs = volatile organic compounds
µg/L = micrograms per liter
-- = No value or standard found
USEPA = U.S. Environmental Protection Agency
MCL = Maximum Contaminant Level
NMGWQ = New Mexico Groundwater Quality
AFB = Air Force Base
NM = New Mexico
SWMU = solid waste management unit
< = less than associated concentration

Results in **BOLD** and *italics* exceed USEPA Primary Drinking Water MCLs and are greater than the background and upgradient values.
Results shaded in **BOLD** and *italics* exceed NMGWQ Standards for Human Health and are greater than the background and upgradient values.
Results in *italics* exceed USEPA or NMGWQ standards but are below background and/or upgradient levels.

^ Radian (1993)

Laboratory qualifiers--assigned as a result of internal laboratory data assessment procedures.
B - Value less than CRDL but greater than or equal to IDL.
J - Estimated value less than CRDL but greater than or equal to IDL.
UB - Qualifies as non-detct due to presence of analyte in associated laboratory blank.
USEPA Qualifiers--assigned as a result of independent data validation.
(J) - Estimated value.
(UJ) - Estimated value blow the reporting limit.
(U) Compound was analyzed for but not detected.
2003 Validation Qualifiers
J - Estimated value detected less than the CRDL but greater than the reporting limit.
U - Compound was analyzed for but not detected. Analyte result was below the CRDL.
UJ - Estimated as a non-detect at the detection limit.

Table 7.2
Long Term Groundwater Analytical Results
LF-23 (SWMU 108)
Holloman AFB, NM

Well Number	Backgrounds	USEPA MCL (µg/L)	NMGWQ Standard (µg/L)	MW-23-03					MW-23-04				
Sampling Date				Aug-95	Sep-97	Sep-99	Sep-01	Apr-03	Aug-95	Sep-97	Sep-99	Sep-01	Apr-03
VOCs[1] (µg/L)													
Acetone	--	--	--	ND	ND	< 5	NA	NA	ND	ND	1 J	NA	NA
Bromoform	--	--	--	ND	ND	< 3	NA	NA	ND	ND	< 3	NA	NA
Methylene chloride	--	--	100	ND	18 UB	< 3	NA	NA	ND	ND	< 3	NA	NA
Metals[2] (µg/L)													
Arsenic	35.4	10	100	ND	ND	< 3	NA	NA	ND	ND	3.8 B (J)	< 10	NA
Barium	85.2	2000	1000	ND	20	25.3 B (J)	35.0 B	15 J	ND	ND	33.3 B (J)	41.1 B	10.6 J
Cadmium	7.4	5	10	ND	ND	< 0.3	NA	NA	ND	ND	< 0.3	NA	NA
Iron	--	--	1000	ND	ND	< 110	*< 10,000*	*< 2000*	ND	ND	91.1 B	*< 10000*	*< 2000*
Manganese	--	--	200	ND	ND	80.3	13.9 (J)	43.6 J	ND	ND	98.5	55.4 (J)	< 100
Selenium	85.3	50	50	ND	11 JS	42.7 B (J)	13.6 (J)	*96.9*	ND	ND	13.0 B (J)	6.9 B (J)	*< 100*
Silver	6.7	--	50	ND	ND	< 0.5	NA	NA	ND	ND	< 0.5	NA	NA
Organochlorine Pesticides[3] (µg/L)													
all	--	--	--	ND	ND	ND	NA	NA	ND	ND	ND	NA	NA
Polychlorinated Biphenyls[4] (µg/L)													
all	--	0.5	1	ND	ND	ND	NA	NA	ND	ND	ND	NA	NA
Chlorinated Herbicides[5] (µg/L)													
4-Nitrophenol	--	--	--	ND	ND	< 0.08	NA	NA	ND	ND	< 0.08	NA	NA

Notes:

[1] Unless otherwise reported, no VOCs were detected prior to 2001 using USEPA Method 8260B.
(USEPA Method 8260A was used to analyze for VOCs in the 1995 and 1997 programs.)
[2] Unless otherwise reported, no metals were detected using USEPA Methods 6010B Trace & 7470A.
(USEPA Method 8080A was used to analyze for organochlorine pesticides in the 1995 and 1997 programs.)
[3] Unless otherwise reported, no organochlorine pesticides were detected prior to 1999 using USEPA Method 8081A.
(USEPA Method 8080A was used to analyze for organochlorine pesticides in the 1995 and 1997 programs.)
[6] Upgradient monitoring well
CRDL - Contract-required Detection Limit
IDL - Instrument Detection Limit
NA - not analyzed
ND - not detected at or above method reporting limit
VOCs - volatile organic compounds
µg/L - micrograms per liter
-- No value or standard found
USEPA = U.S. Environmental Protection Agency
MCL = Maximum Contaminant Level
NMGWQ = New Mexico Groundwater Quality
AFB = Air Force Base
NM = New Mexico
SWMU = solid waste management unit
< = less than associated concentration
Results in **BOLD** and *italics* exceed USEPA Primary Drinking Water MCLs and are greater than the background and upgradient values.
Results shaded in **BOLD** and *italics* exceed NMGWQ Standards for Human Health and are greater than the background and upgradient values.
Results in *italics* exceed USEPA or NMGWQ standards but are below background and/or upgradient levels.

^ Radian (1993)

Laboratory qualifiers--assigned as a result of internal laboratory data assessment procedures.
B - Value less than CRDL but greater than or equal to IDL.
J - Estimated value less than CRDL but greater than or equal to IDL.
UB - Qualifies as non-detct due to presence of analyte in associated laboratory blank.
USEPA Qualifiers--assigned as a result of independent data validation.
(J) - Estimated value.
(UJ) - Estimated value below the reporting limit.
(U) Compound was analyzed for but not detected.
2003 Validation Qualifiers
J - Estimated value detected less than the CRDL but greater than the reporting limit.
U - Compound was analyzed for but not detected. Analyte result was below the CRDL.
UJ - Estimated as a non-detect at the detection limit.

This page intentionally left blank.

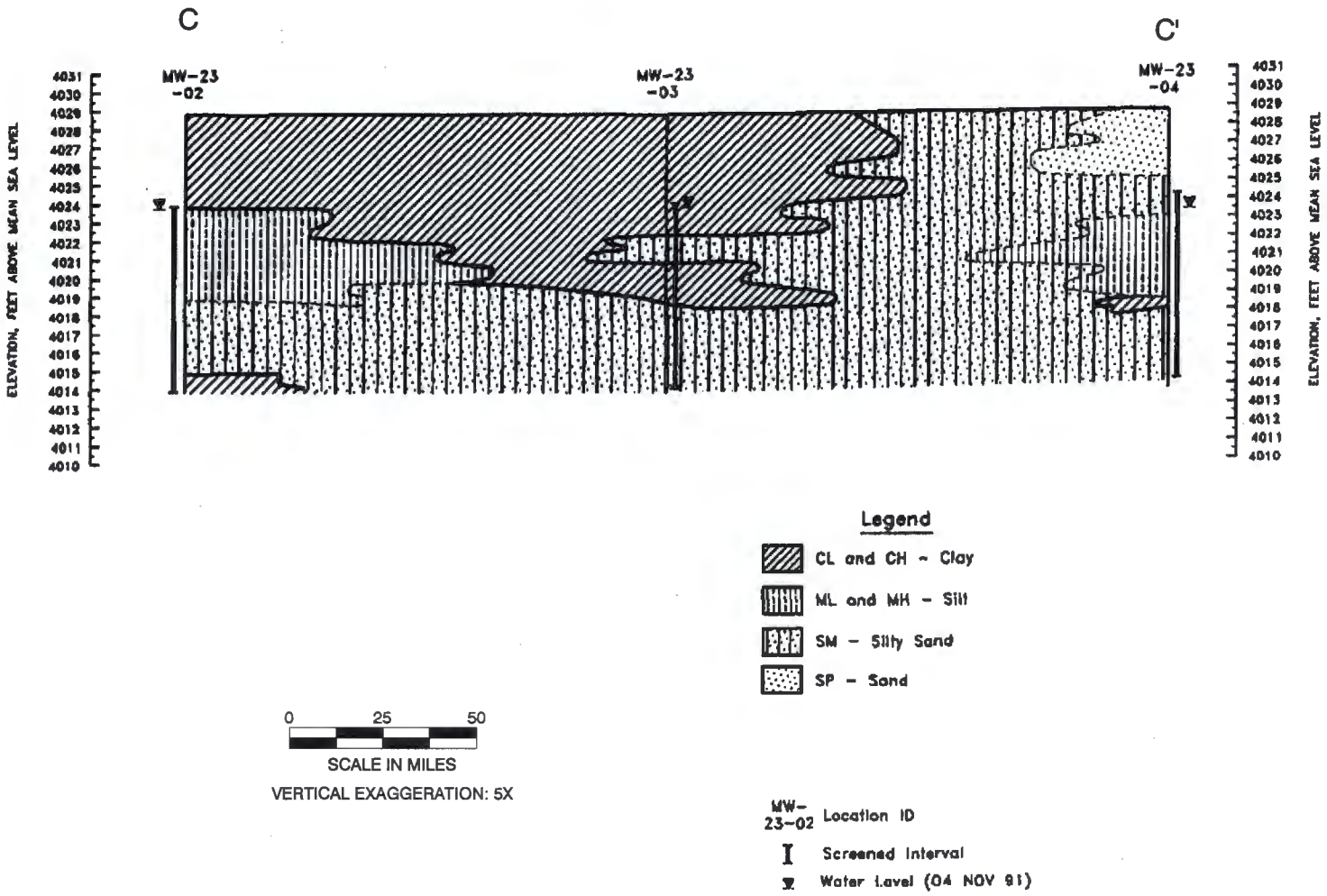
FIGURES

File X:\AFC002\Holloman_AFB\TO37\Maps\LF_19_21_22_23_Supp_RFI\LF-23.mxd
Project: AFC002-037-04-06-05
Revised: 09/25/06 BF
Map Source: Holloman AFB

Legend

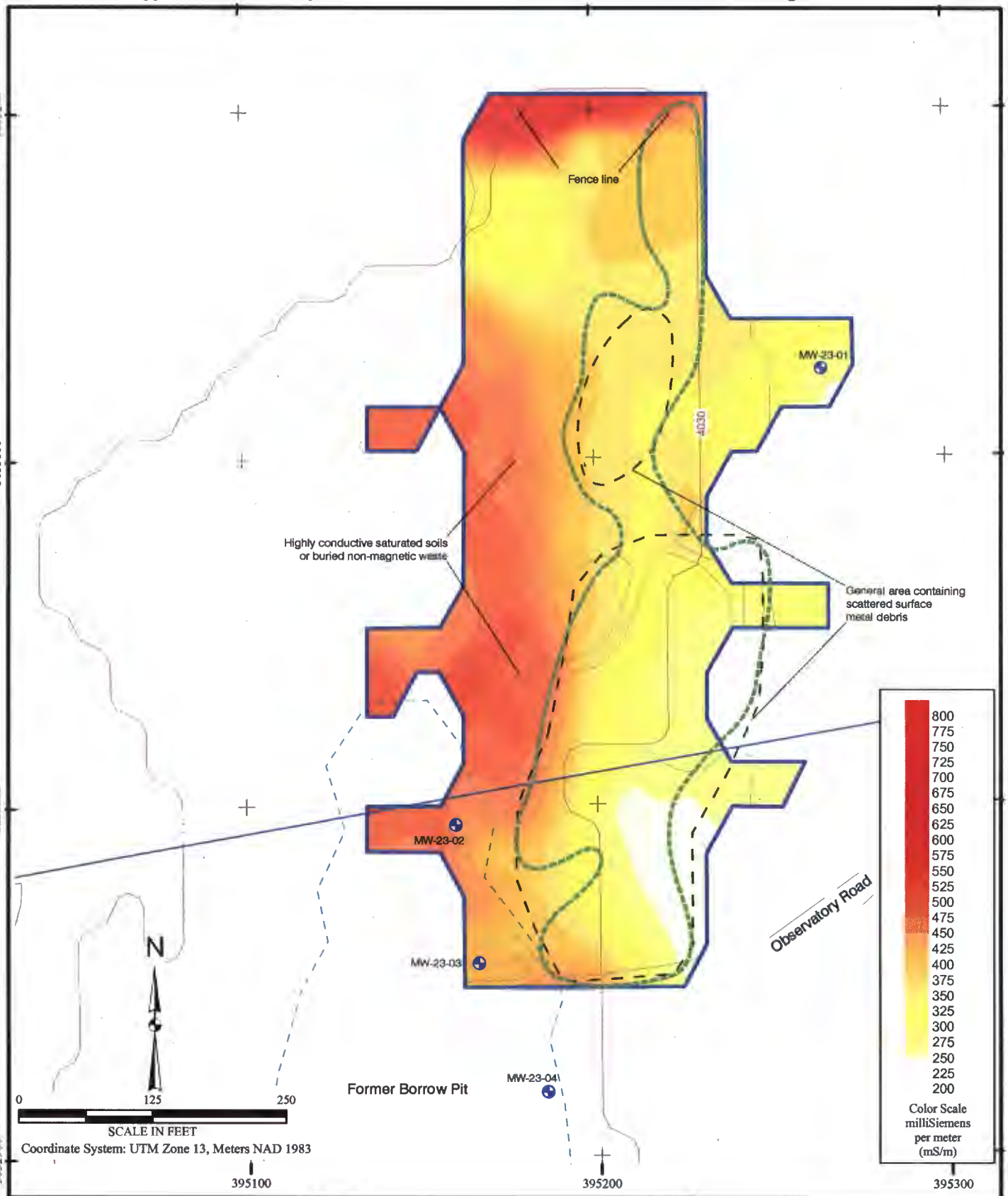
- Unit Boundary Implied by Geophysics
- C——C' Cross Section
- Water Line
- Monitoring Well

Figure 7.1
LF-23 Site Map
Holloman AFB



X:\AFC002\Holloman_AFB\TO37\Maps\LF_19_21_22_23_Supp_RFI\LF_23_xsection.cdr
Project: AFC002-037-04-06-03
Revised: 09/25/06 BF
Source: Radian, 1992

Figure 7.2
LF-23 Geologic Cross Section
Holloman AFB

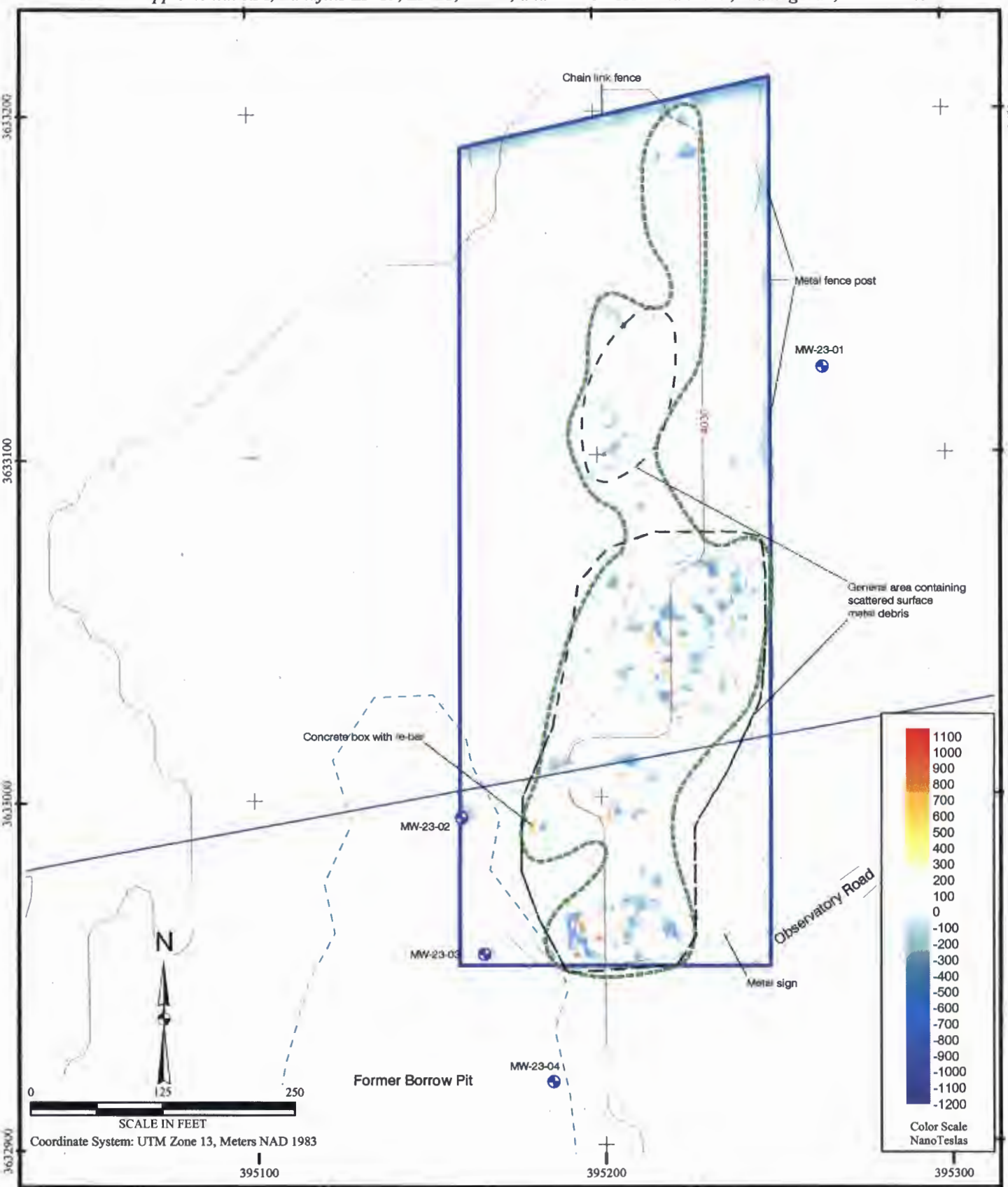


File X:\AFC002\Holloman_AFB\TO37\Maps\LF_19_21_22_23_Supp_RFI\LF-23_Geo.mxd
Project: AFC002-037-04-06-03
Revised: 09/25/06 BF
Map Source: Holloman AFB

Legend

- Monitoring Well
- Water Line (Underground)
- Unit Boundary Implied by Geophysics
- Terrain Conductivity Survey Boundary
- Elevation Contour
- Borrow Pit

Figure 7.3
LF-23 Terrain Conductivity Survey
Holloman AFB

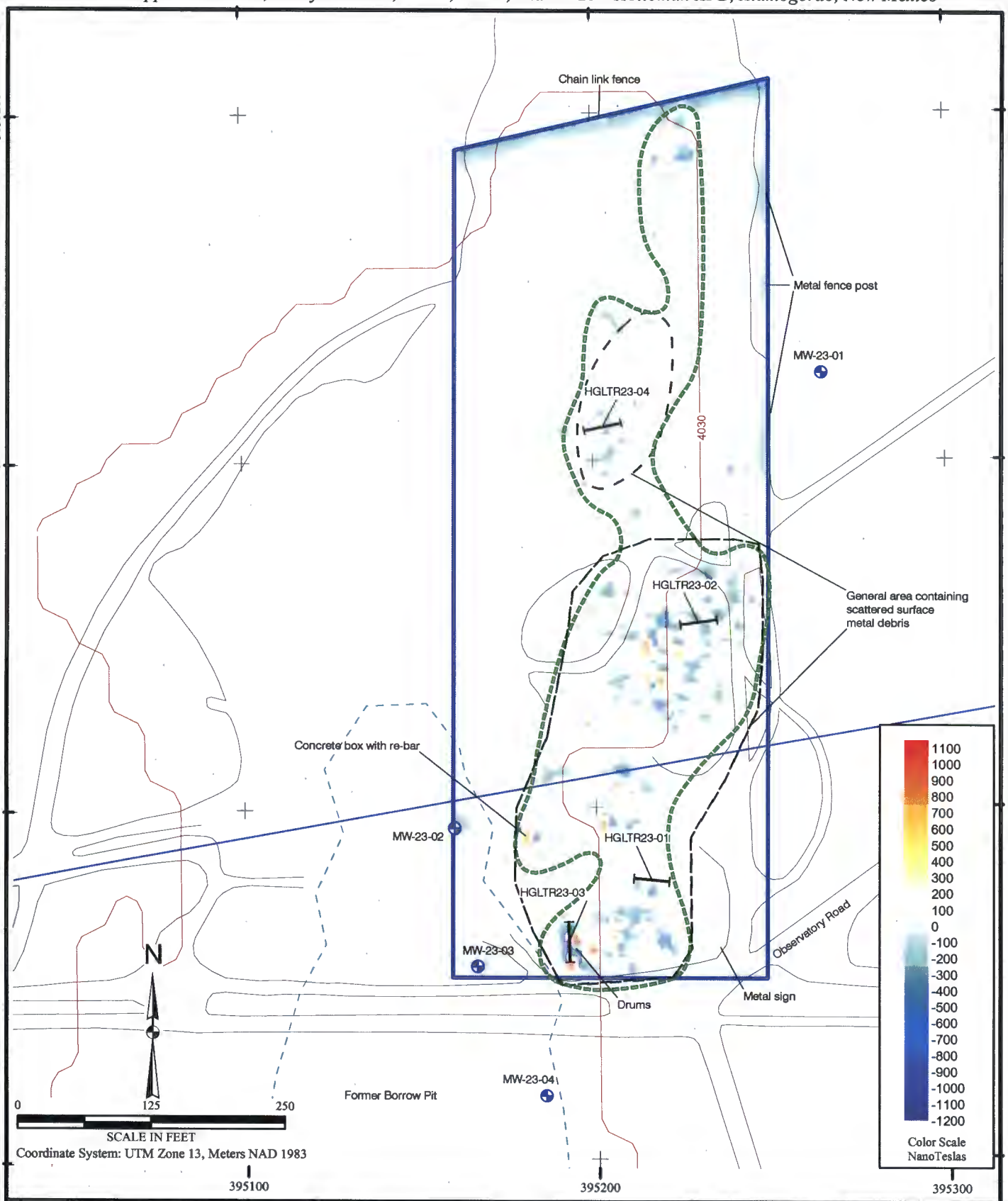


File X:\AFC002\Holloman_AFB\TO37\Maps\LF_19_21_22_23_Supp_RFI\LF-23_Mag.mxd
Project: AFC002-037-04-06-05
Revised: 09/26/06 BF
Map Source: Holloman AFB

Legend

- Monitoring Well
- Water Line (Underground)
- Unit Boundary Implied by Geophysics
- Magnetic Survey Boundary
- Elevation Contour
- Borrow Pit

Figure 7.4
LF-23 Magnetic Survey
Holloman AFB



File X:\AFC002\Holloman_AFB\TO37\Maps\LF_19_21_22_23_Supp_RFI\LF-23_Trench.mxd
Project: AFC002-037-04-06-05
Revised: 09/26/06 BF
Map Source: Holloman AFB

Legend

- Monitoring Well
- Trench
- Water Line (Underground)
- Magnetic Survey Boundary
- Elevation Contour
- Borrow Pit
- Unit Boundary Implied by Geophysics

Figure 7.5
LF-23 Trench Locations
Holloman AFB

8.0 REFERENCES

Bhate (Bhate Environmental Associates, Inc.), 2003. Final 2003 Long-Term Groundwater Monitoring Report, Holloman AFB, New Mexico. September.

HGL (HydroGeoLogic, Inc.) 2005a. Draft Supplemental RCRA Facility Investigation Work Plan, Holloman Air Force Base, Alamogordo, New Mexico. July.

HGL (HydroGeoLogic, Inc.), 2005b. Quality Assurance Project Plan Addendum, Supplemental RCRA Facility Investigation, Holloman Air Force Base, Alamogordo, New Mexico. July.

HGL (HydroGeoLogic, Inc.), 2006a. Response to Notice of Deficiency, Supplemental RFI Work Plan, SWMUs 101, 104, 105, 108, 109, 113B, 115, 116, 165, 177, 179, and 181, July 2005, Holloman Air Force Base, Alamogordo, New Mexico. March.

HGL (HydroGeoLogic, Inc.), 2006b. Supplemental RCRA Facility Investigation Addendum, Passive Soil Gas and Geophysical Survey Results, Technical Memorandum. March.

HGL (HydroGeoLogic, Inc.), 2006c. Site Visit meeting between Messrs. Bill McDonald and David Strasser of NMED and Mr. Ken Cottrell and Ms. Sarah, Gillette at Holloman AFB to discuss proposed trench locations. April 24.

NMED (New Mexico Environment Department), 2004. HAFB Letter of May 21, 2004, Regarding Characterization Requirements for Seven Solid Waste Management Units Holloman Air Force Base NM6572124422, HBW-HAFB-04-022.

NMED (New Mexico Environment Department), 2006. Notice of Deficiency, Supplemental RFI Work Plan, SWMUs 101, 104, 105, 108, 109, 113B, 115, 116, 165, 177, 179, and 181, July 2005, Holloman Air Force Base, Alamogordo, New Mexico. January 17.

Radian Corporation, 1992a. RI, Draft Final Risk Assessment Report, Volume I of IV, Test Investigation, Study and Recommendation for 29 Waste Sites.

Radian Corporation, 1992b. RI, Report, Volume II of III, Appendices A, B, C, and D, Investigation, Study and Recommendation for 29 Waste Sites..

Radian Corporation, 1993, Phase I Groundwater Assessment Monitoring Report, Sewage Lagoons and Lakes Investigation, Holloman AFB, New Mexico.

Radian Corporation, 1995. Decision Documents, Multiple Sites.

Strasser, D., 2006. Personnel communication between Mr. Dave Strasser of NMED and Mr. Brett Brodersen of HGL while conducting an onsite inspection of the LF-19 trenches. The discussion was in regard to the collection of soil samples from trench HGLTR19-01 and associated NMED required analyses. May 22.

USAF (U.S. Air Force), 2004. Characterization Requirements for Seven Solid Waste Management Units (SWMUs) at Holloman AFB, New Mexico. May 21.

USDA (US Department of Agriculture), 1981. Soil Survey of Otero Area, New Mexico; Parts of Otero, Eddy, and Chaves Counties. Soil Conservation Service and Forest Service.

USEPA (U.S. Environmental Protection Agency), 1986. Guidelines for Groundwater Classification Under the USEPA Groundwater Protection Strategy, Final Draft. Office of Groundwater Protection (WH-550G), Washington, D.C. December.

WRRI (New Mexico Water Resources Research Institute), 2005. Proceedings, 49th Annual New Mexico Water Conference, Water Desalination and Reuse Strategies for New Mexico.

APPENDIX A

GEOPHYSICAL SURVEY REPORT

December 21st, 2005

Kenneth J. Cottrell, CPG, PG

HGL
HydroGeologic, Inc.
1155 Herndon Parkway, Suite 900
Herndon, VA 20170
(703) 478-5186

RE: TRANSMITTAL letter regarding FINAL deliverables for ECA Project 05ECA22

Dear Ken,

Enclosed in this mailing are the following items:

1. FINAL report (1 bound hardcopy, 1 unbound hardcopy and 1 WORD file on CD)
2. Raw and final data files (on CD)
3. All photos taken regarding project (on CD)
4. Line-contour and color-contour maps (on CD)
5. ECA's survey field notes (1 hardcopy)
6. INVOICE (next page)

As stated previously, all data files and maps require ***Surfer*** (Golden Software, Inc.) to be viewed and printed out. If you wish to take the data from raw to final form, you will also need ***MagMap2000*** and ***DAT 31w***, from Geometrics, Inc. and Geonics Ltd., respectively. Please note that each map contains a post map that reveals all line traverses made per survey. You can, as with all map elements, turn this layer on or off as you wish.

Due to inadequate printer memory, I was unable to print the LF-10 color contour Mag Map and the accompanying Trench Enhancements Mag Map. Please insert your color plots of these maps into Appendix B where indicated. I apologize for this inconvenience.

I appreciate the opportunity to have performed this most interesting project for **HGL** and look forward to assisting your firm with future projects. Please call me if you have any questions whatsoever.

Ken, may you, Brett, Sarah and everyone else in your circle have a most glorious and happy holiday season and a Merry Christmas!

Sincerely,

Brett D. Smith, PE, PG

Environmental Compliance Associates, LLC
1825 Leslie Road, #184 ♦ Richland, WA 99352 ♦ (509) 628-9959 ♦ ecabrett@charter.net

This page was intentionally left blank.

TABLE OF CONTENTS

1.0 INTRODUCTION 1
1.1 Purpose of Surveys 1
1.2 Survey Equipment 1
2.0 SURVEY PARAMETERS AND DATA QUALITY 1
2.1 Magnetometers 2
2.2 Terrain Conductivity Meter 2
2.3 Global Positioning System 3
3.0 SURVEYS PERFORMED 3
4.0 DATA PROCESSING 3
4.1 EM-31 3
4.2 Magnetometer 4
5.0 CREATION OF CONTOUR MAPS 5
6.0 DISCUSSION OF SURVEY RESULTS 5
6.1 DP-30 / SD-33 5
6.2 LF-10 5
6.3 LF-19 6
6.4 LF-21 6
6.5 LF-22 6
6.6 LF-23 6
6.7 LF-29 6
7.0 CLOSING COMMENTS 7

Appendix A – DP-30 / SD-33 Maps
Appendix B – LF-10 Maps
Appendix C – LF-19 Maps
Appendix D – LF-21 Maps
Appendix E – LF-22 Maps
Appendix F – LF-23 Maps
Appendix G – LF-29 Maps

This page was intentionally left blank.

1.0 Introduction

During September and October of 2005 ECA performed electromagnetic and magnetic geophysical surveys at the Holloman Air Force Base located approximately 10 miles southwest of Alamogordo, New Mexico. This work was performed at the request of **HydroGeologic, Inc. (HGL)**, to enable **HGL** to ultimately determine the lateral extent of solid waste management units or landfills located on the air force base property. Seven sites were investigated by ECA, namely DP-30 / SD-33 (4 acres), LF-10 (24 acres), LF-19 (6 acres), LF-21 (5 acres), LF-22 (3.5 acres), LF-23 (5.5 acres) and LF-29 (5 acres) comprising an approximate total area of 53 acres.

The March 2005 Bid Request specified the electromagnetic method for all sites, as well an additional survey of DP-30 / SD-33 utilizing the ground penetrating radar method. Due to the highly conductive soils encountered onsite, the metal-detection (in-phase) component of the electromagnetic method was adversely and significantly compromised. As a result, the surveying strategy was modified to utilize only the quadrature (conductivity) component of the electromagnetic method in conjunction with magnetometry, which served to detect buried metallic debris.

1.1 Purpose of Surveys

As stated above, **HGL** requested the geophysical surveys to determine landfill boundaries and to locate buried metal-bearing objects. Additionally, all data points were required to have corresponding longitude and latitude coordinates, to enable later acquisition of locations having anomalous readings.

1.2 Survey Equipment

ECA utilized the Geometrics, Inc. Model G-858 and Model G-856 total-field magnetometers for the magnetic surveying portion of the project. The G-858 magnetometer is an electron-based system that utilizes the precessing behavior of Cesium vapor electrons subjected to light energy at specified wavelengths. The G-856 magnetometer is a proton or hydrogen-based system that utilizes the precessing behavior of protons subjected to an induced magnetic field. The G-858 unit was utilized as the actual surveying instrument, whereas the G-856 was employed strictly as a fixed base station, in order to record changes in the earth's daily (diurnal) magnetic field.

The Geonics Limited Model EM-31 Mark2 terrain conductivity instrument was utilized to measure lateral soil conductivity changes at each site. The EM-31 Mark2 system operates on the simple, yet reliable, concept of magnetic induction and Maxwell's Law, whereby an electromagnetic field is transmitted through the soil and the associated electrical field current is ultimately picked up by the receiver and correlated directly to soil conductivity. This instrument is capable of measuring to a depth of 20 feet in low-conductivity terrain, but in the highly conductive soils encountered onsite, the effective depth of signal penetration, which is inversely related to soil conductivity, was probably lessened to approximately 10 feet.

The Trimble AgGPS 132 is a high-performance GPS receiver that utilizes a subscription-based differential correction service to calculate sub-meter positions in real-time. ECA utilized Trimble's AgGPS Parallel Swathing Option that incorporated a light bar guidance system that enabled precision guidance information for navigating reasonably straight and parallel lines.

