CETHA-BC-CR-91007
ANL/EAIS/TM-37

ANL/EAIS/TM--37

DE91 007604

Master Environmental Plan:

Fort Wingate Depot Activity, Gallup, New Mexico

December 1990

prepared for

Commander
U.S. Army Toxic and Hazardous Materials Agency
Aberdeen Proving Ground, Maryland 21010-5401

MASTER

prepared by

Environmental Assessment and Information Sciences Division
Argonne National Laboratory
Argonne, Illinois 60439

U.S. Department of Energy Contract W-31-109-Eng-38

SECURITY CLASSIFICATION OF THIS PAGE

REPORT DOCUMENTATION PAGE

1a. REPORT SECURITY CLASSIFICATION
Unclassified

1b. RESTRICTIVE MARKINGS

2a. SECURITY CLASSIFICATION AUTHORITY

2b. DECLASSIFICATION / DOWNGRADING SCHEDULE

3. DISTRIBUTION / AVAILABILITY OF REPORT
Distribution Unlimited

4. PERFORMING ORGANIZATION REPORT NUMBER(S)
ANL/EAIS/TM-37

5. MONITORING ORGANIZATION REPORT NUMBER(S)
CETHA-BC-CR-91007

6a. NAME OF PERFORMING ORGANIZATION
Environmental Assessment and Information Sciences Division

6b. OFFICE SYMBOL *(If applicable)*
EID

7a. NAME OF MONITORING ORGANIZATION
U.S. Army Toxic & Hazardous Materials Agency

6c. ADDRESS *(City, State, and ZIP Code)*
Argonne National Laboratory
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Argonne, IL 60439-4815

7b. ADDRESS *(City, State, and ZIP Code)*
Attn: CETHA-BC
Aberdeen Proving Ground, MD 21010-5401

8a. NAME OF FUNDING / SPONSORING ORGANIZATION
U.S. Army Toxic & Hazardous Materials Agency

8b. OFFICE SYMBOL *(If applicable)*
CETHA-BC

9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER
U.S. Department of Energy Contract W-31-109-ENG-38

8c. ADDRESS *(City, State, and ZIP Code)*
U.S. Army Toxic & Hazardous Materials Agency
Attn: CETHA-BC
Aberdeen Proving Ground, MD 21010-5401

10. SOURCE OF FUNDING NUMBERS

PROGRAM ELEMENT NO.	PROJECT NO.	TASK NO.	WORK UNIT ACCESSION NO.

11. TITLE *(Include Security Classification)*
Master Environmental Plan: Fort Wingate Depot Activity, Gallup, New Mexico

12. PERSONAL AUTHOR(S)
C. A. Biang, C. R. Yuen, R. P. Biang, A. A. Antonopoulos, and J. D. Ditmars

13a. TYPE OF REPORT
Final

13b. TIME COVERED
FROM ________ TO ________

14. DATE OF REPORT *(Year, Month, Day)*
1990 December

15. PAGE COUNT

16. SUPPLEMENTARY NOTATION

17. COSATI CODES

FIELD	GROUP	SUB-GROUP

18. SUBJECT TERMS *(Continue on reverse if necessary and identify by block number)*

19. ABSTRACT *(Continue on reverse if necessary and identify by block number)*

The master environmental plan is based on an environmental assessment of the areas requiring environmental evaluation (AREEs) at Fort Wingate Depot Activity near Gallup, New Mexico. The Fort Wingate Depot Activity is slated for closure under the Base Closure and Realignment Act, Public Law 100-526. The MEP assesses the current status, describes additional data requirements, recommends actions for the sites, and establishes a priority order for actions. The plan was developed so that actions comply with the hazardous waste and water quality regulations of the State of New Mexico and applicable federal regulations. It contains a brief history of the site, relevant geological and hydrological information, and a description of the current status for each AREE along with a discussion of the available site-specific data that pertain to existing or potential contamination and the impact on the environment.

20. DISTRIBUTION / AVAILABILITY OF ABSTRACT
☒ UNCLASSIFIED/UNLIMITED ☐ SAME AS RPT. ☐ DTIC USERS

21. ABSTRACT SECURITY CLASSIFICATION
Unclassified

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22c. OFFICE SYMBOL
CETHA-BC

DD FORM 1473, 84 MAR — 83 APR edition may be used until exhausted. All other editions are obsolete.

SECURITY CLASSIFICATION OF THIS PAGE
UNCLASSIFIED

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GLOSSARY OF ABBREVIATIONS AND ACRONYMS USED IN THIS MEP

AEHA	Army Environmental Hygiene Agency
Ag	silver
AMCCOM	Armament, Munitions and Chemicals Command
ANL	Argonne National Laboratory
ARARs	applicable or relevant and appropriate requirements
AREE	area requiring environmental evaluation
As	arsenic
Ba	barium
BHC	benzene hexachloride
Bldg.	building
BMTS	Ballistic Missile Testing Site
Cd	cadmium
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
Cr	chromium
CWA	Clean Water Act
DDD	dichlorodiphenyl dichloroethane
DDE	dichlorodiphenyl chloroethane
DDT	dichlorodiphenyl trichloroethane
DNT	dinitrotoluene
DOD	U.S. Department of Defense
DRMO	Defense Reutilization and Marketing Office
EID	Environmental Improvement Division
EP	extraction procedure
EPA	U.S. Environmental Protection Agency
Fig.	figure
FR	Federal Register
FW	Fort Wingate
FWDA	Fort Wingate Depot Activity
FY	fiscal year
Hg	mercury
HMX	cyclotetramethylene tetranitrate
HOCs	halogenated organic compounds
HSWA	Hazardous and Solid Waste Amendments
JATO	jet-assisted takeoff
MCL	maximum contaminant level
MCLG	maximum contaminant level goal
MEP	master environmental plan
MSL	mean sea level
NO_2	nitrogen dioxide (nitrite ion)
NO_3	nitrate ion

NPDES	National Pollutant Discharge Elimination System
NPDWS	National Primary Drinking Water Standards
NPL	National Priorities List
NSDWS	National Secondary Drinking Water Standards
PA	preliminary assessment
Pb	lead
PCBs	polychlorinated biphenyls
PCDD	polychlorinated dioxin
PCDF	polchlorinated furan
PCP	pentachlorphenol
PFTL	paint filter liquids test
PO_4	phosphate ion
POL	petroleum, oil, and lubricants
PVC	polyvinyl chloride
RCRA	Resource Conservation and Recovery Act
RDX	Royal Demolition Explosive - hexohydro-1,3,5-trinitro-1,3,4-triazine
Ref.	reference
SARA	Superfund Amendments and Reauthorization Act
SDWA	Safe Drinking Water Act
Se	selenium
Sec.	section
SWMU	solid waste management unit
TCLP	toxicity characteristic leaching procedure
TDS	total dissolved solids
TNT	2,4,6-trinitritoluene
TSCA	Toxic Substances Control Act
USATHAMA	U.S. Army Toxic and Hazardous Materials Agency
UXO	unexploded ordnance

UNITS OF MEASURE

°F	degree(s) Fahrenheit
ft	foot (feet)
g	gram(s)
gal	gallon(s)
h	hour(s)
in.	inch(es)
L	liter(s)
lb	pound(s)
m	meter(s)
mg	milligram(s)
mi	mile(s)
min	minute(s)
mm	millimeter(s)
µg	microgram(s)
µmho/cm	microhom(s) per centimeter
mph	miles per hour
pCi	picocurie(s)
ppm	parts per million
yr	year(s)

ACKNOWLEDGMENTS

The authors acknowledge the assistance and cooperation of Major Timothy Insman, Commander, Fort Wingate Depot Activity (FWDA) and his staff, particularly, Frank J. O'Donovan, Jr. and Adrian Bond. They readily provided access to information and facilities at FWDA essential for this study.

The authors thank John Cleland at Argonne National Laboratory (ANL) for editing this report. They recognize the contributions to this study of the earlier preliminary assessment efforts of Yee-Ping Chia and John F. Schneider of ANL.

This study was conducted under the auspices of the U.S. Army Toxic and Hazardous Materials Agency (USATHAMA). The authors appreciate the assistance and guidance provided by the USATHAMA Project Officer, Mark A. Mahoney, and his predecessors, Russell Fendick and Joan Jackson.

MASTER ENVIRONMENTAL PLAN: FORT WINGATE DEPOT ACTIVITY, GALLUP, NEW MEXICO

SUMMARY

This master environmental plan (MEP) is based on an environmental assessment of the areas requiring environmental evaluation (AREEs) at Fort Wingate Depot Activity near Gallup, New Mexico. The Fort Wingate Depot Activity is slated for closure under the Base Closure and Realignment Act, Public Law 100-526. The MEP assesses the current status, describes additional data requirements, recommends actions for the sites, and establishes a priority order for actions. The plan was developed so that actions comply with the hazardous waste and water quality regulations of the state of New Mexico and applicable federal regulations.

The report contains a brief history of the site, relevant geological and hydrological information, and a description of the current status. This information is also given for each AREE along with a discussion of the available site-specific data that pertain to existing or potential contamination and the impact on the environment. In a summary, the supporting rationale for the ordering of areas into high, medium, and low priority for action at Fort Wingate is discussed.

Several types of actions are proposed to further characterize the AREEs; most commonly, geophysical surveys, soil sampling, and monitoring well installation. Initial response actions include:

- Conduct reconnaissance and geophysical surveys at 10 AREEs,
- Collect surface soil samples at 12 AREEs,
- Collect surface water and sediment samples at 7 AREEs,
- Drill soil borings at 7 AREEs,
- Install monitoring wells at 3 AREEs, and
- Collect wipe samples at 3 AREEs.

For many of the AREEs, additional actions (i.e., sampling or monitoring) are contingent on the results of the initial actions. Although priorities have been outlined for the AREEs, the ranking is preliminary and subject to change as additional data become available.

1 INTRODUCTION

This master environmental plan (MEP) for Fort Wingate Depot Activity (FWDA), Gallup, New Mexico, consists of an assessment of the environmental status of each area requiring environmental evaluation (AREE), a discussion of proposed environmental investigations, and a recommended ranking of potential responses to FWDA environmental contamination problems. The MEP presents data collected during a site assessment and evaluates those data in terms of FWDA objectives for environmental restoration. Based on these findings, the AREEs have been assigned priorities for response actions. Priority rankings could become critical if a phased approach is required.

1.1 BACKGROUND

Old Fort Wingate was established in 1850 as a storage facility. It has had three locations in the immediate area. By 1860, it was renamed Fort Fauntleroy and, in 1961, became Fort Lyon. In 1941, extensive construction and expansion were undertaken to allow the Fort to supply the needs of overseas troops. Administrative buildings and "igloos" were completed by late 1941. In 1962, when it became part of the U.S. Army Supply Maintenance Command, the name was changed to Fort Wingate Army Depot. During the Vietnam War, shipping activities were escalated. Between 1963 and 1967, it was used as a test site for Pershing missiles. By July 1971, the depot was placed in reserve status and renamed Fort Wingate Depot Activity.

Currently, FWDA stores, ships, and receives materiel and demilitarizes and disposes of obsolete or deteriorated explosives and ammunition. It is slated for closure under the Base Closure and Realignment Act, Public Law 100-526. An Enhanced Preliminary Assessment for FWDA[1] was completed in 1990 in support of the environmental aspects of closure.

1.2 OBJECTIVES

The overall objective of this MEP is to provide the U.S. Army Toxic and Hazardous Materials Agency (USATHAMA) with information that focuses priorities for the environmental restoration of Fort Wingate Depot Activity. This working document has been developed in compliance with New Mexico hazardous waste regulations as well as three relevant bodies of federal legislation: the Superfund Amendments and Reauthorization Act (SARA) of 1986, the corrective action provisions of the 1984 Hazardous and Solid Waste Amendments (HSWA), and the Toxic and Hazardous Substances Act (TSCA). This MEP concerns the process of environmental restoration by the U.S. Army independent of any specific process of the excessing of all, or a portion, of the property.

The MEP can be used to address preremedial activities and to support environmental restoration activities at Fort Wingate Depot Activity. Pursuant to Sec. 120 of SARA, which sets out requirements for preremedial activities at federal facilities, further preliminary assessment and site investigation may be required based on information submitted by FWDA to the U.S. Environmental Protection Agency (EPA).

In evaluating the environmental status of each AREE, the MEP addresses proposed actions representing the next steps to be taken for that area. In many cases, these actions involve sampling and analyses to determine the nature and extent of potential contamination. General recommendations regarding such investigations are made in the MEP. It is not, however, intended to provide the details, including descriptions of specific investigative methods, that a sampling and analysis plan provides. Rather, it seeks to present general sampling guidance, which can be employed with site reconnaissance to prepare such a plan.

Although this MEP considers the environmental status of the designated AREEs, it does not fully address potential off-site impacts, migration pathways, and target populations. These issues may need to be addressed further by preremedial activities. Preremedial activities that form the foundation for the Superfund Remedial Program have been established by EPA and are discussed in further detail in Sec. 3 of this report.

1.3 APPROACH

Argonne National Laboratory (ANL) staff conducted the on-site portion of the assessment of FWDA during the week of October 23, 1989, and on June 13-15, 1990. The site visits included a review of documents, site inspections of all AREEs, and interviews with FWDA staff.

Fort Wingate has been in existence for more than a century and has a varied history. Two limiting factors in this investigation are:

- Information is limited regarding locations and operations of some of the AREEs. Because of the age of FWDA, records of some operations were not available. Without more definitive information, it is difficult in some cases to circumscribe the areas that must be considered as potentially contaminated. Further investigations may lead to more focused definition of these spaces.

- Few of the AREEs at the FWDA have been previously investigated. Additional studies of the soil, geology, and groundwater are considered essential.

1.4 MEP REPORT OUTLINE

Section 2 of this MEP report describes the FWDA installation, including its historical uses, and the environmental setting (topography, climate, soils, geology, and hydrology) of the installation. The regulatory background that provides the basis for federal facility actions is discussed in detail in Sec. 3. Section 4 characterizes each AREE and discusses recommended actions. A summary of the proposed actions and findings is presented in Sec. 5, and a priority ranking of the AREEs is given in Sec. 6.

