

KAFB-4M

# KIRTLAND AIR FORCE BASE

## Long-Term Groundwater Monitoring Report July 1996 Out-Of-Cycle Event

Final Draft - October 1996



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**INSTALLATION RESTORATION PROGRAM  
KIRTLAND AIR FORCE BASE**

**FINAL DRAFT  
LONG-TERM GROUNDWATER MONITORING REPORT -  
JULY 1996 OUT-OF-CYCLE EVENT**

**OCTOBER 1996**

**received**

*Prepared For*  
**U.S. ARMY CORPS OF ENGINEERS  
OMAHA DISTRICT  
OMAHA, NEBRASKA**

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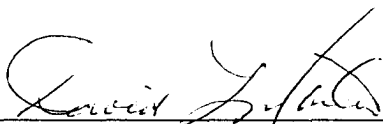
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---

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## PREFACE

This report presents the results of the July 1996 out-of-cycle event of the Long-Term Groundwater Monitoring (LTM) Program for one Resource Conservation and Recovery Act (RCRA) site (Solid Waste Management Unit [SWMU] 6-4, Landfills 4, 5, and 6 [LF-8]) at Kirtland Air Force Base (AFB), New Mexico. Per the Groundwater Monitoring System Plan, amended October 1995, a fifth out-of-cycle sampling event was required for Landfills 4, 5, and 6 to be conducted between the first and second quarters. The July 1996 out-of-cycle sampling event was the second round of sampling for Landfills 4, 5, and 6 under the LTM Program. The first sampling event was completed in May 1996. The primary objective of the first year of sampling is to establish background concentrations and a baseline for a broad suite of parameters against which to compare future sampling results.

This work was performed under the authority of the U.S. Army Corps of Engineers, TERC Contract No. DACW45-94-D-0003, Subcontract No. DENS-94-1159-JM(MOA). All work was conducted in July 1996. Mr. Larry Janis, U.S. Army Corps of Engineers, is the Technical Manager for this program.

The Remedial Program Manager for this program is Mr. Chris DeWitt of Kirtland Air Force Base, Environmental Management Division. Mr. Mark Holmes of Kirtland Air Force Base is the Project Manager. Mr. Steven B. Weber of Foster Wheeler Environmental Corporation is the Delivery Order Manager. Ms. Cymantha Liakos of Groundwater Technology Government Services, Inc. (GTGSI), is the subcontractor Project Manager. The report was prepared by Ms. Teresa J. Bennett (GTGSI) with administrative assistance from Ms. Christine Duncan. Field sampling was performed by Mssrs. Mark Smith and Charles Madewell of GTGSI.



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## ACRONYMS

AFB	Air Force Base
AML	Assessment Monitoring Level
CFR	Code of Federal Regulations
COC	Chain-of-Custody
DCQAP	Data Collection Quality Assurance Plan
DQCR	Daily Quality Control Report
EPA	Environmental Protection Agency
FB	Field Blank
FSP	Field Sampling Plan
ft	Feet
HSWA	Hazardous and Solid Waste Amendments
IDW	Investigation Derived Waste
IRP	Installation Restoration Program
IRPIMS	Installation Restoration Program Information Management System
LIMS	Location Information Management System
LTM	Long-Term Groundwater Monitoring
MCL	Maximum Contaminant Level
MDA	Minimum Detectable Activity
MDL	Method Detection Limit
mg/l	Milligrams per Liter
MRD	Missouri River Division
MSL	Mean Sea Level
NEI/GTEL	NEI/GTEL Environmental Laboratories, Inc.
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
NMSWMR	New Mexico Solid Waste Management Regulations
NMWQCCR	New Mexico Water Quality Control Commission Regulations
NOI	Notice of Intent
NTU	Nephelometric Turbidity Unit
PAH	Polynuclear Aromatic Hydrocarbons
PCB	Polychlorinated Biphenyls
pCi/L	Picocuries per Liter
PID	Photoionization Detector
PQL	Practical Quantitation Limit
PPE	Personal Protection Equipment

**ACRONYMS (Concluded)**

QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
RCRA	Resource Conservation and Recovery Act (of 1976)
RFI	RCRA Facility Investigation
RL	Reporting Limit
RPD	Relative Percent Difference
SAP	Sampling and Analysis Plan
SDWA	Safe Drinking Water Act
SNL	Sandia National Laboratories
SOP	Standard Operating Procedure
SOW	Scope of Work
SVOC	Semi-volatile Organic Compound
SWMU	Solid Waste Management Unit
TB	Trip Blank
TDS	Total Dissolved Solids
TNTC	Too Numerous To Count
TOC	Total Organic Carbon
µg/l	Micrograms per Liter
µmhos/cm	Micromhos per Centimeter
USACE	United States Army Corps of Engineers
USAF	United States Air Force
USGS	U.S. Geological Survey
VOC	Volatile Organic Compound

## EXECUTIVE SUMMARY

This report presents the results of the July 1996 out-of-cycle event of the Long-Term Groundwater Monitoring (LTM) Program for one Resource Conservation and Recovery Act (RCRA) site (Solid Waste Management Unit [SWMU] 6-4, Landfills, 4, 5, and 6 [LF-08]) at Kirtland Air Force Base (AFB), New Mexico. The Kirtland AFB Environmental Restoration Program is conducted under the regulatory authority of the New Mexico Environment Department (NMED) and the U.S. Environmental Protection Agency (EPA) Region 6. Kirtland AFB was granted a permit to operate a waste facility by the EPA under the Hazardous and Solid Waste Amendments (HSWA) of 1984 in October 1990. The NMED was granted HSWA authority in January 1996. Module IV of the permit required the installation of groundwater monitoring wells around SWMUs identified in Appendix I of the permit (EPA Region 6, 1990). The purpose of these wells is to determine if there have been any releases of hazardous substances from the SWMUs to groundwater. Groundwater monitoring wells were installed at nine sites at Kirtland AFB by the U.S. Geological Survey (USGS) Water Resources Division in Albuquerque, New Mexico, during the Appendix I RCRA Facility Investigation (RFI), as documented in the Stage 2A RFI Report (United States Air Force [USAF], 1993). Additional investigation is being conducted under the "*KAFB Final Draft Appendix I Phase 2 RFI Sampling and Analysis Plan (SAP)*" (USAF, 1996a).

In written correspondence of September 9, 1994, the NMED directed Kirtland AFB to formulate a landfill groundwater monitoring plan for Landfills 4, 5, and 6, as required by New Mexico Solid Waste Management Regulations (NMSWMR) (20 New Mexico Administrative Code [NMAC] 9.1) for landfills closed after May 14, 1989 and landfills currently operating. In response to the NMED's directive, Kirtland AFB prepared a Groundwater Monitoring System Plan, dated October 14, 1994. In their August 8, 1995 letter, the NMED directed the plan be modified to include four samples to be taken during the initial sampling event and at least one additional sample during the first semiannual sampling event from each well, and analyzed for parameters listed in Table 1 of Appendix A of 20 NMAC 9.1. The plan was amended and resubmitted on October 2, 1995 to include an out-of-cycle sampling event between the first and second quarters, in lieu of an additional semiannual event. The NMED approved the plan in correspondence dated November 8, 1995 and December 4, 1995. The LTM Plan for Landfills 4, 5, and 6 adheres to the substantive requirements of 40 Code of Federal Regulations (CFR) 264.97 and 20 NMAC 9.1, effective November 1995. These regulations require the owner of a surface impoundment, landfill, or land treatment facility to implement a groundwater monitoring program capable of determining the facility's impact on the quality of groundwater in the uppermost aquifer underlying the facility.

The July 1996 out-of-cycle sampling event was the second round of sampling for Landfills 4, 5, and 6 under the LTM Program. The first sampling event was completed in May 1996 (USAF, 1996b). The wells were sampled using dedicated sampling pumps and analyzed for various parameters in accordance with the LTM Plan. The primary objective of the first year of sampling is to establish background concentrations and a baseline for a broad suite of parameters against which to compare future sampling results.

