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*Final
2003 Long-Term Groundwater Monitoring Report*

*Holloman Air Force Base,
New Mexico*

September 2003



*49 CES/CEV
Holloman Air Force Base,
New Mexico*

Project Number: KWRD20037009

FINAL
2003 LONG-TERM GROUNDWATER MONITORING REPORT
HOLLOMAN AIR FORCE BASE, NEW MEXICO

Prepared for:

49 CES/CEV

Holloman Air Force Base, NM

and

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ACRONYMS

ACC/CEVR	Air Combat Command/Civil Engineering Environmental Restoration
AFB	Air Force Base
AOC	Area of Concern
AST	Aboveground Storage Tank
BHC	Benzene Hexachloride
BRA	Baseline Risk Assessment
BTEX	Benzene, Toluene, Ethylbenzene, and Xylenes
BX	Base Exchange
CES/CEV	Civil Engineering Squadron/Civil Engineering Environmental Flight
CRDL	Contract-Required Detection Limit
DDD	1,1-bis(chlorophenyl)-2,2-dichloroethane
DDE	1,1-bis(chlorophenyl)-2,2-dichloroethene
DDT	1,1-bis(chlorophenyl)-2,2,2-trichloroethane
EPA	U.S. Environmental Protection Agency
ERP	Environmental Restoration Program
FEC	Foothills Engineering Consultants, Inc.
Foster Wheeler Environmental	Foster Wheeler Environmental Corporation
FS	Feasibility Study
ft	feet
GTI	Groundwater Technology, Inc.
HQ	Headquarters

IDL	Instrument Detection Limit
IDW	Investigation-Derived Waste
LTM	Long-Term Groundwater Monitoring
mg/L	milligrams per Liter
MOBBS	Mobile Bare Base Squadron
msl	mean sea level
MTBE	Methyl Tertiary Butyl Ether or Tert-Butyl Methyl Ether
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
NMGWQ	New Mexico Groundwater Quality
NMWQCC	New Mexico Water Quality Control Commission
OCP	Organochlorine Pesticide
PCB	Polychlorinated Biphenyl
PCE	Tetrachloroethylene or 1,1,2,2-tetrachloroethylene
POL	Petroleum, Oils, and Lubricants
ppm	parts per million
QA	Quality assurance
QC	Quality control
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
RI	Remedial Investigation
RL	Reporting Limit
R&R	R&R Environmental Incorporated

SOP	Standard Operating Procedure
SVE	Soil-Vapor Extraction
SVOC	Semivolatile Organic Compound
SWMU	Solid Waste Management Unit
TCE	Trichloroethylene
TCLP	Toxicity Characteristic Leaching Procedure
TDS	Total Dissolved Solids
TOC	Top Of Casing
TOX	Total Organic Halogens
TPH	Total Petroleum Hydrocarbons
TRPH	Total Recoverable Petroleum Hydrocarbons
ug/L	micrograms per Liter
USACE	U.S. Army Corps of Engineers
UST	Underground Storage Tank
VOC	Volatile Organic Compound

EXECUTIVE SUMMARY

This report presents the results of the 2003 Long-Term Groundwater Monitoring Program for selected Resource Conservation and Recovery Act and Environmental Restoration Program sites at Holloman Air Force Base, New Mexico. The 2003 Long-Term Groundwater Monitoring Program represents the fifth sampling event for nine sites and the fourth sampling event for six sites scheduled as part of a 10-year voluntary program in which monitoring is performed once every two years. The 2003 Long Term Groundwater Monitoring sampling event will conclude the 10-year Long Term Monitoring Program for nine of the 15 sites in the Long Term Monitoring Program. The purpose of this program is to satisfy the U.S. Environmental Protection Agency Region 6 and New Mexico Environment Department closure requirement for sites included in this program. Although active remediation in the form of free-phase product removal is ongoing at a few of the sites, this program supports conditional closure of Long Term Monitoring sites as presented in the appropriate decision documents.