2 FWDA PROPERTY DESCRIPTION AND ENVIRONMENTAL SETTING

2.1 PROPERTY INFORMATION

2.1.1 General

Fort Wingate Depot Activity (FWDA) occupies approximately 34 square miles (22,120 acres) of land in northwestern New Mexico, in McKinley County (Fig. 2.1).

The FWDA is located 8 miles (mi) east of Gallup and about 130 mi west of Albuquerque on Interstate 40. It is bordered on the west by the Zuni Indian Reservation, on the south and east by the Cibola National Forest, and on the north by the Red Rock State Park. It can be reached by car on Interstate 40, and it is also served by the Atchison, Topeka, and Santa Fe Railroad (Fig. 2.1).

The FWDA population has varied through the years, from a few thousand to fewer than 100. Currently, the base commander is the only military person assigned to the depot, and there are fewer than 100 civilian employees at the installation.

Transportation facilities for the FWDA are as follows. The main entrance road of the depot connects with US Route 66 approximately 8 mi east of Gallup. The depot itself contains about 150 mi of internal roads (70 mi surfaced and the rest dirt/gravel). There is no bus service between Gallup and the FWDA. The Atchison, Topeka and Santa Fe Railroad serves the major rail needs of the installation, and within the depot are approximately 20 mi of trackage (primarily to the ammunition magazine areas).

The FWDA installation acreage is used for the administration facilities, workshop activities, magazines, demolition and burning of explosives, and other activities. The open spaces can be characterized as woodland, recreational land, and protection and security buffer zone land. Land use and activity areas, as well as their acreages, are shown in Table 2.1.

2.1.2 Overview of Facilities

The FWDA facilities, including some features of their present and past environmental interest, are summarized as follows.

The Administration Area and the main entrance to FWDA are located just south of Interstate 40, between the northern boundary of the installation and the Workshop Area (Fig. 2.2). The principal Administration Area facilities are identified in Table 2.2. The activities associated with specific buildings have changed over time.

The Workshop Area, directly south of the Administration Area (Fig. 2.2), is an industrial area containing ammunition maintenance and renovation facilities. The

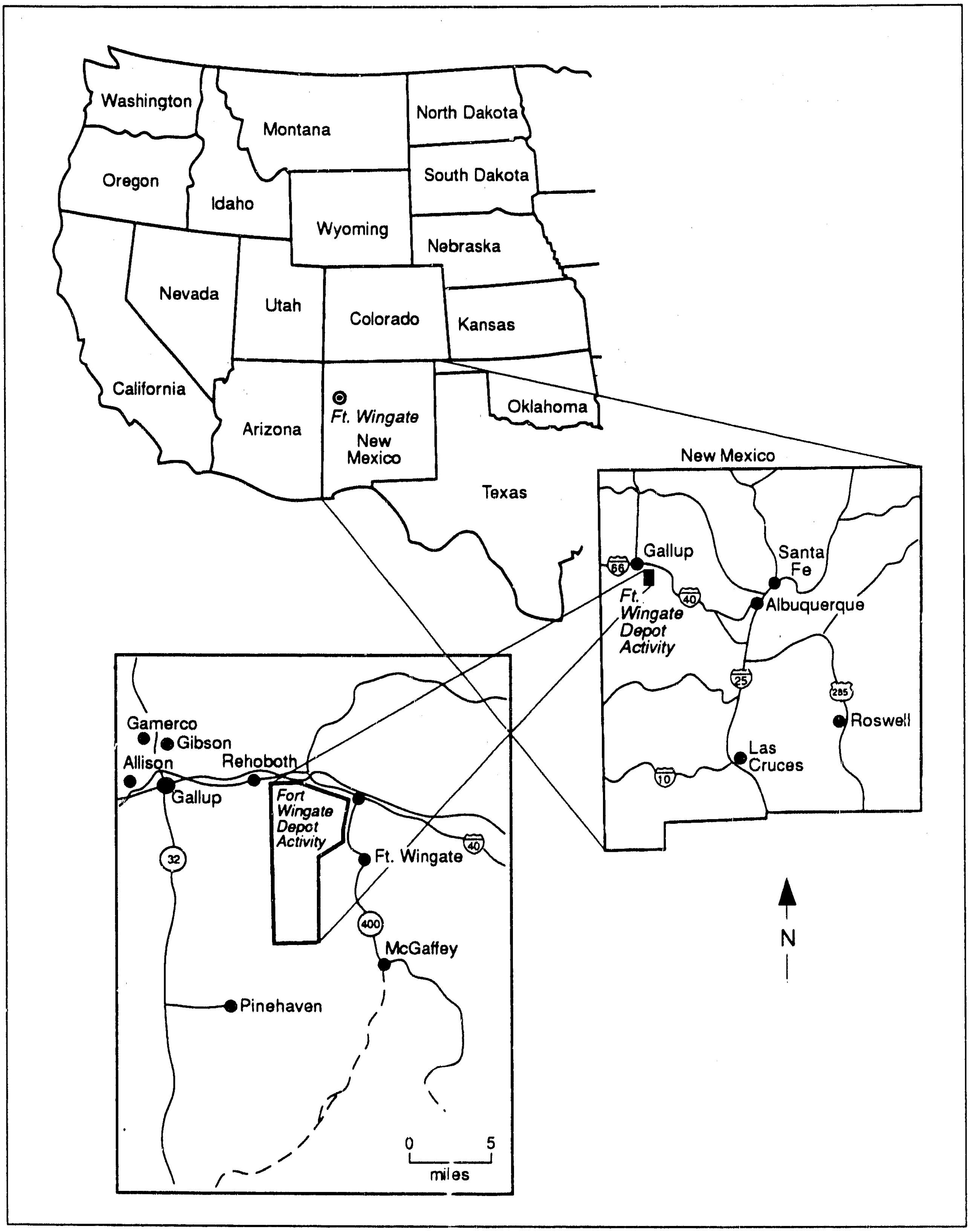

FIGURE 2.1 Location of the FWDA

TABLE 2.1 Acreage and Percentage of FWDA Land, by Use

Land Use Area	Acreage	% of Total Land
Administration	800	4
Workshop	700	3
Sanitary Landfill	8	1
Magazine	7,400	33
Demolition and Burning	1,100	5
Woodlands	5,900	27
Recreational	300	1
Protection and Buffer	5,790	26
Miscellaneous	102	1
Total	22,100	100

Source: Adapted from Ref. 2.

facilities for ammunition maintenance, demilitarization, and surveillance are identified in Table 2.3. Many of the facilities are no longer in service, several of these are partially demolished or in disrepair, and others are in active use.

The current landfill is found just outside of the southwestern corner of the Workshop Area (Fig. 2.3). Most of the central portion of FWDA property is occupied by magazine facilities for storing ammunition (shown in Fig. 2.3. as clusters of lined areas).

Between the Magazine and Woodland areas, and in the west central portion of FWDA, there is a fenced area designated as the Demolition and Burning Area (Fig. 2.3, Area #10).

The southern portion of the installation is a Woodland Area (Fig. 2.3), which consists of forested plateau and mountainous terrain. Several roads cross this area. A recreational area, with picnic facilities, is included within the woodland at Lake McFerren. The old Pershing Missile Launch site and ballistic missile test launch site are located in this southern portion of FWDA.

A substantial part of the FWDA is designated a Protection Area, consisting of buffer zones that surround the magazine and demolition areas. These zones, or nonused sites, are located adjacent to the eastern, northern, and western boundaries of the installation; they serve also as sites for wildlife habitation.

Other areas of environmental interest on FWDA land include functional test ranges and suspected old burning grounds. Other small sites also exist, such as land in

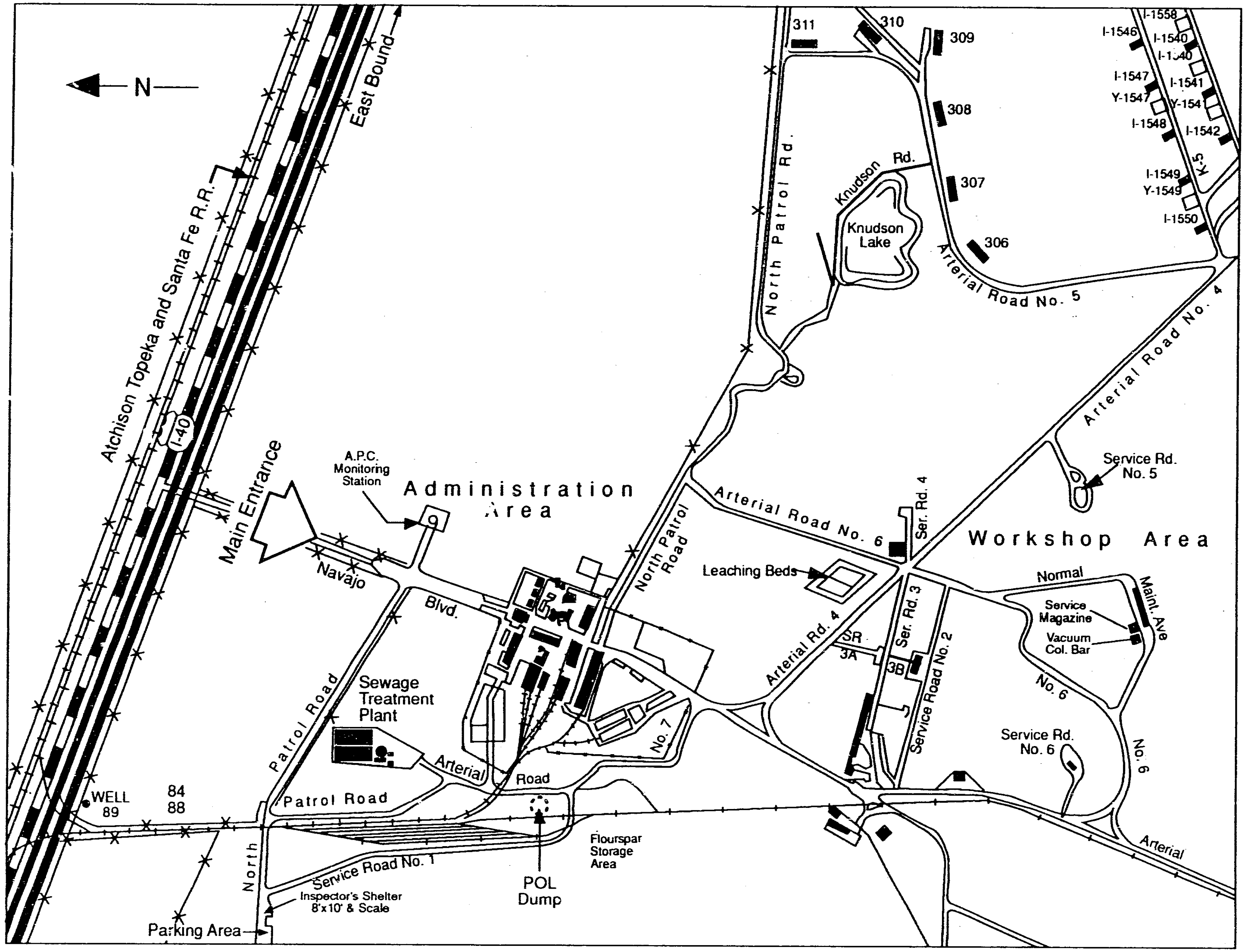

FIGURE 2.2 FWDA Administration and Workshop Areas

TABLE 2.2 Principal Buildings in Administration Area

Bldg. No.	Activity
1	Administration
2	Water Treatment, Clinic, Living Quarters
3,4,28	Living Quarters
5	Vehicle Maintenance
6	Gas Station
7	Paint Storage
8	Storage (formerly a paint shop)
9	Allied Trade Shop
10	Salvage, Carpentry (formerly)
11	Locomotive Shop
12,13	Food Storage and Distribution
14	Unused Offices
15	Storage, Automotive Maintenance (formerly)
16	Living Quarters
26,44	Storage
18	Guard Office
30,31	Billeting Quarters
33	Carpentry
34	Fire Station
36	Heating Plant
61	Water Well House No. 1
63	Sewage Treatment Plant (in limited-access area)
69	Current Well House

the southern sector of the property that has been leased by the National Guard for bivouac and maneuver training. Currently, an area in the eastern portion of the site is used as a practice landing area for airborne troops (the drop zone in Figure 2.3).