Of the six wells sampled at Landfills 4, 5, and 6 during July 1996, two wells yielded analyte concentrations above NMSWMR health-based groundwater standards. Well KAFB-0310 contained total chromium and selenium concentrations above applicable NMSWMR standards, and well KAFB-0311 contained cadmium concentrations above the NMSWMR health-based standard.

## 1. INTRODUCTION

### 1.1 Purpose and Project Objective

This report presents the results of the July 1996 out-of-cycle event of the LTM Program for one RCRA site (SWMU 6-4, Landfills, 4, 5, and 6 [LF-08]) at Kirtland AFB, New Mexico (Figures 1-1 and 1-2). The Kirtland AFB Environmental Restoration Program is conducted under the regulatory authority of the NMED and the U.S. EPA Region 6. Kirtland AFB was granted a permit to operate a waste facility by the NMED and EPA under the HSWA of 1984 in October 1990. The NMED was granted HSWA authority in January 1996. Module IV of the permit required the installation of groundwater monitoring wells around SWMUs identified in Appendix I of the permit (EPA Region 6, 1990). The purpose of these wells is to determine if there have been any releases of hazardous substances from the SWMUs to groundwater. Groundwater monitoring wells were installed at nine sites at Kirtland AFB by the USGS Water Resources Division in Albuquerque, New Mexico, during the Appendix I RFI, as documented in the Stage 2A RFI Report (USAF, 1993). Additional investigation is being conducted under the "*KAFB Final Draft Appendix I Phase 2 RFI Sampling and Analysis Plan (SAP)*" (USAF, 1996a).

In written correspondence of September 9, 1994, the NMED directed Kirtland AFB to formulate a landfill groundwater monitoring plan for Landfills 4, 5, and 6, as required by NMSWMR (20 NMAC 9.1) for landfills closed after May 14, 1989 and landfills currently operating. In response to the NMED's directive, Kirtland AFB prepared a Groundwater Monitoring System Plan, dated October 14, 1994. In their August 8, 1995 letter, the NMED directed the plan be modified to include four samples to be taken during the initial sampling event and at least one additional sample during the first semiannual sampling event from each well, and analyzed for parameters listed in Table 1 of Appendix A of 20 NMAC 9.1. The plan was amended and resubmitted on October 2, 1995 to include an out-of-cycle sampling event between the first and second quarters, in lieu of an additional semiannual event. The NMED approved the plan in correspondence dated November 8, 1995 and December 4, 1995. The LTM Plan for Landfills 4, 5, and 6 adheres to the substantive requirements of 40 CFR 264.97 and 20 NMAC 9.1, effective November 1995. These regulations require the owner of a surface impoundment, landfill, or land treatment facility to implement a groundwater monitoring program capable of determining the facility's impact on the quality of groundwater in the uppermost aquifer underlying the facility.

The July 1996 out-of-cycle sampling event was the second round of sampling for Landfills 4, 5, and 6 under the LTM Program. The first sampling event was completed in May 1996 (USAF, 1996b). The primary objective of the first year of sampling is to establish background concentrations and a baseline for a broad suite of parameters against which to compare future sampling results. Following completion of the first year of the LTM Program, statistical analyses will be conducted to establish background concentrations. It is anticipated that after the first year of monitoring, the frequency of monitoring and number of analytical parameters will be reduced for subsequent events based on the statistical analysis and comparison against state and federal standards.

### 1.2 Document Organization

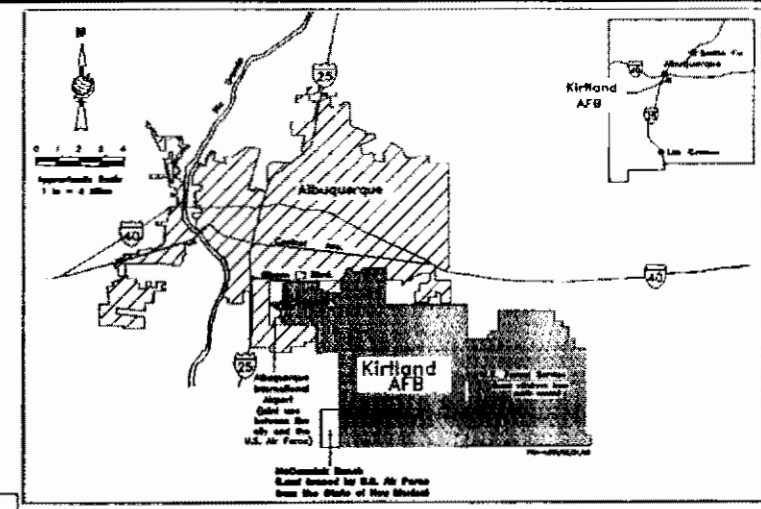
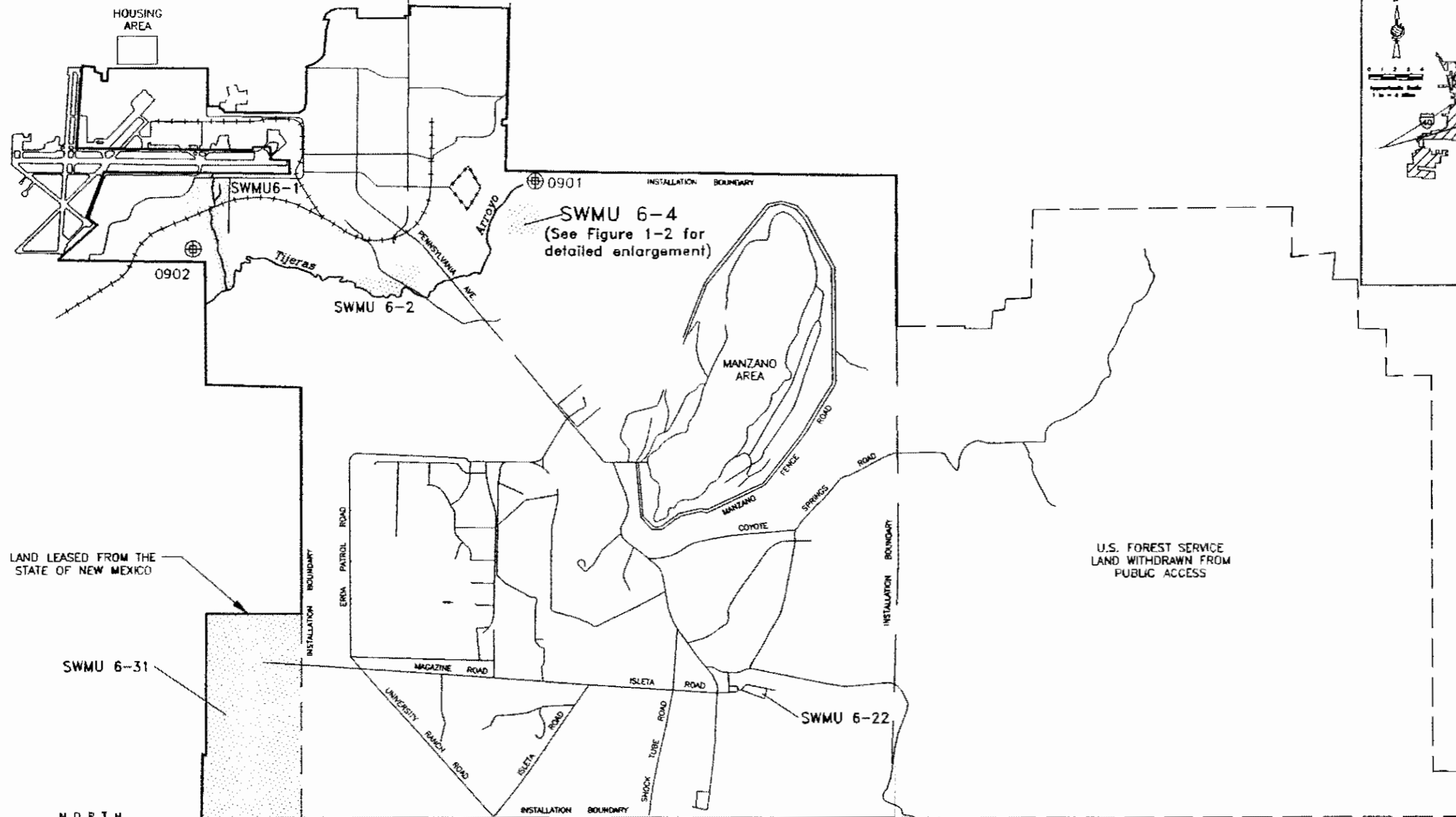
The scope of work performed at Landfills 4, 5, and 6 site is briefly discussed in this report. The LTM was performed in accordance with the "*Kirtland Air Force Base Final Long-Term Groundwater Monitoring Plan*" (USAF, 1996c) which contains project-specific information and procedures. The LTM Plan also

incorporates by reference detailed explanations and protocols from the "Kirtland Air Force Base Base-Wide Plans for Investigations Under the Installation Restoration Program" (USAF, 1996d).