In this report, analytical results obtained during the 2003 Long Term Monitoring Program activities were evaluated and compared with results generated in 1995, 1997, 1999, and 2001. The Long Term Monitoring Program began in August 1995 and consisted of 12 sites. The 1995 analytical results served as baseline concentrations from which to compare all subsequent results. For the six sites introduced in 1997, analytical results obtained during the 1997 Long Term Monitoring Program served as a baseline sampling event from which to compare all subsequent results.

In general, groundwater sample results from 2003 were consistent with sample results from previous Long Term Monitoring Programs (i.e., did not change by one order of magnitude). Nine wells at seven sites had analyte detections that exceeded New Mexico Groundwater Quality Standards (NMED 2002). Overall, metals were detected at similar concentrations in 2003 as compared to previous years. Fewer volatile organic compounds were detected in 2003 than in 2001.

Recommendations for revising the 2005 Long Term Monitoring Program were made for all of the sites addressed in this report. These recommendations primarily focus on closure of the site or continued sampling of the site. Table ES-1 summarizes the 2003 Long Term Monitoring Program and the recommendations for the 2005 Long Term Monitoring Program.

Table ES-1. Summary of 2003 Long-Term Groundwater Monitoring Findings and Recommendations for Future Monitoring

Site	2003 Analyses (EPA Methods)	2003 Results Above CRDL	2003 Results Above NMGWQ Standards	LTM Program Recommendations
LF-01	Metals (<i>arsenic, barium, manganese, selenium</i>) (6010B Trace), VOCs (8260B) on S1-MW3	Arsenic, Selenium	None	Site eligible for closeout per completion of five sampling rounds in 2003. Site recommended for closeout because contaminants have not been detected above the NMGWQ Standards for five sampling rounds, and groundwater TDS concentrations are above 10,000 mg/L (NMGWQ Standards do not apply).
SS-02 & SS-05	VOCs (8260B)	Benzene, Ethylbenzene, m,p-xylenes, o-Xylene	Benzene	Continue sampling for benzene, ethylbenzene and xylenes.
SD-08	VOCs (<i>1,2-dichloroethane</i> [8260B]), Metals (<i>arsenic, barium, iron, manganese</i> 6010B Trace)	Arsenic, Barium, Iron, Manganese, 1,2-dichloroethane	Iron, Manganese, 1,2-dichloroethane	Site eligible for closeout per completion of five sampling rounds in 2003. Site recommended for closeout because undiluted groundwater TDS concentrations are above 10,000 mg/L (NMGWQ Standards do not apply).
LF-10	Metals (<i>arsenic, barium, manganese, selenium</i> [6010B Trace])	Arsenic, Manganese	None	Site eligible for closeout per completion of five sampling rounds in 2003. Site recommended for closeout because contaminant concentrations were not detected above NMGWQ Standards for five sampling rounds, and groundwater TDS concentrations are above 10,000 mg/L (NMGWQ Standards do not apply).
OT-16	VOCs (<i>trichloroethylene, chloroform, chlorobenzene</i> [8260B]), Organochlorine Pesticides (<i>Gamma-BHC [Lindane]</i> in 118-MW1602 only [8081A])	Chloroform, Chlorobenzene, TCE	None	Continue sampling for trichloroethylene, chloroform, and chlorobenzene. Sample 118-MW1602 for gamma-BHC (Lindane).
SS-17	VOCs (8260B)	Benzene, 1,2-Dichloroethane; Ethylbenzene; tert-butylmethyl ether (MTBE), 1,1,2,2-tetrachloroethane	1,2-Dichloroethane	No changes to the 2005 LTM Program. Continue sampling for VOCs.
LF-19	Metals (<i>barium, iron, manganese</i> [6010B Trace])	Barium, Manganese	Manganese	Site eligible for closeout per completion of five sampling rounds in 2003. Site recommended for closeout because undiluted groundwater TDS concentrations are above 10,000 mg/L (NMGWQ Standards do not apply).
LF-21	VOCs (<i>trichloroethylene</i> [8260B]), Metals (<i>arsenic, barium, iron, manganese, selenium</i> [6010B Trace])	Arsenic, Barium, Manganese, Trichloroethylene	None	Site eligible for closeout per completion of five sampling rounds in 2003. Site recommended for closeout because contaminant concentrations were not detected above NMGWQ Standards, and a trend of decreasing concentrations has been observed over the past five rounds.