2.2 PROPERTY HISTORY

Although its history dates back to 1850 (Old Fort Wingate), almost all of the present FWDA facilities were constructed since 1941.[3] Prior to that time, some magazines and storage facilities were located at the site; most administrative facilities were east of the present FWDA in the vicinity of the town of Fort Wingate (Fig. 2.1). The present site is only a portion of the site formerly known as "Fort Wingate." The FWDA is dotted with ruins of prehistoric and historic inhabitation by Indian tribal entities. The site and land in the vicinity have been inhabited for centuries by farming and hunting Indian tribes, primarily the Pueblo Indians. Ruins of Anasazi civilization are found on FWDA.[4] Since 1850, the history of Fort Wingate has been tightly woven with the historical events of New Mexico and the U.S. Army. Three locations in New Mexico

TABLE 2.3 Principal Buildings in Workshop Area

Bldg. No.	Activity
501	Boiler Plant
503	TNT Washout
507, 508	Smokeless Powder Magazines
510	Vacuum Producer
515	Clean and Paint
516	Ammunition Receiving
517-521	Disassembly Plant
527	Heating Plant
528	Ammunition Maintenance
529	Flammable Materials Storehouse
530	Deactivation Facility
535	Heating Plant
536	Inspectors Workshop
537	Field Battery, Pesticide Storage
539	Change House, Laundry
541	Heating Plant
542	Ammunition Workshop

eventually hosted the fort, and seven names have been used to designate it. The first post was east of the current FWDA site. It was named Fort Fauntleroy, and later (1861) Fort Lyon.[3] Early in 1941, an extensive rebuilding and reconstruction program started at the site of the present Wingate to meet the needs of shipping foreign aid and supplying armies overseas. At the end of 1941, the administrative buildings and igloo-shaped structures for storing ammunition were finished; all buildings then on the installation were new. In 1962, Fort Wingate became a part of the new U.S. Army Supply and Maintenance Command, and in the same year the Army designated the depot Fort Wingate Army Depot.[3] Between 1963 and 1967, Fort Wingate Army Depot was used by White Sands Missile Range to test the mobility and accuracy of firing of the Pershing missile system.[5] Several missiles were fired from the installation. In 1966, the depot increased its activities by shipping ammunition for the South Vietnam conflict. In July 1971, the depot was placed in Reserve Status under the command of Pueblo Army Depot (Colorado) and redesignated Fort Wingate Depot Activity.[6] The U.S. Army Materiel Command (in General Order No. 151, dated Sept. 18, 1975) reassigned the Fort Wingate Depot Activity to Toole Army Depot, Utah.[6]

Currently, within the FWDA assigned mission, there are three primary functions: (1) to provide facilities for the storage of materiel, namely, ammunition components (explosive and inert), and other commodities (such as equipment and spare parts); (2) to

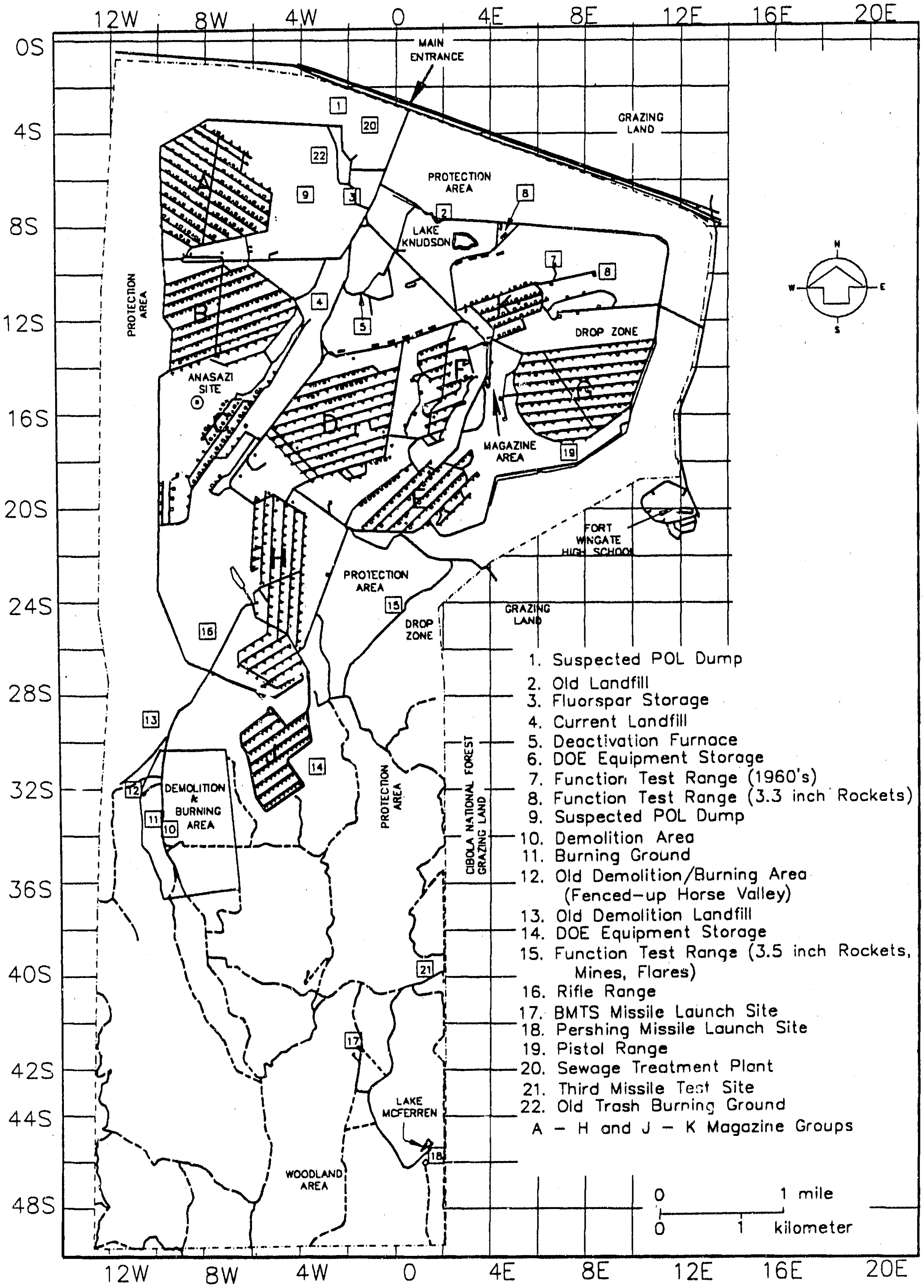

FIGURE 2.3 FWDA Facilities and Sites, Including Magazine Group (10 irregularly shaped clusters, shown as lined areas with letter designations)

handle the shipping and receiving of materiel primarily by rail or vehicular transport; and (3) to demilitarize and dispose of obsolete or deteriorated explosives and munitions, rendering them harmless. In addition to its assigned mission, FWDA hosts, or has hosted, the following tenants: the U.S. Army Reserve (current), the New Mexico Army National Guard (current, once or twice per year), the U.S. Department of Agriculture (current), and the U.S. Department of Energy (recent past). The tenant activities are not directly related to the primary FWDA mission.[6]

2.3 ENVIRONMENTAL SETTING

2.3.1 Topography

Topographically, the FWDA site may be divided into three areas: the rugged north-to-south-trending hogback in the west and the southwest, the northern hill slopes of the Zuni Mountain Range in the south, and the alluvial plains dissecting bedrock remnants in the northern portion of the depot. The hogback area is formed by interbedded Mesozoic sedimentary rocks dipping to the west and is dissected by northeastern-trending intermittent streams. The streams unload their sediment in the low-lying areas in the northern part of the depot, creating an extensive alluvial deposit among remnants of bedrock. The streams eventually end in the South Fork of the Puerco River near the northern boundary of the depot.

The altitude of the depot ranges from approximately 8,200 ft above mean sea level (MSL) in the south to 6,660 ft above MSL in the north (Fig. 2.4). Main drainages following the topography flow from south to north and empty into the South Fork of the Puerco River. Many tributaries, however, follow the regional trend, flowing from southwest to northeast. Because of the thunderstorm nature of precipitation in the arid area, the drainage is relatively shallow near its headwaters. Downward erosion intensifies as the stream moves downstream, resulting in a system of well developed arroyos. The cause of the arroyo formation is also attributable to the good erodibility of locally silty and clayey bedrock. It should be noted that a few arroyos near the western boundary of the depot were used as the dumping grounds for residual material from demolition and burning activities (see Sec. 4.4, Demolition and Burning Area).

2.3.2 Climate[2]

The area in which the FWDA is located is characterized by an arid to semiarid and cold continental climate. Most of the precipitation occurs in May through October as localized and brief summer storms. Spring and fall droughts characterize the area.

Mean annual rainfall for the area ranges between 10 and 16 inches (in.), while the recorded average precipitation during the year for FWDA is 11 in. and fluctuates between 8 to 20 in., according to local elevations. Most of the precipitation occurs as rain or hail in violent summer thunderstorms, and the remainder is provided by light winter snow accumulations.

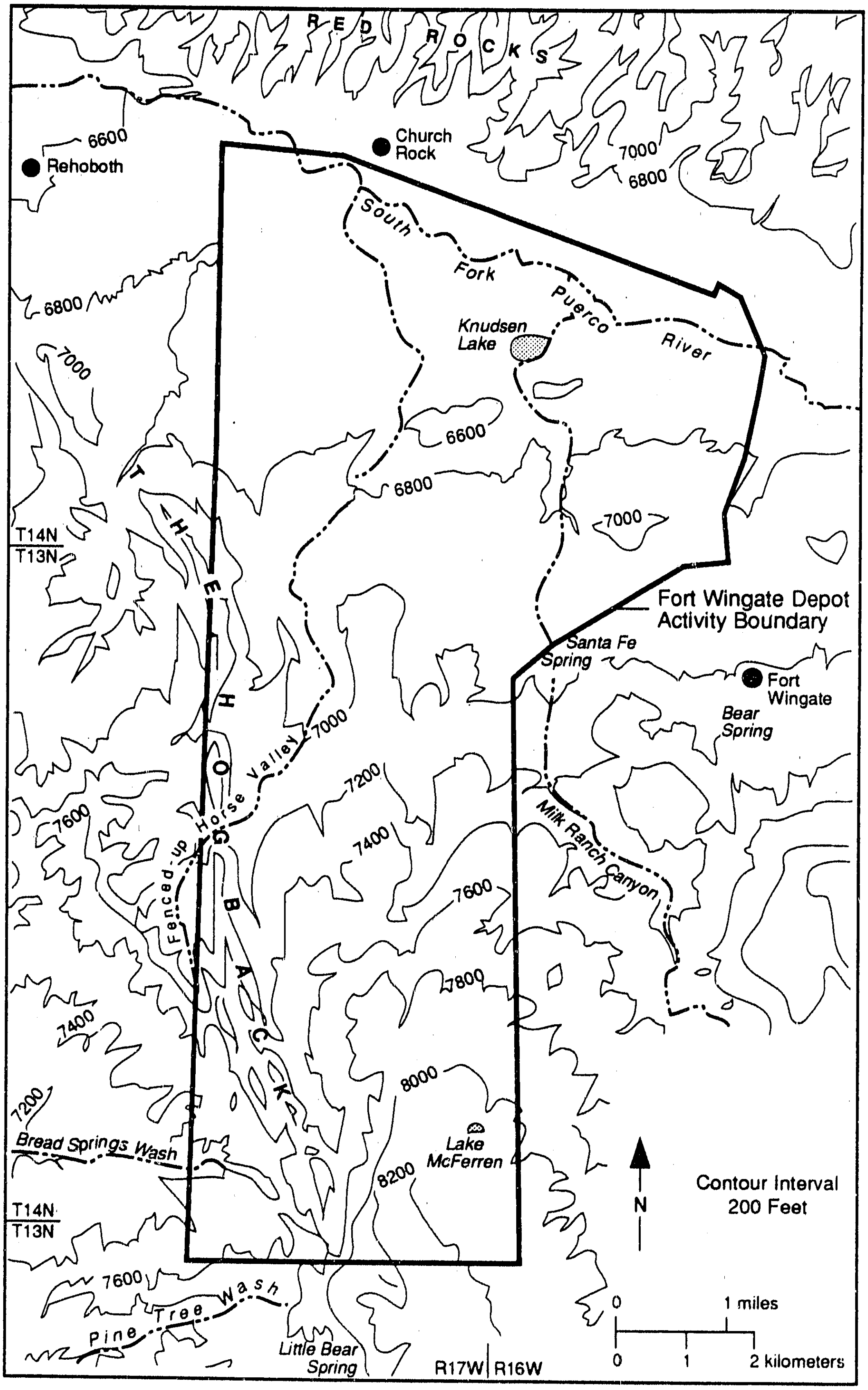

FIGURE 2.4 Topographic Map of FWDA Property

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

The area has generally sunny weather, with the sun shining more than 3000 hours annually. Average relative humidity varies from 50% to 15%, respectively, during the wet season (fall) and the dry season (spring). During spring, the area experiences strong winds from west and southwest, with an average wind speed of 12 miles per hour (mph). Strong winds, high temperatures, and low relative humidities in the area contribute to high evapotranspiration rates.

2.3.3 Soils and Geology

2.3.3.1 Soils[2,5,7]

The soils found on the installation are similar to those occurring in cool plateau and mountain regions of New Mexico. The major FWDA soil types are permeable sand and sandy loam clays. These soils are relatively shallow, and the parent bedrock is either at or near the surface in over a quarter of the installation.

According to U.S. Soil Conservation Service studies in 1981, four soil units occur on FWDA land: (1) Camborthids-Torriothents soils, which are shallow to deep, loamy, and clayey, which occur on plains hillslopes (slopes of 1-12%), and which occupy approximately the entire northeastern quarter of the installation; (2) Torriothents-Rock Outcrop soils, which are shallow, loamy soils and rock outcrop on the dissected plateaus, escarpments, and hillslopes (slopes 3-60%) and which occur on the north central-western quarter of the depot; (3) rock Outcrop-Haplustolls-Argiustolls soils, which are shallow, loamy, and clayey soils, which roll over steep hillsides and canyon walls (slopes of 30-70%), and which are situated in the central (east-to-west) zone, constituting less than half of the southern portion of the property; and (4) Eutrobocalfs Argiborolls soils, which are shallow to moderately deep, loamy and clayey, slightly sloping to steep soils on the mountainous southeastern part of the installation. Figure 2.5 depicts the location and extent of each soil unit on the FWDA land.

The thickness of these soils varies widely over the installation, with alluvial accumulations deepest along canyon floors and in the Puerco River valley. Bedrock exposures are common throughout the area to the south. Generally, the soils are loamy, or loamy and clayey, and contain varying amounts of silt, sand, gravel, stones, or rock fragments. All these soils are fragile. Wind and water cause extensive soil erosion, especially where vegetation cover is absent. From an agricultural point of view, these soils are more suitable for exploitation as range land than for any kind of farming. Limited timber production can be also considered on the mountainous parts of the installation.