Specific variances in the original sampling plans due to field conditions or other factors are identified in Sections 2.0, 3.0, and 5.0 of this report.

The LTM Report for the July 1996 out-of-cycle event includes discussions of results from the groundwater monitoring and sampling conducted. This report is organized as follows:

Section 1	Introduction
Section 2	Sampling Procedures
Section 3	Long-Term Monitoring Results
Section 4	Investigation Derived Waste (IDW) Management Procedures
Section 5	Quality Assurance/Quality Control (QA/QC) Summary
Section 6	References

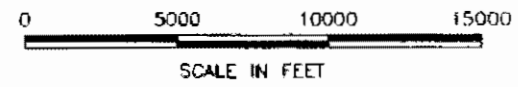
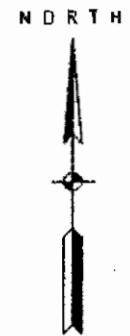


- SITES**
- SWMU 5-1 LANDFILL 1
  - SWMU 6-2 LANDFILL 2
  - SWMU 6-4 LANDFILL 4,5,6
  - SWMU 6-31 MCCORMICK RANCH/RANGE
  - SWMU 6-22 LAKE CHRISTIAN

U.S. FOREST SERVICE  
LAND WITHDRAWN FROM  
PUBLIC ACCESS

**LEGEND**

- KIRTLAND AFB PROPERTY BOUNDARY
- - - - - PROPERTY LEASED BY KIRTLAND AFB OR USED THROUGH OTHER AGREEMENT
- ⊕ USGS MONITORING WELL



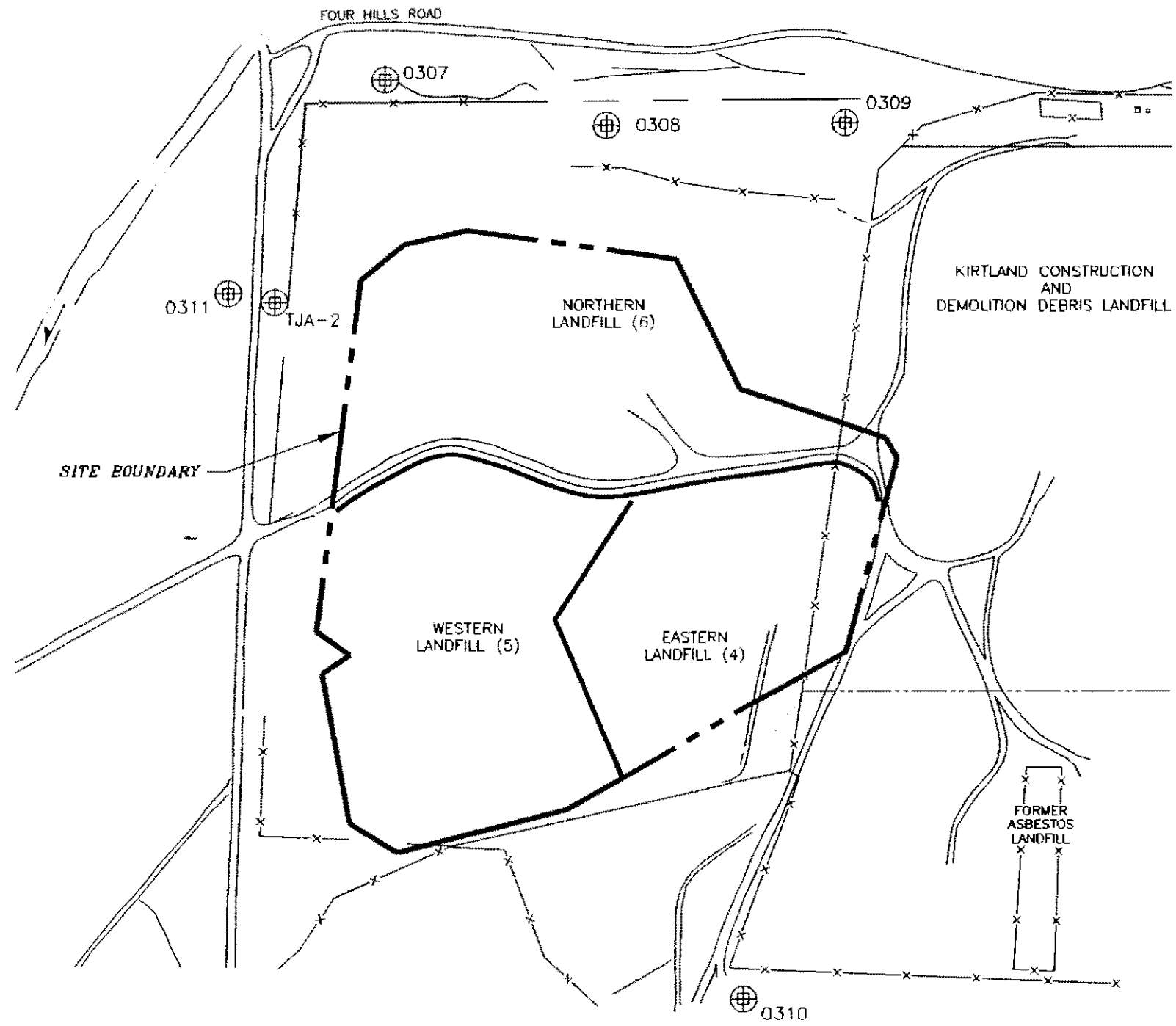
**FIGURE 1-1 SITE LOCATION MAP**

SLMDOC.DWG (10/22/96)

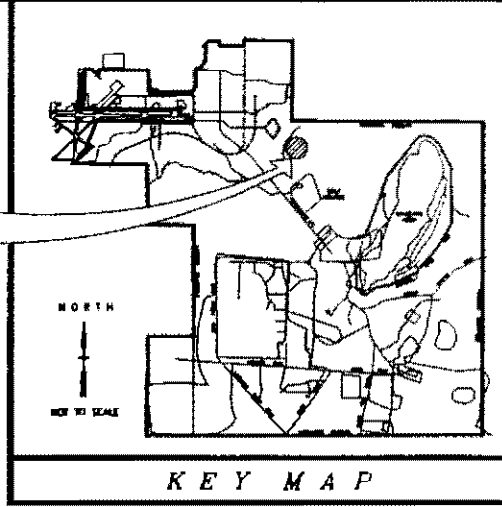


**NOTES**

1. BASE MAP COMPILED FROM THE FOLLOWING SOURCES:
  - A) DRAFT APPENDIX I RFI WORK PLAN
  - B) USAF RFI STAGE 2A, VOL. 1



SITE LOCATION



**LEGEND**

- x-x- FENCE
- ⊕ USGS MONITORING WELL
- + + RAILROAD

SMDDC.DWG (10/22/96)

**Figure 1-2 Site Map of SWMU 6-4, Landfills 4,5, AND 6 (LF-08)**

## 2. SAMPLING PROCEDURES

### 2.1 Project Summary

Groundwater monitoring and sampling of Landfills 4, 5, and 6 for the out-of-cycle LTM event were conducted from July 8-11, 1996. Specific procedures followed for the LTM Program were detailed in Section 2.0 of the LTM Plan and appropriate standard operating procedures (SOPs) contained in Appendix A of the Field Sampling Plan (FSP) of the Base-Wide Data Collection Quality Assurance Plan (DCQAP) (USAF, 1996c). The July 1996 monitoring and sampling episode of the LTM Program generally followed the outlined procedures. Noted variances or exceptions to the procedures encountered during the field activities are described in the following subsections.