2.0 Survey Parameters and Data Quality

Geophysical surveys must be designed to prevent aliasing or under-sampling the survey area with respect to the locations of causative bodies or features. The following discussion reveals how the parameters for each of the survey methods were determined.

deviation represented a repeatability accuracy of 99.167 percent, within an approximate conductivity environment of 60 mS/m.

2.3 Global Positioning System

Utilizing the Trimble AgGPS 132 global positioning system (GPS), ECA was able to perform magnetometer and EM-31 surveys along straight-line traverses spaced set distances apart. All traverses were referenced against a baseline, through the utilization of the Trimble Swathing Option – an established field surveying technique that has been accurately employed by farmers throughout the world. A light bar attached to the GPS backpack enabled ECA to maintain sufficiently straight and evenly spaced survey lines, ultimately creating well-controlled grids over all seven landfill sites.

The GPS-based surveys proved to be considerably more cost and time efficient than pre-survey gridding, in light of the fact that most sites were characterized by high brush, dense foliage, trees and/or less-than-level survey conditions. Because the GPS system acquired locational (XY) data simultaneously with the geophysical (Z) data, the resultant databases consisted of virtually continuous XYZ data that were readily plotted in Lon-Lat coordinates. GPS-based surveys typically have an accuracy of ± ½-meter.

Latency errors occur when the incoming data streams do not align perfectly. Latency corrections were not necessary during the magnetometer surveys, due to the insignificant magnitude of the maximum potential error possible with once-per-second GPS readings. No latency errors occurred during the EM-31 surveys, because the instrument is designed to only record a reading upon receipt of the GPS signal, thus ensuring perfect alignment. In the case of the magnetometer surveys, readings occurred every 0.1 seconds. The maximum latency time error would equal the entire sampling interval time of 0.1 seconds. At a maximum surveying speed of 3 feet per second, the latency distance error is 0.3 feet or 3.6 inches. Such an error can be dismissed without explanation, given the tolerances of a metal detection survey.

3.0 Surveys Performed

The following table lists the sites that were surveyed and the methods employed therein:

SITE	SURVEY DATES (EM-31)	SURVEY DATES (MAG)	EM-31	MAG
DP-30 / SD-33	9/27, 9/29, 9/30		✓	
LF-10	9/30, 10/02, 10/04, 10/05	10/02, 10/05, 10/06, 10/09-10/11	✓	✓
LF-19	10/01	10/07, 10/08	✓	✓
LF-21	10/03	10/13, 10/14	✓	✓
LF-22	9/30, 10/01	10/08, 10/12	✓	✓
LF-23	9/30, 10/01	10/12, 10/13	✓	✓
LF-29		10/14, 10/15	✓	✓

4.0 Data Processing

4.1 EM-31

No post-survey data processing was performed on the EM-31 data, other than simply disregarding the in-phase data that were "pegged" at –20.47 ppt, in response to the highly conductive soils encountered onsite. In-phase readings are often severely compromised when soil conductivities exceed 100 mS/m.

4.2 Magnetometer

Contrary to the relatively simple conductivity surveys, the G-856 base station data and especially the G-858 magnetometer data required considerable post-survey processing. Utilizing the MagMap2000 proprietary software (version 4.65b) provided by Geometrics, Inc. of San Jose, California, ECA performed the following processing steps upon all G-858 data sets, in the order presented below:

1. Global dropout removal – A dropout is a reading that drops to zero and is clearly out of context. Dropouts result from the sensor being near or within a dead-zone or within a high magnetic gradient. A dead-zone is that volume of space wherein the sensor cannot produce a reading, due to misalignment with the earth's magnetic field. The software effectively and exclusively removed all dropouts from each dataset in one step.
2. Global duplicate time removal – All readings having duplicate time stamps were effectively and exclusively removed in one step.
3. Global spike removal – A spike is a single reading or set of readings that jump to unrealistically high levels at vertical or near-vertical slopes. Textbook spikes comprise 1-3 readings that differ significantly from the adjacent readings. Spikes, like dropouts, result from the sensor being near or within a dead-zone or within a high magnetic gradient. After hours of conservative trial processing runs, ECA designed a despiking filter measuring 8 readings wide and 250 nT (and greater) in amplitude. All reading sets matching these parameters were effectively and exclusively removed in one step.
4. Custom range despiking – ECA performed a detailed inspection of each and every line within each survey dataset, whereby all suspicious reading sets, having near-vertical or vertical slopes and thus not typical of monopole and dipole signatures, were removed in non-global surgical fashion.
5. GPS offset – A careful analysis of each and every site's dataset revealed, with the exception of LF-10, that all magnetometer surveys did not appear to be compensated by the 1.22-m (4-ft) GPS antenna to sensor offset that ECA input into the Trimble AgGPS system before every surveying event. This locational error was discovered when interim maps readily revealed a "herringbone" pattern, whereby misaligned GPS and sensor readings create a locational shift in one direction and a shift of similar magnitude in the returning or opposite direction. Such a magnified error is easily revealed in the form of chevron-shaped point-source anomalies or as a herringbone pattern along edges of elongate anomalies.

   ECA performed GPS-offsets at values ranging from –2.44 meters through +2.44 meters and empirically determined +1.22 meters to most effectively minimize the herringbone effect and convert chevron-shapes into tight circular anomalies.

   The 1.22-m GPS-offset correction (which happens to equal the actual GPS-to-sensor offset) was effectively inserted into each dataset in one step.
6. Removal of diurnal magnetic field – With the exception of the LF-10 gradiometer datasets, all other datasets consisted of total-field data that required the removal of the diurnal field, in order to achieve complete anomaly separation within a variable magnetic environment. As stated earlier, the diurnal field was recorded by a dedicated stationary G-856 magnetometer that was located nearby each landfill site being surveyed. Field readings were recorded every 2 to 5 minutes, in order to adequately sample the earth field.

   As stated earlier, the LF-10 gradiometer data did not require the removal of the diurnal field, since gradiometer data already eliminate extraneous fields, including the earth's magnetic field, and thus represent the *difference* between two total-field readings that are measured 1 meter apart.
7. Heading error removal - An analysis of each and every site's dataset revealed line-by-line "striping", whereby each traverse appeared as a series of elongate anomalies, creating an overall map with obvious data "stripes". Heading errors result when the measurement of the earth's magnetic field is somewhat different when surveying one direction versus another. This is attributable to the fact

that the magnetic field is not perpendicular to the ground and is therefore at a different angle to the sensor when going north versus south or east versus west and so on.

ECA performed heading error corrections at values ranging from 5 nT to 20 nT and found the 10 nT operator to effectively destripe all datasets without compromising data integrity.

5.0 Creation of Contour Maps

All datasets were gridded and computer-contoured, utilizing proprietary software (version 7.04) provided by Golden Software, Inc. of Golden, Colorado. To preserve the integrity of the data while also displaying high-resolution contour maps, ECA utilized grid spacing approximately 1/3 actual size and applied the Minimum Curvature gridding operator to each dataset. Among the myriad gridding operators in use, Minimum Curvature is considered to be an excellent gridding operator, because it minimizes (via a biharmonic Laplacian differential equation) the tendency for data to extrapolate beyond grid nodes, as can be the case with other operators. This feature of Minimum Curvature thus creates contour maps that closely resemble actual control points (data).

The maps presented in the attached appendices, are displayed as black contour lines at low contour intervals and as color-spectral maps at higher intervals. The line-contoured maps enable a detailed analysis of anomalies, whereas the color-contoured maps enable the reviewer to gain a broader perspective of features such as metal debris fields (ie, Mag data) or landfill boundaries (ie, EM-31 data).

Embedded within each map are layers depicting 1) the GPS-directed survey traverses and 2) cross-hatched grid lines that enable the map interpreter to better locate a particular location on the map.

6.0 Discussion of Survey Results

Appendices A through G include line-contour as well as color-contour maps of the seven sites surveyed during this geophysical investigation. The following discussion represents ECA's interpretation of the color contour maps only, as the line-contour maps are being provided strictly as a non-scope convenience, in the event **HGL** chooses to perform a more detailed analysis of the survey sites.

We are not providing interpretations for *each and every* discrete anomaly or set of coalesced anomalies. However, it is our opinion that circular anomalies probably indicate shallow buried metallic trash piles or spherical bodies, whereas the dipolar anomalies probably indicate buried cylinders such as drums. The determination of the depth of each causative source requires depth-estimation calculations that are beyond the scope of this project.

6.1 DP-30 / SD-33

This site was surveyed exclusively with the EM-31 terrain conductivity meter, as metallic debris was not anticipated here, since the anticipated waste stream consists primarily of low-conductivity oil and grease. Inspection of the map reveals two areas of lower conductivity (shown in blue) that appear to be waste disposal areas.

6.2 LF-10

The EM-31 map does not show anything conclusive, in ECA's opinion. The map is labeled to identify such features as fences, the gatehouse, concrete rebar (parking lot) and the nearby power substation fence. The only readily apparent anomalous features revealed in the EM-31 color map are the two high-conductivity areas along the eastern boundary. These conductivity highs may be attributable to the water-saturated gypsum soils located in this topographically lower area, or they may be attributable to buried non-magnetic and primarily non-metallic wastes such as glass, porcelain, wood, and gravel that were observed in this area.

The full-color G-858 map is labeled to also identify such cultural noise sources as monitoring wells and fences. The eastern boundary is relatively magnetically quiet (not anomalous), whereas the EM-31 map reveals two large conductivity highs. What readily appears of significance in this map is the presence of

numerous northwest-southeast trending linear features, which ECA interprets to be burial trenches. An additional "Trench Enhancement" map is included to better define the numerous trench locations. The anomalies that define these linear trench-like features are not robust, but they nonetheless reveal sufficient buried metal to be detected by a gradiometer magnetic survey.

6.3 LF-19

The EM-31 map reveals three distinct areas, as indicated by the diffusely bordered areas of high conductivity shown in red, that may represent water-saturated gypsum soils or disposal areas of non-metallic waste. Based upon the magnetometer surveys, these areas did not contain metallic objects. The most distinct anomalies are attributable to a barbwire fence.

The full-color G-858 map is labeled to identify surface noise sources. All unlabeled anomalies are probably buried metal debris and other magnetically susceptible causative bodies.

6.4 LF-21

The EM-31 map reveals what might be water-saturated gypsum soils or disposal areas of non-metallic waste, as indicated by the diffusely bordered areas of high conductivity shown in red. Based upon the magnetometer surveys, these areas did not contain metallic objects. The more distinct anomaly is attributable to a green metal shed.

The full-color G-858 map is labeled to identify the green metal shed and the three monitoring wells along the western boundary. All unlabeled anomalies are probably buried metal debris and other magnetically susceptible causative bodies.

6.5 LF-22

The EM-31 map reveals what appears to be a well-defined disposal area of low-conductivity (shown in blue).

The full-color G-858 map is labeled to identify surface noise sources and the three monitoring wells along the southern boundary. All unlabeled anomalies are probably buried metal debris and other magnetically susceptible causative bodies. Field observations indicated that the concrete rubble lacked metal such as rebar, so the anomalies in these areas might be attributable to sources located adjacent to or beneath the rubble. A field check with a high-quality metal detector over and around isolated pieces of rubble could possibly clarify this cursory observation.

6.6 LF-23

The EM-31 map does not show anything conclusive, in ECA's opinion. The map is labeled to identify the fence along the northern boundary. The only readily apparent anomalous feature revealed in the EM-31 color map is the high-conductivity area along the western boundary. This conductivity high may be attributable to the water-saturated gypsum soils located in this topographically lower area or may be attributable to buried non-magnetic high-conductivity waste.

The full-color G-858 map is labeled to identify surface noise sources and the two monitoring wells within the southwestern corner. The western boundary is magnetically quiet, whereas the EM-31 map reveals a large conductivity high. All unlabeled anomalies are probably buried metal debris and other magnetically susceptible causative bodies. As with LF-22, field observations indicated that the concrete rubble lacked metal such as rebar, so the anomalies in these areas might also be attributable to sources located adjacent to or beneath the rubble. As with LF-22, a field check with a high-quality metal detector over and around isolated pieces of rubble could possibly clarify this cursory observation.

6.7 LF-29

This site was surveyed exclusively with the G-858 magnetometer, as it comprises a classic metal debris field. The full-color G-858 map is labeled to identify surface noise sources, as well as the two monitoring wells located along the western boundary and the monitoring well along the northern boundary. All unlabeled anomalies are probably buried metal debris and other magnetically susceptible causative bodies.

7.0 Closing Comments

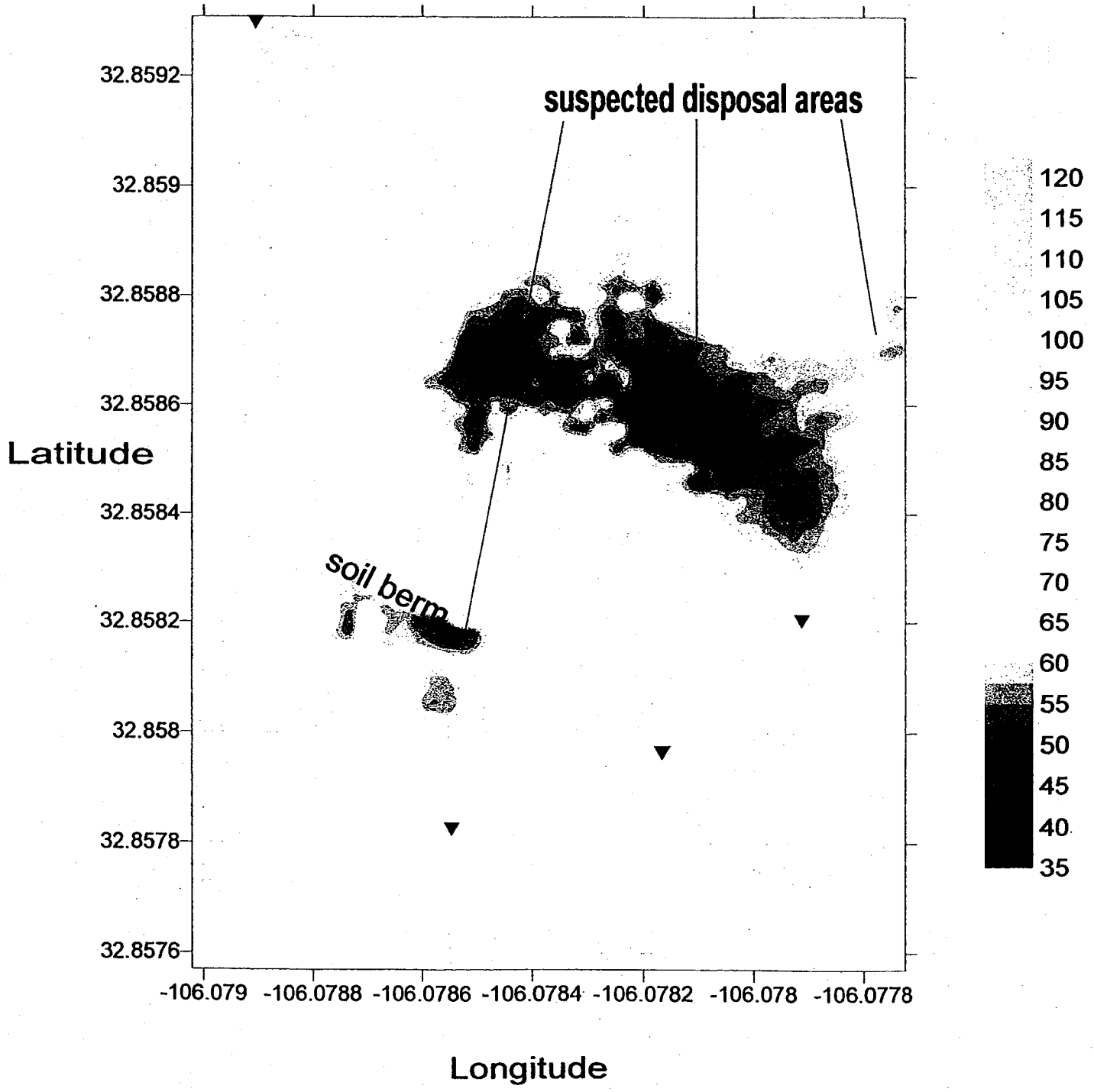
ECA performed this geophysical surveying project, utilizing best available methods and practices. However, all interpretations and opinions presented herein should in no way be considered as unequivocal facts. Geophysical data are simply displays of anomalous signatures that deviate from the normal field.

Appendix A

DP-30 / SD-33 Maps

DP-30 / SD-33

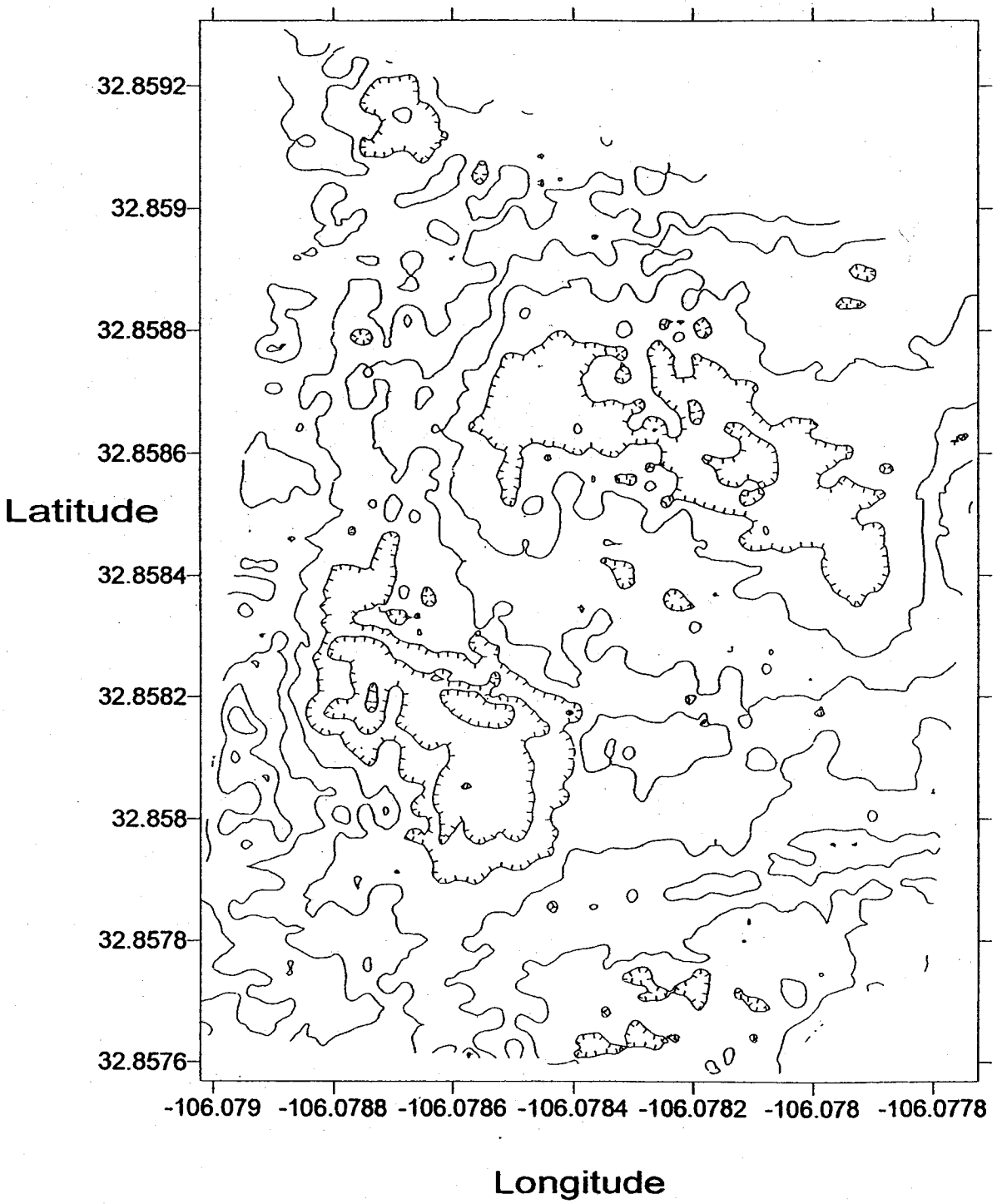
Terrain Conductivity Data



▼ - approximate location of monitoring well

DP-30 / SD-33

Terrain Conductivity Data



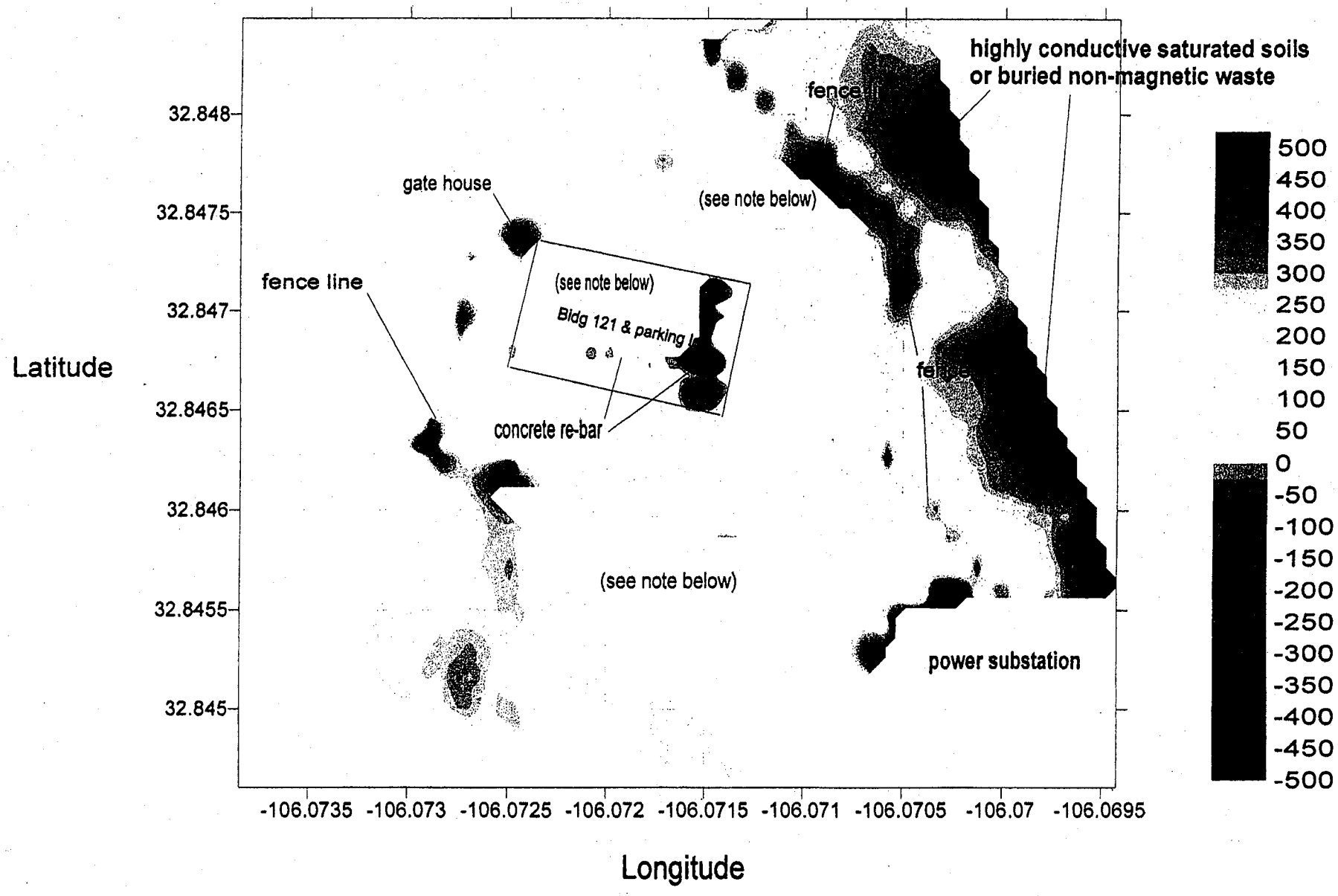
Contour Interval = 10 mS/m

Appendix B

LF-10 Maps

Landfill 10

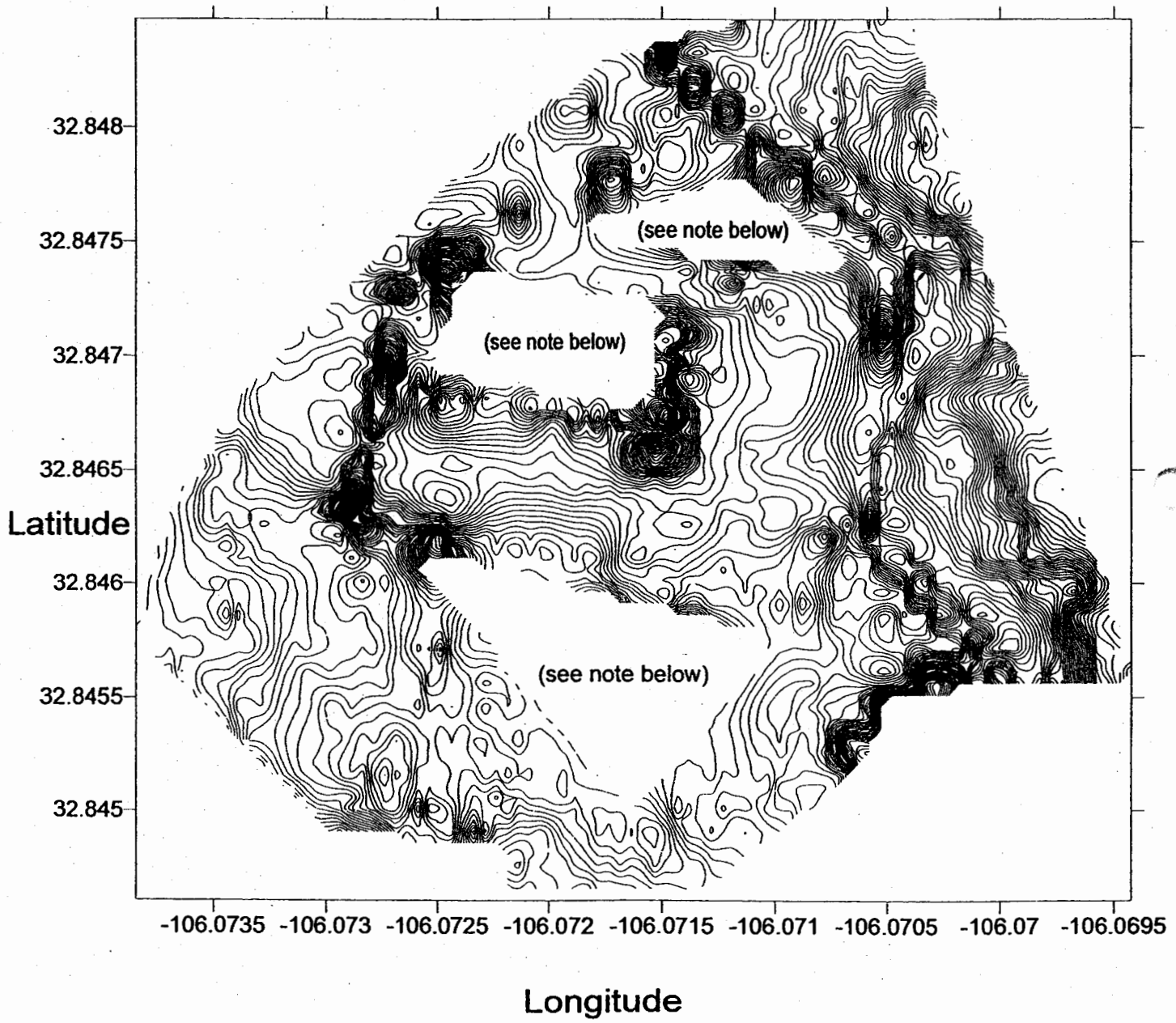
Terrain Conductivity Data



NOTE - blank areas on map are where no survey traverses were made

Landfill 10

Terrain Conductivity Data

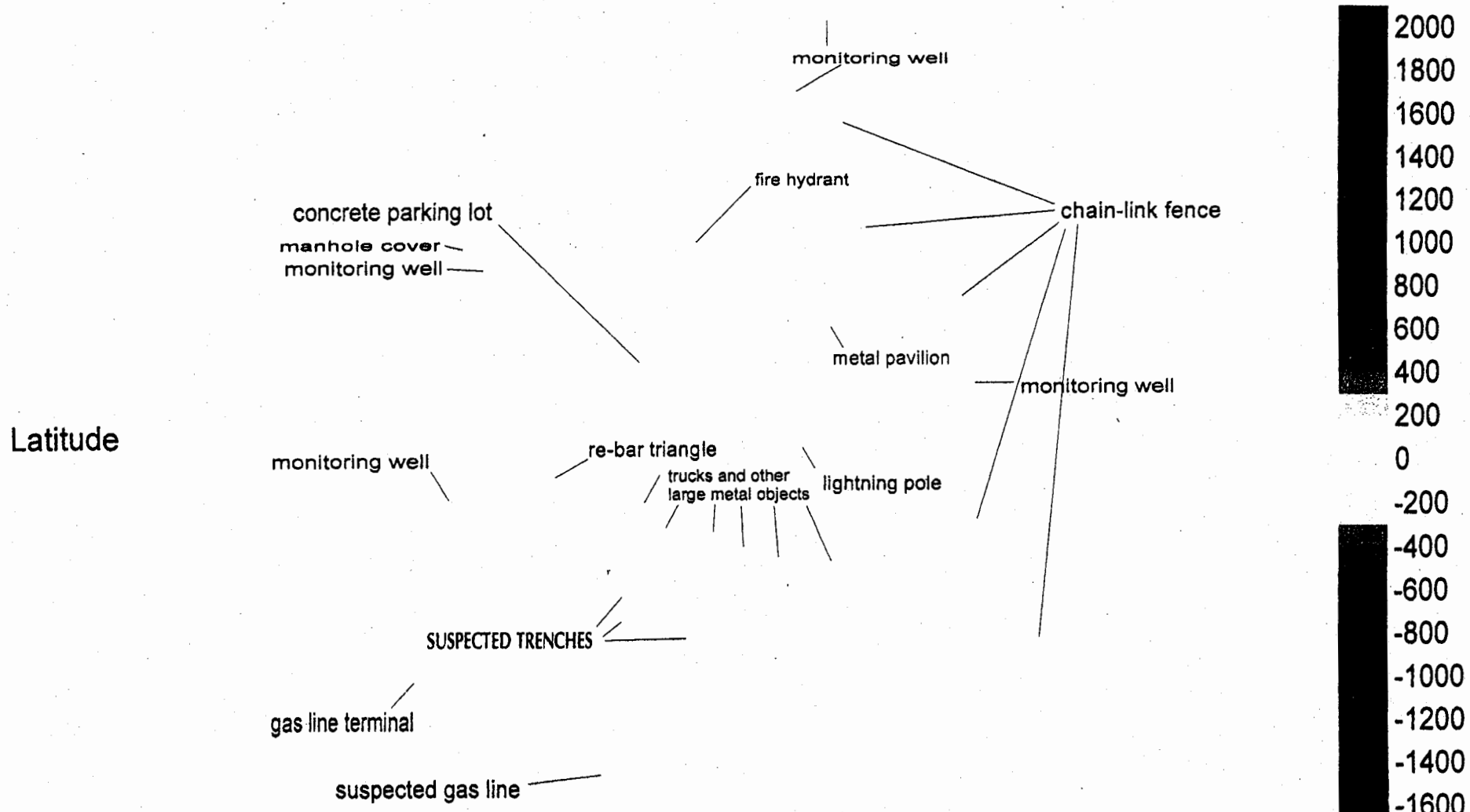


Contour Interval = 10 mS/m

NOTE - blank areas on map are where no survey traverses were made

Landfill 10

Vertical Gradient Data

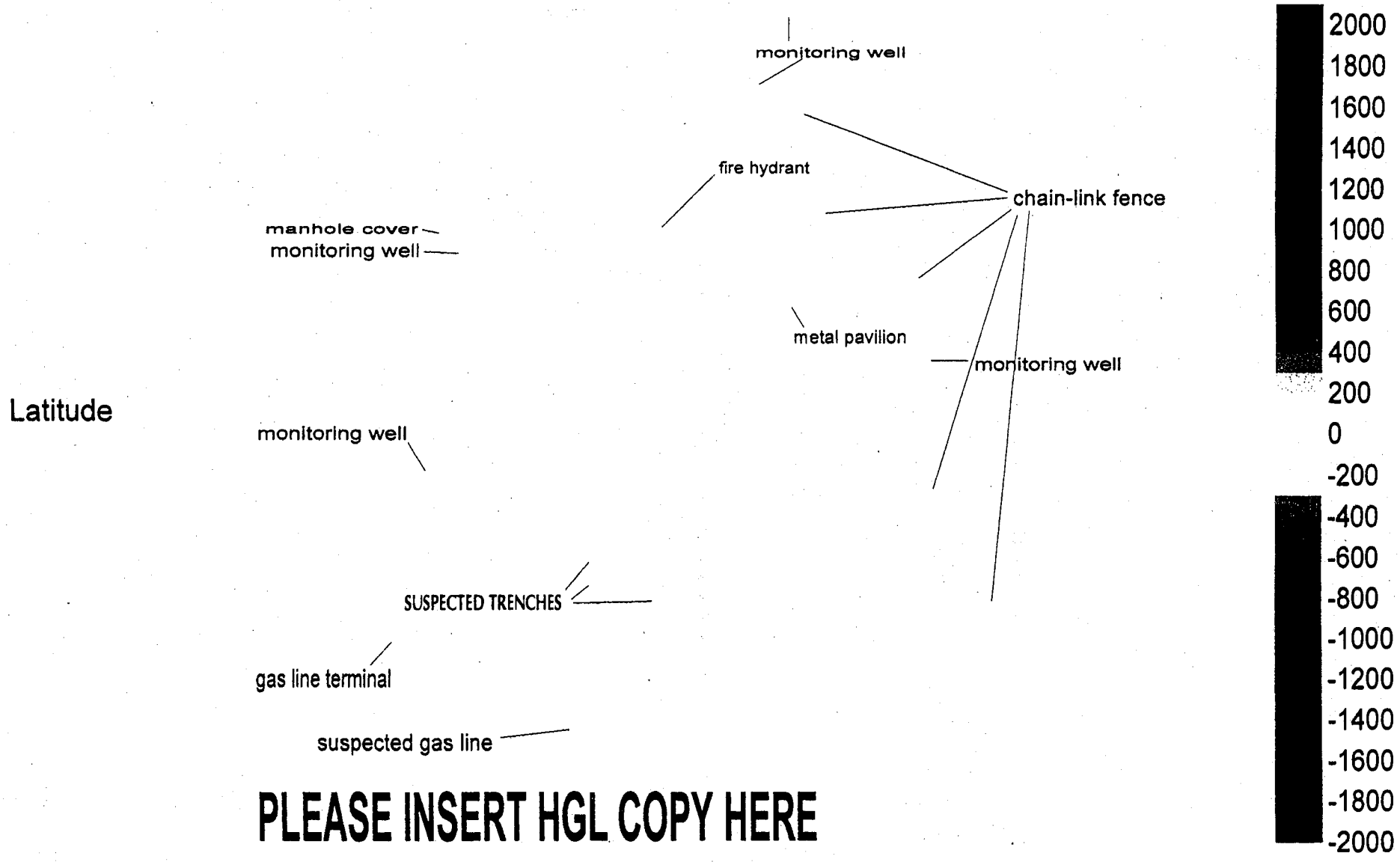


PLEASE INSERT HGL COPY HERE

(ECA's plotter memory unable to handle this large file!)