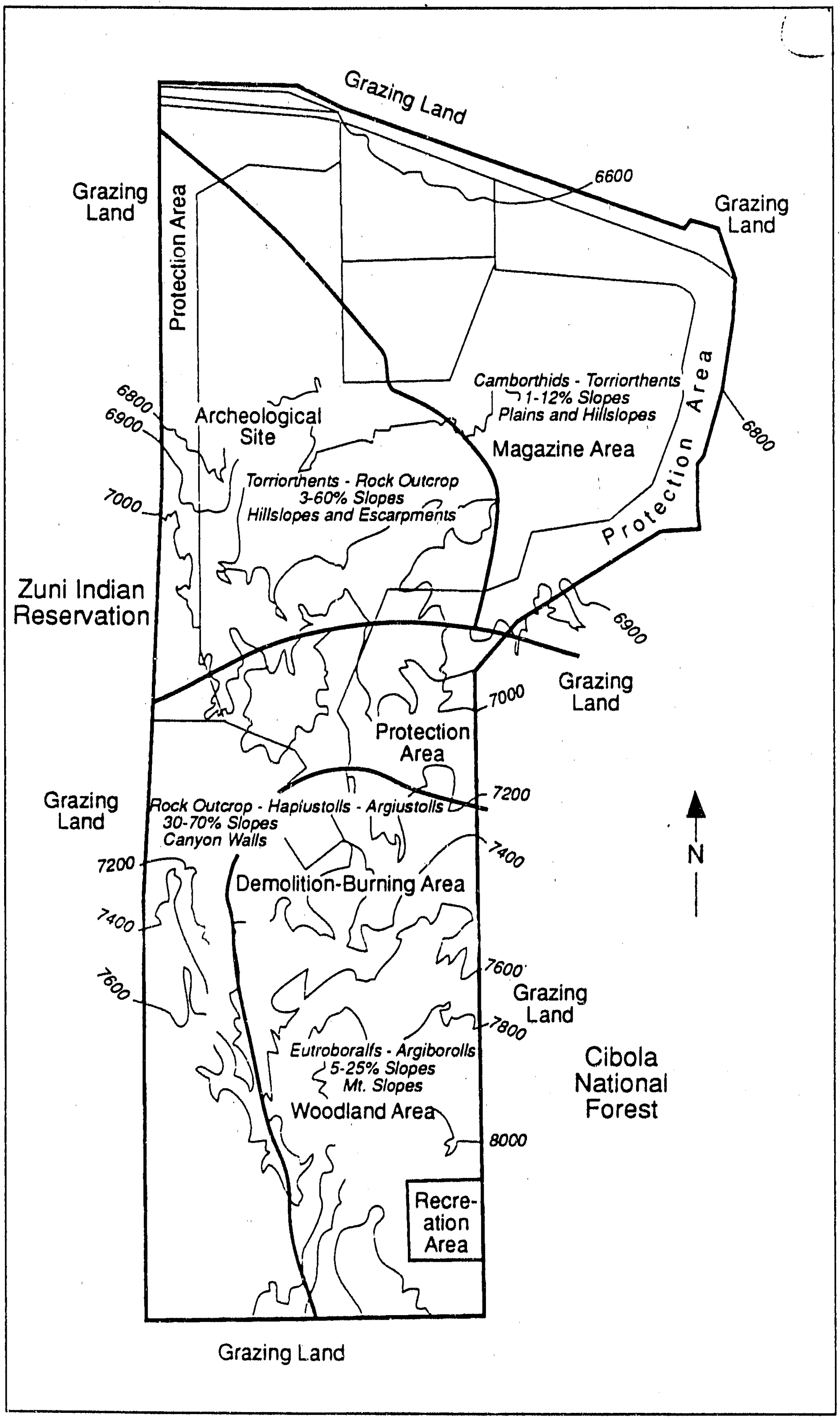

FIGURE 2.5 Soil Units Occurring at FWDA (Source: Adapted from Ref. 1)

2.3.3.2 Geology

Bedrock Geology. The depot is located in an erosional basin on the Navajo section of the Colorado Plateau Physiographic Province. During the uplift of the Zuni Mountain Range in the southern and southeastern sectors of the depot, the area occupied by the erosional basin was under tensional stress such that bedrock was extensively fractured. Differential weathering and erosion in the fracture zone resulted in the formation of the basin currently occupied by FWDA.

The geology of the depot is shown in Fig. 2.6. In the northern part, where the Administration, Workshop and Magazine/Igloo areas are located, the surface is covered by either remnants of Chinle Formation bedrock or alluvial deposits. The latter are fed by the drainages from the south Zuni Mountain and the hogback in the western part of the depot. The hogback probably represents a monocline fold,[8] where westerly dipping Mesozoic bedrock is exposed to form a long sharp-crested ridge trending north to south. In the southeastern part of the depot, bedrock formations of Permian and Triassic ages were uplifted by a thrust striking north to northeast. The strata in areas away from the hogback generally dip to the north. In Table 2.4, the stratigraphic sequence and lithology of the bedrock are summarized.

The majority of the FWDA area, which is underlain by the Chinle Formation of Triassic age (Table 2.4), is dissected by arroyos. The formation consists primarily of calcareous mudstone, with minor amounts of calcareous fine-grained sandstone. The sandstone is relatively weather-resistant; it forms a cap rock in the remnant bedrock of the northern FWDA. On the other hand, the softer mudstone is easily eroded to form badlands or arroyos on hillslopes and in eroded valleys.

Alluvial deposits. Alluvial deposits are best developed in the northern part of the FWDA, in low land among bedrock remnants (Fig. 2.6). Other alluvial deposits are found along arroyos. The deposits were formed when streams from the hogback and Zuni Mountain entered the lowland in the northern part of the depot before joining the South Fork of the Puerco River. Since the alluvium was deposited under a braided river sedimentation environment, the alluvium is expected to change its texture and structure laterally and vertically over a short distance. The grain size of the deposit ranges from clay to gravel.

From previous well records, the alluvial deposits increase in thickness towards major drainages. The change may be abrupt when a drainage channel is encountered. An alluvial thickness as great as 150 ft was recorded northwest of the depot, close to the South Fork of the Puerco River. Near the Wingate high school, the alluvial deposit in a major alluvial fan is 75 ft thick.[8] In the Administration Area, a water supply well (Well 68) indicates a 30-ft-thick alluvial deposit, while another well (Well 69) 30 ft away shows a 70-ft-thick alluvium.[9] The alluvium revealed in these two wells is composed of fine- to medium-grained sand and sandy silt.

The alluvium away from the major drainage channel is commonly thinner. For example, alluvium in the demolition area or in Fenced-Up Horse Valley is less than

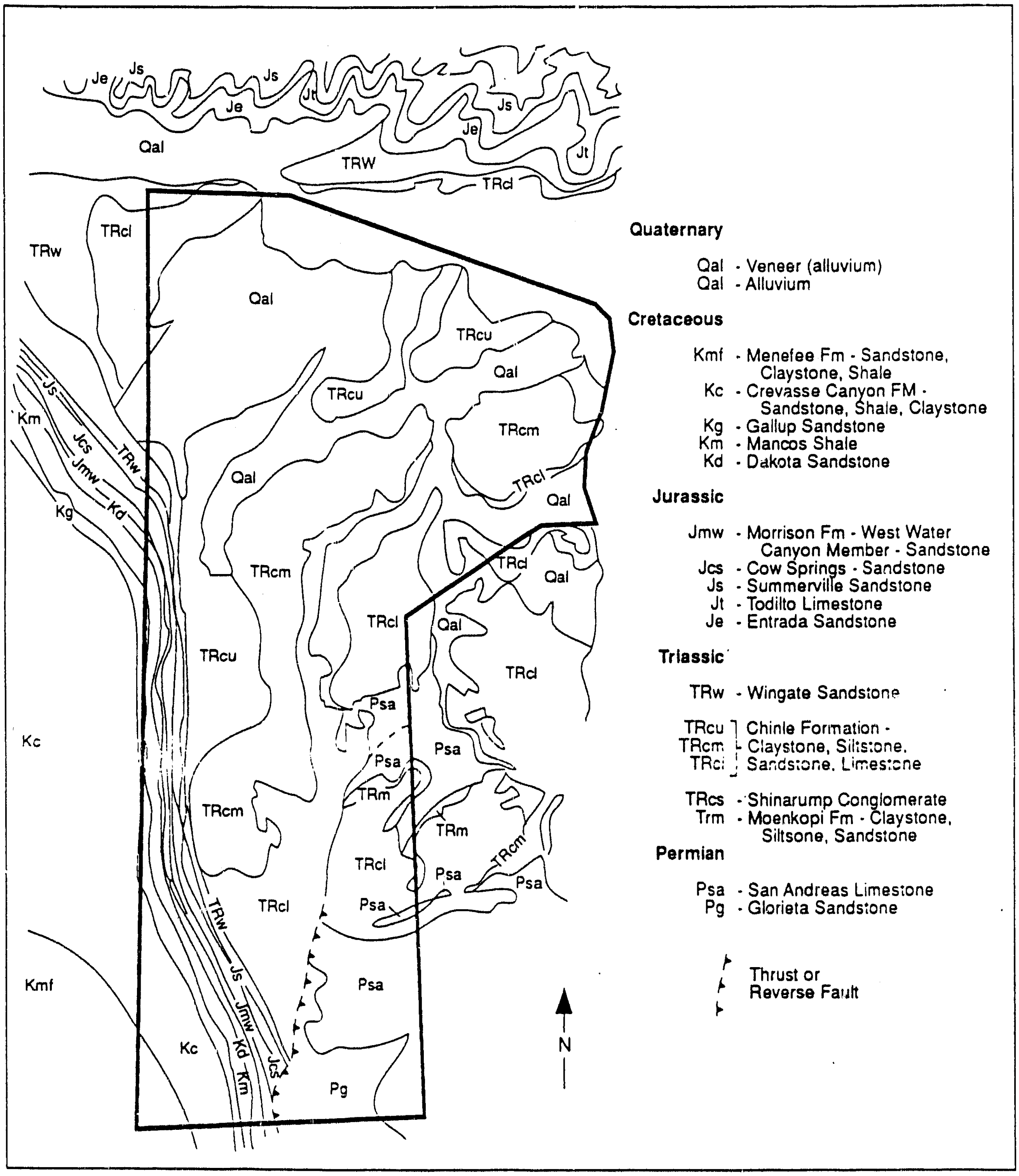

FIGURE 2.6 Geological Formations Found at FWDA (adapted from Ref. 1)

TABLE 2.4 Stratigraphic Sequence and Lithology of Bedrock in FWDA

Geologic Age	Formation	Lithology
Cretaceous	Menefee	Sandstone, claystone, and shale
	Crevasse Canyon	Sandstone, shale, claystone, and coal
	Gallup Sandstone	Massive sandstone, with minor amount of shale
	Mancos Shale	Calcareous shale, with minor amount of sandstone and siltstone
	Dakota Sandstone	Conglomeratic sandstone
Jurassic	Morrison	Calcareous siltstone, coarse-grained sandstone, and mudstone
	Cow Springs Sandstone	Fine- to medium-grained sandstone
	Summerville	Fine- to medium-grained sandstone and argillaceous siltstone
	Todilto Limestone	Thin-bedded limestone
	Entrada Sandstone	Fine-grained sandstone and siltstone
Triassic	Wingate Sandstone	Fine-grained, friable sandstone
	Chinle	Sandstone, siltstone, and mudstone, with basal conglomerate
	Moenkopi (?)	Claystone, siltstone, and sandstone
Permian	San Andres Limestone	Finely crystalline limestone, with solution porosity
	Glorieta Sandstone	Fine-grained, well-cemented sandstone

Source: Ref. 8.

15 ft thick. Bedrock of mudstones of Chinle Formation has been exposed at the bottom of the arroyos. A well near the group F Magazine/Igloo Area (Well 340) penetrated 10-ft-thick alluvium composed of fragments of sandstone and siltstone in a clay matrix.[10] The content of rock fragments tends to increase as the alluvium approaches bedrock outcrops.

2.3.4 Hydrology

2.3.4.1 Drainage System and Surface Water Bodies

The Fort Wingate Depot Activity lies between the South Fork of the Puerco River and the northern foothills of the Zuni Mountain Range. All drainages in this area are intermittent. Flows in the drainages are found only during and after heavy rainfall or during snowmelt.[5] They are fed by washes in the Zuni Mountain Range or the hogback. Except in the southwestern corner of the depot, the drainages generally flow to the north until the South Fork of the Puerco River is encountered (Fig. 2.7). Three major drainage systems may be identified. They are divided by either bedrock ridges or bedrock remnants. However, drainage capture may have occurred across two systems in the past. Also, in the northwest part of the depot, two artificial channels were constructed during the 1940s to divert water away from Magazine/Igloo groups A and B and the Administration Area. Understanding the drainage systems is important because they provide information on potential transport routes for contaminants.

The eastern system drains the eastern part of the depot (Fig. 2.7). Washes run in northwestern and northeastern directions on the slopes of Zuni Mountain, then join to form several drainages flowing to the north. Alluvium fans may form in basins at the front of the slope, as well as between bedrock remnants. The former is illustrated by a braided river system, such as in the southeastern part of Igloo group G and in the vicinity of Fort Wingate high school. Functional Test Range 1 (see Sec. 4.4.6) is located in a basin among the bedrock remnants. In the northeast part of the depot, the drainage flows around bedrock remnants (on which many igloos were built) before joining the South Fork of the Puerco River. An artificial lake, Knudson Lake, is located at the intersection of two drainages in the northern FWDA. Water can be diverted into the lake through a diversion dam.

The western drainage system (except for the southwest corner) consists primarily of two main drainages covering the western FWDA. In the upper reaches of the system are two tributaries; one passes the demolition area, while the other cuts across the hogback and creates Fenced-up Horse Valley. The tributaries then join to form a main drainage flowing north among bedrock remnants, laying alluvium along the drainage. The current landfill is located on the alluvium. In the northwestern section of the FWDA, the main drainage system creates an alluvial fan in the Workshop and Administration areas. This fan merges with another fan, which is deposited by a drainage originating in the hogback, in the Igloo groups A and B. In the 1940s, two artificial channels were constructed in the fan areas, such that the discharge from the two drainages would bypass the Administration, Workshop, and Igloo group A areas to the South Fork of the Puerco River.