### 2.2 Field Equipment Calibration and Measurements

Calibration of field equipment used during the LTM Program was conducted in accordance with the procedures described in Section 2.1 of the LTM Plan and in the Quality Assurance Project Plan (QAPP) of the Base-Wide DCQAP. Equipment calibration logs were maintained for each instrument and are provided in Appendix A. No variances from the outlined procedures were encountered during equipment calibration.

In accordance with the LTM Plan, several field measurements were collected during the monitoring well sampling. They included:

- Photoionization detector (PID) readings at the wellhead, and explosimeter and percent oxygen readings inside the well upon opening the well cap. These measurements were recorded in the project field log book;
- Static water level prior to purging. These measurements are included on the well gauging form in Appendix B. Total depth of the wells was not measured prior to purging at the request of the Kirtland AFB project manager in order to limit turbidity. Previous total depth measurements recorded during installation of the dedicated sampling pumps were used for purging calculations instead;
- Temperature, pH, specific conductance, and turbidity during purging. These data are included in Appendix B; and
- Water level recovery during and following purging.

To prevent any potential cross-contamination and to protect the integrity of the samples, the pH of preserved samples was not measured in the field.

### 2.3 Water-Level Measurements

Groundwater level measurements were obtained with an electronic water level indicator following the procedures detailed in the LTM Plan in Section 2.2 and in SOP A-3.6 of the Base-Wide DCQAP. Water level measurements were collected at each well prior to conducting the sampling activities. A well gauging data form containing the measurements is included in Appendix B. All water-level measurements for the site were collected on the same day.

## 2.4 Well Purging

Each monitoring well sampled was purged of stagnant water within the well using dedicated submersible piston sampling pumps (Bennett Sample Pump, Model No. 1800). Well purging was conducted in general accordance with the protocols established in Section 2.3 of the LTM Plan, SOP A1.2 of the Base-Wide FSP, and the Groundwater Monitoring System Plan, amended October 2, 1995. Compressed nitrogen was used to operate the pumps. All wells had a minimum of one saturated casing volume removed and were purged to stabilization of field parameters of pH, temperature, conductivity, and turbidity. Well purging records are included in Appendix B as part of the Water Quality Field Data Sheets.

Variances to the outlined procedures include:

- A sample was collected from well KAFB-0308 after purging one casing volume, but before the temperature and conductivity values were within 1 degree Celsius and 5%, respectively. The temperature changes were 3.7 degrees Celsius and the conductivity values were within 7.2% between the last four consecutive readings. However, both the pH and turbidity consecutive readings were within 0.1 units and less than 20 nephelometric turbidity units (NTUs), respectively. Conductivity readings for purge water from wells KAFB-0309 and 0310 were also within 6% and 9%, respectively. These variations were due to sampler error and will be corrected for future LTM events.
- Purging and sampling of Sandia National Laboratories (SNL) well TJA-2 were coordinated with onsite SNL personnel. This well was purged and sampled using the existing SNL dedicated pump in the well. The well was sampled in accordance with SNL's SOP for micro-purge groundwater sampling which is based on purging two delivery tube volumes and subsequent stabilization of groundwater parameters. Purging of this well in accordance with the SNL SOP was approved by Mr. Mark Holmes of Kirtland AFB.

## 2.5 Groundwater Sample Collection

All groundwater sampling procedures detailed in Section 2.4 of the LTM Plan were followed during the July 1996 LTM sampling episode. Samples were collected in order of highest to lowest volatility, with samples collected for volatile organic analysis first and metals last.

## 2.6 Sample Handling and Documentation

Sample handling and documentation procedures for the project were conducted in general accordance with the procedures detailed in the LTM Plan and the Base-Wide QAPP. Documentation used for the July 1996 LTM sampling event included the field notebook, instrument calibration logs, well gauging forms, monitoring well purging and sample collection logs, chain-of-custody (COC) forms, sample labels, log forms, and daily quality control reports (DQCR).

As required for the LTM Program, original COC documentation was prepared for each shipping container and the samples were shipped to NEI/GTEL Environmental Laboratories, Inc. (NEI/GTEL), in Wichita, Kansas. Because of the short holding time for coliform analysis, samples were hand-delivered to Assaigai Analytical Laboratories in Albuquerque, New Mexico for analysis.

## 2.7 Sample Containers

As identified in the LTM Plan, samples for each specific class of analytes were collected in containers and preserved as required by the analytical method. Details concerning these requirements are summarized in Table 2-1 of the LTM Plan and Tables 5-1 and 5-2 of the Base-Wide QAPP. These procedures were provided to the field personnel and were followed during the July 1996 event of the LTM Program.

## 2.8 Sample Numbering System

The existing well identifiers were used for the wells involved with the LTM Program. The sample numbering system followed during the July 1996 event of the LTM Program is detailed in Section 2.7 of the LTM Plan. The laboratory used the same sample designation when reporting the results.

Variances to the sample designation system included the inconsistent use of sampling event codes or identifiers for some samples. The designation "OC" for out-of-cycle event was used on some sample names and omitted from others, due to sampler error. In all cases, the last two digits of the sample identification indicate that the sample is either the primary sample (01) or the duplicate sample (02).

Additionally, trip blanks (TB) for volatile organic compound (VOC) analysis accompanied each shipment of samples and one field (ambient condition) blank (FB) was collected per day for VOC analysis (see Section 5.3). Trip and field blank identifiers were numbered consecutively so that the last two-digit code was listed in ascending numerical order (i.e., LF08-TB-OC-01, LF08-TB-OC-02, etc.).

Analytical data will be compiled in the Installation Restoration Program Information Management System (IRPIMS) format as required in the scope of work (SOW) and in accordance with the LTM Plan. Because the sample designations are limited to 10 characters for the IRPIMS format, an abbreviated sample identifier will be used for future LTM events. Sample designations will consist of the four-character site name (e.g., LF08, OT28, etc.), followed by the four-digit well identifier (e.g., 0307, 1005, etc.), and two-digit identifier (01 for original sample, 02 for field duplicate, and 03 for Missouri River Division [MRD] laboratory duplicate). Trip and field blank samples will be numbered consecutively (e.g., KAFBTB01, KAFBTB02, etc.). For the July 1996 LTM event, a key is provided in Appendix C which lists the sample designations as stated on the COCs and laboratory reports and cross-references the IRPIMS sample designations.

## 2.9 Sample Packaging and Shipping

All sample handling and shipping procedures detailed in the LTM Plan and referenced in the Base-Wide FSP (Section 7.1) were followed.

## 2.10 Equipment Decontamination

Dedicated sampling equipment was installed in all wells in the LTM Program. All sample and field monitoring equipment decontamination procedures detailed in SOP A2.1 of the FSP of the Base-Wide DCQAP were followed.

### 3. LONG-TERM MONITORING RESULTS

This section describes the monitoring program followed at Landfills 4, 5, and 6 for the out-of-cycle LTM event at Kirtland AFB and presents the analytical results. Because historical analytical data is several years old, the first year of sampling to be conducted in 1996-1997 will be used as the baseline analytical data for the site. For discussion purposes, the baseline analytical data in this report have been compared to applicable NMSWMR health-based groundwater standards (20 NMAC 9.1). For gross alpha and beta radioactivity where NMSWMR standards are not established, maximum contaminant levels (MCLs) from the federal Safe Drinking Water Act (SDWA) were used. The summary table lists the standard used and highlights values which exceeded the corresponding standard.