Landfill 10

Trenches Enhancement

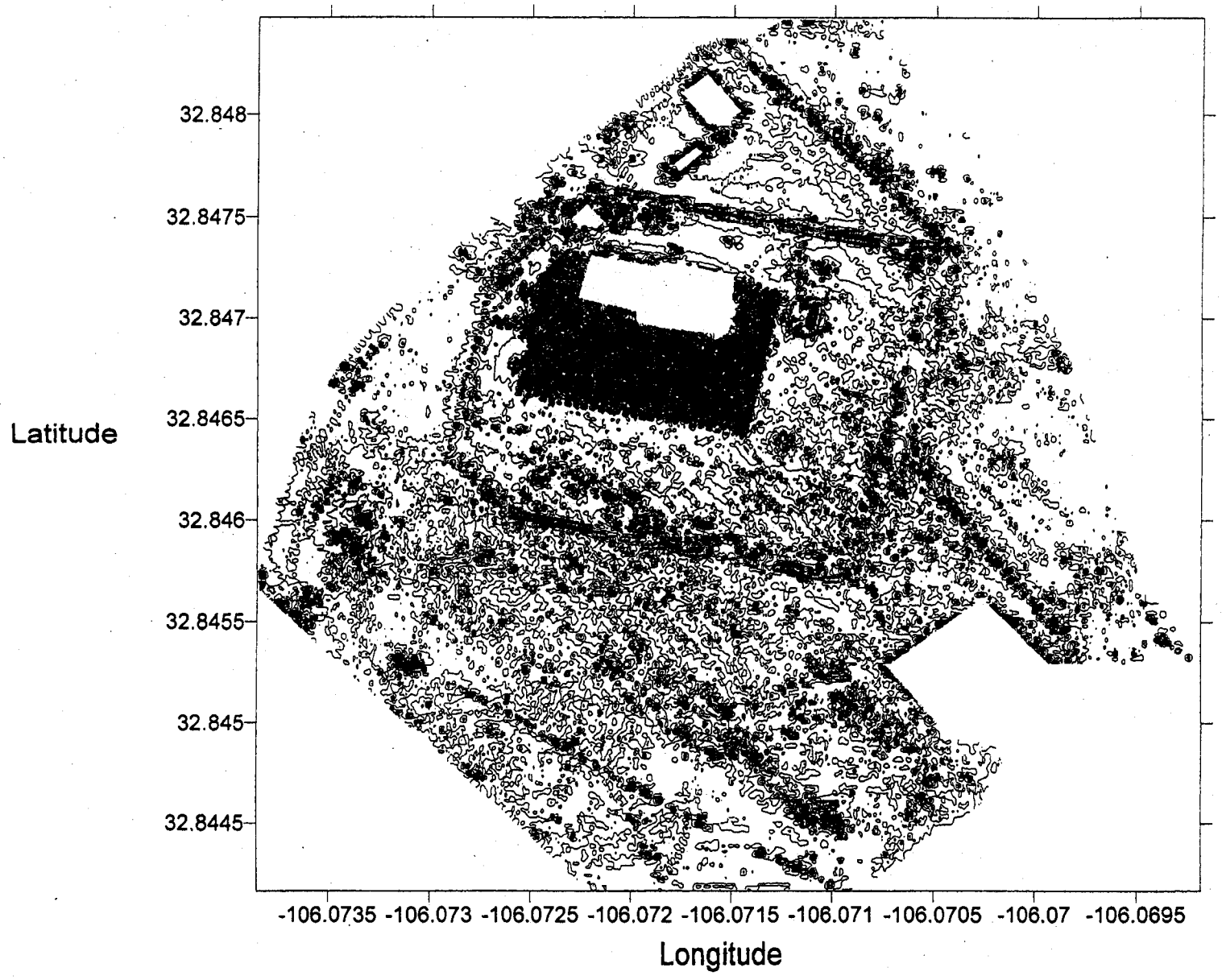


PLEASE INSERT HGL COPY HERE

(ECA's plotter memory unable to handle this large file!)