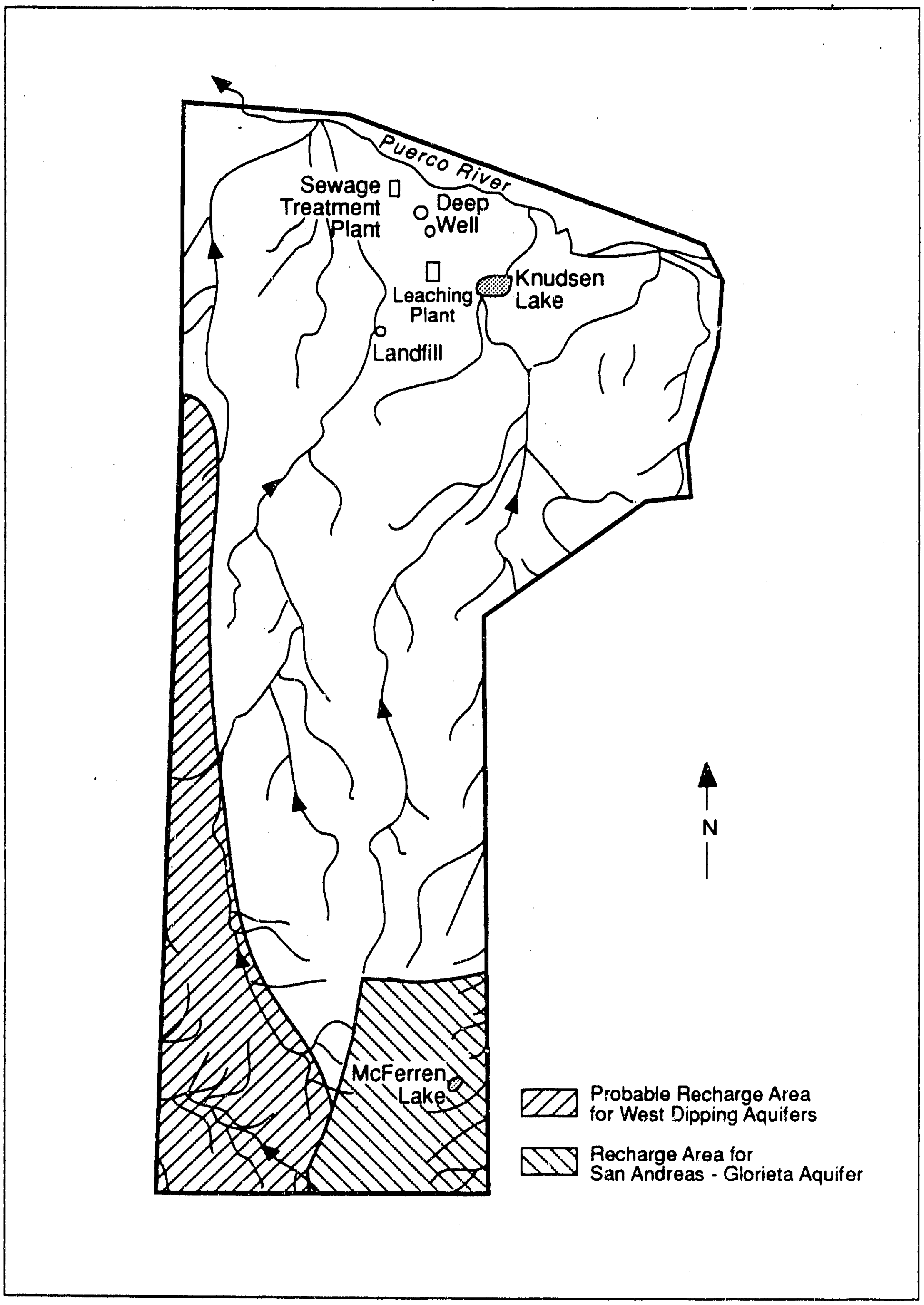

FIGURE 2.7 Surface Water Drainage System at FWDA (adapted from Ref. 7)

The third, southwestern-corner drainage system flows southwest and joins the Bread Springs Wash on the western side of the hogback. The Bread Springs Wash flows west. This drainage system is hydrologically isolated from other parts of the depot. Since depot activities have apparently not occurred in this area, the drainage system is of little environmental concern for the FWDA.

There are two man-made lakes and two ponds in the FWDA. The 2-acre McFerren Lake is located near the southeastern boundary in a woodland area. Lake Knudson, a 20-acre shallow intermittent lake, is located in the northern area. A small pond fed by a well and used for watering livestock is located on the Eastern Patrol Road.

2.3.4.2 Groundwater

Groundwater is present in many rock units underlying the installation (Fig. 2.8). Examination of these rocks and of records of wells in the area indicates that the only formations at FWDA capable of yielding more than a few gallons per minute (gal/min) in a well are the San Andreas Limestone and Glorieta Sandstone, of Permian age, and alluvium, of Quarternary age. Water-bearing formations of Jurassic and Cretaceous ages, capable of yielding 100 or more gal/min, are present 4 to 6 mi west of FWDA.

The San Andreas-Glorieta aquifer, which constitutes the primary groundwater source for FWDA, crops out near the depot's southern boundary and dips to the north. The recharge zone is located east of a fault in the southeastern part of FWDA. Snowmelt probably furnishes much of the recharge water to the aquifer. According to records from the U.S. Weather Bureau, slightly more than 3 in. of water is received annually in the area as snow. It is assumed that 1 in./yr of precipitation infiltrates the groundwater body at FWDA, and that about 2,300 acre/ft per year is obtained for annual recharge. Groundwater flow in the San Andreas-Glorieta aquifer is in a northwesterly direction.

The top of the San Andreas-Glorieta aquifer lies about 1,100 ft below land surface near the Administration Area. Here, the aquifer is about 200 ft thick and under artesian pressure. Local variations in aquifer permeability are large and unpredictable. Currently, one deep artesian well, W2, located at Bldg. 69, meets the installation's demand. This artesian well is 412 meters (m) deep. Since its completion, the pressure of W2 has been diminishing with time.

Another source of groundwater in the area is the Westwater Canyon Member of the Morrison Formation. This formation could be tapped at a minimum depth of 300 ft in a location approximately 6 mi northwest of FWDA. A well drilled through the Gallup Sandstone, the Dakota Sandstone, and the Westwater Canyon Member of the Morrison Formation, located approximately 4 mi west of the installation, would provide a dependable water source. Such a well would have to be about 1,500 ft deep.[2]

Several other younger units associated with the hogback, including the Entrada Sandstone, are also recharged to some extent within installation boundaries. These strata, dipping steeply to the west, yield very little water within the installation boundaries but do serve as water sources for much of the area west of the boundary.

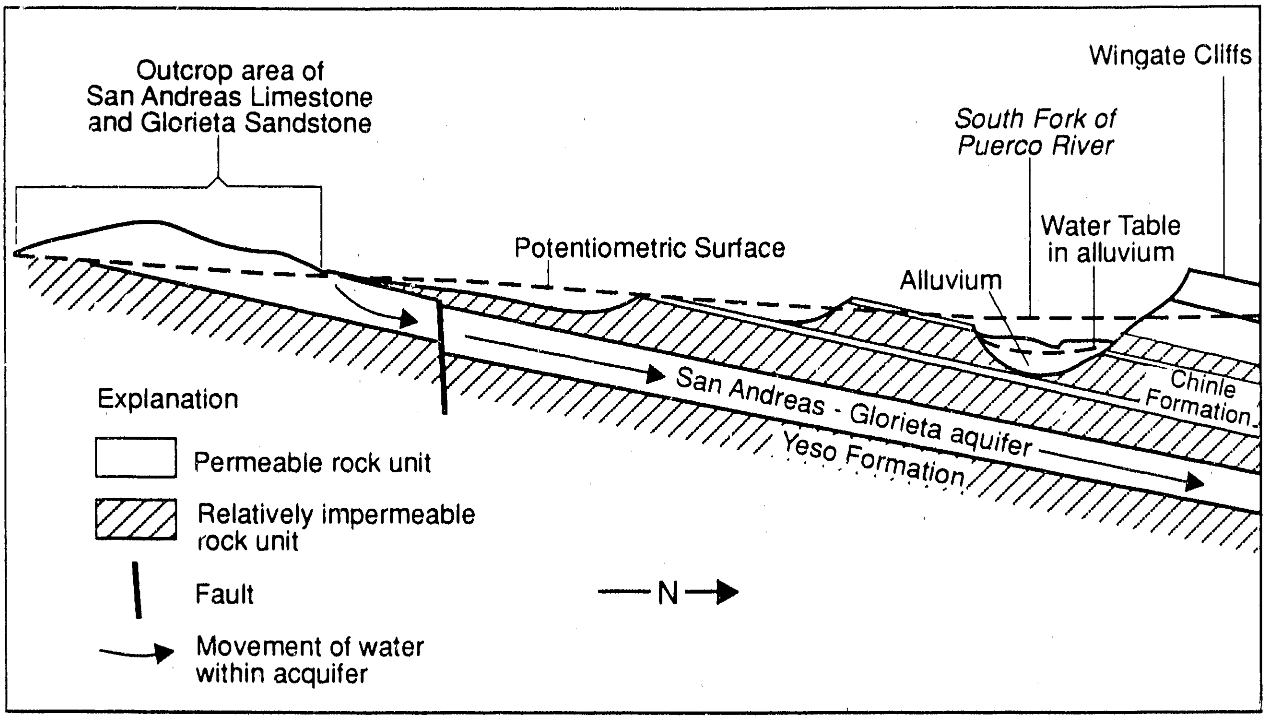

FIGURE 2.8 Groundwater Availability at FWDA (adapted from Ref. 11)

The hydrologic characteristics of different aquifers are summarized in Table 2.5.[3] The information is derived from test data on wells inside and near the installation. Bedrock in the San Andres-Glorieta aquifer provides water for the FWDA, with hydraulic conductivity ranging from 0.05 to 150 ft/day; water supply is highly variable from one location to another. The groundwater flows to the northwest. The horizontal hydraulic gradient of the aquifer in the FWDA during the late 1960s was about 0.0063 in.[8] and seems to decline with time. Upward movement of the groundwater from the bedrock aquifer is possible along fractures, since the aquifer is under artesian pressure.

The alluvial aquifer, which includes the Puerco River Valley along the northern edge of the installation, is composed of gravel, sand, silt, and clay derived from rocks of Triassic and Jurassic age that border it. These deposits are primarily recharged from surface runoff, although some deposits in the upper reaches of the installation are recharged by springs from underlying bedrock aquifers. Recharge of groundwater flow within the alluvium occurs mainly during the wet seasons of the year, specifically with the snowmelt in the spring. The groundwater would flow from areas of high elevation along the direction of arroyos. In the FWDA, the general flow direction is from the Zuni Mountain Range at the southern boundary of FWDA, to those areas of lower elevation such as the Puerco River Valley north of FWDA. The saturated thickness of the alluvium aquifer varies greatly and tends to increase toward drainage channels. In general, depths to water in the alluvium in the Administration Area range from 20 to 30 ft and may fluctuate dramatically from time to time, depending on rainstorms or snowstorms.[5] A

TABLE 2.5 Hydrological Characteristics of Aquifers near FWDA

Formation		Characteristics
Alluvium	Lithology:	unconsolidated sand, silt, and clay, with lenses of fine gravel
	Thickness:	0-215 ft
	Hydraulic conductivity:	0.17-23 ft/day
	Storage coefficient:	0.8 E-3
	Remark:	yields are erratic but can be 50 gal/min or more where alluvium is thick and contains a relatively high proportion of gravel
Crevasse Canyon Formation	Lithology:	interbedded sandstone, claystone, shale and coal; bedding is irregular
	Thickness:	not available
	Hydraulic conductivity:	0.5 ft/day
	Storage coefficient:	not available
	Remark:	yields as much as 25 gal/min; crops out within FWDA in the hogback; bedrock dips steeply to the west
Gallup Sandstone	Lithology:	thinly to massively bedded sandstone, with lesser amounts of shale and coal
	Thickness:	365 ft
	Hydraulic conductivity:	6.8 ft/day
	Storage coefficient:	not available
	Remark:	yields as much as 400 gal/min, but water levels have dropped significantly; crops out in the hogback
Morrison Formation	Lithology:	*Westwater Canyon Member*; coarse-grained, massively bedded sandstone
	Thickness:	not available
	Hydraulic conductivity:	not available
	Storage coefficient:	not available
	Remark:	the member is a good aquifer in many areas outside FWDA but is not known to yield water to wells near FWDA; crops out in the hogback

TABLE 2.5 (Cont'd)

Formation		Characteristics
Wingate Sandstone	Lithology:	*Lukachukai Member*; fine-grained, friable, crossbedded sandstone
	Thickness:	200 ft
	Hydraulic conductivity:	not available
	Storage coefficient:	not available
	Remark:	yields a few gal/min of good-quality water; crops out in the hogback
Chinle Formation	Lithology:	*Sonsela Sandstone*; crossbedded sandstone and pebble conglomerate
	Thickness:	20-115 ft
	Hydraulic conductivity:	0.4-(?) ft/day
	Storage coefficient:	not available
	Remark:	yields a small amount of poor-quality water
	Lithology:	*Shinarump Member*; sandstone and conglomerate, with minor amount of claystone
	Thickness:	0-130 ft
	Hydraulic conductivity:	0.4-1.7 ft/day
	Storage coefficient:	not available
	Remark:	yields as much as 70 gal/min of good-quality water
San Andres Limestone and Glorieta Sandstone	Lithology:	finely crystalline limestone, with some solution porosity in the San Andres Limestone, and fine-grained, well-cemented sandstone in the Glorieta Sandstone
	Thickness:	110 (?)-352 ft
	Hydraulic conductivity:	0.05-150 ft/day
	Storage coefficient:	7.6 E-5; 1.3 E-4
	Remark:	yields as much as several hundred gal/min to wells; yield highly variable from one location to another

Source: Ref. 8.

well located just north of the installation near Indian Village taps the alluvium aquifer at a depth of 50 ft, where the saturated thickness is 165 ft. This well yields over 100 gal/min and is probably located in the thickest alluvium in the area. The hydraulic conductivity of the alluvium ranges from 0.17 to 23 ft/day, depending on the gravel content of the aquifer.

This alluvial basin at the northern edge of the installation has been penetrated by only a few wells. The region around Gallup, including FWDA, was declared an underground water basin in 1980 by the State of New Mexico. This action prohibits any major new groundwater withdrawals without approval of the State Engineer. The basin covers 1,439 mi^2 and includes the communities of Gallup, Fort Wingate, Camerco, Mariano Lake, Navajo Wingate Village, and Rehoboth.