Table ES-1. Summary of 2003 Long-Term Groundwater Monitoring Findings and Recommendations for Future Monitoring

Site	2003 Analyses (EPA Methods)	2003 Results Above CRDL	2003 Results Above NMGWQ Standards	LTM Program Recommendations
LF-22	Metals (<i>arsenic, barium, iron, manganese, selenium</i> [6010B Trace])	Arsenic, Barium, Manganese, Selenium	None	Site eligible for closeout per completion of five sampling rounds in 2003. Site recommended for closeout because contaminant concentrations were not detected above NMGWQ Standards over the past five sampling rounds.
LF-23	Metals (<i>barium, iron, manganese, selenium</i> [6010B Trace])	Selenium	Selenium	Site eligible for closeout per completion of five sampling rounds in 2003. Site recommended for closeout because groundwater TDS concentrations are above 10,000 mg/L (NMGWQ Standards do not apply).
LF-29	1,2-dichloroethane and chloroform (8260B)	1,2-Dichloroethane, chloroform	1,2-Dichloroethane	No changes to the 2005 LTM Program. Continue sampling for chloroform and 1,2-dichloroethane only.
DP-30 & SD-33	1,1-dichloroethane, chloroform, TCE (8260B), Metals (<i>arsenic, barium, iron, selenium</i> [6010B Trace])	Arsenic, Barium, Iron, Selenium; Chloroform, 1,1-Dichloroethane; Trichloroethylene	None	Site eligible for closeout per completion of five sampling rounds in 2003. Site recommended for closeout because contaminant concentrations were not detected above NMGWQ Standards, a trend of decreasing concentrations has been observed over the past five rounds, and groundwater TDS concentrations are above 10,000 mg/L (NMGWQ Standards do not apply).
SS-39	VOCs (8260B)	Carbon Tetrachloride, TCE	None	No changes to 2005 LTM Program. Continue sampling for VOCs. Remove roots from all wells 2 weeks prior to sampling to ensure that representative water level measurements and groundwater samples are obtained.
SS-46	bromodichloromethane, chloroform, methylene chloride (8260B)	Bromodichloromethane, Chloroform	None	Continue sampling for bromodichloromethane, and chloroform, Discontinue sampling for methylene chloride since it has not been detected above NMGWQ Standards.
SS-48	VOCs (8260B)	Benzene, Carbon disulfide, Chloroform, 1,2-dichloroethane, ethylbenzene, PCE, TCE, toluene, o-xylene, m,p-xylene	Benzene	Site eligible for closeout per completion of five sampling rounds in 2003. Site recommended for closeout because undiluted groundwater TDS concentrations are above 10,000 mg/L (NMGWQ Standards do not apply).

Notes:

CRDL - contract-required detection limit
 EPA - United States Environmental Protection Agency
 LTM - Long-Term Groundwater Monitoring

MTBE - tert-Butylmethyl ether
 NMGWQ - New Mexico Groundwater Quality
 Trace - inductively coupled plasma trace analysis

VOC - volatile organic compound

1.0 INTRODUCTION

This report presents the results of the 2003 Long Term Monitoring (LTM) Program for 15 Resource Conservation and Recovery Act (RCRA) and Environmental Restoration Program (ERP) sites at Holloman Air Force Base (AFB), New Mexico (Figure 1-1). Sites were included in the LTM Program based on investigations and risk assessments conducted for each site. The community participation, background information, quantitative risk assessments, and selected remedies are summarized in the Decision Document for each site or presented in the following documents: *Decision Documents for Installation Restoration Program Sites* (Walk, Haydel & Associates 1990), *Decision Documents for Installation Restoration Program* (EBASCO/Groundwater Technology Inc. [GTI] 1995), and *Feasibility Study – Investigation, Study, and Recommendations for 29 Waste Sites* (Radian 1993). These documents establish the requirement for LTM as a condition of site closure. The objective of the LTM Program is twofold:

- Ensure that the selected remedy has effectively stopped the release of contamination to the groundwater for the two sites with ongoing remediation, and/or
- Ensure that further degradation to groundwater quality is not occurring at the 15 sites.