Landfill 10

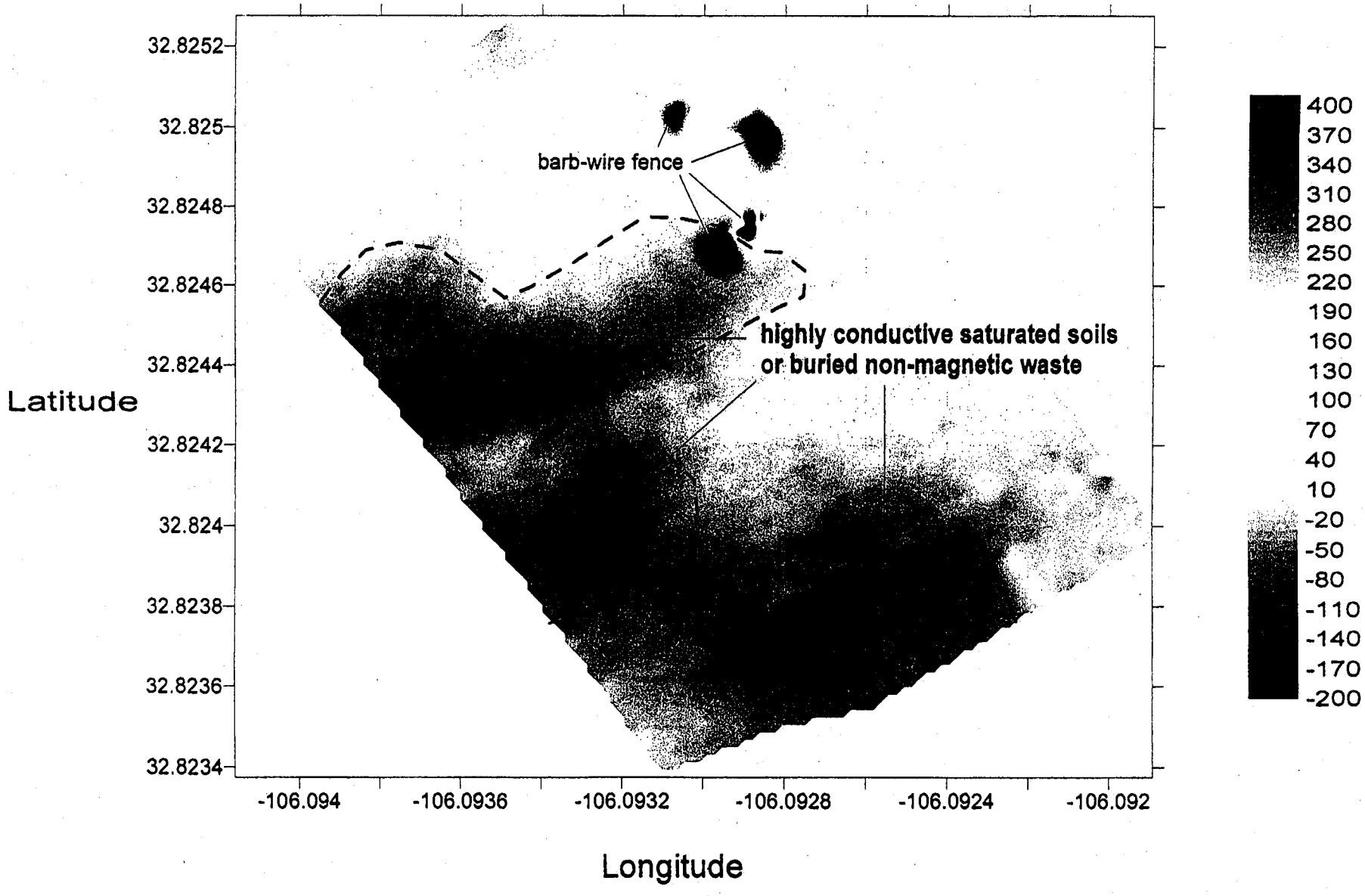
Vertical Gradient Data



Contour Interval = 100 nT

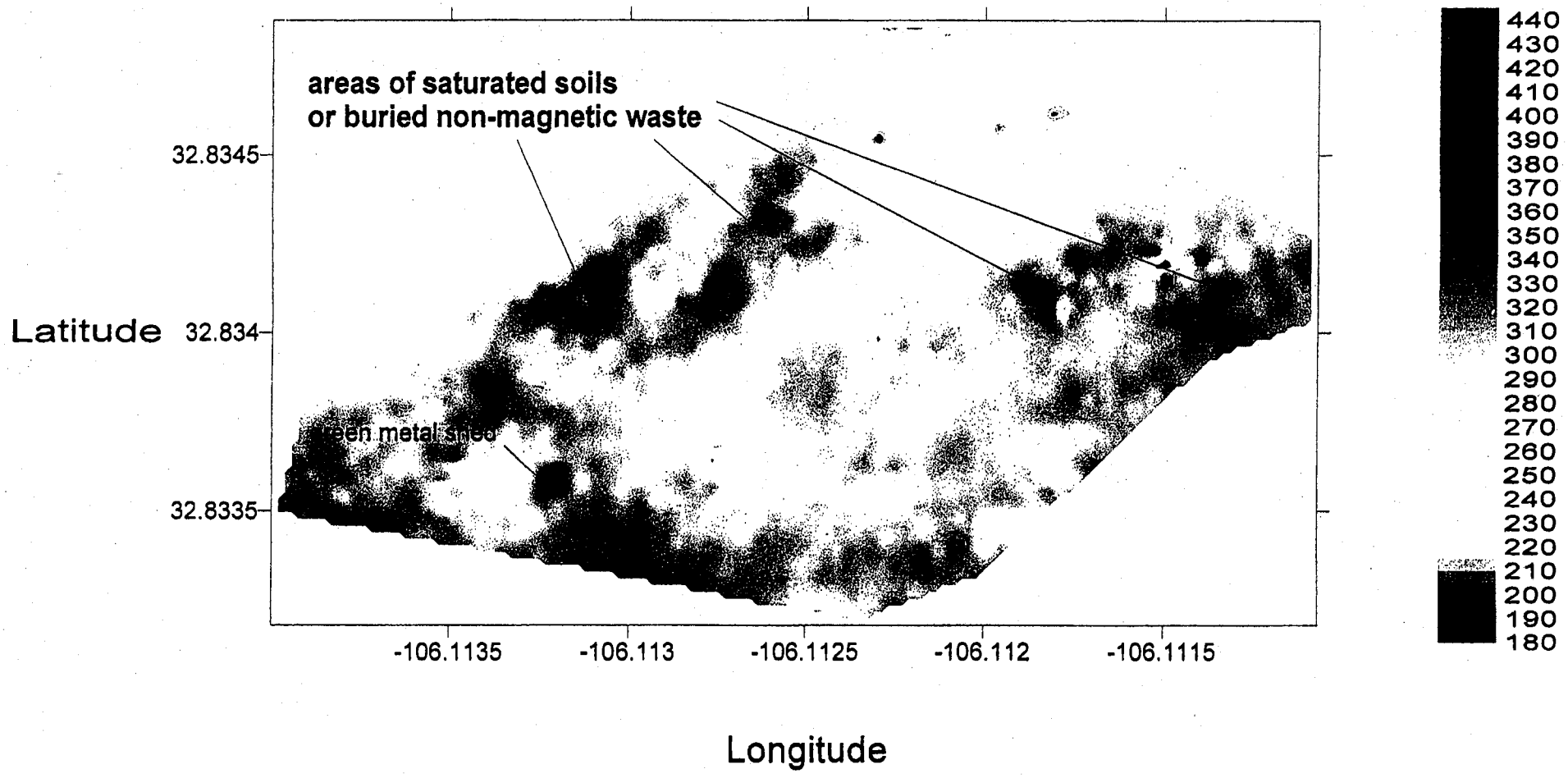
Landfill 19

Terrain Conductivity Data



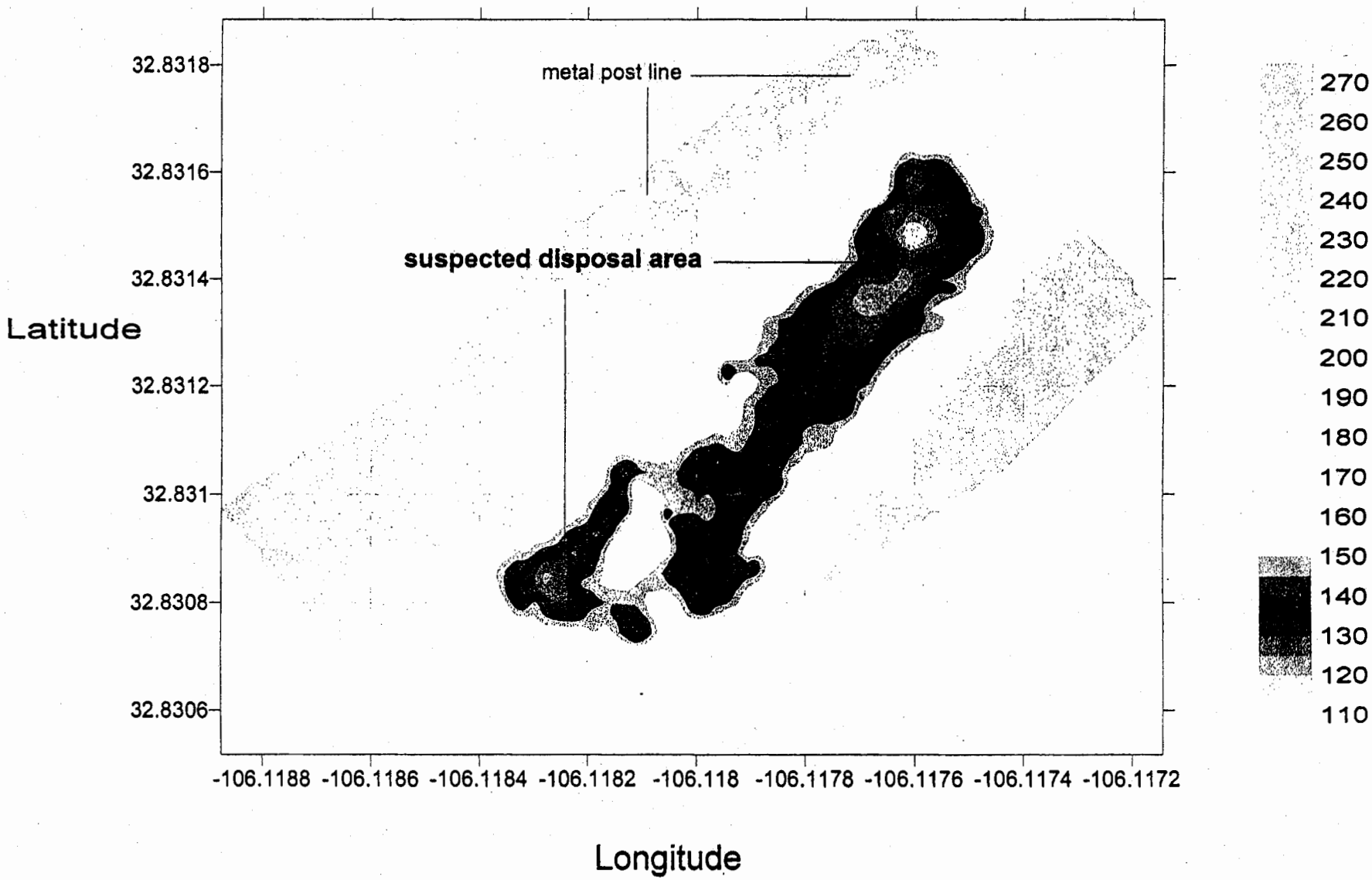
Landfill 21

Terrain Conductivity Data



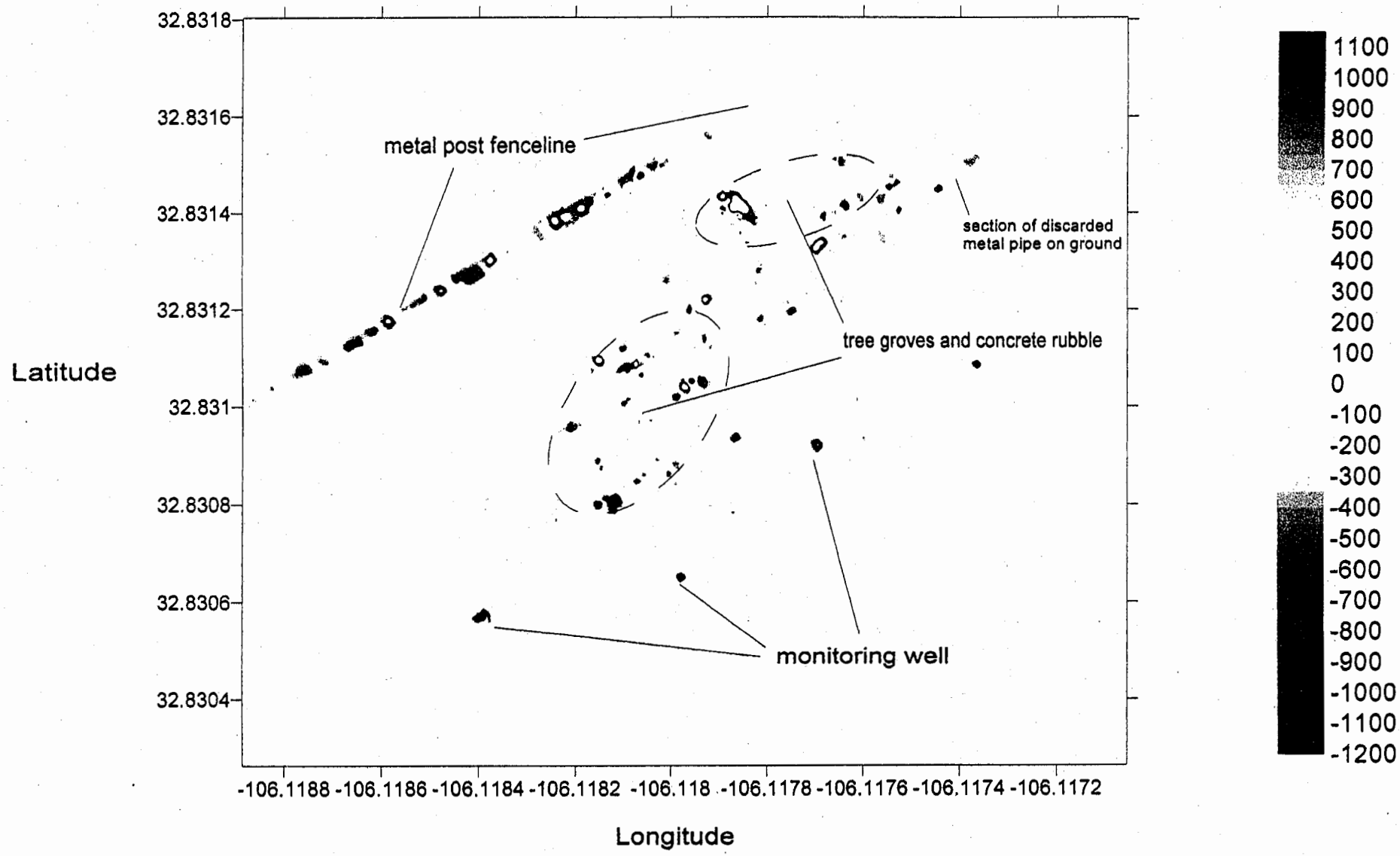
Landfill 22

Terrain Conductivity Data



Landfill 22

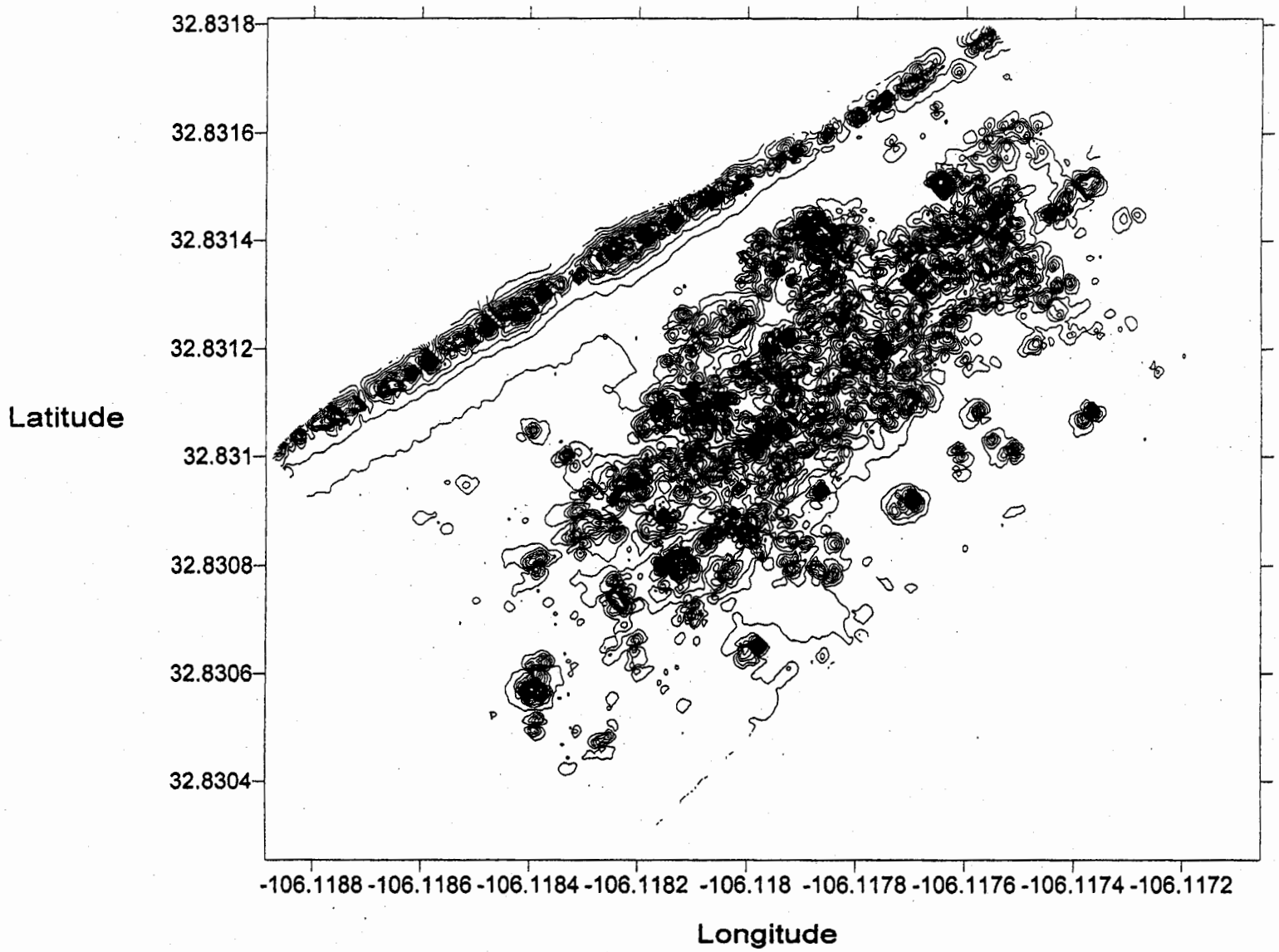
Magnetometer Residual Data



NOTE - unlabeled aomalies are probably buried metal debris

Landfill 22

Magnetometer Residual Data



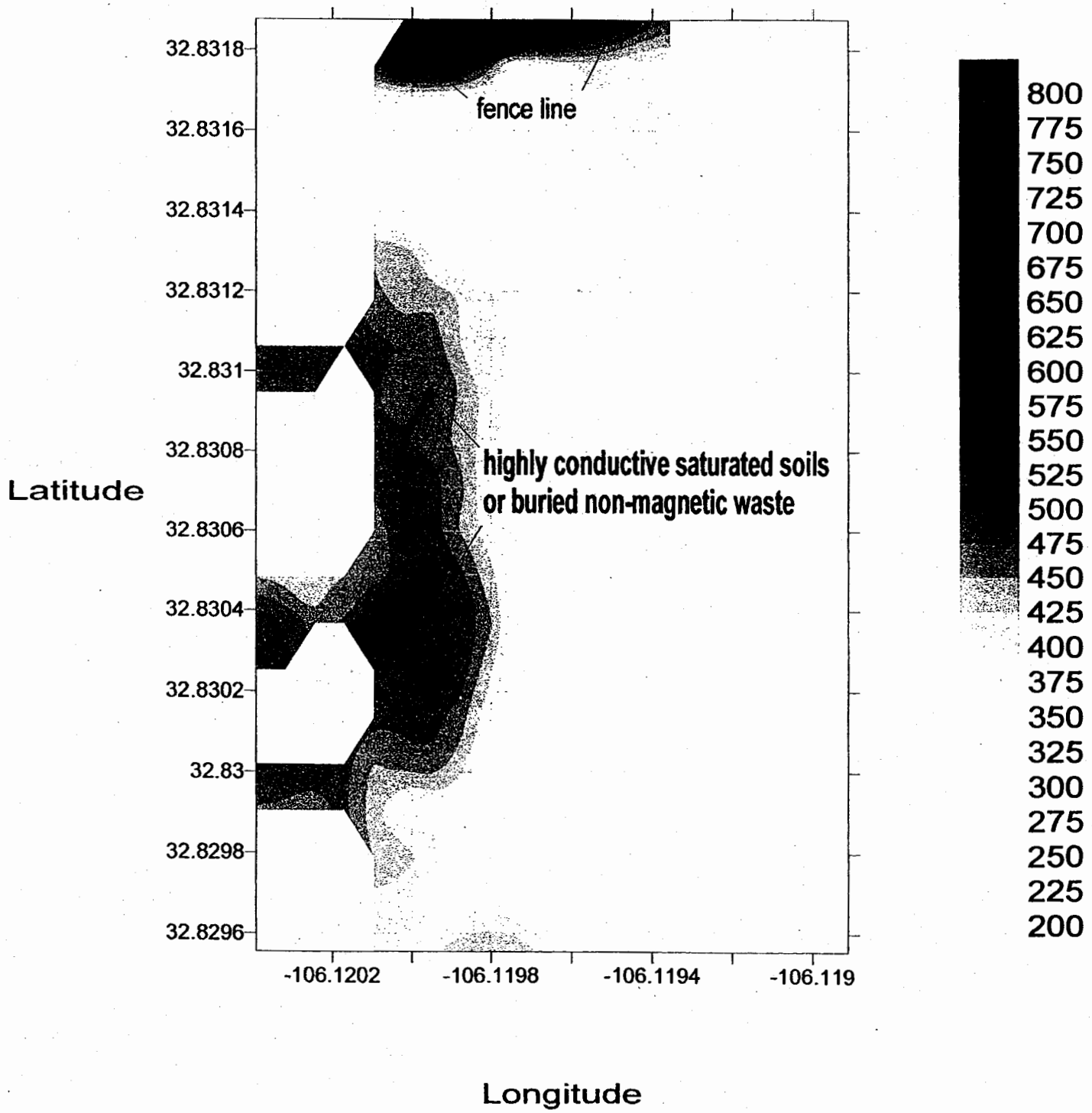
Contour Interval = 50 nT

Appendix F

LF-23 Maps

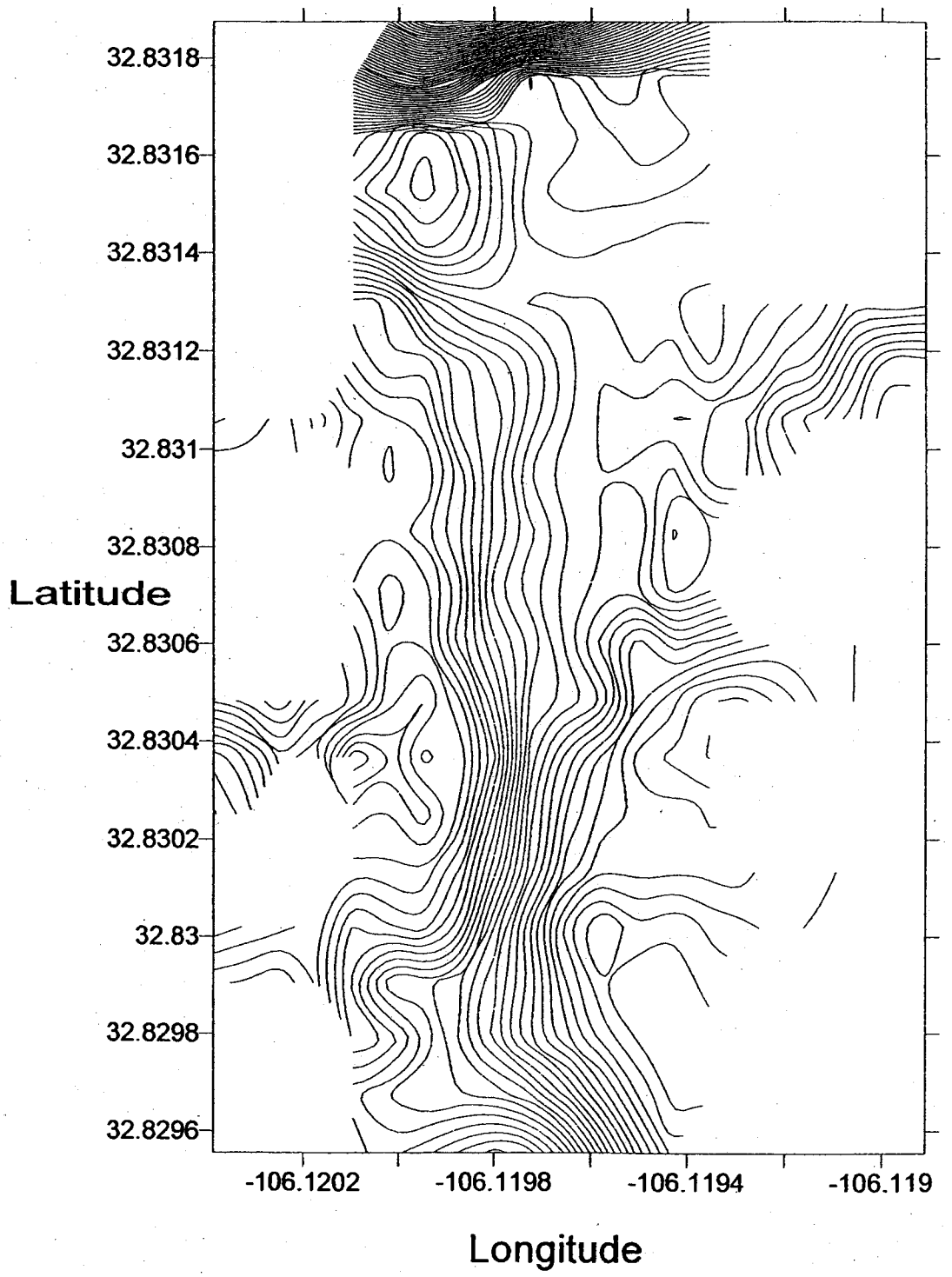
Landfill 23

Terrain Conductivity Data



Landfill 23

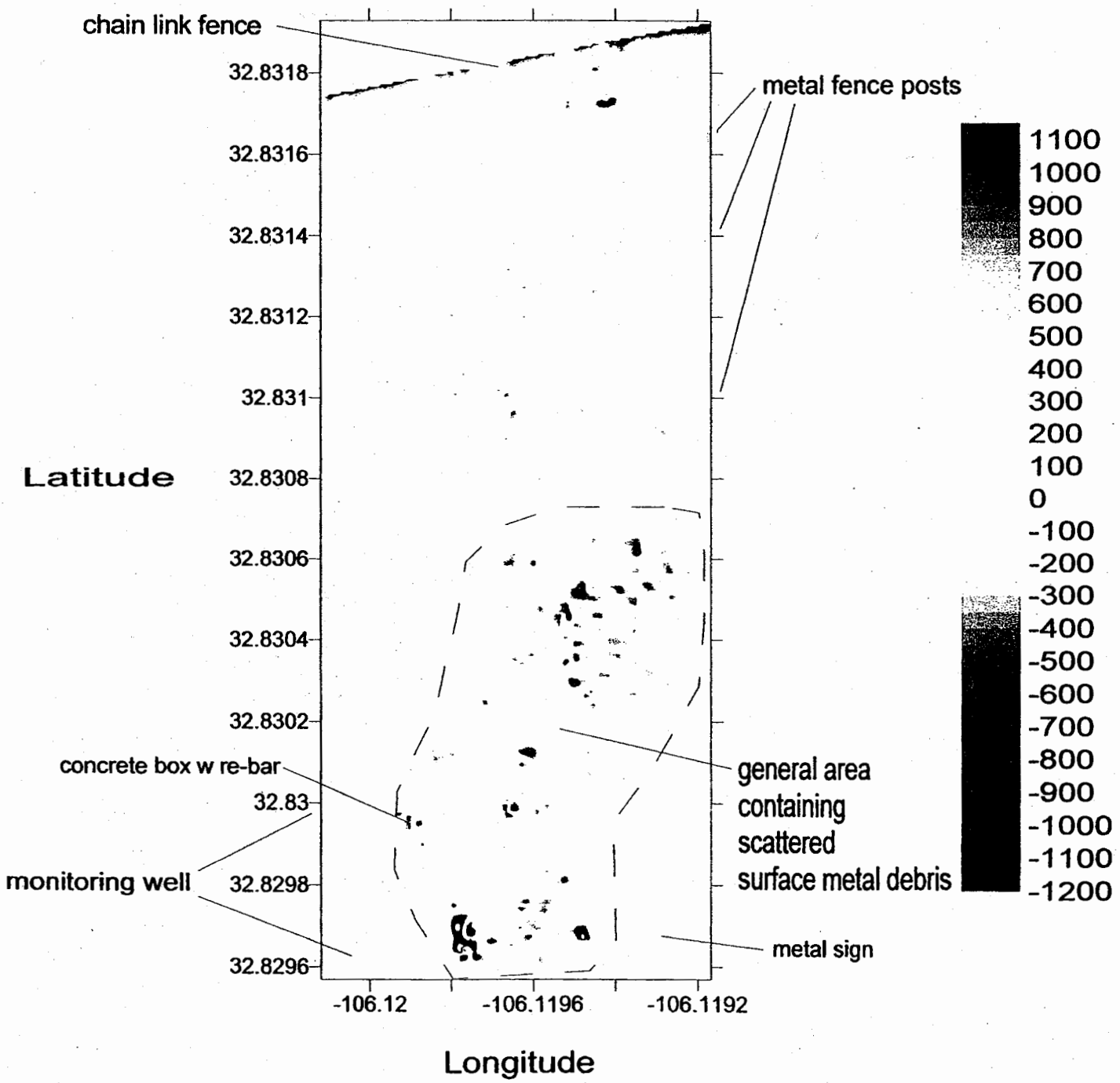
Terrain Conductivity Data



Contour Interval = 10 mS/m

Landfill 23

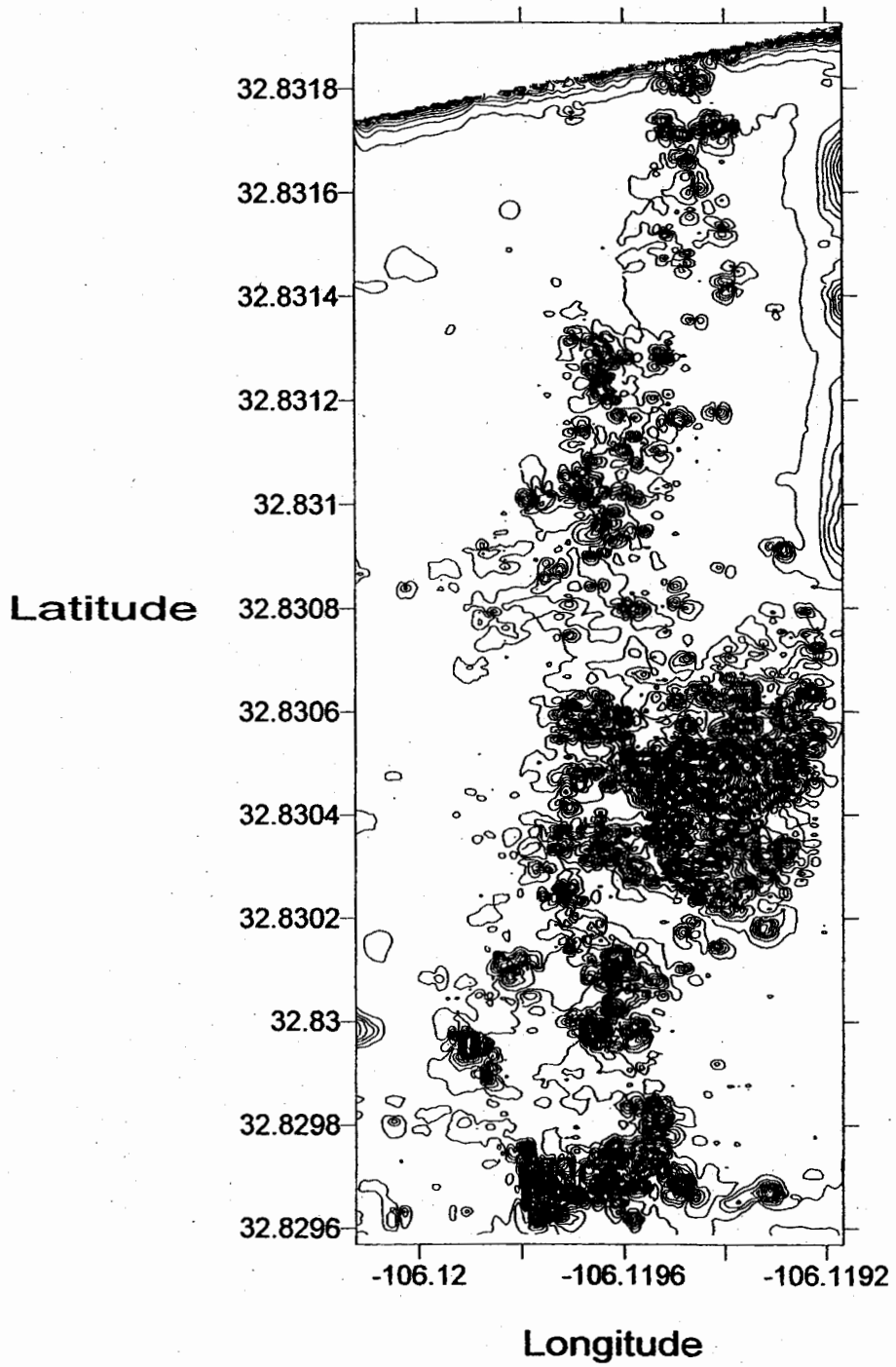
Magnetometer Residual Data



NOTE - unlabeled aomalies are probably buried metal debris

Landfill 23

Magnetometer Residual Data



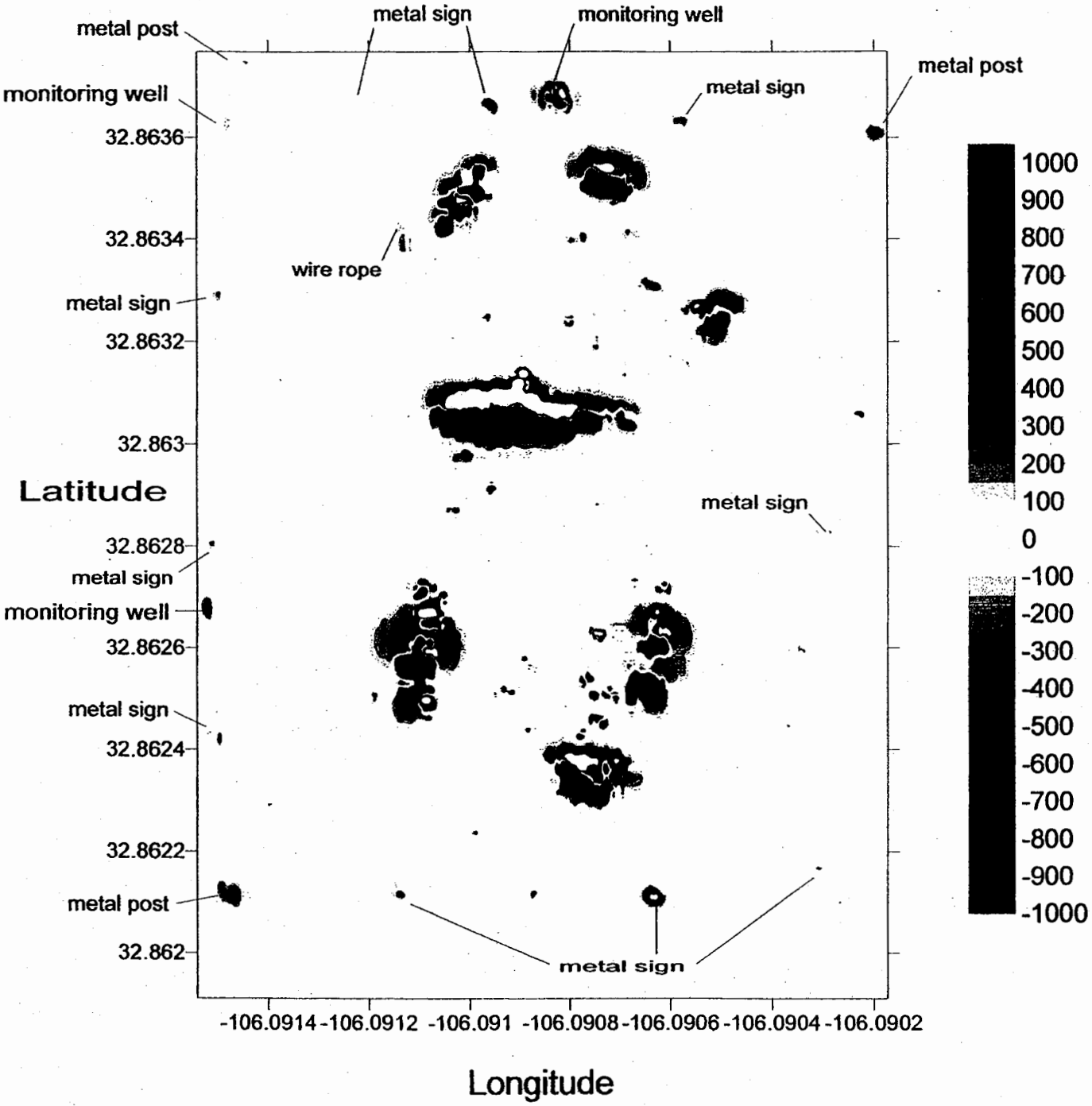
Contour Interval = 50 nT

Appendix G

LF-29 Maps

Landfill 29

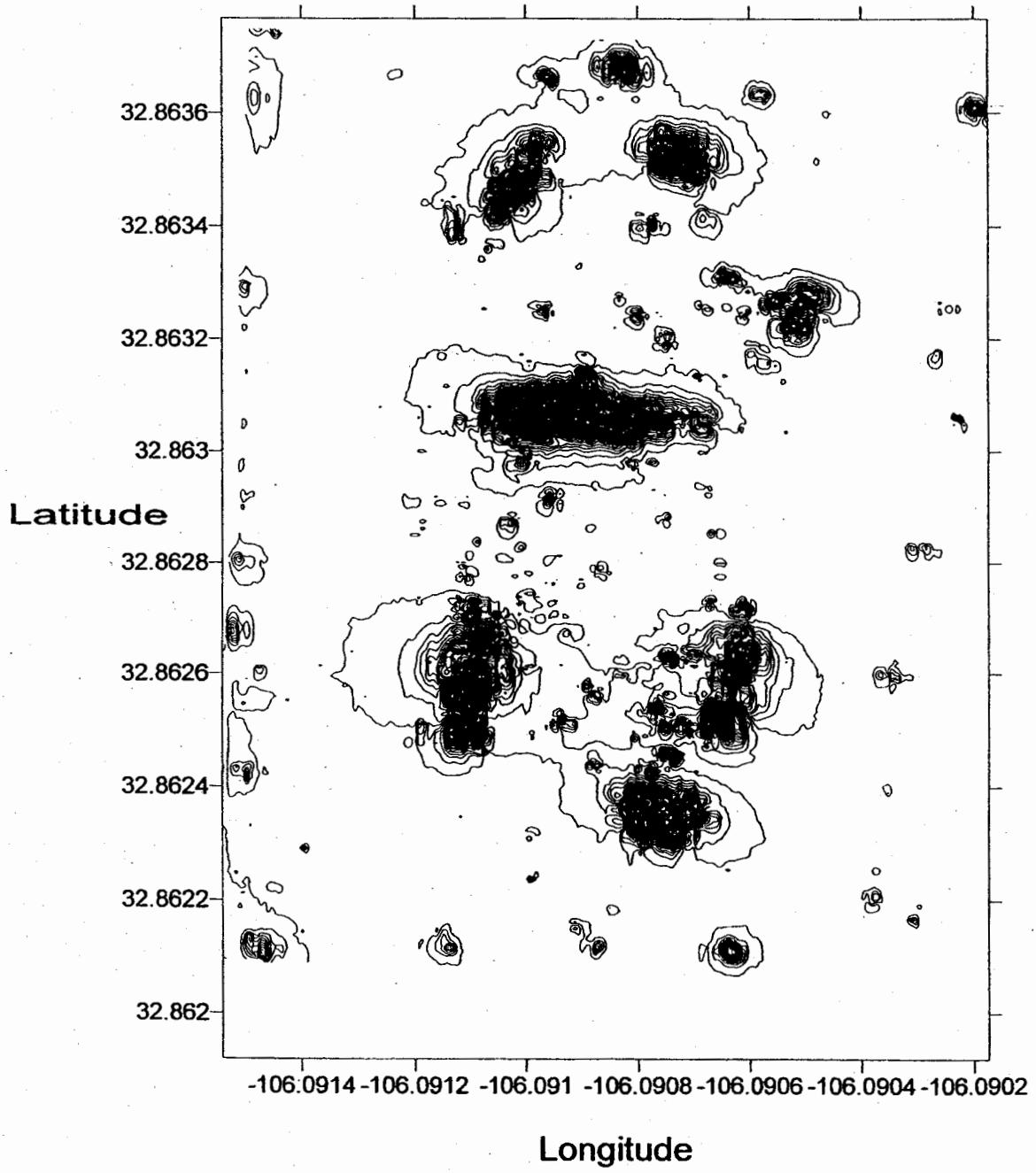
Magnetometer Residual Data



NOTE - LARGE unlabeled aomalies are probably buried metal debris

Landfill 29

Magnetometer Residual Data



Contour Interval = 50 nT

APPENDIX B

PHOTOGRAPHIC RECORD

HGL, Inc.
Photographic Record - Supplemental RCRA Facility Investigaton

SITE LOCATION:
Landfill LF-19 (SWMU 105); Holloman AFB, New Mexico

PROJECT:
AFC002-037-04-03

CLIENT: AFCEE

Photographer:
Brett Brodersen

Date:
5/22/2006

Direction:
North-northwest

Photograph: LF19-01

Description:
View of the southern disposal area. Disposal mound in the foreground. Shallow drainage ditch, marked by the brown tree line, in the center of the photograph.

Photographer:
Brett Brodersen

Date:
5/22/2006

Direction:
South-Southeast

Photograph: LF19-02

Description:
View of the northern disposal area of LF-19. Slashed vegetation, and supplies (drainage culvert piping for golf course activities shown in the photograph.

HGL, Inc.
Photographic Record - Supplemental RCRA Facility Investigaton

SITE LOCATION:
Landfill LF-19 (SWMU 105); Holloman AFB, New Mexico

PROJECT:
AFC002-037-04-03

CLIENT: AFCEE

Photographer:
Brett Brodersen

Date:
5/22/2006

Direction:
South-Southeast

Photograph: LF19-03

Description:
Test Pit HGLTP19-01.
The test pit was completed to investigate a magnetic anomaly. No magnetic susceptible material observed in subsurface soils beneath the 2 20 foot long metal pipes and corrigated pipe.

Photographer:
Brett Brodersen

Date:
5/22/2006

Direction:
South-Southeast

Photograph: LF19-04

Description:
Test Pit HGLTP19-01.
Close up view of the undisturbed soil encountered adjacent and beneath the stockpiled metal piping.

HGL, Inc.
Photographic Record - Supplemental RCRA Facility Investigaton

SITE LOCATION:
Landfill LF-19 (SWMU 105); Holloman AFB, New Mexico

PROJECT:
AFC002-037-04-03

CLIENT: AFCEE

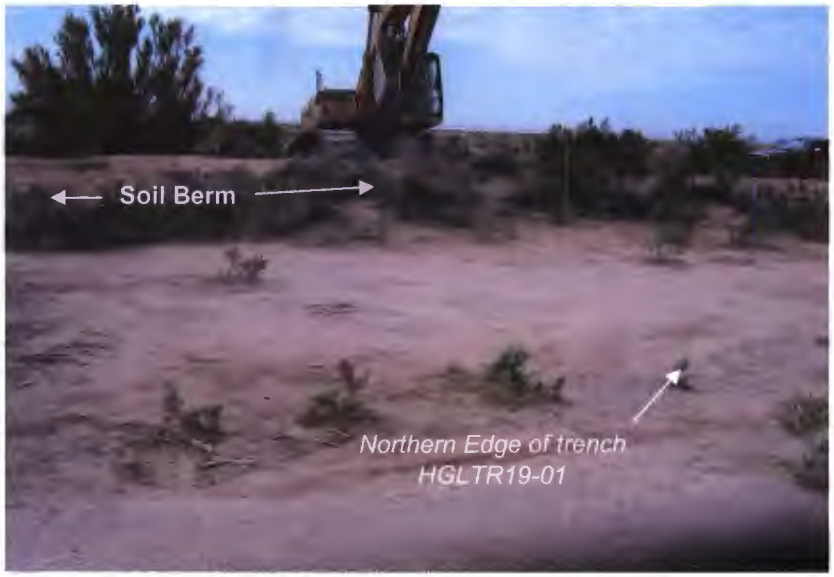
Photographer:
Brett Brodersen

Date:
5/22/2006

Direction:
South

Photograph: LF19-05

Description:
Northern surface view of trench HGLTR19-01



Photographer:
Brett Brodersen

Date:
5/22/2006

Direction:
South-southwest

Photograph: LF19-06

Description:
Western sidewall of northern portion of trench HGLTR19-01

HGL, Inc.
Photographic Record - Supplemental RCRA Facility Investigaton

SITE LOCATION:
Landfill LF-19 (SWMU 105); Holloman AFB, New Mexico

PROJECT:
AFC002-037-04-03

CLIENT: AFCEE

Photographer:
Brett Brodersen

Date:
5/22/2006

Direction:
South

Photograph: LF19-07

Description:
Trenching HGLTR19-01
No visual evidence of debris, waste material, or impacted soils in the northern portion of the trench

Photographer:
Brett Brodersen

Date:
5/22/2006

Direction:
Southwest

Photograph: LF19-08

Description:
Trenching HGLTR19-01
No visual evidence of debris, waste material, or impacted soils in the northern portion of the trench

HGL, Inc.
Photographic Record - Supplemental RCRA Facility Investigaton

SITE LOCATION:
Landfill LF-19 (SWMU 105); Holloman AFB, New Mexico

PROJECT:
AFC002-037-04-03

CLIENT: AFCEE

Photographer:
Brett Brodersen

Date:
5/22/2006

Direction:
Southwest

Photograph: LF19-09

Description:
Central portion of trench HGLTR19-01
waste material, or impacted soils in the northern portion of the trench
2 to 3 feet of reworked soil observed overlying undisturbed soil (brown, silty sand, very moist)

Photographer:
Brett Brodersen

Date:
5/22/2006

Direction:
South

Photograph: LF19-10

Description:
Waste material encountered in central portion of trench HGLTR19-01
waste material included: plastic sheeting, piping, wiring, and blue crystalline substance
Sample collected of the blue material (HGLTR19-01-0102) and from undisturbed soil beneath blue material (HGLTR19-01-0203)

HGL, Inc.
Photographic Record - Supplemental RCRA Facility Investigaton

SITE LOCATION:
Landfill LF-19 (SWMU 105); Holloman AFB, New Mexico

PROJECT:
AFC002-037-04-03

CLIENT: AFCEE

Photographer:
Brett Brodersen

Date:
5/22/2006

Direction:

Photograph: LF19-11

Description:
Close-up of waste material (plastic sheeting, piping, and paper) observed in trench HGLTR19-01
Waste material encountered in areas of identified magnetic anomalies.

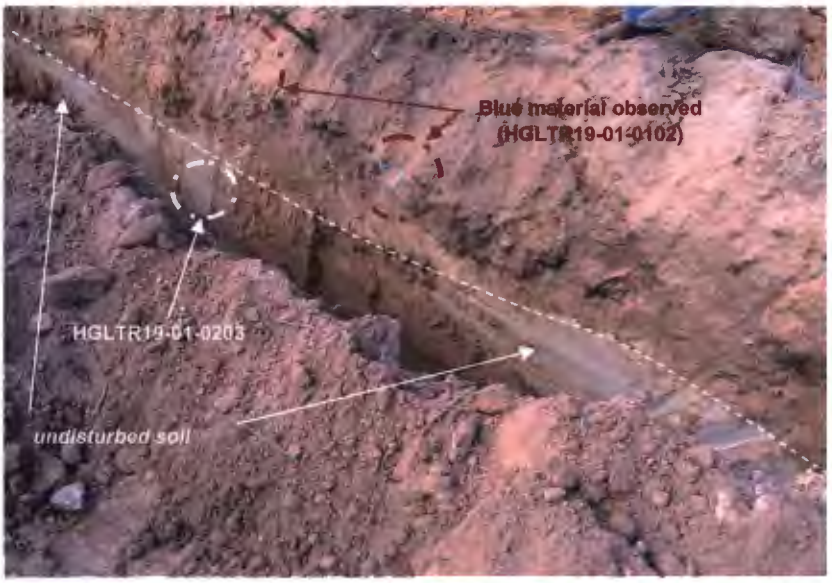
Photographer:
Brett Brodersen

Date:
5/22/2006

Direction:
Northwest

Photograph: LF19-12

Description:
Location of soil samples collected from trench HGLTR19-01



HGL, Inc.
Photographic Record - Supplemental RCRA Facility Investigaton

SITE LOCATION:
Landfill LF-19 (SWMU 105); Holloman AFB, New Mexico

PROJECT:
AFC002-037-04-03

CLIENT: AFCEE

Photographer:
Brett Brodersen

Date:
5/22/2006

Direction:
South-southwest

Photograph: LF19-13

Description:
Southern portion of trench
HGLTR19-01

Photographer:
Brett Brodersen

Date:
5/22/2006

Direction:
Southwest

Photograph: LF19-14

Description:
Subsurface soils in southern
portion of trench
HGLTR19-01

HGL, Inc.
Photographic Record - Supplemental RCRA Facility Investigaton

SITE LOCATION:
Landfill LF-19 (SWMU 105); Holloman AFB, New Mexico

PROJECT:
AFC002-037-04-03

CLIENT: AFCEE

Photographer:
Brett Brodersen

Date:
5/22/2006

Direction:
South-Southwest

Photograph: LF19-15

Description:
Southern extent of trench HGLTR19-01.
The soil (brown, silty sand, moist) completely undisturbed in this portion of the trench.
No evidence of impacted soils or waste materials in this portion of the trench.

Photographer:
Brett Brodersen

Date:
5/22/2006

Direction:
Southwest

Photograph: LF19-16

Description:
Begin trenching of trench HGLTR19-02 (trench located in northern portion of landfill LF-19)
Area is used for stockpiling materials for golf course maintenance (mulch, slashed vegetation, grass clippings, soil, etc.)

HGL, Inc.
Photographic Record - Supplemental RCRA Facility Investigaton

SITE LOCATION:
Landfill LF-19 (SWMU 105); Holloman AFB, New Mexico

PROJECT:
AFC002-037-04-03

CLIENT: AFCEE

Photographer:
Brett Brodersen

Date:
5/22/2006

Direction:
South

Photograph: LF19-17

Description:
The northern extent of trench HGLTR19-02.
No evidence of impacted soils (brown, silty sand, damp to moist), or waste materials in the shallow subsurface

Photographer:
Brett Brodersen

Date:
5/22/2006

Direction:
South

Photograph: LF19-18

Description:
Completion of trench HGLTR19-02.
The trench extends approximately 110 feet
No evidence of impacted soils, waste materials, or drums/canisters observed during trenching.

HGL, Inc.
Photographic Record - Supplemental RCRA Facility Investigaton

SITE LOCATION:
Landfill LF-19 (SWMU 105); Holloman AFB, New Mexico

PROJECT:
AFC002-037-04-03

CLIENT: AFCEE

Photographer:
Brett Brodersen

Date:
5/22/2006

Direction:
North-northwest

Photograph: LF19-19

Description:
View looking north of trench HGLTR19-02.
Trench completed in area used by the golf course for exterior material and supply storage (gravel, sand, mulch, and slashed vegetation).

Photographer:
Brett Brodersen

Date:
5/22/2006

Direction:
Northeast

Photograph: LF19-20

Description:
View of trench HGLTR19-03, completed in the northern portion of LF-19.
No evidence of impacted soils, waste materials, or drums/ canisters during trenching.
Soil (brown, silty sand, moist) appears to be completely undisturbed.

HGL, Inc.
Photographic Record - Supplemental RCRA Facility Investigaton

SITE LOCATION:
Landfill LF-19 (SWMU 105); Holloman AFB, New Mexico

PROJECT:
AFC002-037-04-03

CLIENT: AFCEE

Photographer:
Brett Brodersen

Date:
5/22/2006

Direction:
Northeast

Photograph: LF19-21

Description:
View of eastern sidewall of trench HGLTR19-03.
No evidence of disturbed soil, impacted soils, waste materials, or drums/ canisters.

Photographer:
Brett Brodersen

Date:
5/22/2006

Direction:
North-northeast

Photograph: LF19-22

Description:
View of the northern portion of trench HGLTR19-03.
No evidence of disturbed soil, impacted soils, waste materials, or drums/ canisters.

HGL, Inc.
Photographic Record - Supplemental RCRA Facility Investigaton

SITE LOCATION:
Landfill LF-19 (SWMU 105); Holloman AFB, New Mexico

PROJECT:
AFC002-037-04-03

CLIENT: AFCEE

Photographer:
Brett Brodersen

Date:
5/22/2006

Direction:
North-northeast

Photograph: LF19-23

Description:
Soil excavated from trench HGLTR19-03.
No evidence of landfilling observed.

Photographer:
Brett Brodersen

Date:
5/22/2006

Direction:
North

Photograph: LF19-24

Description:
Excavation of trench HGLTR19-04, located in the central portion of LF-19.
Mulch and small concrete fragments cover the surface of the area.
Soils (brown, silty sand, moist) appear to be undisturbed.
No evidence of landfilling noted.

HGL, Inc.
Photographic Record - Supplemental RCRA Facility Investigaton

SITE LOCATION:
Landfill LF-19 (SWMU 105); Holloman AFB, New Mexico

PROJECT:
AFC002-037-04-03

CLIENT: AFCEE

Photographer:
Brett Brodersen

Date:
5/22/2006

Direction:
North

Photograph: LF19-25

Description:
Southern section of trench HGLTR19-04.
No visual or field screening evidence of impacted soils or former landfilling material.

Photographer:
Brett Brodersen

Date:
5/22/2006

Direction:
Northwest

Photograph: LF19-26

Description:
Soil excavated from trench HGLTR19-04
No visual or field screening evidence of impacted soils or former landfilling material.

HGL, Inc.
Photographic Record - Supplemental RCRA Facility Investigaton

SITE LOCATION:
Landfill LF-19 (SWMU 105); Holloman AFB, New Mexico

PROJECT:
AFC002-037-04-03

CLIENT: AFCEE

Photographer:
Brett Brodersen

Date:
5/22/2006

Direction:
North

Photograph: LF19-27

Description:
Completion of the northern portion of trench HGLTR19-04 and view of soil. being excavated from the trench.

Photographer:
Brett Brodersen

Date:
5/22/2006

Direction:
North-northeast

Photograph: LF19-28

Description:
View of the subsurface soil in the northern portion of trench HGLTR19-04.
Soils (brown, silty sand, moist) appear to be undisturbed and no visual or field screening evidence of impacted soils, waste materials, or former landfilling activities.

HGL, Inc.
Photographic Record - Supplemental RCRA Facility Investigaton

SITE LOCATION:
Landfill LF-19 (SWMU 105); Holloman AFB, New Mexico

PROJECT:
AFC002-037-04-03

CLIENT: AFCEE

Photographer:
Brett Brodersen

Date:
5/22/2006

Direction:
South

Photograph: LF19-29

Description:
View looking south of the eastern sidewall of trench HGLTR19-04.
No evidence of disturbed soils, waste materials, or impacated soils observed during trenching.

Photographer:
Brett Brodersen

Date:
5/22/2006

Direction:
Northwest

Photograph: LF19-30

Description:
Additional test pit HGLTP19-02 added during trenching activities to investigate area covered with grass clippings and containing concrete fragments.
Soils beneath grass clippings completely undisturbed, no evidence of impacted soils, waste material, or former landfilling activities.