Groundwater samples collected during the LTM Program were analyzed by NEI/GTEL in Wichita, Kansas. The NEI/GTEL laboratory subcontracted Assagai Analytical Laboratories (Albuquerque, NM) for coliform bacteria analyses, Southwest Laboratory of Oklahoma, Inc. (Broken Arrow, OK), for explosives analysis, and ThermoNUtech (Richmond, CA) for radiological analyses (gross alpha/beta, radium, and uranium).

#### 3.1 Long-Term Groundwater Monitoring

As described in the LTM Plan, the LTM Program for Landfills 4, 5, and 6 consisted of gauging and sampling of all six groundwater monitoring wells (KAFB-0307 through KAFB-0311 and TJA-2) at the site. All wells were operable and accessible for LTM.

The LTM Program at Landfills 4, 5, and 6 is summarized in Table 3-1. The wells were analyzed for the parameters shown in Table 4-2 of the LTM Plan which adheres to the requirements for groundwater monitoring in Table 1 of Appendix A of 20 NMAC 9.1. The parameter list in Table 4-2 includes:

- General Water Chemistry Parameters (temperature, pH, specific conductance, total dissolved solids (TDS), total organic carbon (TOC), total Kjeldahl nitrogen, nitrate + nitrite, total nitrogen, ammonia, bicarbonate, carbonate, chloride, cyanide, fluoride, phenols, potassium, sodium, and sulfate)
- Total metals (aluminum, antimony, barium, beryllium, boron, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, molybdenum, nickel, selenium, silver, thallium, uranium, vanadium, and zinc)
- Polynuclear aromatic hydrocarbons (PAHs)
- VOCs
- Polychlorinated biphenyls (PCBs)
- Radium-226/radium-228

In addition, groundwater samples were analyzed for the following parameters from Table 4-1 of the LTM Plan for consistency with the other LTM programs:

- Pesticides (endrin, lindane, methoxychlor, toxaphene)
- Herbicides (2,4-D, 2,4,5-TP Silvex)
- Gross alpha and gross beta radioactivity
- Coliform bacteria.

In addition to the QA/QC samples discussed in Section 2.10 of the LTM Plan, three ambient condition blanks were collected during the monitoring event (one per day of sampling) and analyzed for VOCs. The ambient condition blanks were collected in the field by pouring reagent-grade water into sample containers under field conditions.

Table 3-1. Summary of LTM Program at SWMU 6-4, Landfills 4, 5, and 6 (LF-08)

Wells to Be Sampled	Wells Sampled	Analytes	
0307 0308 0309 0310 0311 TJA-2	0307 0308 0309 0310 0311 TJA-2	<i>Table 4-1 of Section 4.0 of LTM Plan</i> <ul style="list-style-type: none"> <li>● Pesticides</li> <li>● Herbicides</li> <li>● Gross alpha and gross beta radioactivity</li> <li>● Coliform bacteria</li> </ul>	<i>Table 4-2 of Section 4.0 of LTM Plan</i> <ul style="list-style-type: none"> <li>● General Water Chemistry</li> <li>● Metals (total)</li> <li>● PAHs</li> <li>● VOCs</li> <li>● PCBs</li> <li>● Radium 226/228</li> </ul>

### 3.2 Groundwater Monitoring Results

Depth-to-water at Landfills 4, 5, and 6 ranged from 365.92 to 489.94 feet (ft) below top of well casing, as measured in all wells except TJA-2. Depth-to-water in TJA-2, completed in a perched aquifer, was 274.23 ft. The depth-to-water measurements were converted to groundwater elevations relative to mean sea level (MSL) (Appendix B). A groundwater elevation map was prepared using the July 1996 elevation data and the May 1996 survey data measured by Harris Surveying, Inc., of Albuquerque, NM (Figure 3-1). Groundwater contours were not drawn due to apparently anomalous data recorded for well KAFB-0307 and the occlusion of the screened interval in several of the wells. The groundwater elevation in KAFB-0307 was 13.4 ft higher than in the next nearest well, KAFB-0308, located approximately 350 ft to the southeast. This is consistent with May 1996 data in which there was a groundwater elevation difference of 20.4 ft between these two wells (USAF, 1996b). The apparent groundwater mound in the vicinity of KAFB-0307 may be due to recharge from the Tijeras Arroyo. Additionally, the water table was above the top of the screen in all wells except 0307 when gauged in both May and July 1996. Review of the map shows that groundwater flows from the northwest and the southeast toward the center of the site. This groundwater flow direction is inconsistent with previous monitoring conducted in September 1992, which indicated northwestward flow (USAF, 1993), and with 1960 regional data which indicated westward groundwater flow.

### 3.3 Groundwater Sampling Results

Groundwater analytical results are summarized in Table 3-2. The laboratory reports are provided in Appendix C.

No volatile or semi-volatile organic compounds were detected in any of the monitoring wells sampled (KAFB-0307, -0308, -0309, -0310, -0311, and TJA-2). Additionally, no VOCs were detected in the ambient condition field blanks (LF08-FB-OC-01, LF08-FB-OC-03, and LF08-FB-OC-02).

Several metals were detected in the wells at Landfills 4, 5, and 6. Metals detected in all wells sampled included calcium (56,000-120,000 micrograms per liter [ $\mu\text{g/l}$ ]), magnesium (10,000-22,000  $\mu\text{g/l}$ ), and sodium (20,000-28,000  $\mu\text{g/l}$ ). Aluminum was detected in two wells (KAFB-0309 and KAFB-0311) at levels of 230 and 210  $\mu\text{g/l}$ , respectively. Cadmium was detected in KAFB-0311 at 6.1  $\mu\text{g/l}$ . Chromium was

detected in KAFB-0310 at a concentration of 330 µg/l. Iron was detected in wells KAFB-0309 through 0311 at levels of 130-1,700 µg/l. Lead was detected in four wells (KAFB-0308, -0310, -0311, and TJA-2) at levels ranging from 9.7 to 21 µg/l. Well KAFB-0310 also yielded concentrations of manganese (16 µg/l), nickel (41 µg/l), and selenium (13 µg/l).

Other inorganic parameters detected in all the wells included bicarbonate alkalinity (100-140 milligrams per liter [mg/l]), chloride (12-160 mg/l), fluoride (0.32-0.42 mg/l), nitrate-nitrite-N (4.1-7.8 mg/l), sulfate (32-130 mg/l), TDS (54-650 mg/l), and total nitrogen (4.4-7.8 mg/l). Well KAFB-0310 also contained total Kjeldahl nitrogen at a concentration of 0.32 mg/l. No phenols or TOC were detected in any of the wells. Field measurements of pH and specific conductance for all wells ranged from 7.51 to 7.87 and from 471 to 882 micromhos per centimeter (µmhos/cm), respectively. Temperature ranged from 64.2 to 72.8 degrees Fahrenheit. Turbidity values ranged from 0.08 to 8.8 NTU.

No pesticides, PCBs or chlorinated herbicides were detected in any of the wells. Total and fecal coliforms were detected in one well, KAFB-0309, at a level too numerous to count (TNTC). This may be due to contamination during sample collection or handling, or from sewage waste disposed in the landfill, faulty seals of wells allowing surface infiltration, animal feces or fertilizers.

The samples were also analyzed for radiological parameters. Gross alpha radioactivity was detected in the samples from all wells at levels ranging from 1.0 to 2.2 picocuries per liter (pCi/L), while gross beta activities ranged from 2.1 to 3.2 pCi/L. Radium -226 and radium -228 activities for all wells ranged from -0.54 to 0.27 and -0.17 to 0.33 pCi/L, respectively. Total uranium activities for all wells ranged from 1.4 to 2.2 pCi/L.