2.3.4.3 Water Supply and Quality

Groundwater has been the only source of water at FWDA since the 1940s. From 1942 to 1970, the water for FWDA was supplied from a 1125-ft (343-m) deep artesian well (Well 68) located in the Administration Area.[12] The well tapped the groundwater from the San Andreas-Glorieta aquifer. In 1970, in an effort to drill the well deeper, the casing of the well was damaged,[13] and the well was capped. A new well (W2, Bldg. 69) was drilled to a depth of 1,330 ft, approximately 30 ft southwest of the old well. W2 (also called Well 69) was reported recently to be blocked. A new well is planned in Bldg. 68 to replace Well 69.

There are two FWDA water supply systems, one potable and one nonpotable, based on the single source at the installation. Water from the supply well in Bldg. 69 is pumped into a 378,500-L aboveground tank. The nonpotable water, which is used for fire fighting and irrigation, is simply diverted from this tank to a 757,000-L ground storage reservoir, and then to an elevated 946,250-L storage tank. The potable water is created by treating water taken from the 378,500-L tank at the water treatment plant in Bldg. 2, where the water is treated with a sodium zeolite ion exchange process and is chlorinated with calcium hydrochlorite. The treated water is distributed into the potable water system for human consumption and heating plant boilers in the Administration Area.

There are five other wells on the installation.[14] (None of the five is now operating.) Well 324, drilled in the 1950s, is located approximately 1 mi southeast of the Administration Area. Because the well yielded inadequate water, it was capped. In 1966, three wells were drilled next to Interstate 40, north of the installation, during the highway's construction. After the construction of the wells was completed, they were capped and the water transferred to FWDA. In 1968, Well 340 was drilled near Well 324 to test the water resources of FWDA.

Besides the wells mentioned above, there is a spring located in the demolition area. The spring discharge is diverted through a PVC pipe 6 mi long to six storage tanks. The water is primarily for the use of buffalo within FWDA.

The data on the quality of surface waters on the installation are limited. However, a surface water sample taken from Lake Knudson in 1981 detected excessive chromium in the surface water and oil and grease in the lake sediments. In general, groundwater from the San Andreas-Glorieta aquifer is often high in iron, sulfates, and total dissolved solids (TDS). Hardness of water from the aquifer ranges from 39 to 1,760 milligrams per liter (mg/L).

Dissolved solids content of groundwater in the area usually varies. In general, dissolved solid content ranges from 540 to 7,509 mg/L near the recharge area, which is located on the slopes of Zuni Mountain in the southern part of the depot, and by as much as 2,400 mg/L in the most distant wells. Sulfate ion concentration also increases with distance from the recharge area (approximately 200 mg/L); more distant wells have concentrations of more than 500 mg/L. Chloride ion content is highly variable in the area.[1]

The State of New Mexico Health and Environmental Department is responsible for enforcing regulations governing public water supplies. Federal contaminant standards are adapted by the state. Maximum contaminant levels are listed in Table 2.6. Primary levels are those that may affect the health of consumers; secondary levels address the aesthetic qualities of drinking water and are guidelines only.

The results of some raw water analyses at FWDA since 1970 are shown in Table 2.6. All parameters have been within applicable standards except for iron, sulfates, and TDS. Water samples often exceeded the proposed National Secondary Drinking Water Standards (NSDWS) for iron. Excessive iron is common in deep wells and is not a health hazard. The sulfate and TDS concentrations have exceeded the proposed NSDWS. No health hazards are associated with elevated levels of these parameters, though the water may be aesthetically unpleasant, particularly to people unaccustomed to it. Both sulfates and dissolved solids impart objectionable tastes to water and cause scale buildup in plumbing and hot water heaters.[1]

A high gross alpha radiation level (greater than 18 to 20 picocuries per liter (pCi/L)) was frequently found in the raw water since 1984. The maximum contaminant level (MCL) criteria for gross alpha is 15 pCi/L. The combined pCi/L of radium 226 and radium 228 found in the raw water was 7.9 in the third quarter of fiscal year (FY) 86 and 7.1 in the third quarter of FY 87, exceeding the MCL criteria of 5 pCi/L.

TABLE 2.6 FWDA Raw Water Quality Data, 1970-1990

Parameter	FWDA Raw Water Data[a] (mg/L[b])					National Drinking Water Regulations (maximum contaminant level [mg/L[b]])	
	1970	1976	1981	(Oct.) 1988	(April) 1990	Primary[c]	Secondary[d]
Alkalinity (g/L $CaCO_3$)	175.0	180	169	174[e]	164	--	--
Arsenic	--	<0.01	0.018	0.025	0.002	0.05	--
Bicarbonate	214	--	--	158	200	--	--
Cadmium	0	<0.005	0.001	<0.1	<0.001	0.010	--
Chloride	1.6	5.6	4.0	5.8	6.0	--	250
Chromium	--	0.025	0.002	<1	0.0024	0.05	--
Fluoride	0.2	0.27	0.40	0.25	0.29	4.0	2.0
Gross alpha (pCi/L)	--	10.8	10.4 ± 5.9	19	10	15	--
Gross beta (pCi/L)	--	16.6	13.7 ± 3.2	8	8	--	--
Hardness (total as $CaCO_3$)	650	620	618	647[e]	652	--	--
Iron	0.39	1.07	0.096	0.115	1.75	--	0.3
Lead	--	0.005	0.01	<10.05	<0.001	0.05	--
Magnesium	102	71	79	4.1	71	--	--
Manganese	--	<0.03	0.02	<4.0	0.072	--	0.05
Mercury	--	0.0005	<0.0004	<0.2	<0.0002	0.002	--
Nitrate as nitrogen	0	<1.0	<0.2	0.02	0.03	10	
pH	7.7	7.6	7.95	8.24	8.1	--	6.5-8.5
Silver	--	<0.025	0.02	<0.2	<0.0002	0.05	--
Sodium and potassium	53	61.9	52	346	60	--	--
Specific conductance (μmho/cm)	1,280	1,314	1,314	1.494	1230	--	--
Sulfate	564	650	585	585	582	--	250
Tritium (pCi/L)	--	800	<420	--	--	20,000	--
Total dissolved solids	918	1,079	1,029	1,013	--	--	500

[a]Refs. 1,15.

[b]Unless otherwise indicated.

[c]Ref. 16.

[d]Ref. 17.

[e]1987 information.

3 REGULATORY CONSIDERATIONS

3.1 BACKGROUND

There are presently no environmental permits held by FWDA. A RCRA, Part B, permit application has been submitted to the State of New Mexico for the open burning/open detonation areas.[1]

The statutory basis for this investigation is established by Sec. 120 of SARA, which sets forth requirements for preremedial activities at federal facilities. The EPA's preremedial activity procedures form the foundation for the Superfund Remedial Program. The agency has developed a structured process to determine what, if any, cleanup actions are appropriate for sites included in the national inventory of potential hazardous waste sites. The process has two major phases. The first phase leads to proposal of sites for the National Priorities List (NPL). This preremedial phase consists of discovery, preliminary assessment, site investigation, and scoring on the Hazard Ranking System. The second phase consists of remedial planning.

Title II of SARA addresses cleanup standards and provides the basis for consideration of other statutes in this MEP. Section 121(d) of SARA requires compliance with applicable or relevant and appropriate requirements (ARARs) and federal and state standards, requirements, criteria, or limitations unless such requirements are waived. Federal statutes specifically cited in SARA are the TSCA, the Safe Drinking Water Act (SDWA), the Clean Air Act, the Clean Water Act (CWA), the Marine Protection Research and Sanctuaries Act, and the Solid Waste Disposal Act. On-site remedial action is to attain at least the standards of the maximum contaminant levels (MCLs) of the SDWA and the water quality criteria of the CWA. In general, state standards that are more stringent than federal standards should be applied to any remedial action. Where no specific ARARs exist, pertinent health advisory levels should be identified through the use of reference doses; health-effect advisories; the Interim Final, *Risk Assessment Guidance for Superfund*, OSWER Directive 9285.7-01a, Sept. 1989; Vol. I of the *Human Health Evaluation Manual*, Sept. 1989; Vol. II of the *Environmental Evaluation Manual*, Interim Final, EPA/540/1-89/001, March 1989; and other federal and state criteria.

3.2 WATER QUALITY CRITERIA

3.2.1 Federal

The federal ambient water quality criteria are given in Table 3.1. The MCLs, which include the Primary Drinking Water Regulations (40 CFR 141), are enforceable standards used for developing remedial actions.

Maximum contaminant level goals (MCLGs) are recommended, or guidance, levels rather than enforceable standards. MCLGs that are included in SARA as potential

TABLE 3.1 Federal Ambient Water Quality Regulations and Criteria (µg/L except as noted otherwise)[a]

	Safe Drinking Water Act				Clean Water Act, Water Quality Criteria[d]		
			Health Advisories		Human Health		
Chemical	Maximum Contaminant Level[b]	Maximum Contaminant Level Goal[c]	10-Day	Chronic	Toxic Effect	Carcinogen[e] (10^{-6} risk)	Organoleptic[f]
Acenaphthene	–	–	–	–	–	–	20
Acrolein	–	–	–	–	–	–	540
Acrylonitrile	–	0	–	–	–	0.063	–
Aldrin	–	0	–	–	–	0.0012	–
Antimony	–	–	–	–	146	–	–
Arsenic	50	0	–	–	–	0.0025	–
Asbestos	–	0	–	–	–	30,000 fibers/L	–
Barium	1,000	5,000[g]	–	–	–	–	–
Benzene	5	0	230	70	–	0.67	–
Benzidine	–	0	–	–	–	0.00015	–
Beryllium	–	0	–	–	–	0.0039	–
Cadmium	10	5[g]	–	–	10	–	–
Carbon tetrachloride	5	0	–	–	–	0.42	–
Chlordane	–	0	62.5	7.5	–	0.022	–
Chlorinated benzenes							
Hexachlorobenzene	–	0	–	–	–	0.021	–
1,2,4,5-Tetrachlorobenzene	–	–	–	–	180	–	–
Pentachlorobenzene	–	–	–	–	570	–	–
Dichlorobenzene		470					
p-Dichlorobenzene	75	75	–	–	–	–	–
Monochlorobenzene	–	60[g]	–	–	488	–	–
Chlorinated ethanes							
1,2-Dichloroethane	5	0	–	–	–	0.94	–
1,1,1-Trichloroethane	200	200	–	1,000	19,000	–	–
1,1,2-Trichloroethane	–	0	–	–	–	0.6	

TABLE 3.1 (Cont'd)

Chemical	Safe Drinking Water Act				Clean Water Act, Water Quality Criteria[d]		
			Health Advisories		Human Health		
	Maximum Contam-inant Level[b]	Maximum Contam-inant Level Goal[c]	10-Day	Chronic	Toxic Effect	Carcinogen[e] (10^{-6} risk)	Organo-leptic[f]
Chlorinated ethanes (Cont'd)							
1,1,2,2-Tetrachloroethane	–	0	–	–	–	0.17	–
Hexachloroethane	–	0	–	–	–	2.4	–
Chlorinated phenols							
3-Chlorophenol	–	–	–	–	–	–	0.1
4-Chlorophenol	–	–	–	–	–	–	0.1
2,3-Dichlorophenol	–	–	–	–	–	–	0.04
2,5-Dichlorophenol	–	–	–	–	–	–	0.5
2-Chlorophenol	–	–	–	–	–	–	0.1
2,4-Dichlorophenol	–	–	–	–	3.09	–	–
2,6-Dichlorophenol	–	–	–	–	–	–	0.2
3,4-Dichlorophenol	–	–	–	–	–	–	0.3
2,3,4,6-Tetrachlorophenol	–	–	–	–	–	–	1
2,4,5-Trichlorophenol	–	–	–	–	2,600	–	–
2,4,6-Trichlorophenol	–	0	–	–	–	1.8	–
2-Methyl-4-chlorophenol	–	–	–	–	–	–	1,800
3-Methyl-4-chlorophenol	–	–	–	–	–	–	3,000
3-Methyl-6-chlorophenol	–	–	–	–	–	–	20
Pentachlorophenol		220[g]					
1,2-Dichloropropane	–	0[g]	–	–	–	–	–
Chlorophenoxys							
2,4-Dichlorophenoxyacetic acid (2,4-D)	100	70[g]	–	–	–	–	–
2,4,5-Trichlorophenoxy-propionic acid (2,4,5-T)	10	52[g]	–	–	–	–	–

TABLE 3.1 (Cont'd)

Chemical	Safe Drinking Water Act: Maximum Contaminant Level[b]	Safe Drinking Water Act: Maximum Contaminant Level Goal[c]	Safe Drinking Water Act: Health Advisories 10-Day	Safe Drinking Water Act: Health Advisories Chronic	Clean Water Act, Water Quality Criteria[d]: Human Health Toxic Effect	Clean Water Act, Water Quality Criteria[d]: Human Health Carcinogen[e] (10^{-6} risk)	Clean Water Act, Water Quality Criteria[d]: Organoleptic[f]
Chloroalkyl ethers							
bis(chloromethyl) ether	-	0	-	-	-	3.9×10^{-6}	-
bis(2-Chloroethyl) ether	-	0	-	-	-	0.030	-
bis(2-Chloroisopropyl) ether	-	-	-	-	34.7	-	-
Chloroform	100[h]	0	-	-	-	0.19	-
Chromium (VI)	50	120[g]	-	-	50	-	-
Chromium (III)	-	-	-	-	179,000	-	-
Copper	-	1,300[g]	-	-	-	-	1,000
Cyanide	-	200	-	-	-	-	-
DDT	-	0	-	-	-	>0.0012	-
Dichlorobenzidines	-	0	-	-	-	0.0207	-
1,1-Dichloroethylene	7	0	-	70	-	0.033	-
1,2-Dichloroethylene (cis)	-	70[g]	400	-	-	-	-
1,2-Dichloroethylene (trans)	-	70[g]	270	-	-	-	-
Dichloromethane	i	i	1,300	150	i	i	-
Dichloropropylenes	-	-	-	-	87	-	-
Dieldrin	-	0	-	-	-	0.0011	-
2,4-Dimethylphenol	-	-	-	-	-	-	400
2,4-Dinitrotoluene	-	0	-	-	-	0.16[j]	-
2,6-Dinitrotoluene	-	0	-	-	-	j	-
p-Dioxane	-	-	568	-	-	-	-
1,2-Diphenylhydrazine	-	0	-	-	-	0.046	-
Endosulfan	-	-	-	-	138	-	-
Endrin	0.2	-	-	-	1	-	-
Ethylbenzene	-	680	-	-	2,400	-	-
Ethylene glycol	-	-	-	5,500	-	-	-