HGL, Inc.
Photographic Record - Supplemental RCRA Facility Investigaton

SITE LOCATION:
Landfill LF-21 (SWMU 116); Holloman AFB, New Mexico

PROJECT:
AFC002-037-04-04

CLIENT: AFCEE

Photographer:
Brett Brodersen

Date:
5/18/2006

Direction:
East-southeast

Photograph: LF21-01

Description:
North-central portion of LF-21.

Photographer:
Brett Brodersen

Date:
5/18/2006

Direction:
West-southwest

Photograph: LF21-02

Description:
View of west-central portion of LF-21. Surface debris observed at LF-21 include asphalt, concrete, piping, wiring, a wood door, and terra cotta pipe fragments.

HGL, Inc.
Photographic Record - Supplemental RCRA Facility Investigaton

SITE LOCATION:
Landfill LF-21 (SWMU 116); Holloman AFB, New Mexico

PROJECT:
AFC002-037-04-04

CLIENT: AFCEE

Photographer:
Brett Brodersen

Date:
5/18/2006

Direction:
South-southwest

Photograph: LF21-03

Description:
Another view of the central portion of LF-21. Debris observed in the foreground includes concrete rubble, sheet metal, and terra cotta piping fragments.

Photographer:
Brett Brodersen

Date:
5/18/2006

Direction:
Southeast

Photograph: LF21-04

Description:
View of northeastern portion of LF-21. Moderately vegetated area containing discrete piles of asphalt and concrete fragments with minor amounts of piping.

HGL, Inc.
Photographic Record - Supplemental RCRA Facility Investigaton

SITE LOCATION:
Landfill LF-21 (SWMU 116); Holloman AFB, New Mexico

PROJECT:
AFC002-037-04-04

CLIENT: AFCEE

Photographer:
Brett Brodersen

Date:
5/18/2006

Direction:
West-southwest

Photograph: LF21-05

Description:
Location of trench HGLTR21-01.

Photographer:
Brett Brodersen

Date:
5/18/2006

Direction:
Southeast

Photograph: LF21-06

Description:
Trenching of HGLTR21-01 initiated.

HGL, Inc.
Photographic Record - Supplemental RCRA Facility Investigaton

SITE LOCATION:
Landfill LF-21 (SWMU 116); Holloman AFB, New Mexico

PROJECT:
AFC002-037-04-04

CLIENT: AFCEE

Photographer:
Brett Brodersen

Date:
5/18/2006

Direction:
West-southwest

Photograph: LF21-07

Description:
Debris consisting of metal piping, terra cotta piping, scrap metal, and plastic sheeting observed in shallow subsurface of trench HGLTR21-01.

Photographer:
Brett Brodersen

Date:
5/18/2006

Direction:
Southwest

Photograph: LF21-08

Description:
View of southern sidewall of trench HGLTR21-01. Undisturbed soil (reddish brown, silty sand, damp to moist) observed several feet beneath reworked soils containing asphalt, concrete, metal piping, and plastic sheeting.

HGL, Inc.
Photographic Record - Supplemental RCRA Facility Investigaton

SITE LOCATION:
Landfill LF-21 (SWMU 116); Holloman AFB, New Mexico

PROJECT:
AFC002-037-04-04

CLIENT: AFCEE

Photographer:
Brett Brodersen

Date:
5/18/2006

Direction:
North-northeast

Photograph: LF21-09

Description:
View of northern sidewall of trench HGLTR21-01 and the soil excavated from the trench. No visual or field screening evidence of impacted soils, waste materials, or drums/containers observed during trenching.

Photographer:
Brett Brodersen

Date:
5/18/2006

Direction:
West

Photograph: LF21-10

Description:
Trench HGLTR21-02. Minor debris consisting of asphalt and concrete rubble and PVC piping observed in shallow subsurface. Undisturbed soils (brown to reddish brown, silty sand, damp) present immediately beneath reworked soils.

HGL, Inc.
Photographic Record - Supplemental RCRA Facility Investigaton

SITE LOCATION:
Landfill LF-21 (SWMU 116); Holloman AFB, New Mexico

PROJECT:
AFC002-037-04-04

CLIENT: AFCEE

Photographer:
Brett Brodersen

Date:
5/18/2006

Direction:
West

Photograph: LF21-11

Description:
Another view of trench HGLTR21-02 and the soil excavated from the trench. No visual or field screening evidence of impacted soils, waste materials, or drums/containers observed during trenching.

Photographer:
Brett Brodersen

Date:
5/18/2006

Direction:
West

Photograph: LF21-12

Description:
Trench HGLTR21-02. Dark soils contain aspahlt fragments. No odors noted either by olfactory or by field screening.

HGL, Inc.
Photographic Record - Supplemental RCRA Facility Investigaton

SITE LOCATION:
Landfill LF-21 (SWMU 116); Holloman AFB, New Mexico

PROJECT:
AFC002-037-04-04

CLIENT: AFCEE

Photographer:
Brett Brodersen

Date:
5/18/2006

Direction:

Photograph: LF21-13

Description:
Some corrigated piping present in trench HGLTR21-02.

Photographer:
Brett Brodersen

Date:
5/18/2006

Direction:
West-southwest

Photograph: LF21-14

Description:
Large (4 feet by 3 feet by 0.5 feet) thick concrete fragments encountered during trenching of HGLTR21-02.

HGL, Inc.
Photographic Record - Supplemental RCRA Facility Investigaton

SITE LOCATION:
Landfill LF-21 (SWMU 116); Holloman AFB, New Mexico

PROJECT:
AFC002-037-04-04

CLIENT: AFCEE

Photographer:
Brett Brodersen

Date:
5/19/2006

Direction:
Southeast

Photograph: LF21-15

Description:
View of southern sidewall of trench HGLTR21-03. Three feet of reworked soil containing rebar and concrete fragments overlying undisturbed soil (light brown, silty sand, moist). No visual or field screening evidence indicating former disposal of hazardous materials.

Photographer:
Brett Brodersen

Date:
5/19/2006

Direction:
West

Photograph: LF21-16

Description:
View of trench HGLTR21-03 as the trench is progressing.

HGL, Inc.
Photographic Record - Supplemental RCRA Facility Investigaton

SITE LOCATION:
Landfill LF-21 (SWMU 116); Holloman AFB, New Mexico

PROJECT:
AFC002-037-04-04

CLIENT: AFCEE

Photographer:
Brett Brodersen

Date:
5/19/2006

Direction:
Southeast

Photograph: LF21-17

Description:
View of southern sidewall of trench HGLTR21-03. Three feet of reworked soil containing rebar and concrete fragments overlying undisturbed soil (light brown, silty sand, moist). No visual or field screening evidence indicating former disposal of hazardous materials.

Photographer:
Brett Brodersen

Date:
5/19/2006

Direction:
West

Photograph: LF21-18

Description:
View of trench HGLTR21-03 as the trench is progressing.

HGL, Inc.
Photographic Record - Supplemental RCRA Facility Investigaton

SITE LOCATION:
Landfill LF-21 (SWMU 116); Holloman AFB, New Mexico

PROJECT:
AFC002-037-04-04

CLIENT: AFCEE

Photographer:
Brett Brodersen

Date:
5/19/2006

Direction:
West-southwest

Photograph: LF21-19

Description:
Location of test pit HGLTP21-01.
Area is covered with asphalt debris, concrete rubble, terra cotta piping, and a few pieces of metallic piping.

Photographer:
Brett Brodersen

Date:
5/19/2006

Direction:
East

Photograph: LF21-20

Description:
Trenching test pit HGLTP21-01.

HGL, Inc.
Photographic Record - Supplemental RCRA Facility Investigaton

SITE LOCATION:
Landfill LF-21 (SWMU 116); Holloman AFB, New Mexico

PROJECT:
AFC002-037-04-04

CLIENT: AFCEE

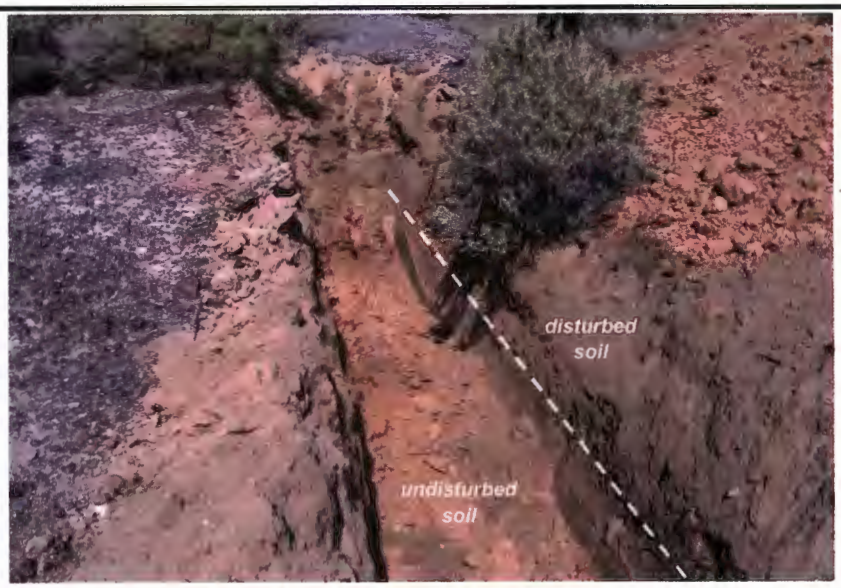
Photographer:
Brett Brodersen

Date:
5/19/2006

Direction:
West

Photograph: LF21-21

Description:
Test pit HGLTP21-01 and view of the disturbed soil/ undisturbed soil boundary. Disturbed soil included re-worked soil with asphalt and concrete fragments, pebbles, and some piping. No visual or field screening evidence, waste material, or drums/canisters observed.



Photographer:
Brett Brodersen

Date:
5/19/2006

Direction:

Photograph: LF21-22

Description:
Test Pit HGLTP21-01 and close-up view of the disturbed/undisturbed soil boundary.

HGL, Inc.
Photographic Record - Supplemental RCRA Facility Investigaton

SITE LOCATION:
Landfill LF-21 (SWMU 116); Holloman AFB, New Mexico

PROJECT:
AFC002-037-04-04

CLIENT: AFCEE

Photographer:
Brett Brodersen

Date:
5/19/2006

Direction:
North

Photograph: LF21-23

Description:
Close-up view of the soil excavated from test pit HGLTP21-01.
No visual or field screening evidence, waste material, or drums/canisters observed.

Photographer:
Brett Brodersen

Date:
5/19/2006

Direction:
East

Photograph: LF21-24

Description:
Location of test pit HGLTP21-02.
No surface expression of the material causing the identified magnetic anomaly was present at this location.

HGL, Inc.
Photographic Record - Supplemental RCRA Facility Investigaton

SITE LOCATION:
Landfill LF-21 (SWMU 116); Holloman AFB, New Mexico

PROJECT:
AFC002-037-04-04

CLIENT: AFCEE

Photographer:
Brett Brodersen

Date:
5/19/2006

Direction:
Northeast

Photograph: LF21-25

Description:
Excavation of test pit HGLTP21-02 initiated. Soils encountered were typically light brown, silty sand, damp to moist. Debris observed included: asphalt and concrete rubble, an old gas line (yellow insulated line), metal and PVC piping.

Photographer:
Brett Brodersen

Date:
5/19/2006

Direction:
North

Photograph: LF21-26

Description:
View of debris observed immediately beneath the surface one excavation of test pit HGLTP21-02 was initiated.

HGL, Inc.
Photographic Record - Supplemental RCRA Facility Investigaton

SITE LOCATION:
Landfill LF-21 (SWMU 116); Holloman AFB, New Mexico

PROJECT:
AFC002-037-04-04

CLIENT: AFCEE

Photographer:
Brett Brodersen

Date:
5/19/2006

Direction:
North

Photograph: LF21-27

Description:
Close-up of the piping observed within test pit HGLTP21-02.
No soil staining was observed and field screening with a PID did not detect the presence of volatile organic compounds in the soil.

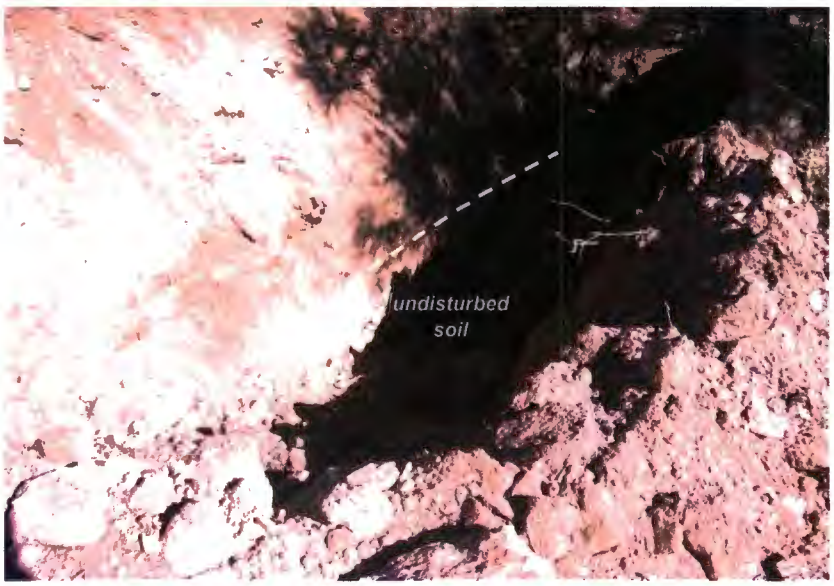
Photographer:
Brett Brodersen

Date:
5/19/2006

Direction:
North

Photograph: LF21-28

Description:
View of the completed HGLTP21-02 test pit.
Undisturbed soil was observed at the bottom of the test pit. No evidence of hazardous material disposal, drums/ canisters, or impacted soils was observed during excavation of the test pit.



HGL, Inc.
Photographic Record - Supplemental RCRA Facility Investigaton

SITE LOCATION:
Landfill LF-21 (SWMU 116); Holloman AFB, New Mexico

PROJECT:
AFC002-037-04-04

CLIENT: AFCEE

Photographer:
Brett Brodersen

Date:
5/19/2006

Direction:
South

Photograph: LF21-29

Description:
Location of test pit HGLTP21-03.
Area is littered with several small mounds of asphalt and concrete debris and several fragments of metal piping.

Photographer:
Brett Brodersen

Date:
5/19/2006

Direction:
North

Photograph: LF21-30

Description:
View of test pit HGLTP21-03. Soils (light brown, silty sand, damp) beneath the mounded debris piles appears to be undisturbed. No visual or field screening evidence observed indicating the disposal of hazardous materials or waste containers.

HGL, Inc.
Photographic Record - Supplemental RCRA Facility Investigaton

SITE LOCATION:
Landfill LF-21 (SWMU 116); Holloman AFB, New Mexico

PROJECT:
AFC002-037-04-04

CLIENT: AFCEE

Photographer:
Brett Brodersen

Date:
5/19/2006

Direction:
North

Photograph: LF21-31

Description:
View of the eastern sidewall of test pit HGLTP21-03.

Photographer:
Brett Brodersen

Date:
5/19/2006

Direction:
Southwest

Photograph: LF21-32

Description:
View of the soil excavated from test pit HGLTP21-03. No impacted soils observed in test pit HGLTP21-03.

HGL, Inc.
Photographic Record - Supplemental RCRA Facility Investigaton

SITE LOCATION:
Landfill LF-21 (SWMU 116); Holloman AFB, New Mexico

PROJECT:
AFC002-037-04-04

CLIENT: AFCEE

Photographer:
Brett Brodersen

Date:
5/19/2006

Direction:
South

Photograph: LF21-33

Description:
Location of test pit HGLTP21-04.
Area is littered with asphalt and concrete rubble.

Photographer:
Brett Brodersen

Date:
5/19/2006

Direction:
North

Photograph: LF21-34

Description:
Started trenching of test pit HGLTP21-04.

HGL, Inc.
Photographic Record - Supplemental RCRA Facility Investigaton

SITE LOCATION:
Landfill LF-21 (SWMU 116); Holloman AFB, New Mexico

PROJECT:
AFC002-037-04-04

CLIENT: AFCEE

Photographer:
Brett Brodersen

Date:
5/19/2006

Direction:
South

Photograph: LF21-35

Description:
Western sidewall of test pit HGLTP21-04.
No evidence of hazardous material disposal observed in the test pit.

Photographer:
Brett Brodersen

Date:
5/19/2006

Direction:
North

Photograph: LF21-36

Description:
Eastern sidewall of test pit HGLTP21-04.

HGL, Inc.
Photographic Record - Supplemental RCRA Facility Investigaton

SITE LOCATION:
Landfill LF-21 (SWMU 116); Holloman AFB, New Mexico

PROJECT:
AFC002-037-04-04

CLIENT: AFCEE

Photographer:
Brett Brodersen

Date:
5/19/2006

Direction:
South

Photograph: LF21-37

Description:
Close-up of the disturbed/ undisturbed soil boundary in test pit HGLTP21-04.
No visual or field screening evidence of hazardous material disposal or impacted soils encountered.

Photographer:
Brett Brodersen

Date:
5/19/2006

Direction:
North

Photograph: LF21-38

Description:
Soils and debris excavated from test pit HGLTP21-04.

HGL, Inc.
Photographic Record - Supplemental RCRA Facility Investigaton

SITE LOCATION:
Landfill LF-22 (SWMU 115); Holloman AFB, New Mexico

PROJECT:
AFC002-037-04-05

CLIENT: AFCEE

Photographer:
Brett Brodersen

Date:
5/18/2006

Direction:
North-northwest

Photograph: LF22-01

Description:
View of the LF-22.
Concrete debris deposited in old drainage swale and on the surrounding surface.
Debris consists primarily of concrete fragments and some metal piping.

Photographer:
Brett Brodersen

Date:
5/18/2006

Direction:
South-Southwest

Photograph: LF22-02

Description:
Another view of the concrete rubble deposited at LF-22.

HGL, Inc.
Photographic Record - Supplemental RCRA Facility Investigaton

SITE LOCATION:
Landfill LF-22 (SWMU 115); Holloman AFB, New Mexico

PROJECT:
AFC002-037-04-05

CLIENT: AFCEE

Photographer:
Brett Brodersen

Date:
5/18/2006

Direction:
North-northwest

Photograph: LF22-03

Description:
Another view of the concrete debris deposited at LF-22. Concrete fragments and soil placed in a down in the form of a vehicle ramp.

Photographer:
Brett Brodersen

Date:
5/18/2006

Direction:
South-Southwest

Photograph: LF22-04

Description:
View of the location for trench HGLTR22-01 (located in the southern portion of LF-22.

HGL, Inc.
Photographic Record - Supplemental RCRA Facility Investigaton

SITE LOCATION:
Landfill LF-22 (SWMU 115); Holloman AFB, New Mexico

PROJECT:
AFC002-037-04-05

CLIENT: AFCEE

Photographer:
Brett Brodersen

Date:
5/18/2006

Direction:
West-northwest

Photograph: LF22-05

Description:
Beginning of trench HGLTR22-01.

Photographer:
Brett Brodersen

Date:
5/18/2006

Direction:
West-northwest

Photograph: LF22-06

Description:
View of shallow subsurface soils at trench HGLTR22-01. Subsurface soils (brown, silty sand, loose, and damp) contained concrete rubble of various sizes.

HGL, Inc.
Photographic Record - Supplemental RCRA Facility Investigaton

SITE LOCATION:
Landfill LF-22 (SWMU 115); Holloman AFB, New Mexico

PROJECT:
AFC002-037-04-05

CLIENT: AFCEE

Photographer:
Brett Brodersen

Date:
5/18/2006

Direction:

Photograph: LF22-07

Description:
View of undisturbed soil excavated from trench HGLTR22-01.
MiniRae (field PID meter) present for scale.
No visual or field screening evidence of impacted soils, no waste materials observed, no drums/canisters encountered in trench HGLTR22-01.

Photographer:
Brett Brodersen

Date:
5/18/2006

Direction:
West-northwest

Photograph: LF22-08

Description:
Completed view of trench HGLTR22-01. Disturbed soil containing concrete rubble present in shallow surbsurface and underlain by undisturbed soils (reddish brown, silty sand, damp, moderately loose).

HGL, Inc.
Photographic Record - Supplemental RCRA Facility Investigaton

SITE LOCATION:
Landfill LF-22 (SWMU 115); Holloman AFB, New Mexico

PROJECT:
AFC002-037-04-05

CLIENT: AFCEE

Photographer:
Brett Brodersen

Date:
5/18/2006

Direction:
Northwest

Photograph: LF22-09

Description:
View of the location for trench HGLTR22-02.

Photographer:
Brett Brodersen

Date:
5/18/2006

Direction:
Southeast

Photograph: LF22-10

Description:
Starting to trench HGLTR22-02.
Western extent of the trench HGLTR22-02 extended beyond the primary subsurface limit of the concrete rubble landfill.

HGL, Inc.
Photographic Record - Supplemental RCRA Facility Investigaton

SITE LOCATION:
Landfill LF-22 (SWMU 115); Holloman AFB, New Mexico

PROJECT:
AFC002-037-04-05

CLIENT: AFCEE

Photographer:
Brett Brodersen

Date:
5/18/2006

Direction:
Southeast

Photograph: LF22-11

Description:
View of trench HGLTR22-02 as its progressing. Soil and concrete rubble encountered in the trench is being stockpiled adjacent to the trench. No visual or field screening evidence of impacted soils, waste materials, or drums/containers.

Photographer:
Brett Brodersen

Date:
5/18/2006

Direction:
Southeast

Photograph: LF22-12

Description:
Close-up view of the soil and concrete rubble removed from the shallow subsurface soil during trenching of HGLTR22-02.

HGL, Inc.
Photographic Record - Supplemental RCRA Facility Investigaton

SITE LOCATION:
Landfill LF-22 (SWMU 115); Holloman AFB, New Mexico

PROJECT:
AFC002-037-04-05

CLIENT: AFCEE

Photographer:
Brett Brodersen

Date:
5/18/2006

Direction:
West-northwest

Photograph: LF22-13

Description:
View of trench HGLTR22-02 and the soil and concrete rubble excavated from the trench. No visual or field screening evidence of impacted soils, waste materials, or drums/containers.

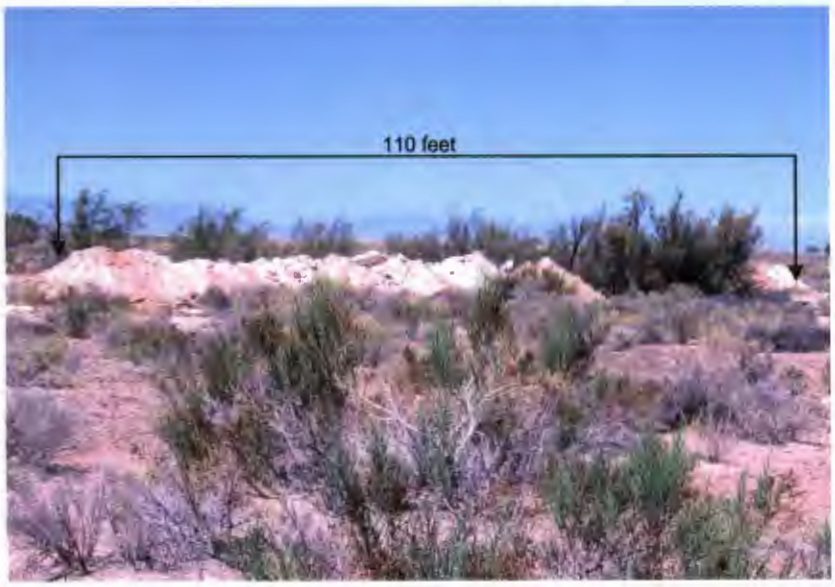
Photographer:
Brett Brodersen

Date:
5/18/2006

Direction:
Southwest

Photograph: LF22-14

Description:
View of the soil and concrete rubble removed from trench HGLTR22-02.



HGL, Inc.
Photographic Record - Supplemental RCRA Facility Investigaton

SITE LOCATION:
Landfill LF-22 (SWMU 115); Holloman AFB, New Mexico

PROJECT:
AFC002-037-04-05

CLIENT: AFCEE

Photographer:
Brett Brodersen

Date:
5/18/2006

Direction:
Northwest

Photograph: LF22-15

Description:
Location of trench HGLTR22-03. Trench located on soi/concrete rubble mound.

Photographer:
Brett Brodersen

Date:
5/18/2006

Direction:
Southwest

Photograph: LF22-16

Description:
View of the southern sidewall of trench HGLTR22-03. Reddish-brown, silty sand, damp to moist (undisturbed) located beneath surface layer of Light Brown, silty sand, loose (powdery) containing concrete rubble.

HGL, Inc.
Photographic Record - Supplemental RCRA Facility Investigaton

SITE LOCATION:
Landfill LF-22 (SWMU 115); Holloman AFB, New Mexico

PROJECT:
AFC002-037-04-05

CLIENT: AFCEE

Photographer:
Brett Brodersen

Date:
5/18/2006

Direction:
Southeast

Photograph: LF22-17

Description:
View of the soil and concrete rubble excavated from trench HGLTR22-03.
No visual or field screening evidence of impacted soils, waste materials, or drums/ containers obtained during trenching.

Photographer:
Brett Brodersen

Date:
5/18/2006

Direction:
Southeast

Photograph: LF22-18

Description:
View of the southeastern portion of trench HGLTR22-03.

HGL, Inc.
Photographic Record - Supplemental RCRA Facility Investigaton

SITE LOCATION:
Landfill LF-23 (SWMU 108); Holloman AFB, New Mexico

PROJECT:
AFC002-037-04-06

CLIENT: AFCEE

Photographer:
Brett Brodersen

Date:
5/17/2006

Direction:
North

Photograph: LF23-01

Description:
Central portion of LF-23. Debris primarily observed at LF-23 consisted of concrete rubble. Asphalt debris, metal piping, old metal signs, metal cables, and several 5 and 1 gallon cans also observed.

Photographer:
Brett Brodersen

Date:
5/17/2006

Direction:
North-northwest

Photograph: LF23-02

Description:
View of western edge of LF-23. LF-23 extends from the foreground to near the top of the photograph.

HGL, Inc.
Photographic Record - Supplemental RCRA Facility Investigaton

SITE LOCATION:
Landfill LF-23 (SWMU 108); Holloman AFB, New Mexico

PROJECT:
AFC002-037-04-06

CLIENT: AFCEE

Photographer:
Brett Brodersen

Date:
5/17/2006

Direction:
West-northwest

Photograph: LF23-03

Description:
View of the south-central and south-eastern portion of LF-23. Area used for training activities.

Photographer:
Brett Brodersen

Date:
5/17/2006

Direction:
West

Photograph: LF23-04

Description:
View of LF-23 from borrow pit located west of the site.

HGL, Inc.
Photographic Record - Supplemental RCRA Facility Investigaton

SITE LOCATION:
Landfill LF-23 (SWMU 108); Holloman AFB, New Mexico

PROJECT:
AFC002-037-04-06

CLIENT: AFCEE

Photographer:
Brett Brodersen

Date:
5/17/2006

Direction:
West

Photograph: LF23-05

Description:
Rusted 5 gallon cans present in southwestern corner of LF-23.

Photographer:
Brett Brodersen

Date:
5/17/2006

Direction:
West

Photograph: LF23-06

Description:
Two 1-gallon cans of tar-like material partially buried in concrete at LF-23.

HGL, Inc.
Photographic Record - Supplemental RCRA Facility Investigaton

SITE LOCATION:
Landfill LF-23 (SWMU 108); Holloman AFB, New Mexico

PROJECT:
AFC002-037-04-06

CLIENT: AFCEE

Photographer:
Brett Brodersen

Date:
5/17/2006

Direction:
South

Photograph: LF23-07

Description:
Concrete drainage culvert encountered approximately 1.5 feet bgs in trench HGLTR23-01.

Photographer:
Brett Brodersen

Date:
5/17/2006

Direction:

Photograph: LF23-08

Description:
Close-up view of trench HGLTR23-01. Abandoned cable utility line encountered approximately 4 feet bgs.

HGL, Inc.
Photographic Record - Supplemental RCRA Facility Investigaton

SITE LOCATION:
Landfill LF-23 (SWMU 108); Holloman AFB, New Mexico

PROJECT:
AFC002-037-04-06

CLIENT: AFCEE

Photographer:
Brett Brodersen

Date:
5/17/2006

Direction:
West

Photograph: LF23-09

Description:
Close-up of trench HGLTR23-01. No visual or field screening evidence indicating the disposal or release of hazardous materials to the underlying soils.

Photographer:
Brett Brodersen

Date:
5/17/2006

Direction:
East

Photograph: LF23-10

Description:
Trenching HGLTR23-02, located in the central portion of LF-23. Debris encountered consisted primarily of concrete rubble in the shallow subsurface. Other debris observed included asphalt, metal piping, and a cloth tarp.

HGL, Inc.
Photographic Record - Supplemental RCRA Facility Investigaton

SITE LOCATION:
Landfill LF-23 (SWMU 108); Holloman AFB, New Mexico

PROJECT:
AFC002-037-04-06

CLIENT: AFCEE

Photographer:
Brett Brodersen

Date:
5/18/2006

Direction:

Photograph: LF23-11

Description:
Close-up of the soil removed from trench HGLTR23-03. No visual or field screening evidence, no stained soils, unusual odors, or canisters observed during trenching indicating the presence of former hazardous material disposal.

Photographer:
Brett Brodersen

Date:
5/18/2006

Direction:
West

Photograph: LF23-12

Description:
Trench HGLTR23-03., The trench was completed in an area formerly containing several 55-gal rusted drums laying down on the soil.

HGL, Inc.
Photographic Record - Supplemental RCRA Facility Investigaton

SITE LOCATION:
Landfill LF-23 (SWMU 108); Holloman AFB, New Mexico

PROJECT:
AFC002-037-04-06

CLIENT: AFCEE

Photographer:
Brett Brodersen

Date:
5/18/2006

Direction:
North-northwest

Photograph: LF23-13

Description:
Debris excavated from the top several feet of soil at HGLTR23-03.
Debris includes primarily concrete rubble along with metal cables and scrap metal.

Photographer:
Brett Brodersen

Date:
5/18/2006

Direction:
Northwest

Photograph: LF23-14

Description:
Close-up of the debris present in the shallow subsurface soil of HGLTR23-03.
Concrete utility box is located in the background.

HGL, Inc.
Photographic Record - Supplemental RCRA Facility Investigaton

SITE LOCATION:
Landfill LF-23 (SWMU 108); Holloman AFB, New Mexico

PROJECT:
AFC002-037-04-06

CLIENT: AFCEE

Photographer:
Brett Brodersen

Date:
5/18/2006

Direction:
West

Photograph: LF23-15

Description:
Close-up of the soil and debris being excavated from trench HGLTR23-03.

Photographer:
Brett Brodersen

Date:
5/18/2006

Direction:
North

Photograph: LF23-16

Description:
View of the eastern side-wall of trench HGLTR23-03.
soil of HGLTR23-03.
Concrete utility box is located in the background.

HGL, Inc.
Photographic Record - Supplemental RCRA Facility Investigaton

SITE LOCATION:
Landfill LF-23 (SWMU 108); Holloman AFB, New Mexico

PROJECT:
AFC002-037-04-06

CLIENT: AFCEE

Photographer:
Brett Brodersen

Date:
5/18/2006

Direction:
Northeast

Photograph: LF23-17

Description:
Trenching HGLTR23-04, located in the north-central portion of LF_23. Debris encountered consisted solely of concrete rubble in the shallow subsurface.

Photographer:
Brett Brodersen

Date:
5/18/2006

Direction:
East-northeast

Photograph: LF23-18

Description:
Trench HGLTR23-04. Close-up view of a 1.5 foot thick sandy gravel (Fill) unit overlying undisturbed native soil. No visual or field screening evidence obtained indicating disposal or a release of hazardous materials to the surrounding soils.

HGL, Inc.
Photographic Record - Supplemental RCRA Facility Investigaton

SITE LOCATION:
Landfill LF-23 (SWMU 108); Holloman AFB, New Mexico

PROJECT:
AFC002-037-04-06

CLIENT: AFCEE

Photographer:
Brett Brodersen

Date:
5/18/2006

Direction:
Northeast

Photograph: LF23-19

Description:
View of the northern side-wall of trench HGLTR23-04. Disturbed soil with concrete rubble and gravel present in shallow subsurface and underlain with undisturbed soils (light brown to reddish brown, silty sand, damp to moist).