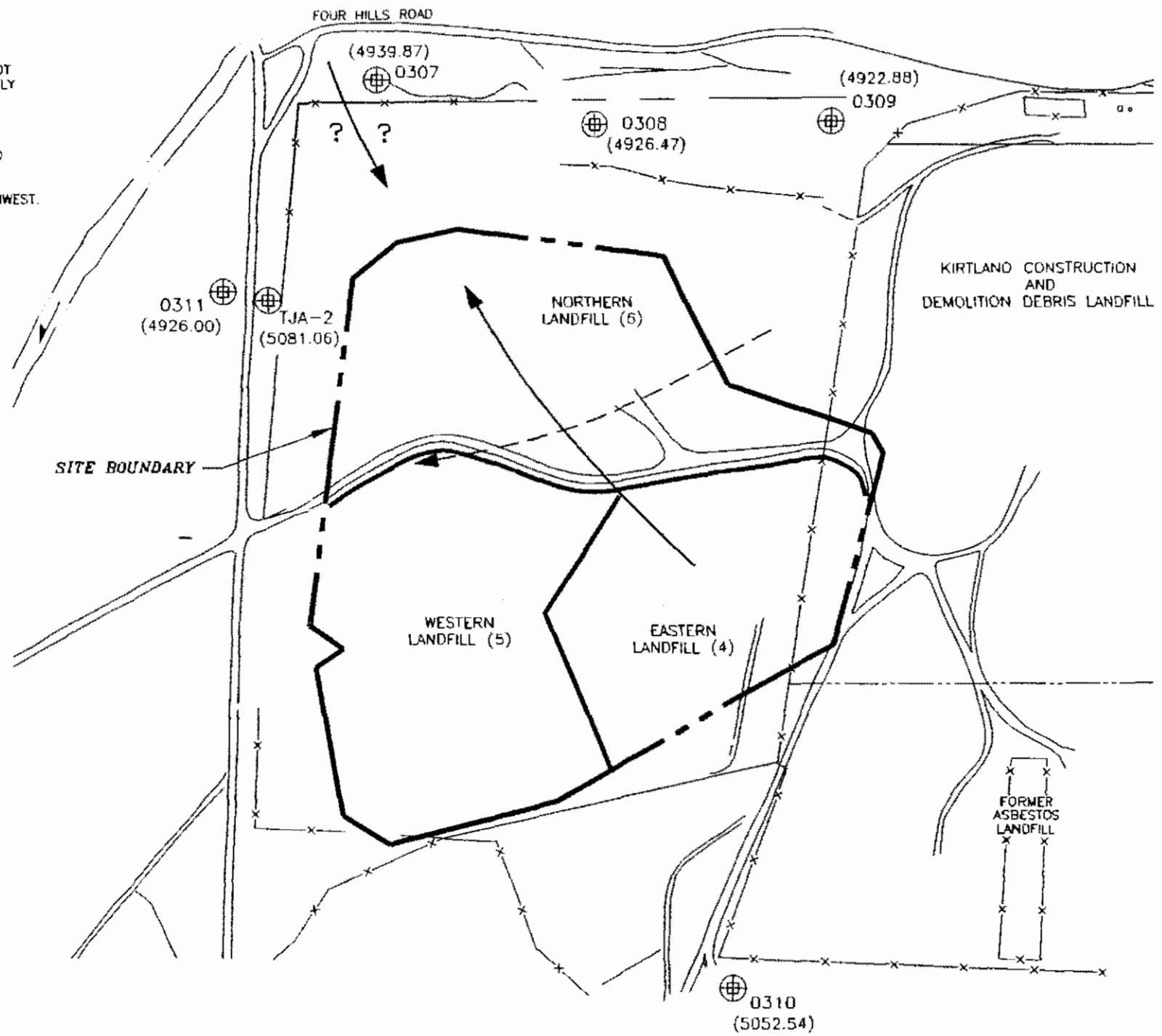
All detected concentrations for this site are below applicable NMSWMR health-based groundwater standards, with the exception of two metals detected in well KAFB-0310 and one metal detected in KAFB-0311. Total chromium (330 µg/l) and selenium (13 µg/l) concentrations in well KAFB-0310 exceed the NMSWMR health-based standards for these two metals of 50 µg/l and 10 µg/l, respectively. Total cadmium (6.1 µg/l) in well KAFB-0311 exceed the NMSWMR health-based standard of 5 µg/l. Concentrations of iron (1,700 µg/l) and TDS (650 mg/l) in well KAFB-0310 also exceeded the NMSWMR aesthetic groundwater standards for these compounds of 300 µg/l and 500 mg/l, respectively.

### 3.4 Recommendations

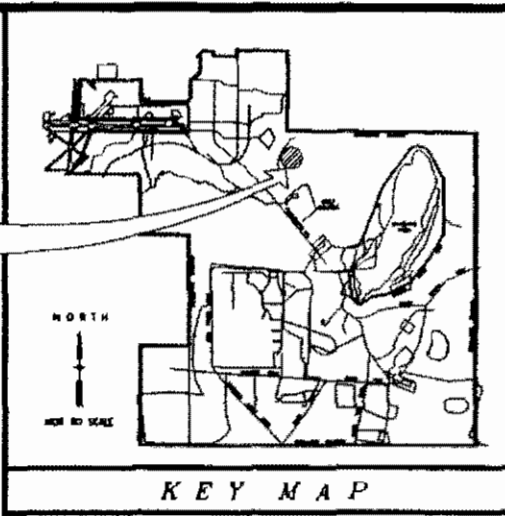
The first year of LTM sampling analytical results are the baseline values for evaluating future sampling data. No formal modifications to the LTM Plan for Landfills 4, 5, and 6 are proposed at this time.

**NOTES**

1. BASE MAP COMPILED FROM THE FOLLOWING SOURCES:  
 A) DRAFT APPENDIX I RFI WORK PLAN  
 B) USAF RFI STAGE 2A, VOL. 1
2. THE TOP OF SCREEN IS BELOW THE WATER TABLE IN ALL WELLS, EXCEPT 0307.
3. GROUNDWATER ELEVATION CONTOURS HAVE NOT BEEN CONSTRUCTED DUE TO THE ANOMALOUSLY HIGH WATER LEVEL MEASURED IN WELL 0307.
4. THE ARROW INDICATING THE SOUTHWARD GROUNDWATER FLOW DIRECTION IS ANNOTATED WITH A "?" INDICATING THE UNCERTAINTY OF THIS DATA. HISTORICALLY, GROUNDWATER FLOW AT THIS SITE HAS BEEN TO THE NORTHWEST.

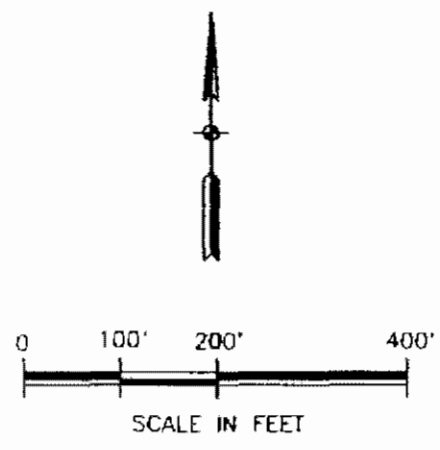


SITE LOCATION



**LEGEND**

- x-x- FENCE
- ⊕ USGS MONITORING WELL
- + + RAILROAD
- (4922.88) GROUNDWATER ELEVATION (JULY 8, 1996)
- ← REGIONAL GROUNDWATER FLOW DIRECTION (1960)
- ← REGIONAL GROUNDWATER FLOW DIRECTION (JULY 8, 1996)



**Figure 3-1 Groundwater Elevation Map For SWMU 6-4, Landfills 4,5, AND 6 (LF-08)**

00C.DWG (10/22/96)



Table 3-2. Summary of Groundwater Analytical Results at SWMU 6-4, Landfills 4, 5, and 6 (LF-08), July 1996