TABLE 3.1 (Cont'd)

Chemical	Safe Drinking Water Act				Clean Water Act, Water Quality Criteria[d]		
	Maximum Contaminant Level[b]	Maximum Contaminant Level Goal[c]	Health Advisories		Human Health		Organoleptic[f]
			10-Day	Chronic	Toxic Effect	Carcinogen[e] (10^{-6} risk)	
Formaldehyde	-	-	30	-	30	-	-
Fluoranthene	-	188	-	-	-	-	-
Fluoride	4[k]	4[k]	-	-	-	-	-
Halomethanes	-	0	-	-	-	0.19	-
Heptachlor	-	0	-	-	-	0.011	-
Hexachlorobutadiene	-	0	-	-	-	0.45	-
Hexachlorocyclohexanes							
α-Hexachlorocyclohexane	-	0	-	-	-	0.013	-
β-Hexachlorocyclohexane	-	0	-	-	-	0.0232	-
γ-Hexachlorocyclohexane (lindane)	4	0	-	-	-	0.0264	-
Hexachlorocyclopentadiene	-	-	-	-	206	-	-
n-Hexane	-	-	4,000	-	-	-	-
Isophorone	-	-	-	-	5,200	-	-
Kerosene/fuel oil No. 2	-	-	350[l]	-	-	-	-
Lead	50	0[g]	-	-	50	-	-
Mercury	2	2[g]	-	-	10	-	-
Methoxychlor	100	340[g]	-	-	-	-	-
Methyl ethyl ketone	-	-	7,500	750	-	-	-
Nickel	-	-	-	-	15.4	-	-
Nitrate, as N	10,000	10,000[g]	-	-	-	-	-
Nitrobenzene	-	-	-	-	19,800	-	-
Nitrophenols							
2,4-Dinitro-o-cresol	-	-	-	-	13.6	-	-
Dinitrophenol	-	-	-	-	70	-	-

TABLE 3.1 (Cont'd)

Chemical	Safe Drinking Water Act: Maximum Contaminant Level[b]	Safe Drinking Water Act: Maximum Contaminant Level Goal[c]	Safe Drinking Water Act: Health Advisories: 10-Day	Safe Drinking Water Act: Health Advisories: Chronic	Clean Water Act, Water Quality Criteria[d]: Human Health: Toxic Effect	Clean Water Act, Water Quality Criteria[d]: Human Health: Carcinogen[e] (10^{-6} risk)	Clean Water Act, Water Quality Criteria[d]: Organoleptic[f]
Nitrosamines							
N-Nitrosodimethylamine	-	0	-	-	-	0.0014	-
N-Nitrosodimethylamine	-	0	-	-	-	0.0008	-
N-Nitrosodi-n-butylamine	-	0	-	-	-	0.0064	-
N-Nitrosodiphenylamine	-	0	-	-	-	7.0	-
N-Nitrosopyrrolidine	-	0	-	-	-	0.0016	-
Phenol	-	-	-	-	3,500	-	-
Phthalate esters							
Dimethyl phthalate	-	-	-	-	350,000	-	-
Diethyl phthalate	-	-	-	-	434,000	-	-
Dibutyl phthalate	-	-	-	-	44,000	-	-
Di-2-ethylhexyl phthalate	-	-	-	-	21,000	-	-
Polychlorinated biphenyls (PCBs)	-	0	12.5	-	-	>0.0126	-
Polynuclear aromatic hydrocarbons	-	0	-	-	-	0.0031	-
RDX	-	-	-	-	33.7[m]	-	-
Selenium	10	45[g]	-	-	10	-	-
Silver	50	-	-	-	50	-	-
2,3,7,8-TCDD (dioxin)	-	0	-	-	-	1.8×10^{-7}	-
Tetrachloroethylene	-	0	175	20	-	0.88	-
Thallium	-	-	-	-	17.8	-	-
Toluene	-	2,000[g]	2,000	340	15,000	-	-
Toxaphene	5	0	-	-	-	25,800	-
Trichloroethylene	5	0	200	75	-	2.8	-
Total Trihalomethanes	100[h]	-	-	-	-	-	-
Trinitroglycerine	-	-	-	-	-	1.4[n]	-

TABLE 3.1 (Cont'd)

Chemical	Safe Drinking Water Act				Clean Water Act, Water Quality Criteria[d]		
	Maximum Contaminant Level[b]	Maximum Contaminant Level Goal[c]	Health Advisories: 10-Day	Health Advisories: Chronic	Human Health: Toxic Effect	Human Health: Carcinogen[e] (10^{-6} risk)	Organoleptic[f]
Trinitrotoluene (TNT)	-	-	-	-	44[m]	-	-
Vinyl chloride	2	0	-	-	-	2	-
Total Xylenes	-	10,000[g]	1,200	620	-	-	-
Zinc	-	-	-	-	-	-	5,000

[a]Source: *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA*, EPA, Report EPA-54016-89-004 (1988), unless otherwise noted. A hyphen denotes the absence of a regulation or criterion.

[b]These standards are part of the National Primary Drinking Water Regulations (40 CFR 141).

[c]MCLGs are nonenforceable health goals that are set at a level at which no known or anticipated adverse health effect occurs and that allows an adequate safety margin. The MCLG for all carcinogens is zero.

[d]These criteria are recommended but not legally enforceable.

[e]To obtain criteria for risks at 10^{-4}, 10^{-5}, and 10^{-7}, multiply the criteria by factors of 100, 10, and 0.1, respectively. Values are for ingestion of water only and do not include ingestion of fish.

[f]Organoleptic criteria are based on odor and taste; health-based water quality criteria are not available.

[g]Proposed MCLG value (see National Primary Drinking Water Regulations (40 CFR 141).

TABLE 3.1 (Cont'd)

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[h]The summed concentration of the four trihalomethanes (chloroform, bromodichloromethane, dibromochloromethane, and bromoform) must be less than 100 µg/L per 40 CFR 141.

[i]See halomethane criteria (EPA-540/G-85/003 - June 1985).

[j]Source: Ref. 18. Insufficient data are available to estimate a human health water quality criterion for 2,6-dinitrotoluene. However, the existing data show that this isomer is a more potent carcinogen than the 2,4 isomer.

[k]See Ref. 16.

[l]Seven-day health advisory for benzene and benzo(a)pyrene in kerosene, respectively.

[m]Source: Ref. 19.

[n]Source: Ref. 20.

ARARs are set at levels that cause no known or anticipated adverse health effects and allow for an adequate margin of safety (52 FR 32496). Goals for all carcinogens are zero. The CWA water quality criteria are given for toxic effects and for carcinogenicity at a 10^{-6} lifetime risk level. Criteria for different risk levels can be obtained as indicated in Table 3.1, footnote e. Organoleptic criteria are based on odor and taste, not on health-based criteria. The 10-day and chronic health advisory criteria refer to exposures for a 10-day period and for continuous exposure, respectively.

3.2.2 State of New Mexico

3.2.2.1 Drinking Water

The State of New Mexico has adopted the Federal National Primary Drinking Water Regulations (40 CFR 141) as primary and secondary drinking water regulations for New Mexico. The State adopted all requirements for siting, MCLs, monitoring, chemical analysis, reporting, public notification, and record keeping (New Mexico Water Quality Act, Chapter 326, Laws of 1973, as amended). The MCLs for the New Mexico primary drinking water regulations are the same as the federal MCLs given in Table 3.1.

Secondary drinking water regulations apply to any substance in drinking water that may adversely affect the taste, odor, or appearance of water or that may adversely affect the public welfare. The state secondary drinking water standards are given in Table 3.2.

3.2.2.2 Surface Water

New Mexico has promulgated surface water quality standards, which apply to waters designated for use as a source of public water supply. The general requirements are given in Table 3.3. Standards, which have been adopted under the Water Quality Control Act 88-1, are available in a publication entitled "Water Quality Standards for Inter- and Intra-state Streams in New Mexico." Water-quality-based effluent limitations for groundwater are listed in Table 3.4. These standards limit the discharge of effluent to protect groundwater as a source of "domestic and agricultural water supply," and to protect those segments of surface waters which are gaining because of groundwater inflow, for uses designated in the New Mexico Water Quality Standards.[11]

3.3 HAZARDOUS WASTE

3.3.1 Federal

Solid wastes are divided into the categories of hazardous and nonhazardous. For regulatory purposes, solid wastes are hazardous if they are among of the following: (1) those listed in 40 CFR 261, Subpart D; (2) those having at least one of four characteristics listed in 40 CFR 261, Subpart C; or (3) those that contain a hazardous

TABLE 3.2 New Mexico Secondary Drinking Water Standards

Parameter	New Mexico Standard
Chloride (mg/L)	250.0
Color (units)	15.0
Copper (mg/L)	1.0
Corrosivity	Noncorrosive
Foaming agents (mg/L)	0.5
Iron (mg/L)	0.3
Manganese (mg/L)	0.05
Odor (odor number)	3.0
pH (standard units)	6.5-8.5
Sulfate (mg/L)	250.0
Total dissolved solids (mg/L)	500.0
Zinc (mg/L)	5.0

Source: 40 CFR 143.

constituent listed in 40 CFR 261, Appendix VIII. A waste may be excluded from regulation by 40 CFR 261, Appendix IX. If it is not specifically or categorically excluded, a waste may still be hazardous unless it can be determined that it "is not capable of posing a substantial presence or potential hazard to human health or the environment when improperly treated, stored, transported or disposed of, or otherwise managed" (40 CFR 261.11).

Wastes, such as contaminated soils, can be characteristically hazardous (Subpart C) based on ignitability, corrosivity, reactivity, or exceedance of a prescribed concentration when extracted (EP toxicity). Extraction procedure toxicity tests the leachability of 14 chemical components regulated by the National Primary Drinking Water Regulations (40 CFR 141). In 1986, EPA proposed to amend the EP toxicity test by expanding the list of components and introducing a new leaching procedure known as the toxicity characteristic leaching procedure (TCLP).

On March 5, 1990, EPA issued the final *toxicity characteristic* (TC) rule. The rule was published in the Federal Register on March 29 (55 FR 11798), and it became effective 6 mo after publication, on September 25, 1990. The effective date for small-quantity generators is 12 mo after publication, on March 29, 1991. Table 3.5 lists the TC compounds and their regulatory levels. The TC rule applies to the 14 compounds regulated under the EP toxicity rule as well as 25 additional compounds. Wastes identified as hazardous under the TC will also become hazardous substances under Section 101(14) of CERCLA.

TABLE 3.3 New Mexico General Requirements for Surface Water Discharges

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Part 2-101. General Requirements

A. Except as otherwise provided in Part 2 of these regulations, no person shall cause or allow effluent to discharge to a watercourse if the effluent as indicated by:

1. any two consecutive daily composite samples;
2. more than one daily composite sample in any thirty-day period (in which less than ten [10] daily composite samples are examined);
3. more than ten percent (10%) of the daily composite samples in any thirty-day period (in which ten [10] or more daily composite samples are examined); or
4. a grab sample collected during flow from an intermittent or infrequent discharge does not conform to the following:

Bio-chemical Oxygen Demand (BOD)	Less than 30 mg/L
Chemical Oxygen Demand (COD)	Less than 125 mg/L
Settleable Solids	Less than 0.5 mg/L
Fecal Coliform Bacteria	Less than 500 organisms/100 mL
pH	Between 6.6 and 8.6

B. Upon application, the director of the Environmental Improvement Division may eliminate the pH requirement for any effluent source that the director determines does not unreasonably degrade the water into which the effluent is discharged.

C. Subsection A of this section does not apply to the weight of constituents in the water diverted.

D. Samples shall be examined in accordance with the most current edition of *Standard Methods for the Examination of Water and Wastewater* published by the American Public Health Association or the most current edition of *Methods for Chemical Analysis of Water and Wastes* published by the Environmental Protection Agency, where applicable.

Source: Bureau of National Affairs, March 1990.

TABLE 3.4 New Mexico Standards for Groundwater of 10,000 mg/L TDS Concentration or Less

A. Human Health Standards	
Arsenic (As)	0.1 mg/L
Barium (Ba)	1.0 mg/L
Cadmium (Cd)	0.01 mg/L
Chromium (Cr)	0.05 mg/L
Cyanide (CN)	0.2 mg/L
Fluoride (F)	1.6 mg/L
Lead (Pb)	0.05 mg/L
Total Mercury (Hg)	0.002 mg/L
Nitrate (NO_3 as N)	10.0 mg/L
Selenium (Se)	0.05 mg/L
Silver (Ag)	0.05 mg/L
Uranium (U)	5.0 mg/L
Radioactivity: Combined Radium-226 and Radium-228	30.0 pCi/L
Benzene	0.01 mg/L
Polychlorinated biphenyls (PCBs)	0.001 mg/L
Toluene	0.75 mg/L
Carbon tetrachloride	0.01 mg/L
1,2-dichloroethane (EDC)	0.01 mg/L
1,1-dichloroethylene (1,1-DCE)	0.005 mg/L
1,1,2,2-tetrachloroethylene (PCE)	0.02 mg/L
1,1,2-trichloroethylene (TCE)	0.1 mg/L
Ethylbenzene	0.75 mg/L
Total xylenes	0.62 mg/L
Methylene chloride	0.1 mg/L
Chloroform	0.1 mg/L
1,1-dichloroethane	0.025 mg/L
Ethylene dibromide (EBD)	0.0001 mg/L
1,1,1-trichloroethane	0.06 mg/L
1,1,2-trichloroethane	0.01 mg/L
1,1,2,2-tetrachloroethane	0.01 mg/L
Vinyl chloride	0.001 mg/L
PAHs: total naphthalene plus monomethylnaphthalenes	0.03 mg/L
Benzo-a-pyrene	0.0007 mg/L
B. Other Standards for Domestic Water Supply	
Chloride (Cl)	250 mg/L
Copper (Cu)	1.0 mg/L
Iron (Fe)	1.0 mg/L
Manganese (Mn)	0.2 mg/L
Phenols	0.005 mg/L
Sulfate (SO_4)	600 mg/L
Total Dissolved Solids (TDS)	1000 mg/L
Zinc (Zn)	10.0 mg/L
pH	between 6 and 9

TABLE 3.4 (Cont'd)

C. Standards for Irrigation Use -- Groundwater Shall Meet the Standards of Subsections A, B, and C unless Otherwise Provided	
Aluminum (Al)	5.0 mg/L
Boron (B)	0.75 mg/L
Cobalt (Co)	0.05 mg/L
Molybdenum (Mo)	1.0 mg/L
Nickel (Ni)	0.2 mg/L

Source: Bureau of National Affairs, March 1990.