Photographer:
Brett Brodersen

Date:
5/18/2006

Direction:
West

Photograph: LF23-20

Description:
View of trench HGLTR23-04. No visual or field screening evidence, stained soils, unusual odors, or canisters indicating former disposal of hazardous materials.

APPENDIX C

FIELD FORMS

HGL HydroGeoLogic, Inc.

TRENCH LOG

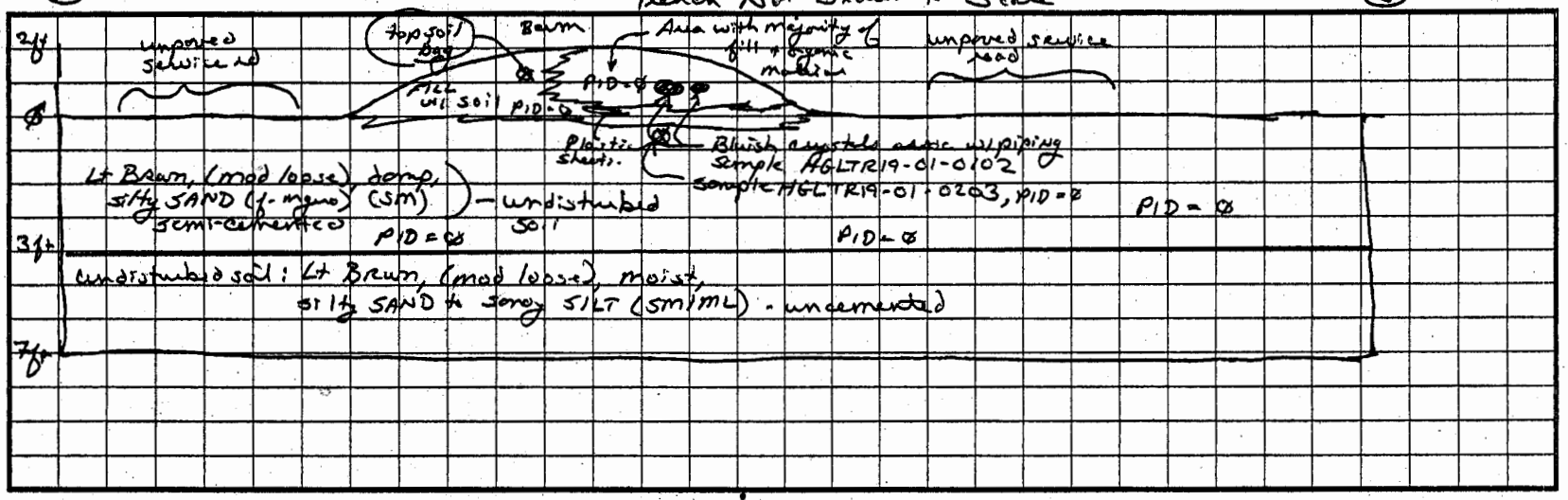
Location: Holloman AFB, NM Site: LF-19 Date/Time: 5/22/06 - 0833

Project: Supplemental RFI Trench ID: HGLTR19-01

Trenching Company: Rhino Operator: Denny Ayeda Equipment: Excavator

Total Depth Trenched: 7ft Width of Trench: 4ft Length of Trench: 100ft Samples Collected: HGLTR19-01-0102, HGLTR19-01-0203

Trench Not Drawn to Scale



Observations: Fill material (reworked soil, organic detritus, scrap metal, plastic sheeting, metal pipe, top soil bag) encountered on in the mound w/ majority in the southern half of the mound

Undisturbed soils observed beneath Fill material

Unusual solid observed in fill material - soil sample collected of the bluish crystals and of soil immediately below unusual crystals

No containers potentially containing hazardous materials encountered; All PIDs = 0; No soil staining

Geologist: [signature] Competent Person: S. Blassingame

HGL HydroGeologic, Inc

TRENCH LOG

Location: Holloman AFB, NM Site: LF-19 Date/Time: 5/22/06 - 0945

Project: Supplemental RFI Trench ID: HGLTR19-02

Trenching Company: Rhino Operator: Denny Ayeda Equipment: Excavator

Total Depth Trenched: 5ft (NW) Width of Trench: 4ft Length of Trench: 114ft Samples Collected: No (SE)

Trench Not Drawn to Scale

0 Flat - unvegetated - area used to stockpile gravel / SAND / Mulch

Wht Brown, (loose to mod loose), dry, silty SAND (f-m grained) - soil crust present at surface (SM)
PID = Ø PID = Ø

4ft Yel Brown to Lt Brown, (loose), damp, silty SAND (f-m grained) (SM)
PID = Ø

5ft

Observations: No fill material encountered in trench. Area used to stockpile gravel / sand / mulch
No soil staining, unusual solids or fluids, or containers potentially
No soil samples collected

Geologist: [signature] Competent Person: S. Blassingame

HGL HydroGeoLogic, Inc. Extending Expectations

TRENCH LOG

Location: Holloman AFB, NM Site: LF-19 Date/Time: 5/22/06-1406

Project: Supplemental RFI Trench ID: HGLTR19-03

Trenching Company: Rhino Operator: Denny Ayeda Equipment: Excavator

Total Depth Trenched: 5ft Width of Trench: 4ft Length of Trench: 32 ft Samples Collected: No

Trench Not Drawn to Scale

(N) (S)

salt crust ↓ Ø

flat - no vegetation - salt crust around trench

Brown (mod loose), ~~dry~~ damp/moist, silty SAND (f-m grnd) (SM); soil crust present; PID = Ø

1ft

↳ Brown, (mod loose to loose), damp/moist, silty SAND (f-m grnd) (SM); PID = Ø

3ft — — — moist — — —

HGL HydroGeologic, Inc

TRENCH LOG

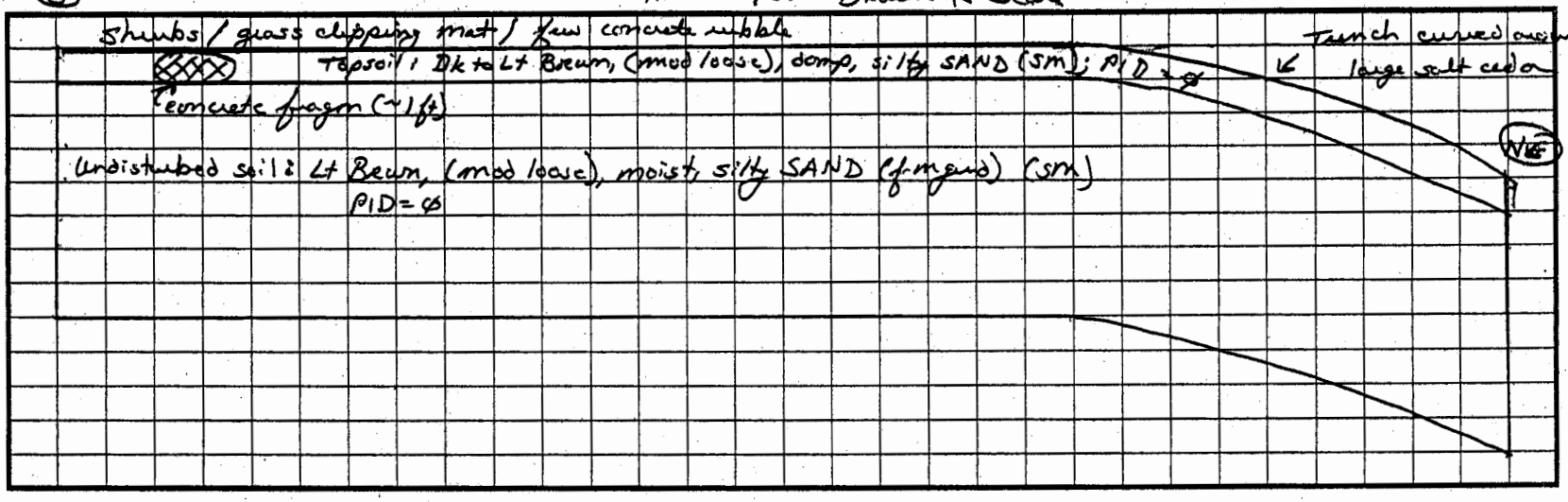
Location: Holloman AFB, NM Site: LF-19 Date/Time: 5/22/06 - 1018

Project: Supplemental RFI Trench ID: HGLTR19-04

Trenching Company: Rhino Operator: Denny Ayeda Equipment: Excavator

Total Depth Trenched: 4ft (S) Width of Trench: 4ft Length of Trench: 79ft Samples Collected: No

Trench Not Drawn to Scale



Observations: No fill material encountered. Trench completed in area used for grass clipping disposal. No soil staining, unusual solids, or fluids, or containers used to store/contain hazardous materials observed; All PIDs = Ø

No soil Sampling Conducted.

Geologist: [signature] Competent Person: S R Massingone

HGL HydroGeoLogic, Inc.

TRENCH LOG (Test Pit)

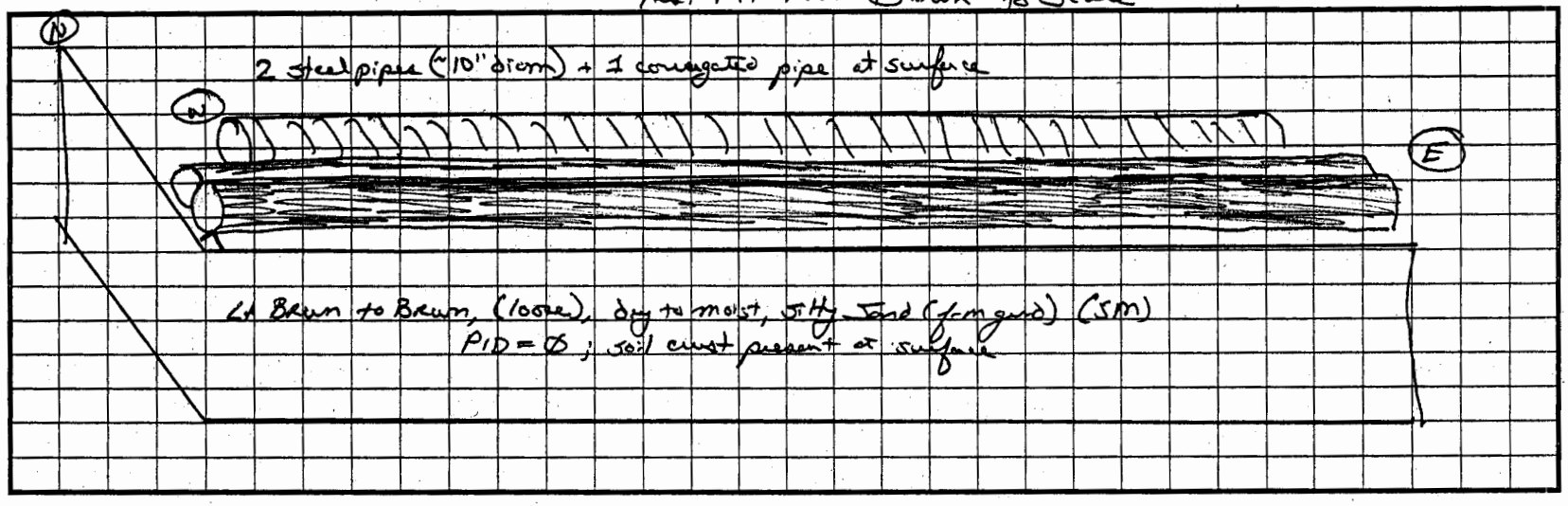
Location: Holloman AFB, NM Site: LF-19 Date/Time: 5/22/06 - 0830

Project: Supplemental RFI Trench ID: HGLTP19-01

Trenching Company: Rhino Operator: Danny Ayeda Equipment: Excavator

Total Depth Trenched: 6 ft Width of Trench: 4 ft Length of Trench: 23 ft Samples Collected: No

Test Pit Not Drawn to Scale



Observations: Trench completed adjacent + perpendicular to 3 metal pipes

No fill material encountered, no unusual solids or fluids, no soil staining; no containers potentially containing hazardous materials encountered

No soil samples collected

Geologist: [signature] Competent Person: S. Blassingame

HGL HydroGeoLogic, Inc.

TRENCH LOG (Test Pit)

Location: Holloman AFB, NM Site: LF-19 Date/Time: 5/22/06 - 1045

Project: Supplemental RFI Trench ID: HGLTP19-02

Trenching Company: Rhino Operator: Denny Ayeda Equipment: Excavator

Total Depth Trenched: 4 ft Width of Trench: 4 ft Length of Trench: 10 ft Samples Collected: No

Test Pit Not Drawn to Scale

(S) (N)

Thick shrubs + mat of grass clippings

Lt Brown, (mod loose), ~~dry~~ damp to moist, silty SAND (f-m grained) (SM)
PID = Ø

Observations: No fill material encountered; trench completed in area covered in thick (~ 1/4 ft) grass clipping mat

No soil staining, unusual solids or fluids, no containers potentially containing hazardous materials encountered; All PIDs = Ø

No Soil samples Collected.

Geologist: [signature] Competent Person: S. Blassingam

HGL HydroGeoLogic, Inc

FIELD SAMPLING REPORT

LOCATION: Holloman AFB PROJECT: Supplemental RFI

SITE: LF-19

SAMPLE INFORMATION

MATRIX So SAMPLE ID: ~~HGE~~ HGLTR19-01-0102

SAMPLING METHOD direct bottle DUP./REP. OF: —

BEGINNING DEPTH 0'-1' 01 MATRIX SPIKE/MATRIX SPIKE DUPLICATE YES ( ) NO (X)

END DEPTH 02

GRAB (X) COMPOSITE ( ) DATE: 5/22/06 TIME: 0910

CONTAINER SIZE/TYPE	#	PRESERVATIVE/ PREPARATION	EXTRACTION METHOD	ANALYTICAL METHOD	ANALYSIS
4oz soil	1	—			Pesticides (Organoch + Organphosp)
4oz soil	1	—			Herbicides
4oz soil	1	—			TAL Metals

NOTABLE OBSERVATIONS

PID READINGS	SAMPLE CHARACTERISTICS	MISCELLANEOUS
1st	COLOR:	
2nd	ODOR:	
	OTHER:	

pH _____ Temperature _____ Dissolved oxygen _____ Specific Conductivity _____

GENERAL INFORMATION

WEATHER: SUN/CLEAR X OVERCAST/RAIN ____ WIND DRIECTION ____ AMBIENT TEMP 88

SHIPMENT VIA: FED-X ____ HAND DELIVER ____ COURIER ____ OTHER ____

SHIPPED TO: _____

COMMENTS: Sample of blue crystals observed in Trench 1 (LF-19)

SAMPLER: [signature] OBSERVER: _____

MATRIX TYPE CODES

DC=DRILL CUTTINGS
WG=GROUND WATER
LH=HAZARDOUS LIQUID WASTE
SH=HAZARDOUS SOLID WASTE
SE=SEDIMENT
SL=SLUDGE
SO=SOIL
GS=SOIL GAS
WS=SURFACE WATER
SW=SWAP\WIPE

SAMPLING METHOD CODES

B=BAILER
BR=BRASS RING
CS=COMPOSITE SAMPLE
C=CONTINUOUS FLIGHT AUGER
DT=DRIVEN TUBE
W=SWAB\WIPE
G=GRAB
HA=HAND AUGER
H=HOLLOW STEM AUGER
HP=HYDRO PUNCH
SS=SPLIT SPOON
SP=SUBMERSIBLE PUMP

HGL HydroGeoLogic, Inc

FIELD SAMPLING REPORT

LOCATION: Holloman AFB PROJECT: Supplemental RFI

SITE: LF-19

SAMPLE INFORMATION

MATRIX Soil SAMPLE ID: HGLTR19-01-0203

SAMPLING METHOD direct bottle fill DUP./REP. OF: —

BEGINNING DEPTH 2' MATRIX SPIKE/MATRIX SPIKE DUPLICATE YES ( ) NO (X)

END DEPTH 3'

GRAB (X) COMPOSITE ( ) DATE: 5/22/06 TIME: 0915

CONTAINER SIZE/TYPE	#	PRESERVATIVE/ PREPARATION	EXTRACTION METHOD	ANALYTICAL METHOD	ANALYSIS
4oz soil	1	—			Pesticides (Organch + Organoph)
4oz soil	1	—			Herbicides
4oz soil	1	—			TAL Metals

NOTABLE OBSERVATIONS

PID READINGS	SAMPLE CHARACTERISTICS	MISCELLANEOUS
1st	COLOR:	
2nd	ODOR:	
	OTHER:	

pH _____ Temperature _____ Dissolved oxygen _____ Specific Conductivity _____

GENERAL INFORMATION

WEATHER: SUN/CLEAR X OVERCAST/RAIN ____ WIND DRIECTION ____ AMBIENT TEMP 88

SHIPMENT VIA: FED-X ____ HAND DELIVER ____ COURIER ____ OTHER ____

SHIPPED TO: _____

COMMENTS: Sample of undisturbed soil below blue crystals (sample HGL TR19-01-0102)

SAMPLER: [signature] OBSERVER: _____

MATRIX TYPE CODES

DC=DRILL CUTTINGS
WG=GROUND WATER
LH=HAZARDOUS LIQUID WASTE
SH=HAZARDOUS SOLID WASTE
SE=SEDIMENT
SL=SLUDGE
SO=SOIL
GS=SOIL GAS
WS=SURFACE WATER
SW=SWAP\WIPE

SAMPLING METHOD CODES

B=BAILER
BR=BRASS RING
CS=COMPOSITE SAMPLE
C=CONTINUOUS FLIGHT AUGER
DT=DRIVEN TUBE
W=SWAB\WIPE
G=GRAB
HA=HAND AUGER
H=HOLLOW STEM AUGER
HP=HYDRO PUNCH
SS=SPLIT SPOON
SP=SUBMERSIBLE PUMP

HGL
HydroGeoLogic, Inc.
Exceeding Expectations

TRENCH LOG

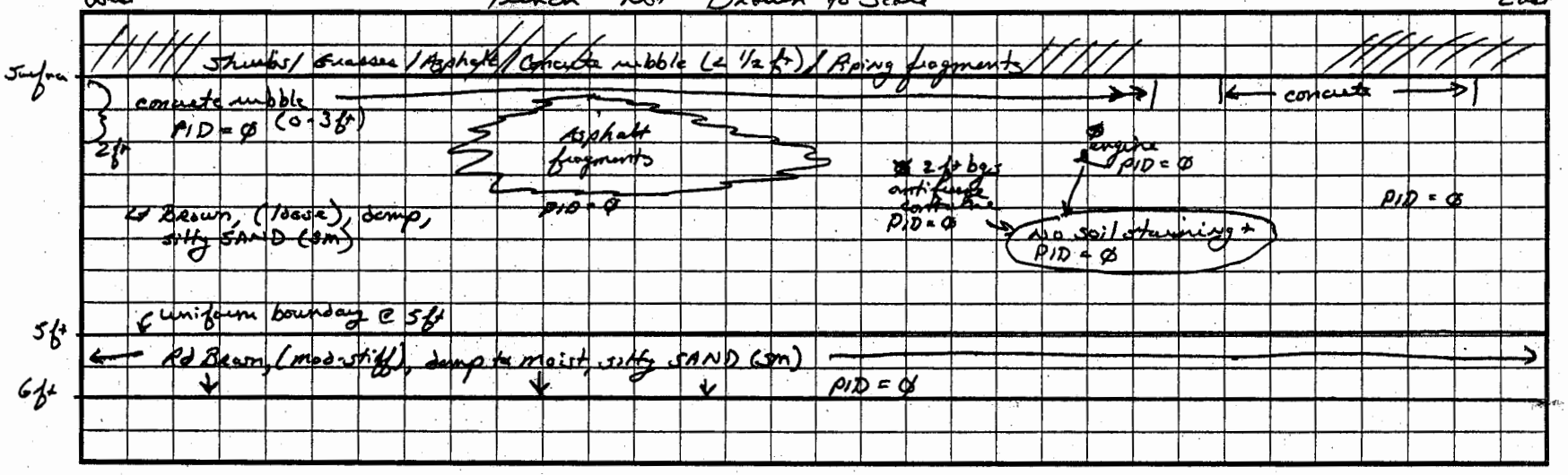
Location: Holloman AFB, NM Site: LF-21 Date/Time: 5/18/06 - 1356

Project: Supplemental RFI Trench ID: HGLTR21-01

Trenching Company: Rhino Operator: Denny Ayeda Equipment: Excavator

Total Depth Trenched: 6ft Width of Trench: 4ft Length of Trench: 50ft Samples Collected: No

West — Trench Not Drawn to Scale — East



Observations: Debris - base of fill unit essentially uniform across trench; Debris scattered in shallow subsurface (0-5ft) throughout w/ majority in western half. - Fill unit primarily silty SAND w/ debris present
Debris: concrete rubble (< 1/2 ft 1ft diameter), asphalt, Piping (6" metal, 4" terracotta, blue PVC (6"), green PVC (6")), engine frame 2-gallon, shredded, antifreeze containers

No visual evidence of contaminated soils, no containers used to house haz. materials observed; All PIDs = Ø

No Samples collected.

Geologist [signature] Competent Person: S. Blassingame (HGL)

HGL HydroGeoLogic, Inc. Exceeding Expectations

TRENCH LOG

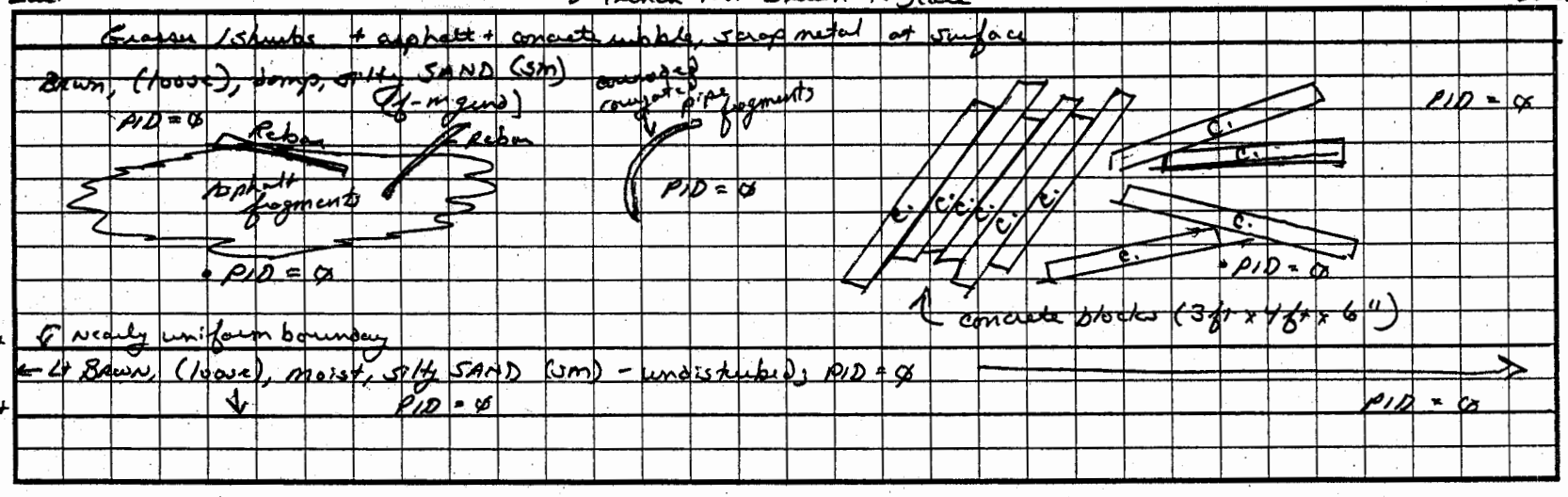
Location: Holloman AFB, NM Site: LF-21 Date/Time: 5/18/06 - 1415

Project: Supplemental RFI Trench ID: HGLTR21-02

Trenching Company: Rhino Operator: Denny Ayeda Equipment: Excavator

Total Depth Trenched: 6ft Width of Trench: 4ft Length of Trench: 116ft Samples Collected: ~~Yes~~ No

East Trench Not Drawn to Scale West



Observations: Debris from surface to 4ft bgs, relatively uniform bottom of the fill material @ 4ft bgs
Fill unit is primarily reworked soil (brown, silty SAND (SM)), w/ asphalt and concrete rubble, some rebar

No odors or staining observed; PID = Ø; No hazardous storage containers observed.

Debris ~~is below~~ occurs in relative groupings - asphalt / scrap metal / concrete rubble

No soil samples collected

Geologist: [signature] Competent Person: S. Passingame (HGL)

HGL HydroGeoLogic, Inc. Expanding Expectations

TRENCH LOG

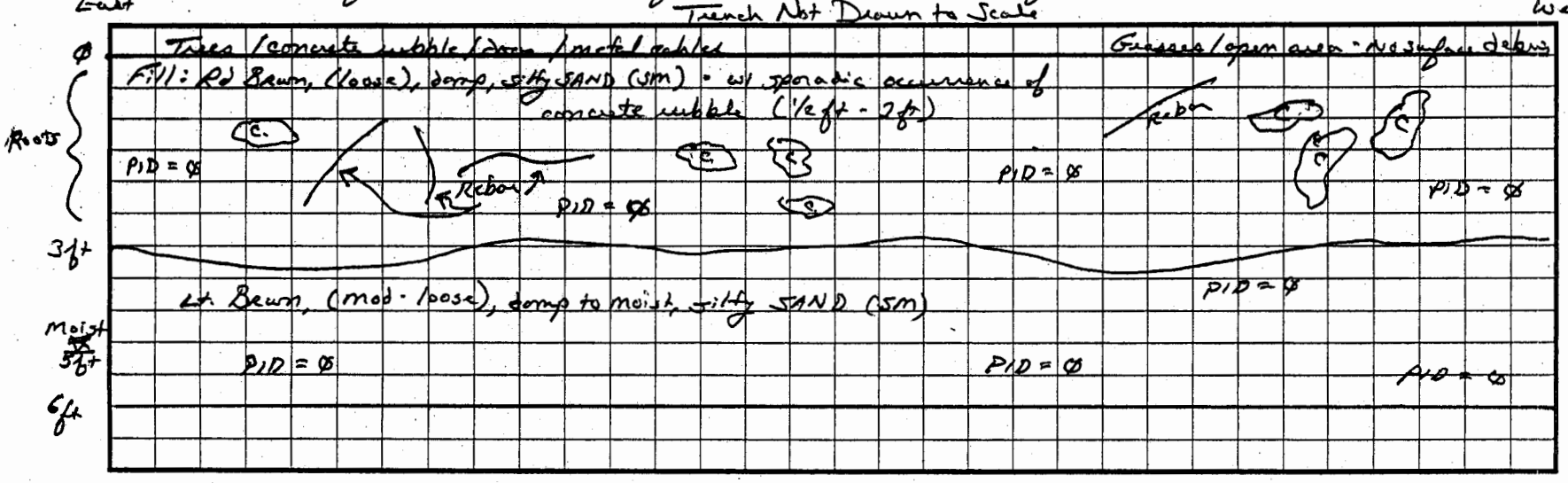
Location: Holloman AFB Site: LF-21 Date/Time: 5/19/06 - 0850

Project: Supplemental RFI Trench ID: HGLTR21-03

Trenching Company: Rhino Operator: Denny Ayeda Equipment: Excavator

Total Depth Trenched: 5ft Width of Trench: 4ft Length of Trench: 111ft Samples Collected: No

Trench Not Drawn to Scale



Observations: Fill unit: surface to ≈3ft (irregular base) - consists primarily of reworked soil w/ rebar + concrete rubble (1/2 to 2' diameter)

No soil staining; No PID hits; No unusual soils / fluids; No containers

Geophysical anomalies most likely associated with surface debris and rebar in subsurface

No soil samples collected

Geologist: [signature] Competent Person: S. Blassingame (HGL)

HGL HydroGeoLogic, Inc. Exceeding Expectations

TRENCH LOG (Test Pit)

Location: Holloman AFB, NM

Site: LF-21

Date/Time: 5/19/06

Project: Supplemental RFI

Trench ID: ~~HGLTP21-4~~ HGLTP21-01 (BTB)

Trenching Company: Rhino

Operator: Denny Ayala

Equipment: Excavator

Total Depth Trenched: 5ft

Width of Trench: 4ft

Length of Trench: 45ft

Samples Collected: No

ENE — Trench Not Drawn to Scale — WSW

	Grasses/shrubs - w/ Asphalt fragments/pipe fragments
0	Fill & Reworked soil (Brown, (loose), damp, silty SAND (f-m gnd) (SM)
	PID = 0
	PID = 0 PID = 0
	PID = 0
3.5'	
	Pea Gravel mixed with reworked soil PID = 0
4ft	Lt Brown/beige, damp to moist, (mod-loose) silty SAND (f-m gnd) (SM)
	PID = 0 moist @ bottom PID = 0 PID = 0
5ft	

Observations: Fill material (0-4ft) ≈ uniform bottom @ 4ft bgs; composed of brown, (loose) silty sand (SM) w/ concrete fragments, asphalt only at surface - none in subsurface.

Pea gravel mixed with reworked soil at basal contact boundary

No soil contamination observed; PIDs = 0; no haz materials storage containers observed

No soil samples collected.

Geologist: [signature]

Competent Person: S. Blassingame

HGL HydroGeoLogic, Inc

TRENCH LOG (Test Pit)

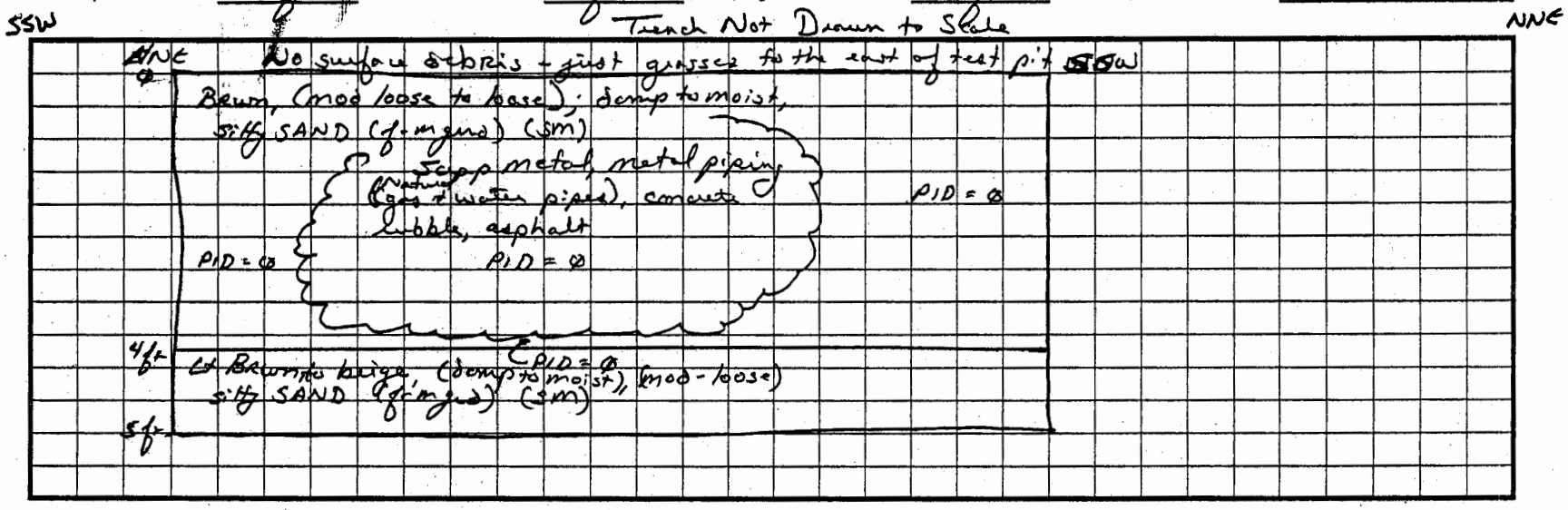
Location: Hollomon AFB Site: LF-21 Date/Time: 5/19/06

Project: Supplemental RFI Trench ID: HGLTP21-02

Trenching Company: Rhino Operator: Denny Ayeda Equipment: Excavator

Total Depth Trenched: 5 ft Width of Trench: 4 ft Length of Trench: 10 ft Samples Collected: No

Trench Not Drawn to Scale



Observations: Fill material from 0.5 ft to ≈ 3.8 ft bgs, consists of scrap metal, piping (natural gas + water pipes) concrete rubble, and asphalt - located primarily in center of test pit

No soil staining, no hazardous material containers, no unusual solids or fluids; PID = 0

No soil samples collected

Geologist: [signature] Competent Person: S Blassingame

HGL HydroGeologic, Inc.