The LTM Program was designed as a 10-year program with monitoring performed once every 2 years. The 2003 LTM Program represents the fifth and last sampling event for nine of the sites. The 2003 LTM Program sampling event was conducted in April 2003. The first four LTM Program sampling events were conducted in August 1995, September 1997, September 1999, and September 2001.

During the 1995 LTM Program, monitoring was conducted at 12 different sites. Eleven of these sites (OT-45 was eliminated) were included in the 1997, 1999, and 2001 LTM sampling events along with six additional sites. In response to the 2001 LTM program results, two of the sites (OT-44 and SS-56) were eliminated from the program. Site OT-

44 was eliminated because the frequency and concentration of volatile organic compounds (VOCs) detected in groundwater had decreased over the past four sampling events. Site SS-56 was eliminated because the past four sampling events showed VOCs and lead below the contract-required detection limit (CRDL). Currently, the 2003 LTM program includes a total of 15 sites. The 15 LTM sites were included in the 2003 sampling event and are listed in Table 1-1. Remediation is on-going for the following sites:

- SS-02 & SS-05, Petroleum, Oils, and Lubricants (POL) Spill Sites Nos. 1 and 2—Operation of soil-vapor extraction (SVE) system
- SS-17, Base Exchange (BX) Service Station—Operation of SVE system

The 2003 LTM Program activities included measuring static water levels and collecting groundwater samples at selected monitoring wells. Groundwater samples were collected in April 2003 from 63 monitoring wells located at the 15 LTM sites listed in Table 1-1. Site locations are shown on Figure 1-2. Groundwater samples were submitted for site-specific chemical analyses including VOCs, organochlorine pesticides (OCPs), arsenic, barium, iron, manganese, and selenium. Analyses were performed in accordance with *SW-846 Test Methods for Evaluating Solid Waste*, third edition and updates (EPA 1986).

1.1 PURPOSE

This report presents the background and site-specific information necessary to assess groundwater quality and provides recommendations for future LTM at Holloman AFB. The data evaluation will provide the basis for recommending future monitoring under the LTM Program. Any recommendation made in this report to revise the analytical requirements at a site is supported by the data evaluation results.

1.2 OBJECTIVES FOR SITE CLOSEOUT

The 2003 LTM Program includes nine sites (LF-01, SD-08, LF-10, LF-19, LF-21, LF-22, LF-23, DP-30 & SD-33, and SS-48) eligible for closeout, because the five required

sampling events have been conducted. Eligible sites were evaluated and recommended for closeout based on at least one of the following three objectives:

- Sites with contaminant concentrations below New Mexico Groundwater Quality (NMGWQ) Standards, either consistently or with decreasing concentration trends, will be recommended for closeout.
- Sites with total dissolved solids (TDS) concentrations greater than 10,000 milligrams per liter (mg/L) will be recommended for closeout. Groundwater with TDS concentrations greater than 10,000 mg/L are not a potential domestic or agricultural water supply; therefore, NMGWQ Standards do not apply.
- Sites that do not meet either of the above objectives will be recommended for closeout based on water quality data collected during the 2002 and 2003 Quarterly Well-Gauging Programs. The 2002 Quarterly Well-Gauging Program supports the hypothesis that TDS concentrations below 10,000 mg/L at Holloman AFB are caused by dilution of natural groundwater from leaking water lines and surface irrigation from the domestic water supply. In conclusion, NMGWQ Standards do not apply because groundwater at Holloman AFB in its natural state (TDS concentrations above 10,000 mg/L) is not a potential domestic or agricultural water supply.