Analytes	NMSWMR Standard	KAFB-0307	KAFB-0308	KAFB-0309	KAFB-0310	KAFB-0311	TJA-2
<b>Volatile Organic Compounds - EPA Method 8260 (µg/l)</b>							
All Constituents	various	<RL	<RL	<RL	<RL	<RL	<RL
<b>Semi-Volatile Organics - EPA Method 8270 (µg/l)</b>							
All Constituents	various	<RL	<RL	<RL	<RL	<RL	<RL
<b>Total Metals - EPA Methods 6010A &amp; 7000-series (µg/l)</b>							
Aluminum	5,000	<200	<200	230	<200	210	<200
Cadmium	5	<0.40	<0.40	<0.40	<0.40	6.1	<0.40
Calcium	NE	57,000	58,000	64,000	120,000	79,000	56,000
Chromium	50	<30	<30	<30	330	<30	<30
Iron	300	<100	<100	230	1,700	130	<100
Lead	50	<4.0	21	<4.0	9.7	17	16
Magnesium	NE	11,000	10,000	11,000	22,000	12,000	10,000
Manganese	50	<15	<15	<15	16	<15	<15
Nickel	100	<40	<40	<40	41	<40	<40
Selenium	10	<10	<10	<10	13	<10	<10
Sodium	NE	20,000	21,000	22,000	28,000	22,000	21,000

Table 3-2. Summary of Groundwater Analytical Results at SWMU 6-4, Landfills 4, 5, 6 (LF-08), July 1996 (Continued)

Analytes	NMSWMR Standard	KAFB-0307	KAFB-0308	KAFB-0309	KAFB-0310	KAFB-0311	TJA-2
<b>Inorganics - EPA Methods 160.1, 300-series, and 400-series (mg/l)</b>							
Bicarbonate-Alkalinity	NE	140	140	140	100	110	140
Chloride	250	21	13	12	160	17	73
Fluoride	1.6	0.41	0.42	0.40	0.32	0.42	0.32
Nitrate-Nitrite-N	10	7.7	4.8	4.7	4.1	7.8	5.9
Sulfate	250	37	66	77	130	32	72
TDS	500	280	310	54	650	410	290
Total Kjeldahl Nitrogen	NE	<0.1	<0.1	<0.1	0.32	<0.1	<0.1
Total Nitrogen	10	7.7	4.8	4.7	4.4	7.8	5.9
<b>Field Measurements</b>							
pH	6.5-8.5	7.75	7.85	7.87	7.51	7.73	7.70
Specific Conductance (µmhos/cm)	NE	471	482	515	882	477	607
Temperature °F	NE	64.2	72.1	72.8	71.3	67.7	72.1
Turbidity (NTU)	NE	4.3	0.2	0.08	8.8	0.73	0.84

Table 3-2. Summary of Groundwater Analytical Results at SWMU 6-4, Landfills 4, 5, and 6 (LF-08), July 1996 (Concluded)

Analytes	NMSWMR Standard	KAFB-0307	KAFB-0308	KAFB-0309	KAFB-0310	KAFB-0311	TJA-2
<b>Organochlorine Pesticides, PCBs, and Chlorinated Herbicides - EPA Methods 8081 and 8151 (µg/l)</b>							
All Constituents	NE	<RL	<RL	<RL	<RL	<RL	<RL
<b>Total Coliform - SM 9222E (Colonies/100 ml)</b>							
Total Coliform	NE	Absent	Absent	TNTC	Absent	Absent	Absent
Fecal Coliform	NE	Absent	Absent	TNTC	Absent	Absent	Absent
<b>Radiological Parameters - EPA Methods 900.0, 904.0 and ASTM D-5174-91 (pCi/L)</b>							
Gross Alpha	15 <sup>(1)</sup>	1.7	1.9	1.9	2.2	1.3	1.0
Gross Beta	4 mrem/yr <sup>(1)</sup>	2.6	3.0	2.2	3.2	2.7	2.1
Radium -226	combined 5.0	0.15	-0.54	-0.28	0.084	0.27	-0.35
Radium -228		-0.056	0.20	0.054	-0.083	0.33	-0.17
Total Uranium	3,436 <sup>(2)</sup>	2.2	2.1	1.8	1.7	2.1	1.4

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**FOOTNOTES**

1	Only detected constituents for metals and inorganics are presented in the table.
2	Shaded/bolded values indicate concentration exceeded the corresponding NMSWMR standard.
(1)	Standard is Maximum Contaminant Level from federal Safe Drinking Water Act
(2)	Conversion for uranium standard in ug/L to pCi/L using 0.6872 multiplier
<	Indicated compound not detected at the stated reporting limit.
°F	Degrees Fahrenheit
mg/l	Milligrams per liter
ml	Milliliters
mrem/yr	Millirems per year
N	Nitrogen
NE	Not established
NMSWMR	New Mexico Solid Waste Management Regulation
NTU	Nephelometric turbidity unit
PCBs	Polychlorinated biphenyls
pCi/L	Picocuries per liter
RL	Reporting limit
TDS	Total dissolved solids
TNTC	Too numerous to count
µg/l	Micrograms per liter
µmhos/cm	Micromhos per centimeter

## 4. INVESTIGATION DERIVED WASTE (IDW) MANAGEMENT PROCEDURES

### 4.1 Introduction

The procedures defined in the LTM Plan for handling IDW generated during the field activities were generally followed. Based on the data collected during previous investigations, the IDW generated during the 1996 LTM Program was not anticipated to be hazardous.

### 4.2 Waste Characterization

The IDW generated during the LTM consisted of purge water from each well, personal protection equipment (PPE), paper towels, and soapy decontamination water. Waste minimization techniques (including the use of dedicated sampling pumps) were employed where possible to reduce the quantity of IDW generated. Waste characterization was primarily based on comparison of the field analytical data with applicable regulatory levels. No direct sampling of IDW for waste characterization was conducted.

### 4.3 Management of Purged Water and Decontamination Water

Purge and decontamination waters were the primary waste generated during the LTM. The water from the July 1996 out-of-cycle event was combined with the purge water from the May 1996 LTM event and placed in permanently mounted, 175-gallon, polyethylene storage tanks located adjacent to each well head. A sign was posted on each tank indicating the contents and that no material should be added or removed. Purge water was stored in the tanks pending waste characterization. Waste characterization was performed by reviewing the groundwater sample analytical results for all sites. Any detected constituents were compared to Toxicity Standards (40 CFR 261.24, Table 1) and New Mexico Water Quality Control Commission Regulations (NMWQCCR), Part 2, 3103, A, B, and C groundwater quality standards. No analytical results were greater than the listed standards in 40 CFR. For the May 1996 LTM event, the following wells yielded analytical results exceeding those listed in NMWQCCR, Part 2, 3103: Well KAFB-0310 at Landfills 4, 5, and 6 (1,200 µg/l chromium, 6,400 µg/l iron) and well KAFB-1903 at Lake Christian (OT-46) (11,000 µg/l iron, 1.8 mg/l fluoride). For the July 1996 LTM event at Landfills 4, 5, and 6, the following well yielded analytical results exceeding those listed in NMWQCCR, Part 2, 3103: Well KAFB-0310 (330 µg/l chromium, 1,700 µg/l iron).

A Notice of Intent (NOI) to discharge the purge water onto the ground surface was prepared and submitted by Kirtland AFB (June 18, 1996) to the NMED. The NMED's approval was received in correspondence dated August 12, 1996. Permission to discharge the purge water from wells KAFB-0310 and KAFB-1903 which exceeded some NMWQCCR standards was requested and granted by the NMED on August 13, 1996. Purge water from all wells from the May and July 1996 sampling events was discharged to the ground prior to sampling for the second quarter of the LTM Program, beginning on August 19, 1996. A letter confirming this approval will be forwarded to the NMED by Kirtland AFB.

### 4.4 Personal Protective Equipment and Sampling Equipment

All PPE and disposable sampling equipment were placed in double plastic trash bags and sealed. These items were disposed of in dumpsters at Kirtland AFB as specified in the LTM Plan.