TRENCH LOG (Test Pit)

Location: Holloman AFB Site: LF-21 Date/Time: 5/19/06 - 1010

Project: Supplemental RFI Trench ID: HGLTP21-03

Trenching Company: Rhino Operator: Denny Ayeda Equipment: Excavator

Total Depth Trenched: 5 ft Width of Trench: 48 ft Length of Trench: 22 ft Samples Collected: No (N)

(S)

Trench Not Drawn to Scale

Concrete Rubble / asphalt fragments + pile

Concrete rubble (primarily), some asphalt mixed w/

PID = Ø Whitish brown, (dry) (v. loose), SILT (ML) PID = Ø

2.5

Brown to Red Brown, (loose), damp, silty SAND (f-m grained) (SM)

PID = Ø

4 ft

Beige, (mod-loose), damp to moist, silty SAND (f-m grained) (SM)

PID = Ø PID = Ø

5 ft

Observations: Fill material (0-2.5 ft bgs), consists primarily of reworked soils ~~mixed~~ with concrete rubble, PID = Ø.

No soil contamination, PID = Ø; No hazardous materials containers, No unusual solids or fluids

No Soil Samples Collected

Geologist: [signature] Competent Person: S Blassingame

HGL HydroGeologic, Inc.

TRENCH LOG (Test Pit)

Location: Holloman AFB, NM Site: LF-21 Date/Time: 5/19/06

Project: Supplemental RFI Trench ID: HGLTP21-04

Trenching Company: Rhino Operator: Denny Ayeda Equipment: Excavator

Total Depth Trenched: 5ft Width of Trench: 4ft Length of Trench: 29ft Samples Collected: No

(S) Trench Not Drawn to Scale (N)

asphalt debris + concrete fragments

0 — white, (V loose), dry, SILT (ML) w/ concrete rubble

PID = 0 PID = 0 PID = 0

2ft — Red Brown, (mod-loose), (damp), silty SAND (SM)

PID = 0

PID = 0

5ft

Observations: Fill : 0 to 2ft bgs (∞ uniform basal boundary); consists almost exclusively of concrete rubble with some asphalt - concrete + asphalt rubble pile on surface

No soil contamination; No hazardous materials, storage containers, No unusual solids or fluids, PID = 0

No soil samples

Geologist: [signature] Competent Person: S. Bassingame

This page was intentionally left blank.

HGL HydroGeoLogic, Inc.

TRENCH LOG

Location: Holloman AFB, NM Site: LF-22 Date/Time: 5/18/06 - 0843

Project: ~~Supplemental~~ BTB Supplemental RFI Trench ID: HGLTR22-01

Trenching Company: Rhino Operator: Denny Ayeda Equipment: Excavator

Total Depth Trenched: 4 ft Width of Trench: 4 ft Length of Trench: 49 ft Samples Collected: No

SE Trench Not Drawn to Scale NW

0 ft	Concrete rubble (1/2 ft to 2 ft) w/ glass - metal sign post (SE - location)
	Fill unit: Concrete rubble (1/2 ft - 2 ft) with a lt Brown/wht Brown (loose), dry silty sand (f-gnd) (SM) w/ vegetation roots - rebar observed in some of the concrete
	PID = 0 ✓ uniform boundary PID = 0 PID = 0
2 ft	Rd Brown, (mod - loose), damp, silty SAND (f-m gnd) (SM), with white calcite crystals in soil fractures (veining), no odors, no staining
4 ft	

Observations: Fill unit is primarily concrete rubble with a fine-grained, silty sand matrix; some rebar and a metal sign post is adjacent to trench

No soil contamination observed, no unusual solids or fluids noted; no containers encountered; PID = 0

No soil samples collected

Geologist: [signature] Competent Person: S. Blassingame

HGL HydroGeoLogic, Inc.

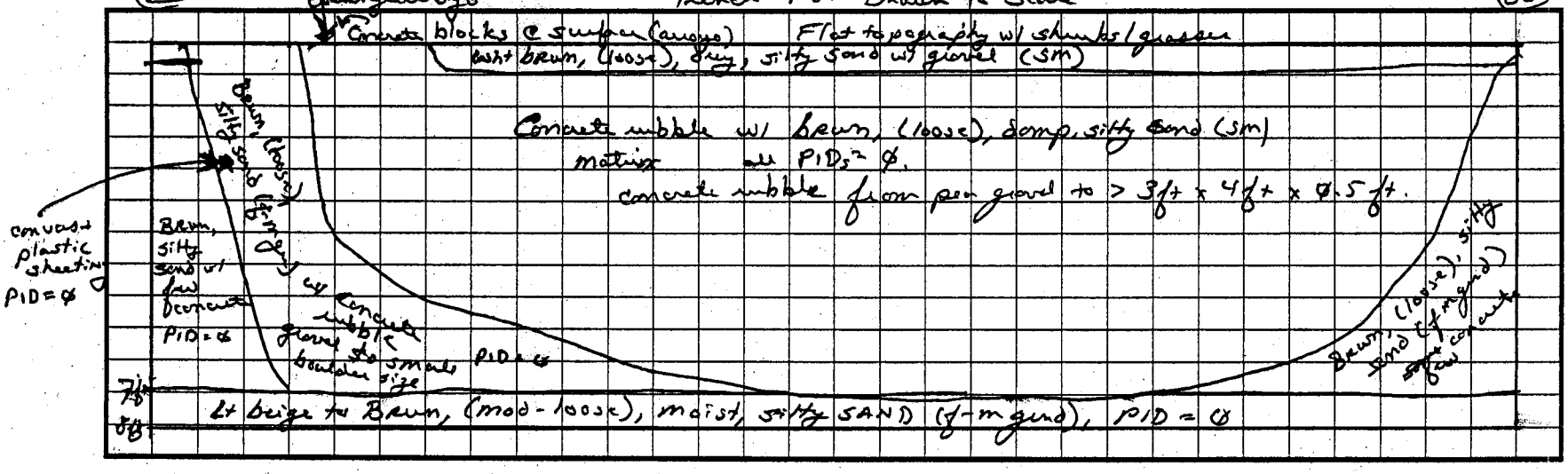
TRENCH LOG

Location: Holloman AFB, NM Site: LF-22 Date/Time: 5/18/06 - 1005

Project: Supplemental RFI Trench ID: HGLTR22-02

Trenching Company: Rhino Operator: Denny Ayeda Equipment: Excavator

Total Depth Trenched: 8 ft Width of Trench: 4 ft Length of Trench: 117 ft Samples Collected: No



Observations: Fill unit observed from surface to 7 ft bgs, primary area composed of large concrete rubble w/ minimal soil matrix while edges are more soil w/ some concrete. Plastic sheeting/tarp cloth also observed. No other debris observed in trench

No soil staining; All PIDs were Ø; No unusual solids or fluids; No hazardous containers observed.

No Soil Samples collected

Geologist: [signature] Competent Person: S. Blassingame

HGL HydroGeoLogic, Inc

TRENCH LOG

Location: Holloman AFB, NM Site: LF-22 Date/Time: 5/18/06

Project: Supplemental RFI Trench ID: HGLTR22-03

Trenching Company: Rhino Operator: Denny Ayuda Equipment: Excavator

Total Depth Trenched: 6 ft Width of Trench: 4 ft Length of Trench: ~~[illegible]~~ 44 ft (BTB) Samples Collected: No

Trench Not Drawn to Scale

SE NW

0 — concrete rubble @ surface

Concrete rubble (< 0.5 ft to > 2 ft long) with rebar in a soil matrix
Soil: Lt Brown, (Loose), dry, silty SAND (f-m grained) (SM)
PID = 0; No odors, no staining
Concrete rubble present throughout trench length from 0 to 4 ft bgs

4 ft — Red Brown, (loose to med loose), damp to moist, silty SAND (f-m grained) (SM) w/ calcite veining
– Native, undisturbed

PID = 0 PID = 0 PID = 0

6 ft

Observations: Fill material (concrete rubble ranging from < 0.5 ft to 2 ft long) present from 0 to 4 ft bgs across entire trench. No sign of contamination, no unusual solids or fluids, no containers potential used to store hazardous materials.

Trench completed in area covered with concrete rubble

No Soil Samples collected

Geologist: [signature] Competent Person: S. Blassingame

This page was intentionally left blank.

HGL HydroGeologic, Inc. Exceeding Expectations

TRENCH LOG

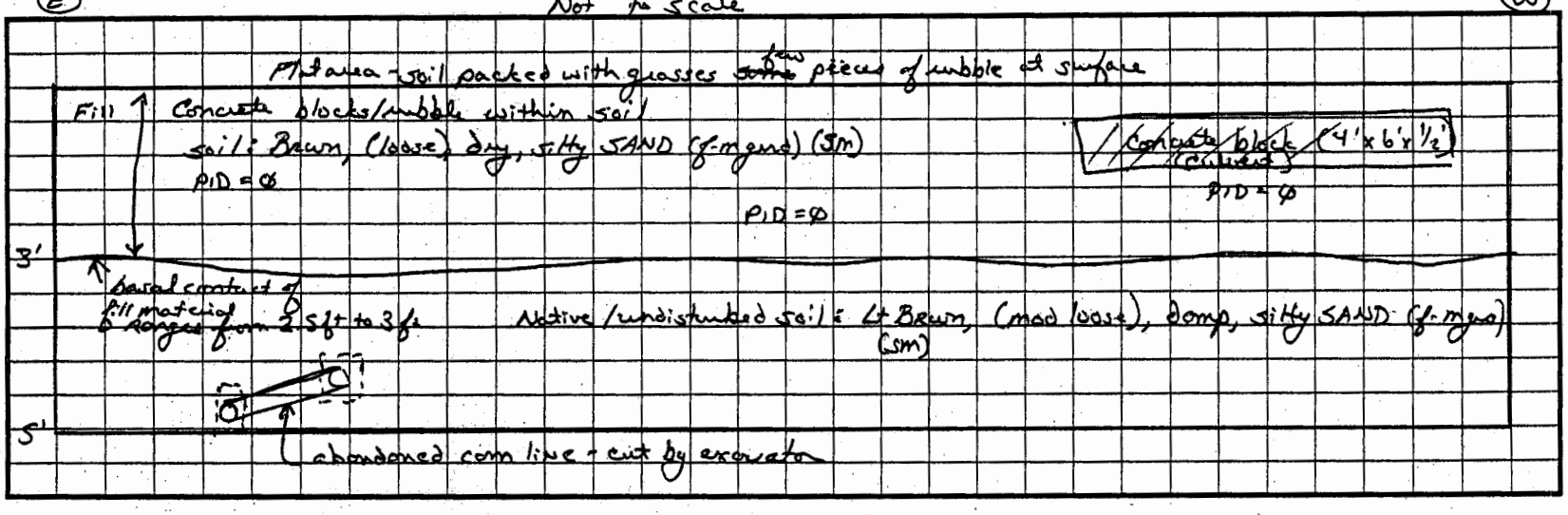
Location: Holloman AFB, NM Site: LF-23 Date/Time: 5/17/06

Project: Supplemental RFI Trench ID: HGLTR23-01

Trenching Company: Rhino Operator: Denny Ayeda Equipment: Excavator

Total Depth Trenched: 5 ft Width of Trench: 4 ft Length of Trench: 37 ft Samples Collected: No

Not to scale



Observations: Fill material: Reworked soil w/ concrete rubble (gravel to 4'x6'x1/2ft) size along entire length of trench from Ø to 3ft (basal contact varies from 2.5' to 3')

No soil staining; No unusual odors, solids, or fluids; No containers potentially containing hazardous materials all PIDs were Ø.

Spoke w/ CE Customer Service + Base Maintenance about severed com line. Aurora ~~people~~ come out - Consensus - ~~all~~ line was abandoned.
No soil samples collected

Geologist: [signature] Competent Person: J Blassingame

HGL HydroGeoLogic, Inc. Exceeding Expectations

TRENCH LOG

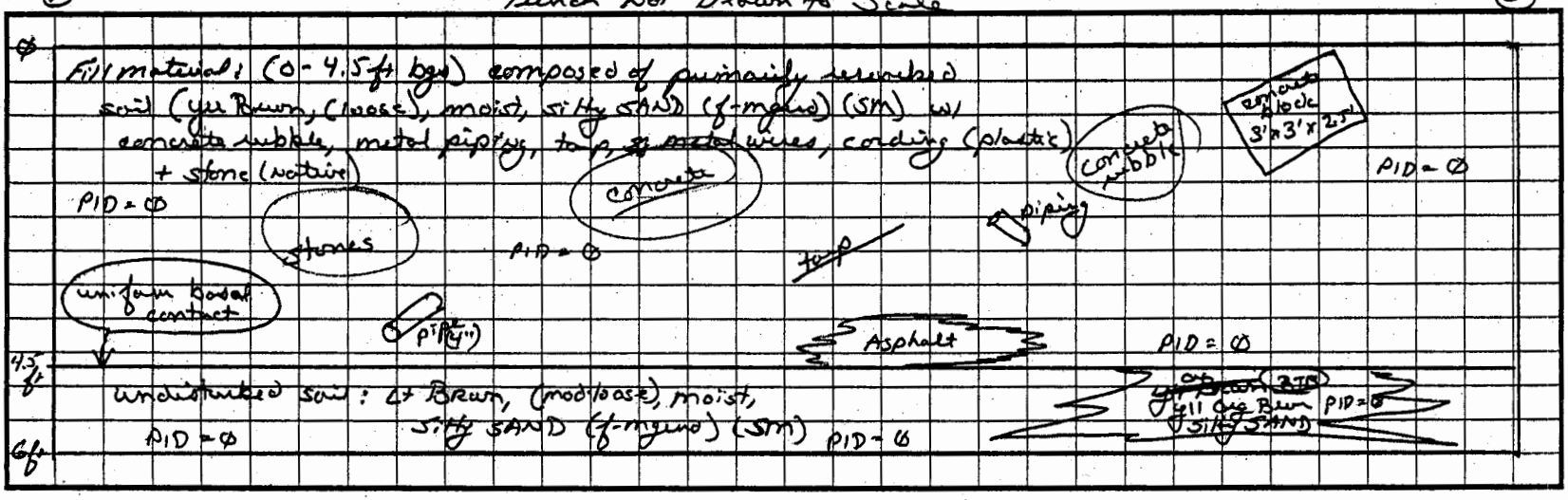
Location: Holloman AFB, NM Site: LF-23 Date/Time: 5/17/06

Project: Supplemental RFI Trench ID: ~~HF~~ HGLTR23-02

Trenching Company: Rhino Operator: Denny Ayeda Equipment: Excavator

Total Depth Trenched: 6ft Width of Trench: 4ft Length of Trench: 33ft Samples Collected: No

(W) Trench Not Drawn to Scale (E)



Observations: Fill material encountered throughout trench - consists primarily of reworked soils w/ debris (construction material) scattered throughout. No soil staining, no unusual solids or fluids, No containers possibly used to store/contain hazardous materials encountered; All PIDs = Ø

No Soil Samples Collected

Geologist: Scott Rood Competent Person: S. Blassingame

HGL HydroGeoLogic, Inc. Exceeding Expectations

TRENCH LOG

Location: Holloman AFB, NM Site: LF-23 Date/Time: 5/18/06 - 0805

Project: Supplemental RFI Trench ID: HGLTR23-03

Trenching Company: Rhino Operator: Denny Ayala Equipment: Excavator

Total Depth Trenched: 4 ft Width of Trench: 4 ft Length of Trench: 42 ft Samples Collected: No

(S) Trench Not Drawn to Scale (N)

Ø	Surface littered w/ debris (concrete rubble) gravel piles, shrubs + small trees
1 ft	Fill (from Ø ft to 1 ft bgs) - Rd Brown to Brown, (mod loose) damp, silty SAND (SM) w/ concrete rubble, metal tanking, 5 gal water can, and rubber bondings PID = Ø
	PID = Ø
	PID = Ø Brown to Yll Brown, (mod-loose), damp to moist, silty SAND (f-m grained), (SM) PID = Ø
2 ft	moist
	PID = Ø
3 ft to 4 ft	PID = Ø
	PID = Ø
	Abandoned com line, severed. Same line encountered in HGLTR23-01

Observations: Trench complete in area formerly containing, wasted drums on surface; Surface littered with concrete rubble, gravel piles; scrap metal and heavily vegetated with shrubs and small salt cedars

Fill material encountered from surface to 1 ft bgs.; No soil staining; no contamination; No unusual solids or fluids; No containers potentially containing or used to store hazardous materials. All PIDs were Ø.

No Soil Samples Collected.

Geologist: [signature] Competent Person: [signature]

HGL HydroGeologic, Inc. Exceeding Expectations

TRENCH LOG

Location: Holloman AFB, NM Site: LF-23 Date/Time: 5/18/06 - 0823

Project: Supplemental RFI Trench ID: HGLTR23-04

Trenching Company: Rhino Operator: Denny Ayala Equipment: Excavator

Total Depth Trenched: 3ft Width of Trench: 4ft Length of Trench: 30ft Samples Collected: No

(W) Trench Not Drawn to Scale (E)

Ø — Fill from Ø to 1ft/1.5ft - Reworked soil w/ Concrete rubble (<1" to 3ft)

1ft — PID = Ø Soil: Lt Brown, (loose), damp, silty SAND (f-mgrd) (SM) PID = Ø

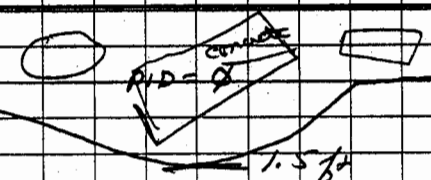
Undisturbed soil: Brown, (mod loose to loose), moist, silty SAND (f-mgrd) (SM)

PID = Ø

PID = Ø

PID = Ø

3ft



Observations: Fill material was from Ø to 1ft/1.5ft bgs consisted primarily of reworked soil and contained concrete rubble (<1" to 3ft); No soil staining; No unusual solids or fluids observed; No containers potentially used to store hazardous materials ~~were~~ encountered.

No Soil Samples Collected

Geologist: [signature] Competent Person: S. Blassingame

APPENDIX D

ANALYTICAL LABORATORY DATA SHEETS

TRACEANALYSIS, INC.

6701 Aberdeen Avenue, Suite 9 Lubbock, Texas 79424 800•378•1296 806•794•1296 FAX 806•794•1298
155 McCutcheon, Suite H El Paso, Texas 79932 888•588•3443 915•585•3443 FAX 915•585•4944
E-Mail: lab@traceanalysis.com

Analytical and Quality Control Report

Ken Cottrell
HydroGeologic Inc.
1155 Herndon Pkey
Suite 900
Herndon, VA, 20170

Report Date: June 14, 2006

Work Order: 6052408

Project Location: Holloman AFB,NM
Project Name: Supplemental RFI
Project Number: AFC002-037-04

Enclosed are the Analytical Report and Quality Control Report for the following sample(s) submitted to TraceAnalysis, Inc.

Sample	Description	Matrix	Date Taken	Time Taken	Date Received
91137	HGLTR19-01-0102	soil	2006-05-22	09:10	2006-05-23
91138	HGLTR19-01-0203	soil	2006-05-22	09:15	2006-05-23

Comment(s)

These results represent only the samples received in the laboratory. The Quality Control Report is generated on a batch basis. All information contained in this report is for the analytical batch(es) in which your sample(s) were analyzed.

This report consists of a total of 14 pages and shall not be reproduced except in its entirety, without written approval of TraceAnalysis, Inc.

Notes:
For inorganic analyses, the term MQL should actually read PQL.

Standard Flags

U - Not detected. The analyte is not detected above the SQL.
J - Estimated. The analyte is positively identified and the value is approximated between the SQL and MQL.
B - The sample contains less than ten times the concentration found in the method blank.
JB - The analyte is positively identified and the value is approximated between the SQL and MQL.
The sample contains less than ten times the concentration found in the method blank.
The result should be considered non-detect to the SQL.

Michael Abel

Dr. Blair Leftwich, Director

Analytical Report

Sample: 91137 - HGLTR19-01-0102

Analysis:	Pesticides	Analytical Method:	S 8081A	Prep Method:	S 3550
QC Batch:	27202	Date Analyzed:	2006-06-07	Analyzed By:	AG
Prep Batch:	23779	Sample Preparation:	2006-06-01	Prepared By:	AG

Parameter	Flag	SQL Based Result	MQL Based Result	Method Blank Result	Units	Dilution	SQL	MQL (Unadjusted)	MDL (Unadjusted)
alpha-BHC	U	<0.00120	<0.00400	<0.00120	mg/Kg	0.8	0.00150	0.005	0.0015
gamma-BHC (Lindane)	U	<0.00160	<0.00400	<0.00160	mg/Kg	0.8	0.00200	0.005	0.002
beta-BHC	U	<0.00184	<0.00400	<0.00184	mg/Kg	0.8	0.00230	0.005	0.0023
Heptachlor	U	<0.00120	<0.00400	<0.00120	mg/Kg	0.8	0.00150	0.005	0.0015
delta-BHC	U	<0.00144	<0.00400	<0.00144	mg/Kg	0.8	0.00180	0.005	0.0018
Aldrin	U	<0.00200	<0.00400	<0.00200	mg/Kg	0.8	0.00250	0.005	0.0025
Heptachlor Epoxide	U	<0.00184	<0.00400	<0.00184	mg/Kg	0.8	0.00230	0.005	0.0023
gamma-Chlordane		**0.144**	**0.144**	<0.00168	mg/Kg	0.8	0.00210	0.005	0.0021
alpha-Chlordane		**0.119**	**0.119**	<0.00184	mg/Kg	0.8	0.00230	0.005	0.0023
Endosulfan I		**0.0932**	**0.0932**	<0.00160	mg/Kg	0.8	0.00200	0.005	0.002
p,p-DDE		**0.0516**	**0.0516**	<0.00128	mg/Kg	0.8	0.00160	0.005	0.0016
Dieldrin	U	<0.00168	<0.00400	<0.00168	mg/Kg	0.8	0.00210	0.005	0.0021
Endrin	U	<0.00192	<0.00400	<0.00192	mg/Kg	0.8	0.00240	0.005	0.0024
p,p-DDD	U	<0.00104	<0.00400	<0.00104	mg/Kg	0.8	0.00130	0.005	0.0013
Endosulfan II	U	<0.00168	<0.00400	<0.00168	mg/Kg	0.8	0.00210	0.005	0.0021
p,p-DDT		**0.00700**	**0.00700**	<0.00232	mg/Kg	0.8	0.00290	0.005	0.0029
Endrin aldehyde		**0.105**	**0.105**	<0.00248	mg/Kg	0.8	0.00310	0.005	0.0031
Endosulfan sulfate		**0.00610**	**0.00610**	<0.00112	mg/Kg	0.8	0.00140	0.005	0.0014
Methoxychlor	U	<0.00160	<0.00400	<0.00160	mg/Kg	0.8	0.00200	0.005	0.002
Endrin Ketone	U	<0.00144	<0.00400	<0.00144	mg/Kg	0.8	0.00180	0.005	0.0018
Toxaphene	U	<0.0140	<0.0160	<0.0140	mg/Kg	0.16	0.0877	0.1	0.0877
Technical Chlordane	U	<0.00509	<0.0160	<0.00509	mg/Kg	0.16	0.0318	0.1	0.0318

Surrogate	Flag	Result	Units	Dilution	Spike Amount	Percent Recovery	Recovery Limits
2,4,5,6-Tetrachloro-m-xylene		0.00920	mg/Kg	0.8	0.0200	58	10 - 171
Deca chlorobiphenyl		0.0126	mg/Kg	0.8	0.0200	79	10 - 179

Sample: 91137 - HGLTR19-01-0102

Analysis:	TAL Metals	Analytical Method:	S 6010B	Prep Method:	S 3050B
QC Batch:	26873	Date Analyzed:	2006-05-26	Analyzed By:	RR
Prep Batch:	23562	Sample Preparation:	2006-05-25	Prepared By:	DS
QC Batch:	26896	Date Analyzed:	2006-05-28	Analyzed By:	TP
Analysis:	TAL Metals	Analytical Method:	S 7471A	Prep Method:	N/A
QC Batch:	27264	Date Analyzed:	2006-06-12	Analyzed By:	TP
Prep Batch:	23910	Sample Preparation:	2006-06-10	Prepared By:	TP

Parameter	Flag	SQL Based Result	MQL Based Result	Method Blank Result	Units	Dilution	SQL	MQL (Unadjusted)	MDL (Unadjusted)
Total Aluminum		**58300**	**58300**	<27.0	mg/Kg	100	0.270	10	0.27
Total Antimony	J	**3.64**	<10.0	<0.992	mg/Kg	1	0.992	10	0.992536
Total Arsenic		**3.17**	**3.17**	<0.228	mg/Kg	1	0.228	1	0.227774

continued . . .

sample 91137 continued . . .

Parameter	Flag	SQL Based Result	MQL Based Result	Method Blank Result	Units	Dilution	SQL	MQL (Unadjusted)	MDL (Unadjusted)
Total Barium		**16.4**	**16.4**	<0.601	mg/Kg	1	0.601	1	0.600628
Total Beryllium	U	<0.00800	<5.00	<0.00800	mg/Kg	1	0.00800	5	0.008
Total Cadmium	U	<0.0795	<0.500	<0.0795	mg/Kg	1	0.0795	0.5	0.079491
Total Calcium		**28700**	**28700**	<6.83	mg/Kg	10	0.683	50	0.683
Total Chromium		**78.6**	**78.6**	<0.125	mg/Kg	1	0.125	1	0.125172
Total Cobalt		**3.47**	**3.47**	<0.164	mg/Kg	1	0.164	1	0.163974
Total Copper		**7870**	**7870**	<2.68	mg/Kg	10	0.268	0.5	0.26781
Total Iron		**4060**	**4060**	<2.08	mg/Kg	10	0.208	10	0.208
Total Lead		**367**	**367**	<6.50	mg/Kg	10	0.650	1	0.650424
Total Magnesium		**8640**	**8640**	<0.263	mg/Kg	1	0.263	5	0.263
Total Manganese		**480**	**480**	<2.95	mg/Kg	10	0.295	1	0.295
Total Mercury	U	<0.00880	<0.0400	<0.00880	mg/Kg	1	0.00880	0.04	0.0088
Total Nickel		**310**	**310**	<2.22	mg/Kg	10	0.222	10	0.221898
Total Potassium		**1240**	**1240**	<0.291	mg/Kg	1	0.291	50	0.291
Total Selenium	U	<0.767	<1.00	<0.767	mg/Kg	1	0.767	1	0.767141
Total Silver		**4.26**	**4.26**	<0.0444	mg/Kg	1	0.0444	0.2	0.044386
Total Sodium		**9280**	**9280**	<0.0820	mg/Kg	1	0.0820	50	0.082
Total Thallium	U	<0.512	<1.00	<0.512	mg/Kg	1	0.512	1	0.512
Total Vanadium		**15.4**	**15.4**	<0.126	mg/Kg	1	0.126	10	0.125985
Total Zinc		**2040**	**2040**	<1.24	mg/Kg	10	0.124	1	0.124

Sample: 91138 - HGLTR19-01-0203

Analysis:	Pesticides	Analytical Method:	S 8081A	Prep Method:	S 3550
QC Batch:	27202	Date Analyzed:	2006-06-07	Analyzed By:	AG
Prep Batch:	23779	Sample Preparation:	2006-06-01	Prepared By:	AG

Parameter	Flag	SQL Based Result	MQL Based Result	Method Blank Result	Units	Dilution	SQL	MQL (Unadjusted)	MDL (Unadjusted)
alpha-BHC	U	<0.000240	<0.000800	<0.000240	mg/Kg	0.16	0.00150	0.005	0.0015
gamma-BHC (Lindane)	U	<0.000320	<0.000800	<0.000320	mg/Kg	0.16	0.00200	0.005	0.002
beta-BHC	U	<0.000368	<0.000800	<0.000368	mg/Kg	0.16	0.00230	0.005	0.0023
Heptachlor	U	<0.000240	<0.000800	<0.000240	mg/Kg	0.16	0.00150	0.005	0.0015
delta-BHC	U	<0.000288	<0.000800	<0.000288	mg/Kg	0.16	0.00180	0.005	0.0018
Aldrin	U	<0.000400	<0.000800	<0.000400	mg/Kg	0.16	0.00250	0.005	0.0025
Heptachlor Epoxide	U	<0.000368	<0.000800	<0.000368	mg/Kg	0.16	0.00230	0.005	0.0023
gamma-Chlordane		**0.00200**	**0.00200**	<0.000336	mg/Kg	0.16	0.00210	0.005	0.0021
alpha-Chlordane		**0.00290**	**0.00290**	<0.000368	mg/Kg	0.16	0.00230	0.005	0.0023
Endosulfan I	U	<0.000320	<0.000800	<0.000320	mg/Kg	0.16	0.00200	0.005	0.002
p,p-DDE	U	<0.000256	<0.000800	<0.000256	mg/Kg	0.16	0.00160	0.005	0.0016
Dieldrin	U	<0.000336	<0.000800	<0.000336	mg/Kg	0.16	0.00210	0.005	0.0021
Endrin	U	<0.000384	<0.000800	<0.000384	mg/Kg	0.16	0.00240	0.005	0.0024
p,p-DDD	U	<0.000208	<0.000800	<0.000208	mg/Kg	0.16	0.00130	0.005	0.0013
Endosulfan II	U	<0.000336	<0.000800	<0.000336	mg/Kg	0.16	0.00210	0.005	0.0021
p,p-DDT		**0.00190**	**0.00190**	<0.000464	mg/Kg	0.16	0.00290	0.005	0.0029
Endrin aldehyde		**0.00100**	**0.00100**	<0.000496	mg/Kg	0.16	0.00310	0.005	0.0031
Endosulfan sulfate	U	<0.000224	<0.000800	<0.000224	mg/Kg	0.16	0.00140	0.005	0.0014
Methoxychlor	U	<0.000320	<0.000800	<0.000320	mg/Kg	0.16	0.00200	0.005	0.002
Endrin Ketone	U	<0.000288	<0.000800	<0.000288	mg/Kg	0.16	0.00180	0.005	0.0018

continued . . .

sample 91138 continued . . .