1.3 DOCUMENT ORGANIZATION

This 2003 LTM report presents groundwater sampling procedures, site-specific background information, and analytical results. The document contains the following 19 sections:

- Section 1.0 – Introduction
- Section 2.0 – Sampling Procedures
- Sections 3.0 through 17.0 – Site-Specific LTM Results

- Section 18.0 – Conclusions and Recommendations
- Section 19.0 – References

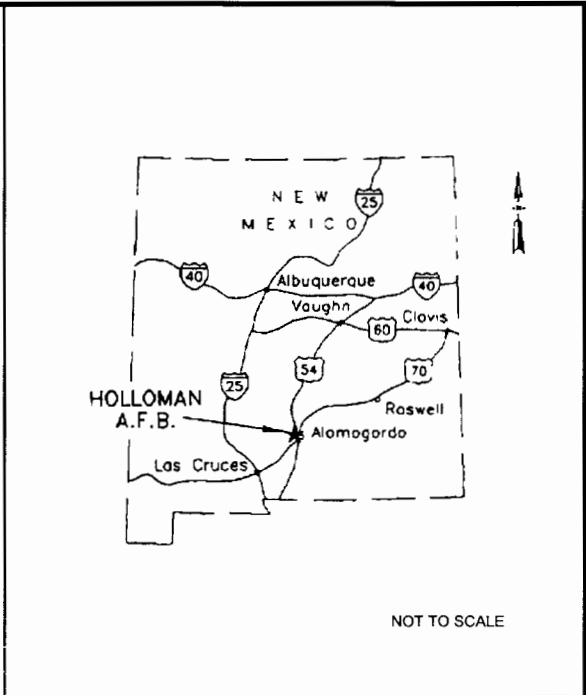
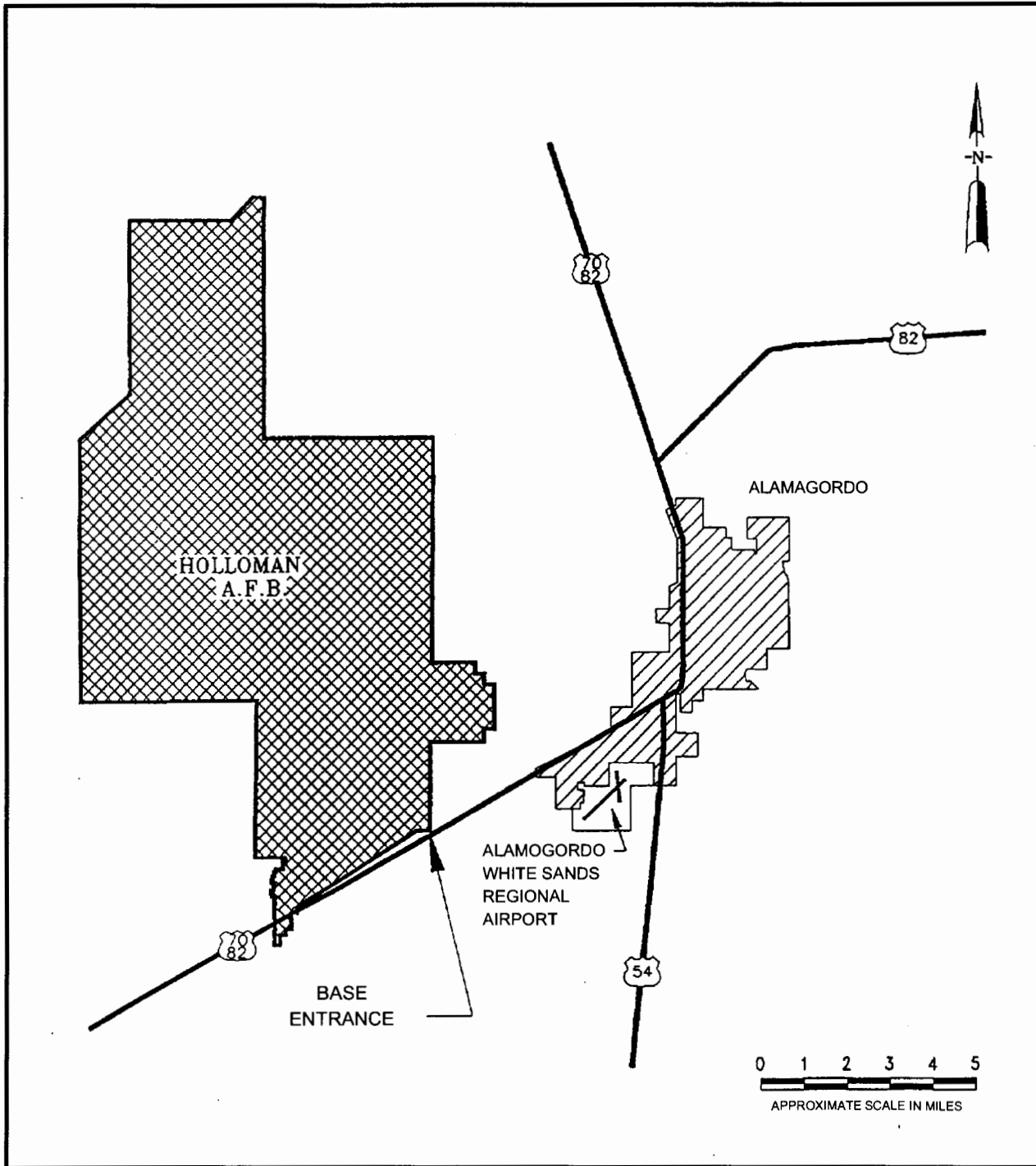
Pertinent site background information and specific agreements made between the U.S. Air Force and the New Mexico Environment Department (NMED) for each site are presented in the *Draft Final 1995 Long-Term Groundwater Monitoring Report* (Foster Wheeler Environmental Corporation [Foster Wheeler Environmental] and GTI 1996). This information, which provided the basis for the site-specific 2003 LTM Program, has been updated and is summarized in each site-specific section (Sections 3.0 through 17.0).