## 5. QUALITY ASSURANCE/QUALITY CONTROL (QA/QC) SUMMARY

### 5.1 QA/QC Sampling Requirements

In accordance with the field QA/QC program presented in Section 2.10 of the LTM Plan and in accordance with the Base-Wide FSP (Section 8.0), the following QA/QC sampling is to be conducted for each groundwater event under the LTM Program:

- Trip Blank - One trip blank to accompany every cooler of aqueous samples sent to the laboratory for the analysis of VOCs only.
- Temperature Blank - One temperature blank to be placed in the middle portion of every cooler shipped containing samples which are temperature sensitive. The purpose of this blank is to verify the cooler temperature.
- Duplicate - Ten percent of all water samples will be field duplicates. Samples and their respective duplicates will be analyzed for the same parameters in the laboratory.
- QA Duplicates - In addition to field QC samples, 10 percent of all field samples will be collected as QA duplicates and submitted to the United States Army Corps of Engineers (USACE) MRD laboratory for analysis.

For the July 1996 LTM sampling event, samples were sent to the MRD laboratory with the reference project Location Information Management System (LIMS) Number of 2899.

The above QA/QC sampling protocol was generally followed during the July 1996 LTM event with the following variances. These variances were approved by the Kirtland AFB Project Manager:

- Each total shipment of samples sent to the laboratory for VOC analysis contained a trip blank sample which was analyzed for VOCs. However, not every cooler containing VOC samples contained a trip blank. Trip blanks will be shipped with every cooler containing VOC samples for all future LTM events.

### 5.2 Duplicate Groundwater Sample Results

One duplicate groundwater sample was collected from Landfills 4, 5, and 6 and analyzed for all proposed analytes. The duplicate sample location (well KAFB-0307) was selected in advance of the event, based on the location most likely to have contamination. This well was believed to be the most hydraulically downgradient well. A comparison of the duplicate groundwater sample results with the original sample results is summarized in Table 5-1. Laboratory analytical reports are provided in Appendix C.

Groundwater samples were collected following the procedures detailed in the FSP. The analytical results for the primary and duplicate field sample were consistent for VOCs, semi-volatile organic compounds (SVOCs), pesticides, PCBs, and herbicides, since none of these constituents were detected in any of the samples. The relative percent differences (RPDs) for the metal samples ranged from 0 to 6.8%, and from 0 to 5.6% for the inorganic parameters. The absence of total coliform was replicated in the duplicate sample. For radiological parameters, the RPD between the primary and duplicate samples ranged from 0 to 3.8%. For all

compounds, a RPD was not calculated if either the primary or the duplicate sample (or both) had a result below the reporting limit (RL), or the minimum detectable activity (MDA) for radioactivity. The duplicate sample results are within acceptable limits.

### 5.3 Trip Blank and Temperature Blank Results

Trip blanks were analyzed for each shipment of samples submitted for VOC analysis (total of four trip blanks). Laboratory analytical reports are provided in Appendix C. No VOCs were detected above the applicable detection limits in any of the blanks (Table 5-2). Shipping cooler temperatures for all shipments upon receipt at the laboratory were 1 degree Celsius for all coolers, with the exception of one cooler at 2 degrees and one cooler at 4 degrees Celsius.

### 5.4 Laboratory QA/QC

In accordance with the LTM Plan, a detailed discussion of the laboratory QA/QC (summary of laboratory analytical methods, method detection limits [MDLs], QC activities, conformance/nonconformance summaries, summary of any deviations, and summary of the evaluation of the data quality for each analysis and matrix) is not presented herein, but will be included in the annual monitoring report.

A cursory review of the laboratory QA/QC data for the July 1996 LTM sampling event was conducted, however, to flag any potential problems or concerns that may effect future LTM events. The following notations are made:

- No groundwater sample analytical holding times were exceeded.
- The required reporting limits (RLs) were not met for the following compounds: dibromochloropropane, 1,2-dibromoethane, thallium, and mercury. However, the laboratory reported down to the MDL, flagging any values detected below the practical quantitation limit (PQL). These variances were approved by the USACE project chemist.
- The following analytical methods reported for the July 1996 LTM event were variances from the LTM Plan. These variances were approved by the USACE project chemist prior to the first sampling event:

<u>Analysis</u>	<u>Proposed Method</u>	<u>Actual Method</u>
Total Kjeldahl Nitrogen	EPA 351.3	EPA 351.2
Nitrate-Nitrite-N	EPA 353.2	EPA 353.1
Ammonia	EPA 350.3	EPA 350.1
Chloride	EPA 325.3	EPA 325.2

### 5.5 Daily Reports

The DQCRs which summarized the activities conducted on site were prepared by the field team leader. The reports describe the activities conducted during the work day and include problems encountered and any deviations. Copies of the DQCRs are presented in Appendix A.

Table 5-1. Comparison of Duplicate Groundwater Sample Results

Analytes	LF08-GW-0307-01 LF08-GW-0307-02	RPD (%)
<b>Volatile Organic Compounds - EPA Method 8260 (µg/l)</b>		
All Constituents	<RL/<RL	NA
<b>Semi-Volatile Organics - EPA Method 8270 (µg/l)</b>		
All Constituents	<RL/<RL	NA
<b>Metals - EPA Methods 6010A &amp; 7000-series (µg/l)</b>		
Cadmium	<0.40/0.58	NA
Calcium	57,000/61,000	6.8
Lead	<4.0/4.3	NA
Magnesium	11,000/11,000	0
Sodium	20,000/21,000	4.9
<b>Inorganics - EPA Methods 160.1, 300-series, and 400-series (mg/l)</b>		
Bicarbonate-Alkalinity	140/140	0
Chloride	21/21	0
Fluoride	0.41/0.41	0
Nitrate-Nitrite-N	7.7/8.1	5.1
Sulfate	37/35	5.6
TDS	280/270	3.6
Total Nitrogen	7.7/8.1	5.1
<b>Organochlorine Pesticides, PCBs, and Chlorinated Herbicides - EPA Methods 8081 and 8151 (µg/l)</b>		
All Pesticide Constituents	<RL/<RL	NA
All PCB Constituents	<RL/<RL	NA
All Herbicide Constituents	<RL/<RL	NA



Table 5-1. Comparison of Duplicate Groundwater Sample Results (Concluded)

Analytes	LF08-GW-0307-01 LF08-GW-0307-02	RPD (%)
<b>Total Coliform - SM 9222E (Colonies/100 ml)</b>		
Total Coliform	Absent/Absent	NA
Fecal Coliform	Absent/Absent	NA
<b>Radiological Parameters - EPA Methods 900.0, 904.0, and ASTM D-5174-91 (pCi/L)</b>		
Gross Alpha	1.7/3.1	NA
Gross Beta	2.6/2.7	3.8
Radium -226	0.15/0.47	NA
Radium -228	-0.056/0.045	NA
Total Uranium	2.2/2.2	0

## FOOTNOTES

1	Only detected constituents for metals and inorganics are presented in the table.
<	Indicated compound not detected at the stated reporting limit.
%	Percent
mg/l	Milligrams per liter
ml	Milliliters
N	Nitrogen
NA	Not applicable
PCBs	Polychlorinated biphenyls
pCi/L	Picocuries per liter
RL	Reporting limit
RPD	Relative percent difference
TDS	Total dissolved solids
µg/l	Micrograms per liter

Table 5-2. Trip Blank Results

Trip Blank ID	Trip Blank Date	Shipment Date	VOCs (EPA 8260) (µg/l)
LF08-TB-OC-01	6/26/96	7/9/96	<RL
LF08-TB-OC-02	7/2/96	7/10/96	<RL
LF08-TB-OC-03	7/2/96	7/11/96	<RL
LF08-TB-OC-04	7/2/96	7/11/96	<RL

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**FOOTNOTES**

<	Indicated compound not detected at the stated reporting limit.
RL	Reporting limit
µg/l	Micrograms per liter
VOCs	Volatile organic compounds

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## REFERENCES

- New Mexico Environment Department-Solid Waste Bureau, November 1995. *New Mexico Solid Waste Management Regulations 20 NMAC 9.1.*
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