Parameter	Flag	SQL Based Result	MQL Based Result	Method Blank Result	Units	Dilution	SQL	MQL (Unadjusted)	MDL (Unadjusted)
Toxaphene	U	<0.0140	<0.0160	<0.0140	mg/Kg	0.16	0.0877	0.1	0.0877
Technical Chlordane	U	<0.00509	<0.0160	<0.00509	mg/Kg	0.16	0.0318	0.1	0.0318

Surrogate	Flag	Result	Units	Dilution	Spike Amount	Percent Recovery	Recovery Limits
2,4,5,6-Tetrachloro-m-xylene		0.00920	mg/Kg	0.16	0.100	58	10 - 171
Deca chlorobiphenyl		0.0124	mg/Kg	0.16	0.100	78	10 - 179

Sample: 91138 - HGLTR19-01-0203

Analysis:	TAL Metals	Analytical Method:	S 6010B	Prep Method:	S 3050B
QC Batch:	26873	Date Analyzed:	2006-05-26	Analyzed By:	RR
Prep Batch:	23562	Sample Preparation:	2006-05-25	Prepared By:	DS
QC Batch:	26896	Date Analyzed:	2006-05-28	Analyzed By:	TP
Analysis:	TAL Metals	Analytical Method:	S 7471A	Prep Method:	N/A
QC Batch:	27264	Date Analyzed:	2006-06-12	Analyzed By:	TP
Prep Batch:	23910	Sample Preparation:	2006-06-10	Prepared By:	TP

Parameter	Flag	SQL Based Result	MQL Based Result	Method Blank Result	Units	Dilution	SQL	MQL (Unadjusted)	MDL (Unadjusted)
Total Aluminum		**1200**	**1200**	<2.70	mg/Kg	10	0.270	10	0.27
Total Antimony	U	<0.992	<10.0	<0.992	mg/Kg	1	0.992	10	0.992536
Total Arsenic		**1.88**	**1.88**	<0.228	mg/Kg	1	0.228	1	0.227774
Total Barium		**17.4**	**17.4**	<0.601	mg/Kg	1	0.601	1	0.600628
Total Beryllium	U	<0.00800	<5.00	<0.00800	mg/Kg	1	0.00800	5	0.008
Total Cadmium	U	<0.0795	<0.500	<0.0795	mg/Kg	1	0.0795	0.5	0.079491
Total Calcium		**156000**	**156000**	<13.7	mg/Kg	20	0.683	50	0.683
Total Chromium	J	**0.976**	<1.00	<0.125	mg/Kg	1	0.125	1	0.125172
Total Cobalt	J	**0.695**	<1.00	<0.164	mg/Kg	1	0.164	1	0.163974
Total Copper		**20.0**	**20.0**	<0.268	mg/Kg	1	0.268	0.5	0.26781
Total Iron		**1240**	**1240**	<2.08	mg/Kg	10	0.208	10	0.208
Total Lead		**7.37**	**7.37**	<0.650	mg/Kg	1	0.650	1	0.650424
Total Magnesium		**2250**	**2250**	<0.263	mg/Kg	1	0.263	5	0.263
Total Manganese		**17.5**	**17.5**	<0.295	mg/Kg	1	0.295	1	0.295
Total Mercury	U	<0.00880	<0.0400	<0.00880	mg/Kg	1	0.00880	0.04	0.0088
Total Nickel	J	**1.21**	<10.0	<0.222	mg/Kg	1	0.222	10	0.221898
Total Potassium		**619**	**619**	<0.291	mg/Kg	1	0.291	50	0.291
Total Selenium	U	<0.767	<1.00	<0.767	mg/Kg	1	0.767	1	0.767141
Total Silver	U	<0.0444	<0.200	<0.0444	mg/Kg	1	0.0444	0.2	0.044386
Total Sodium		**3020**	**3020**	<0.0820	mg/Kg	1	0.0820	50	0.082
Total Thallium	U	<0.512	<1.00	<0.512	mg/Kg	1	0.512	1	0.512
Total Vanadium	J	**2.19**	<10.0	<0.126	mg/Kg	1	0.126	10	0.125985
Total Zinc		**5.16**	**5.16**	<0.124	mg/Kg	1	0.124	1	0.124

Method Blank (1)

QC Batch:	26873	Date Analyzed:	2006-05-26	Analyzed By:	RR
Prep Batch:	23562	QC Preparation:	2006-05-25	Prepared By:	DS

Parameter	Flag	Result	Units	Reporting Limits
Total Aluminum		<0.270	mg/Kg	0.27
Total Antimony		<0.992	mg/Kg	0.992536
Total Arsenic		<0.228	mg/Kg	0.227774
Total Barium		<0.601	mg/Kg	0.600628
Total Beryllium		<0.00800	mg/Kg	0.008
Total Cadmium		<0.0795	mg/Kg	0.079491
Total Chromium		<0.125	mg/Kg	0.125172
Total Cobalt		<0.164	mg/Kg	0.163974
Total Copper		<0.268	mg/Kg	0.26781
Total Iron		<0.208	mg/Kg	0.208
Total Lead		<0.650	mg/Kg	0.650424
Total Manganese		<0.295	mg/Kg	0.295
Total Nickel		<0.222	mg/Kg	0.221898
Total Selenium		<0.767	mg/Kg	0.767141
Total Silver		<0.0444	mg/Kg	0.044386
Total Vanadium		<0.126	mg/Kg	0.125985
Total Zinc		<0.124	mg/Kg	0.124

Method Blank (1)

QC Batch: 26896 Date Analyzed: 2006-05-28 Analyzed By: TP
Prep Batch: 23562 QC Preparation: 2006-05-25 Prepared By: DS

Parameter	Flag	Result	Units	Reporting Limits
Total Calcium		78.0	mg/Kg	0.683
Total Magnesium		<0.263	mg/Kg	0.263
Total Potassium		120	mg/Kg	0.291
Total Sodium		73.6	mg/Kg	0.082

Method Blank (1)

QC Batch: 27202 Date Analyzed: 2006-06-07 Analyzed By: AG
Prep Batch: 23779 QC Preparation: 2006-06-01 Prepared By: AG

Parameter	Flag	Result	Units	Reporting Limits
alpha-BHC		<0.0008	mg/Kg	0.0015
gamma-BHC (Lindane)		<0.0008	mg/Kg	0.002
beta-BHC		<0.0008	mg/Kg	0.0023
Heptachlor		<0.0008	mg/Kg	0.0015
delta-BHC		<0.0008	mg/Kg	0.0018
Aldrin		<0.0008	mg/Kg	0.0025
Heptachlor Epoxide		<0.0008	mg/Kg	0.0023
gamma-Chlordane		<0.0008	mg/Kg	0.0021
alpha-Chlordane		<0.0008	mg/Kg	0.0023
Endosulfan I		<0.0008	mg/Kg	0.002
p,p-DDE		<0.0008	mg/Kg	0.0016
Dieldrin		<0.0008	mg/Kg	0.0021
Endrin		<0.0008	mg/Kg	0.0024

continued . . .

method blank continued . . .

Parameter	Flag	Result	Units	Reporting Limits
p,p-DDD		<0.0008	mg/Kg	0.0013
Endosulfan II		<0.0008	mg/Kg	0.0021
p,p-DDT		<0.0008	mg/Kg	0.0029
Endrin aldehyde		<0.0008	mg/Kg	0.0031
Endosulfan sulfate		<0.0008	mg/Kg	0.0014
Methoxychlor		<0.0008	mg/Kg	0.002
Endrin Ketone		<0.0008	mg/Kg	0.0018
Toxaphene		<0.0160	mg/Kg	0.0877
Technical Chlordane		<0.0160	mg/Kg	0.0318

Surrogate	Flag	Result	Units	Dilution	Spike Amount	Percent Recovery	Recovery Limits
2,4,5,6-Tetrachloro-m-xylene		0.0124	mg/Kg	0.16	0.100	78	30.1 - 160
Deca chlorobiphenyl		0.0143	mg/Kg	0.16	0.100	89	33.2 - 155

Method Blank (1)

QC Batch: 27264 | Date Analyzed: 2006-06-12 | Analyzed By: TP
Prep Batch: 23910 | QC Preparation: 2006-06-10 | Prepared By: TP

Parameter	Flag	Result	Units	Reporting Limits
Total Mercury		<0.00880	mg/Kg	0.0088

Laboratory Control Spike (LCS-1)

QC Batch: 26873 | Date Analyzed: 2006-05-26 | Analyzed By: RR
Prep Batch: 23562 | QC Preparation: 2006-05-25 | Prepared By: DS

Param	LCS Result	LCSD Result	Units	Dil.	Spike Amount	Matrix Result	Rec.	RPD	Rec. Limit	RPD Limit
Total Aluminum	134	145	mg/Kg	1	100	33.9	100	8	84.6 - 123	20
Total Antimony	23.2	23.6	mg/Kg	1	25.0	<0.992	93	2	87.2 - 95.7	20
Total Arsenic	48.1	48.0	mg/Kg	1	50.0	<0.228	96	0	86 - 107	20
Total Barium	98.8	99.8	mg/Kg	1	100	<0.601	99	1	75 - 125	20
Total Beryllium	2.52	2.55	mg/Kg	1	2.50	<0.00800	101	1	81.5 - 109	20
Total Cadmium	24.1	24.0	mg/Kg	1	25.0	<0.0795	96	0	84.2 - 108	20
Total Chromium	10.0	9.85	mg/Kg	1	10.0	<0.125	100	2	75 - 125	20
Total Cobalt	23.5	23.6	mg/Kg	1	25.0	<0.164	94	0	84.9 - 109	20
Total Copper	12.6	12.6	mg/Kg	1	12.5	<0.268	101	0	92.1 - 108	20
Total Iron	51.1	52.2	mg/Kg	1	50.0	<0.208	102	2	80.5 - 124	20
Total Lead	49.9	49.5	mg/Kg	1	50.0	<0.650	100	1	75 - 125	20
Total Manganese	25.6	25.3	mg/Kg	1	25.0	<0.295	102	1	96 - 103	20
Total Nickel	24.2	24.2	mg/Kg	1	25.0	<0.222	97	0	85.3 - 106	20
Total Selenium	46.0	44.9	mg/Kg	1	50.0	<0.767	92	2	75 - 125	20
Total Silver	12.0	11.9	mg/Kg	1	12.5	<0.0444	96	1	89.6 - 105	20
Total Thallium	48.7	48.2	mg/Kg	1	50.0	<0.512	97	1	75 - 125	20
Total Vanadium	23.6	23.4	mg/Kg	1	25.0	<0.126	94	1	89.2 - 102	20
Total Zinc	24.1	24.1	mg/Kg	1	25.0	<0.124	96	0	80.9 - 112	20

Percent recovery is based on the spike result. RPD is based on the spike and spike duplicate result.

Laboratory Control Spike (LCS-1)

QC Batch: 26896 | Date Analyzed: 2006-05-28 | Analyzed By: TP
Prep Batch: 23562 | QC Preparation: 2006-05-25 | Prepared By: DS

Param	LCS Result	LCSD Result	Units	Dil.	Spike Amount	Matrix Result	Rec.	RPD	Rec. Limit	RPD Limit
Total Calcium	4690	5090	mg/Kg	100	50.0	<68.3	94	8	79.9 - 114	20
Total Magnesium	4790	4660	mg/Kg	100	50.0	<26.3	96	3	76.5 - 113	20
Total Potassium	4590	4560	mg/Kg	100	50.0	<29.1	92	1	85 - 115	20
Total Sodium	4740	4710	mg/Kg	100	50.0	<8.20	95	1	85.4 - 108	20

Percent recovery is based on the spike result. RPD is based on the spike and spike duplicate result.

Laboratory Control Spike (LCS-1)

QC Batch: 27202 | Date Analyzed: 2006-06-07 | Analyzed By: AG
Prep Batch: 23779 | QC Preparation: 2006-06-01 | Prepared By: AG

Param	LCS Result	LCSD Result	Units	Dil.	Spike Amount	Matrix Result	Rec.	RPD	Rec. Limit	RPD Limit
alpha-BHC	0.0127	0.0128	mg/Kg	0.16	0.100	<0.000240	79	1	61.5 - 115	20
gamma-BHC (Lindane)	0.0131	0.0131	mg/Kg	0.16	0.100	<0.000320	82	0	55.2 - 116	20
beta-BHC	0.0140	0.0136	mg/Kg	0.16	0.100	<0.000368	88	3	64.7 - 114	20
Heptachlor	0.0130	0.0134	mg/Kg	0.16	0.100	<0.000240	81	3	62.5 - 112	20
delta-BHC	0.0137	0.0137	mg/Kg	0.16	0.100	<0.000288	86	0	62.3 - 112	20
Aldrin	0.0140	0.0141	mg/Kg	0.16	0.100	<0.000400	88	1	61.6 - 118	20
Heptachlor Epoxide	0.0143	0.0143	mg/Kg	0.16	0.100	<0.000368	89	0	62.4 - 113	20
gamma-Chlordane	0.0140	0.0141	mg/Kg	0.16	0.100	<0.000336	88	1	63.1 - 109	20
alpha-Chlordane	0.0140	0.0141	mg/Kg	0.16	0.100	<0.000368	88	1	58.5 - 112	20
Endosulfan I	0.0140	0.0141	mg/Kg	0.16	0.100	<0.000320	88	1	56.3 - 120	20
p,p-DDE	0.0141	0.0142	mg/Kg	0.16	0.100	<0.000256	88	1	64.4 - 121	20
Dieldrin	0.0145	0.0146	mg/Kg	0.16	0.100	<0.000336	91	1	63.7 - 113	20
Endrin	0.0136	0.0137	mg/Kg	0.16	0.100	<0.000384	85	1	57.3 - 122	20
p,p-DDD	0.0128	0.0132	mg/Kg	0.16	0.100	<0.000208	80	3	52 - 122	20
Endosulfan II	0.0147	0.0146	mg/Kg	0.16	0.100	<0.000336	92	1	64.4 - 112	20
p,p-DDT	0.0150	0.0150	mg/Kg	0.16	0.100	<0.000464	94	0	71.8 - 111	20
Endrin aldehyde	0.0146	0.0147	mg/Kg	0.16	0.100	<0.000496	91	1	62.3 - 115	20
Endosulfan sulfate	0.0143	0.0144	mg/Kg	0.16	0.100	<0.000224	89	1	30.4 - 124	20
Methoxychlor	0.0132	0.0133	mg/Kg	0.16	0.100	<0.000320	82	1	45.5 - 120	20
Endrin Ketone	0.0142	0.0143	mg/Kg	0.16	0.100	<0.000288	89	1	66.2 - 109	20
Toxaphene	0.141	0.150	mg/Kg	0.16	0.800	<0.0140	110	6	63.4 - 135	20
Technical Chlordane	0.144	0.142	mg/Kg	0.16	0.800	<0.00509	112	1	64.8 - 137	20

Percent recovery is based on the spike result. RPD is based on the spike and spike duplicate result.

Surrogate	LCS Result	LCSD Result	Units	Dil.	Spike Amount	LCS Rec.	LCSD Rec.	Rec. Limit
2,4,5,6-Tetrachloro-m-xylene	0.0115	0.0116	mg/Kg	0.16	0.100	72	72	68.3 - 120
Deca chlorobiphenyl	0.0134	0.0135	mg/Kg	0.16	0.100	84	84	62.9 - 121

Laboratory Control Spike (LCS-1)

QC Batch: 27264 | Date Analyzed: 2006-06-12 | Analyzed By: TP
Prep Batch: 23910 | QC Preparation: 2006-06-10 | Prepared By: TP

Param	LCS Result	LCSD Result	Units	Dil.	Spike Amount	Matrix Result	Rec.	RPD	Rec. Limit	RPD Limit
Total Mercury	0.518	0.520	mg/Kg	1	0.500	<0.00880	104	0	85.2 - 118	20

Percent recovery is based on the spike result. RPD is based on the spike and spike duplicate result.

Matrix Spike (MS-1)

QC Batch: 26873 | Date Analyzed: 2006-05-26 | Analyzed By: RR
Prep Batch: 23562 | QC Preparation: 2006-05-25 | Prepared By: DS

Param	MS Result	MSD Result	Units	Dil.	Spike Amount	Matrix Result	Rec.	RPD	Rec. Limit	RPD Limit
Total Aluminum [1]	5760	4970	mg/Kg	10	100	5390	37	15	0 - 6730	20
Total Antimony	21.1	22.0	mg/Kg	1	25.0	<0.992	84	4	75 - 119	20
Total Arsenic	48.7	48.4	mg/Kg	1	50.0	<0.228	97	1	74.2 - 113	20
Total Barium	130	123	mg/Kg	1	100	37.4	93	6	75 - 125	20
Total Beryllium	2.56	2.66	mg/Kg	1	2.50	<0.00800	102	4	67.6 - 136	20
Total Cadmium	21.0	21.8	mg/Kg	1	25.0	<0.0795	84	4	75 - 115	20
Total Chromium	11.6	11.1	mg/Kg	1	10.0	2.83	88	4	75 - 125	20
Total Cobalt	21.7	22.1	mg/Kg	1	25.0	1.14	82	2	79.1 - 120	20
Total Copper	12.7	12.0	mg/Kg	1	12.5	1.7	88	6	75 - 123	20
Total Iron [2]	2720	2070	mg/Kg	10	50.0	2590	26	27	0 - 6880	20
Total Lead	55.9	55.5	mg/Kg	1	50.0	10.4	91	1	75 - 125	20
Total Manganese [3]	113	61.1	mg/Kg	1	25.0	66.7	185	60	0 - 658	20
Total Nickel	22.9	23.0	mg/Kg	1	25.0	<0.222	92	0	62.7 - 147	20
Total Selenium	44.4	46.2	mg/Kg	1	50.0	<0.767	89	4	75 - 125	20
Total Silver	11.5	11.3	mg/Kg	1	12.5	<0.0444	92	2	81.3 - 109	20
Total Thallium	41.5	59.2	mg/Kg	1	50.0	<0.512	83	35	75 - 125	20
Total Vanadium	26.7	25.7	mg/Kg	1	25.0	<0.126	107	4	81.1 - 140	20
Total Zinc	29.4	28.3	mg/Kg	1	25.0	8.12	85	4	75 - 125	20

Percent recovery is based on the spike result. RPD is based on the spike and spike duplicate result.

Matrix Spike (MS-1)

QC Batch: 26896 | Date Analyzed: 2006-05-28 | Analyzed By: TP
Prep Batch: 23562 | QC Preparation: 2006-05-25 | Prepared By: DS

Param	MS Result	MSD Result	Units	Dil.	Spike Amount	Matrix Result	Rec.	RPD	Rec. Limit	RPD Limit
Total Calcium [4]	151000	160000	mg/Kg	100	50.0	155000	-80	6	63.7 - 140	20
Total Magnesium	9840	9840	mg/Kg	100	50.0	6110	75	0	65.2 - 127	20
Total Potassium	5780	6080	mg/Kg	100	50.0	709	101	5	75 - 125	20
Total Sodium	5640	5900	mg/Kg	100	50.0	297	107	4	78.4 - 125	20

Percent recovery is based on the spike result. RPD is based on the spike and spike duplicate result.

Matrix Spike (MS-1)

QC Batch: 27264 | Date Analyzed: 2006-06-12 | Analyzed By: TP
Prep Batch: 23910 | QC Preparation: 2006-06-10 | Prepared By: TP

[1]Matrix spike recovery out of control limits due to matrix interference. Use LCS/LCSD to demonstrate analysis is under control.
[2]Matrix spike recovery out of control limits due to matrix interference. Use LCS/LCSD to demonstrate analysis is under control.
[3]Matrix spike recovery out of control limits due to matrix interference. Use LCS/LCSD to demonstrate analysis is under control.
[4]Matrix spike recovery out of control limits due to matrix interference. Use LCS/LCSD to demonstrate analysis is under control.

Param	MS Result	MSD Result	Units	Dil.	Spike Amount	Matrix Result	Rec.	RPD	Rec. Limit	RPD Limit
Total Mercury	0.556	0.550	mg/Kg	1	0.500	0.0516	101	1	77.6 - 124	20

Percent recovery is based on the spike result. RPD is based on the spike and spike duplicate result.

Standard (ICV-1)

QC Batch: 26873 Date Analyzed: 2006-05-26 Analyzed By: RR

Param	Flag	Units	CCVs True Conc.	CCVs Found Conc.	CCVs Percent Recovery	Percent Recovery Limits	Date Analyzed
Total Aluminum		mg/Kg	1.00	0.997	100	90 - 110	2006-05-26
Total Antimony		mg/Kg	1.00	0.995	100	90 - 110	2006-05-26
Total Arsenic		mg/Kg	1.00	0.993	99	90 - 110	2006-05-26
Total Barium		mg/Kg	1.00	1.02	102	90 - 110	2006-05-26
Total Beryllium		mg/Kg	1.00	0.986	99	90 - 110	2006-05-26
Total Cadmium		mg/Kg	1.00	1.03	103	90 - 110	2006-05-26
Total Chromium		mg/Kg	1.00	1.03	103	90 - 110	2006-05-26
Total Cobalt		mg/Kg	1.00	0.994	99	90 - 110	2006-05-26
Total Copper		mg/Kg	1.00	1.01	101	90 - 110	2006-05-26
Total Iron		mg/Kg	1.00	1.01	101	90 - 110	2006-05-26
Total Lead		mg/Kg	1.00	1.02	102	90 - 110	2006-05-26
Total Manganese		mg/Kg	1.00	0.992	99	90 - 110	2006-05-26
Total Nickel		mg/Kg	1.00	0.990	99	90 - 110	2006-05-26
Total Selenium		mg/Kg	1.00	1.00	100	90 - 110	2006-05-26
Total Silver		mg/Kg	0.125	0.124	99	90 - 110	2006-05-26
Total Thallium		mg/Kg	1.00	1.01	101	90 - 110	2006-05-26
Total Vanadium		mg/Kg	1.00	1.04	104	90 - 110	2006-05-26
Total Zinc		mg/Kg	1.00	1.00	100	90 - 110	2006-05-26

Standard (CCV-1)

QC Batch: 26873 Date Analyzed: 2006-05-26 Analyzed By: RR

Param	Flag	Units	CCVs True Conc.	CCVs Found Conc.	CCVs Percent Recovery	Percent Recovery Limits	Date Analyzed
Total Aluminum		mg/Kg	1.00	0.991	99	90 - 110	2006-05-26
Total Antimony		mg/Kg	1.00	0.983	98	90 - 110	2006-05-26
Total Arsenic		mg/Kg	1.00	0.977	98	90 - 110	2006-05-26
Total Barium		mg/Kg	1.00	1.03	103	90 - 110	2006-05-26
Total Beryllium		mg/Kg	1.00	0.985	98	90 - 110	2006-05-26
Total Cadmium		mg/Kg	1.00	1.02	102	90 - 110	2006-05-26
Total Chromium		mg/Kg	1.00	1.02	102	90 - 110	2006-05-26
Total Cobalt		mg/Kg	1.00	0.990	99	90 - 110	2006-05-26
Total Copper		mg/Kg	1.00	1.02	102	90 - 110	2006-05-26
Total Iron		mg/Kg	1.00	1.01	101	90 - 110	2006-05-26
Total Lead		mg/Kg	1.00	0.991	99	90 - 110	2006-05-26
Total Manganese		mg/Kg	1.00	0.982	98	90 - 110	2006-05-26
Total Nickel		mg/Kg	1.00	0.983	98	90 - 110	2006-05-26
Total Selenium		mg/Kg	1.00	0.976	98	90 - 110	2006-05-26
Total Silver		mg/Kg	0.125	0.123	98	90 - 110	2006-05-26
Total Thallium		mg/Kg	1.00	1.02	102	90 - 110	2006-05-26
Total Vanadium		mg/Kg	1.00	1.01	101	90 - 110	2006-05-26

continued . . .

standard continued . . .

Param	Flag	Units	CCVs True Conc.	CCVs Found Conc.	CCVs Percent Recovery	Percent Recovery Limits	Date Analyzed
Total Zinc		mg/Kg	1.00	0.999	100	90 - 110	2006-05-26

Standard (ICV-1)

QC Batch: 26896 Date Analyzed: 2006-05-28 Analyzed By: TP

Param	Flag	Units	CCVs True Conc.	CCVs Found Conc.	CCVs Percent Recovery	Percent Recovery Limits	Date Analyzed
Total Calcium		mg/Kg	50.0	47.9	96	90 - 110	2006-05-28
Total Magnesium		mg/Kg	50.0	47.9	96	90 - 110	2006-05-28
Total Potassium		mg/Kg	50.0	52.0	104	90 - 110	2006-05-28
Total Sodium		mg/Kg	50.0	51.1	102	90 - 110	2006-05-28

Standard (CCV-1)

QC Batch: 26896 Date Analyzed: 2006-05-28 Analyzed By: TP

Param	Flag	Units	CCVs True Conc.	CCVs Found Conc.	CCVs Percent Recovery	Percent Recovery Limits	Date Analyzed
Total Calcium		mg/Kg	50.0	49.5	99	90 - 110	2006-05-28
Total Magnesium		mg/Kg	50.0	47.2	94	90 - 110	2006-05-28
Total Potassium		mg/Kg	50.0	47.6	95	90 - 110	2006-05-28
Total Sodium		mg/Kg	50.0	46.4	93	90 - 110	2006-05-28

Standard (CCV-2)

QC Batch: 27202 Date Analyzed: 2006-06-07 Analyzed By: AG

Param	Flag	Units	CCVs True Conc.	CCVs Found Conc.	CCVs Percent Recovery	Percent Recovery Limits	Date Analyzed
alpha-BHC		mg/Kg	0.100	0.0950	95	85 - 115	2006-06-07
gamma-BHC (Lindane)		mg/Kg	0.100	0.0994	99	85 - 115	2006-06-07
beta-BHC		mg/Kg	0.100	0.0975	98	85 - 115	2006-06-07
Heptachlor		mg/Kg	0.100	0.101	101	85 - 115	2006-06-07
delta-BHC		mg/Kg	0.100	0.102	102	85 - 115	2006-06-07
Aldrin		mg/Kg	0.100	0.101	101	85 - 115	2006-06-07
Heptachlor Epoxide		mg/Kg	0.100	0.104	104	85 - 115	2006-06-07
gamma-Chlordane		mg/Kg	0.100	0.101	101	85 - 115	2006-06-07
alpha-Chlordane		mg/Kg	0.100	0.101	101	85 - 115	2006-06-07
Endosulfan I		mg/Kg	0.100	0.101	101	85 - 115	2006-06-07
p,p-DDE		mg/Kg	0.100	0.102	102	85 - 115	2006-06-07
Dieldrin		mg/Kg	0.100	0.104	104	85 - 115	2006-06-07
Endrin		mg/Kg	0.100	0.100	100	85 - 115	2006-06-07
p,p-DDD		mg/Kg	0.100	0.0969	97	85 - 115	2006-06-07
Endosulfan II		mg/Kg	0.100	0.101	101	85 - 115	2006-06-07
p,p-DDT		mg/Kg	0.100	0.103	103	85 - 115	2006-06-07
Endrin aldehyde		mg/Kg	0.100	0.103	103	85 - 115	2006-06-07
Endosulfan sulfate		mg/Kg	0.100	0.103	103	85 - 115	2006-06-07

continued . . .

standard continued . . .

Param	Flag	Units	CCVs True Conc.	CCVs Found Conc.	CCVs Percent Recovery	Percent Recovery Limits	Date Analyzed
Methoxychlor		mg/Kg	0.100	0.101	101	85 - 115	2006-06-07
Endrin Ketone		mg/Kg	0.100	0.0995	100	85 - 115	2006-06-07
Toxaphene		mg/Kg	0.800	0.857	107	85 - 115	2006-06-07
Technical Chlordane		mg/Kg	0.800	0.789	99	85 - 115	2006-06-07

Surrogate	Flag	Result	Units	Dilution	Spike Amount	Percent Recovery	Recovery Limit
2,4,5,6-Tetrachloro-m-xylene		0.0957	mg/Kg	1	0.100	96	85 - 115
Deca chlorobiphenyl		0.107	mg/Kg	1	0.100	107	85 - 115

Standard (CCV-3)

QC Batch: 27202 Date Analyzed: 2006-06-07 Analyzed By: AG

Param	Flag	Units	CCVs True Conc.	CCVs Found Conc.	CCVs Percent Recovery	Percent Recovery Limits	Date Analyzed
alpha-BHC		mg/Kg	0.100	0.0954	95	85 - 115	2006-06-07
gamma-BHC (Lindane)		mg/Kg	0.100	0.100	100	85 - 115	2006-06-07
beta-BHC		mg/Kg	0.100	0.0978	98	85 - 115	2006-06-07
Heptachlor		mg/Kg	0.100	0.101	101	85 - 115	2006-06-07
delta-BHC		mg/Kg	0.100	0.102	102	85 - 115	2006-06-07
Aldrin		mg/Kg	0.100	0.102	102	85 - 115	2006-06-07
Heptachlor Epoxide		mg/Kg	0.100	0.106	106	85 - 115	2006-06-07
gamma-Chlordane		mg/Kg	0.100	0.103	103	85 - 115	2006-06-07
alpha-Chlordane		mg/Kg	0.100	0.103	103	85 - 115	2006-06-07
Endosulfan I		mg/Kg	0.100	0.103	103	85 - 115	2006-06-07
p,p-DDE		mg/Kg	0.100	0.105	105	85 - 115	2006-06-07
Dieldrin		mg/Kg	0.100	0.106	106	85 - 115	2006-06-07
Endrin		mg/Kg	0.100	0.102	102	85 - 115	2006-06-07
p,p-DDD		mg/Kg	0.100	0.0997	100	85 - 115	2006-06-07
Endosulfan II		mg/Kg	0.100	0.106	106	85 - 115	2006-06-07
p,p-DDT		mg/Kg	0.100	0.108	108	85 - 115	2006-06-07
Endrin aldehyde		mg/Kg	0.100	0.108	108	85 - 115	2006-06-07
Endosulfan sulfate		mg/Kg	0.100	0.106	106	85 - 115	2006-06-07
Methoxychlor		mg/Kg	0.100	0.102	102	85 - 115	2006-06-07
Endrin Ketone		mg/Kg	0.100	0.103	103	85 - 115	2006-06-07
Toxaphene		mg/Kg	0.800	0.736	92	85 - 115	2006-06-07
Technical Chlordane		mg/Kg	0.800	0.780	98	85 - 115	2006-06-07

Surrogate	Flag	Result	Units	Dilution	Spike Amount	Percent Recovery	Recovery Limit
2,4,5,6-Tetrachloro-m-xylene		0.0988	mg/Kg	1	0.100	99	85 - 115
Deca chlorobiphenyl		0.112	mg/Kg	1	0.100	112	85 - 115

Standard (ICV-1)

QC Batch: 27264 Date Analyzed: 2006-06-12 Analyzed By: TP

Param	Flag	Units	CCVs True Conc.	CCVs Found Conc.	CCVs Percent Recovery	Percent Recovery Limits	Date Analyzed
Total Mercury		mg/L	0.00500	0.00512	102	90 - 110	2006-06-12

Standard (CCV-1)

QC Batch: 27264 Date Analyzed: 2006-06-12 Analyzed By: TP

Param	Flag	Units	CCVs True Conc.	CCVs Found Conc.	CCVs Percent Recovery	Percent Recovery Limits	Date Analyzed
Total Mercury		mg/L	0.00500	0.00512	102	80 - 120	2006-06-12

COC # HGL012

6701 Aberdeen Avenue, Ste. 9
Lubbock, Texas 79424
Tel (806) 794-1296
Fax (806) 794-1298
1 (800) 378-1296
email: lab@traceanalysis.com

TraceAnalysis, Inc.

155 McCutcheon, Suite H
El Paso, Texas 79932
Tel (915) 585-3443
Fax (915) 585-4944
1 (888) 588-3443

CHAIN-OF-CUSTODY AND ANALYSIS REQUEST

LAB Order ID # 6052408

Company Name: Hydro GeoLogic
Phone #:
Address: (Street, City, Zip)
Fax #:
Contact Person: Ken Cottrell (PM)
E-mail: kcottrell@hgl.com
Invoice to: (If different from above)
Project #: AFC002-037-04
Project Name: Supplemental RFI
Project Location (including state): Holloman AFB, NM
Sampler Signature: [signature]

ANALYSIS REQUEST (Circle or Specify Method No.)

LAB # (LAB USE ONLY)	FIELD CODE	# CONTAINERS	Volume / Amount	MATRIX: WATER	MATRIX: SOIL	MATRIX: AIR	MATRIX: SLUDGE		PRESERVATIVE METHOD: HCl	HNO_3	H_2SO_4	NaOH	ICE	NONE		SAMPLING: DATE	SAMPLING: TIME	MTBE 8021B / 602 / 8260B / 624	BTEX 8021B / 602 / 8260B / 624	TPH 418.1 / TX1005 / TX1005 Ext(C35)	TPH 8015 GRO / DRO / TVHC	PAH 8270C / 625	Total Metals Ag As Ba Cd Cr Pb Se Hg 60108/200.7	TCLP Metals Ag As Ba Cd Cr Pb Se Hg	TCLP Volatiles	TCLP Semi Volatiles	TCLP Pesticides	RCI	GC/MS Vol. 8260B / 624	GC/MS Semi. Vol. 8270C / 625	PCB's 8082 / 608	Pesticides 8081A / 608 + 8141	BOD, TSS, pH	Moisture Content	Herbicides	TAL metals				Turn Around Time if different from standard	Hold
91137	HGLTR19-01-0102	3	4oz		X								X			5/22/06	0910															X			X	X					
38	HGLTR19-01-0203	3	4oz		X								X			5/22/06	0915															X			X	X					

Relinquished by:	Date:	Time:	Received by:	Date:	Time:
[signature]	5/23/06	1215	[signature]	5/23/06	1215
[signature]	5/23/06	1630	Lonestar		
			Received at Laboratory by: [signature]	Date: 5/24/06	Time: 0905

LAB USE ONLY
Intact Y / N
Headspace Y / N
Temp Ice 4°C
Log-In-Review [signature]

REMARKS:
- ☐ Dry Weight Basis Required
- ☐ TRRP Report Required
- ☐ Check If Special Reporting Limits Are Needed

Carrier # Lonestar 37155456.

Submittal of samples constitutes agreement to Terms and Conditions listed on reverse side of C. O. C.

ORIGINAL COPY