This report includes three appendices. Appendix A presents the Data Quality Control Summary Report for the analytical data collected during the 2003 LTM Program sampling event. Appendix B provides the analytical results from the subcontractor laboratory for environmental samples and field duplicates. Field sampling documentation, monitoring well gauging documentation, and summary tables are provided in Appendix C.

Table 1-1 2003 Long-Term Monitoring Program Sites

Site	SWMU	Location
LF-01	106	Main Base Landfill
SS-02 & SS-05	AOC-T	POL Spill Sites Nos. 1 and 2
SD-08	4, 82	Refuse Collection Truck Washrack
LF-10	101, 109	Old Main Base Landfill
OT-16	118, 132, AOC-A	Former Entomology Shop Area
SS-17	None	BX Service Station
LF-19	105	Golf Course Landfill
LF-21	116	West Area Landfill No. 2
LF-22	115	West Area Landfill No.1
LF-23	108	MOBBS Landfill
LF-29	104	Former Army Landfill
DP-30 & SD-33	113B	Grease Trap Disposal Pits
SS-39	165, 177, 179, 181	Missile Fuel Spill Area
SS-46	130	JP-4 Spill Site
SS-48	None	Military Gas Station

AOC	Area of Concern	POL	Petroleum, oils, and lubricants
BX	Base Exchange	OT	Other
DP	Disposal Pit	SS	Surface Spill
LF	Landfill	SWMU	Solid Waste Management Unit
MOBBS	Mobile Bare Base Squadron		



**U.S. ARMY CORPS OF ENGINEERS
OMAHA DISTRICT**

HOLLOMAN AIR FORCE BASE, NEW MEXICO

FIGURE 1-1

LOCATION OF HOLLOMAN AFB,
NEW MEXICO