A solid waste exhibits the characteristic of ignitability if it meets any of the following criteria:

- It is a nonaqueous liquid and has a flash point below 140°F;
- It is not a liquid and can cause fire through friction, absorption of moisture, or spontaneous chemical change;
- When ignited, it burns so vigorously and persistently that it creates a hazard; or
- It is an ignitable compressed gas or an oxidizer.

A waste is characteristically corrosive if (1) it is aqueous and has a pH less than or equal to 2 or a pH greater than or equal to 12.5 or (2) it is a liquid that corrodes steel (under prescribed conditions).

A solid waste is reactive if it is capable of (1) detonation or explosive reaction when subjected to a strong initiating source or heated under confinement or (2) detonation or explosive decomposition at standard temperature and pressure. Explosives are included under reactivity. Two classes of explosives are recognized -- Class A and Class B. Class A explosives contain detonating explosives, including priming devices (such as lead azide) and high explosives (such as TNT, tetryl, and black powder). Class B explosives contain rapidly burning explosives (such as propellants). Some of each class have been present at Fort Wingate.

TABLE 3.5 Toxicity Characteristic Constituents and Regulatory Levels

Constituent	EPA Waste No.	Regulatory Level (mg/L)
Arsenic	D004	5.0
Barium	D005	100.0
Benzene	D018	0.5
Cadmium	D006	1.0
Carbon tetrachloride	D019	0.5
Chlordane	D020	0.03
Chlorobenzene	D021	100.0
Chloroform	D022	6.0
Chromium	D007	5.0
o-Cresol[a]	D023	200.0
m-Cresol[a]	D024	200.0
p-Cresol[a]	D025	200.0
Cresol[a]	D026	200.0
2,4-D	D016	10.0
1,4-Dichlorobenzene	D027	7.5
1,2-Dichloroethane	D028	0.5
1,1-Dichloroethylene	D029	0.7
2,4-Dinitrotoluene[b]	D030	0.13
Endrin	D012	0.02
Heptachlor (and its hydroxide)	D031	0.008
Hexachlorobenzene[b]	D032	0.13
Hexachloro-1,3-butadiene	D033	0.5
Hexachloroethane	D034	3.0
Lead	D008	5.0
Lindane	D013	0.4
Mercury	D009	0.2
Methoxychlor	D014	10.0
Methyl ethyl ketone	D035	200.0
Nitrobenzene	D036	2.0
Pentachlorophenol	D037	100.0
Pyridine[b]	D038	5.0
Selenium	D010	1.0
Silver	D011	5.0
Tetrachloroethylene	D039	0.7
Toxaphene	D015	0.5

TABLE 3.5 (Cont'd)

Constituent	EPA Waste No.	Regulatory Level (mg/L)
Trichloroethylene	D040	0.5
2,4,5-Trichlorophenol	D041	400.0
2,4,6-Trichlorophenol	D042	2.0
2,4,5-TP (Silvex)	D017	1.0
Vinyl chloride	D043	0.2

[a]If o-, m-, and p-cresol concentrations cannot be differentiated, then the total cresol (D026) concentration is used.

[b]Because the quantification limit is greater than the regulatory level, the quantification limit becomes the regulatory level.

Source: 55 FR 11804.

3.3.2 State of New Mexico

In determining whether a waste will be regulated as hazardous, the Environmental Improvement Division (EID) first considers the following criteria (New Mexico Statutes, Title 74, Environmental, Article 4):

- The extent to which the waste meets the state's statutory definition and
- The extent to which other state or federal agencies with experience and expertise in regulating and managing hazardous substances have identified or characterized a component of the waste as hazardous or potentially hazardous to public health, safety, or welfare or to the environment.

In addition to the above criteria, the NMEID has adopted the regulations of the EPA as set forth in 40 CFR Parts 261-266, 268 and 270.

The state retains authority to further identify hazardous waste when a waste is not identified or otherwise described in New Mexico Statutes 74, Environmental Improvement, Article 4, Sec. 3 under the following conditions:

- The NMEID in the course of inspecting any premises, has reason to believe that the waste being generated, transported, stored, treated, used, or disposed of meets the general criteria of a hazardous waste or

- The NMEID believes that an imminent threat exists pursuant to New Mexico Hazardous Waste Regulations.

New Mexico also designates certain wastes as special wastes. These are defined by the New Mexico Solid Waste Management Regulations, Part IV, Secs. 401-404, and include:

- General wastes that have unique handling and truck requirements to ensure both public health and safety and environmental protection. These wastes must either be treated prior to disposal or isolated in their disposal to ensure a minimum amount of exposure to the public. All special wastes have to be monofilled and are restricted to Class A and D landfills.

- More specific wastes include asbestos waste, infectious waste, and municipal waste combustion ash.

The exceptions to hazardous waste regulation that are applicable to Fort Wingate are as follows:

- Domestic sewage;

- Any mixture of domestic sewage and other wastes passing through a sewer system to a publicly owned treatment works for treatment;

- Household waste;

- Samples collected for the sole purpose of testing to determine their properties, characteristics, or composition (when complying with given requirements); and

- Explosives that are disposed of by, or if the disposal is supervised by, U.S. Army Explosive Ordnance personnel, if the explosives are generated by a small-quantity generator.

3.4 HAZARDOUS AND SOLID WASTE AMENDMENTS OF 1984

The HSWA greatly expanded authorities under RCRA for requiring corrective action for releases of hazardous wastes and constituents at facilities that manage hazardous wastes. To protect human health and the environment, the amendments also require EPA to establish levels or treatment methods that substantially reduce the toxicity of a waste or the likelihood of the migration of hazardous constituents from the waste.

On November 7, 1986, EPA promulgated a final rule (51 FR 40572) implementing RCRA Section 3004(e). This rule establishes the general framework for the land disposal restrictions program and the treatment standards for listed hazardous wastes from nonspecific sources: solvent-containing wastes F001-F005 and dioxin-containing wastes F020-F023 and F026-F028 (54 FR 26595). Effective November 8, 1986, the HSWA prohibited land disposal (except by underground injection into deep wells) of solvent wastes F001-F005 and dioxin wastes F020-F023 (54 FR 26595).

The HSWA specify effective dates for prohibiting land disposal of hazardous wastes unless they meet one of two criteria: (1) the waste meets EPA treatment standards that minimize short- and long-term threats resulting from land disposal or (2) through an approved, site-specific petition, it can be demonstrated to a reasonable degree of certainty that the waste will not migrate from the disposal unit for as long as it remains hazardous. Table 3.6 lists the schedule by which EPA must promulgate regulations that ban the land disposal of hazardous wastes.

The treatment standards for solvent wastes are based on their inherently toxic characteristics, effects on clay and synthetic liners, and effects on other wastes and on the ability of treatment technologies to remove, destroy, or immobilize hazardous constituents in the wastes. Because of variances and exemptions, some of the banned wastes continue to be disposed of on land.

The ban on landfilling also includes:

- The disposal of bulk, noncontainerized liquids (hazardous or nonhazardous) in facilities permitted under RCRA;
- The disposal of hazardous waste into or above any formation within 0.25 mi of an underground source of drinking water;
- The disposal of bulk liquids in salt domes, salt beds, underground mines, or caves; and
- The use of waste oil as a dust suppressant if it is contaminated with hazardous waste (except ignitable wastes).

Five exceptions to the land disposal ban are provided: national capacity variance, no-migration petition, case-by-case extension, treatment variance, and treatment in surface impoundments. The exceptions are based on the following considerations:

1. At the time the land-ban rules were promulgated, a national capacity variance was established for the wastes. However, only the EPA can request a national capacity variance.

2. The no-migration demonstration must address whether the present or future migration of hazardous waste from the site will affect human health or the environment.

TABLE 3.6 EPA Schedule for Promulgation of Land-Ban Regulations

Waste	Promulgation Date
Solvent-containing wastes	Nov. 8, 1986
Dioxin-containing wastes	Nov. 8, 1986
California list wastes	July 8, 1987
Other listed hazardous wastes	
One-third of wastes	Aug. 8, 1988
Two-thirds of wastes	June 8, 1989
All listed wastes	May 8, 1990
Characteristically hazardous wastes	May 8, 1990

3. The case-by-case extension is not applicable if off-site capacity is not available for a waste that has been banned from disposal.

4. A treatment variance is relevant if a generator finds it difficult to meet an established standard.

5. Treatment of a waste in an impoundment is permitted if certain minimum technology standards are met and if the waste is removed within one year (RCRA Sec. 3005).

EPA is preparing guidance for the second, third, and fourth exceptions.

Land disposal under the HSWA is defined to include placement in a landfill, surface impoundment, waste pile, injection well, land treatment facility, salt dome or bed formation, underground mine or cave, or concrete vault or bunker. Restrictions apply to wastes to be disposed of after the effective date of the prohibition. Wastes that are land disposed prior to the applicable effective date for prohibition do not have to be removed for treatment. However, any hazardous wastes that are removed after the effective date are subject to disposal restrictions and treatment provisions (40 CFR 268.2).

Pursuant to the HSWA, RCRA authorizes EPA to require corrective action under an order or as part of a permit whenever there is or has been a release of hazardous waste or constituents into the environment. The HSWA further direct EPA to require corrective action beyond the facility boundary on a case-by-case basis. EPA interprets corrective action to cover the full range of possible actions, from studies and quick-fix measures to complete cleanups. Wherever applicable, on-site treatment, storage, or disposal of hazardous waste at CERCLA sites must meet RCRA technical requirements for the design and operation or closure of the facility. However, individuals involved in such on-site activities need not comply with RCRA administrative requirements.

3.5 SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT OF 1986 (SARA)

The SARA, enacted January 21, 1986, includes provisions for federal facilities, cleanup standards, and an environmental restoration program to be carried out at U.S. Department of Defense (DOD) facilities. The federal facilities provisions (Sec. 120) of SARA state that all federal facilities are subject to the same guidelines, rules, regulations, and criteria for hazardous substances that are applicable to any nonfederal facility. This applies in particular to preremedial activities, remedial actions, and evaluations under the National Contingency Plan. Remedial actions at DOD or U.S. Department of Energy (DOE) facilities may be modified as necessary to protect national security interests.

The SARA provisions on cleanup standards (Sec. 121) state that remedial actions in which the volume, mobility, or toxicity of hazardous substances or contaminants is permanently and significantly reduced by treatment are preferred over passive actions, such as land disposal without treatment. Off-site transport and disposal without such treatment should be the least-preferred action if practicable treatment technologies are available. Any off-site transfer of hazardous substances must be to an approved facility. The unit receiving the hazardous substances must not be releasing any hazardous waste or constituent into the groundwater, surface water, or soil.

Remedial actions must be selected to attain a degree of cleanup that ensures protection of human health and the environment. Pollutants or hazardous substances remaining after completion of the remedial action are subject to all legally applicable or relevant and appropriate requirements (ARARs). Applicable requirements are cleanup or control standards or environmental limitations that specifically address a hazardous substance, remedial action, location, or circumstance at a CERCLA site. Relevant and appropriate requirements are cleanup standards, control standards, or environmental limitations that address site situations that are sufficiently similar to those encountered at a CERCLA site.

Section 121(d)(2) of CERCLA, as amended by SARA, also states that remedial actions should satisfy ARARs under the SDWA, CWA, and RCRA. It also requires specifically that MCLGs and federal water quality criteria (Table 3.1) should be satisfied where they are relevant and appropriate for the actual or potential release (EPA 1987). EPA is developing guidance on the enforceability of MCLGs under SARA and the nonenforceability of MCLGs under the SDWA.

Section 211 of SARA describes an environmental restoration program for DOD facilities such as FWDA. The program is to be carried out in consultation with the EPA, and it is subject to the requirements given in Sec. 120 (federal facilities) of CERCLA. Goals of the program include the following:

1. Identification, investigation, research and development, and cleanup of contamination from hazardous substances, pollutants, and contaminants;

2. Correction of other environmental damage (such as detection and disposal of unexploded ordnance) that may create an imminent and

substantial threat to the public health or welfare or to the environment; and

3. Demolition and removal of unsafe buildings and structures, including buildings and structures at sites formerly used by the DOD or under the jurisdiction of the Secretary of Defense.

4 SITE ASSESSMENTS AND PROPOSED ACTIONS

An installation as large as Fort Wingate, which has hosted a variety of activities over such a long period of time, is likely to have a great many sites requiring investigation. Some of these sites were first identified in the Pollution Abatement Study prepared in May 1981 by the U.S. Army Environmental Hygiene Agency. The study was performed in order to request a waiver for the groundwater requirements of RCRA. The number of sites was expanded in September of that year by an Environmental Survey completed for USATHAMA.[7] In 1988, the AEHA conducted a groundwater contamination survey[21] and assigned the current SWMU numbers to 18 of the AREEs described in this document. By 1990, in response to the Defense Authorization Amendments and Base Closure and Realignment Act, an enhanced Preliminary Assessment (PA)[1] was completed. In order to address environmental issues that could affect the closure of FWDA, the PA included additional unnumbered SWMUs and other areas and facilities requiring environmental evaluation.

This section of the MEP provides the available historical aspects, current site conditions, and recommended response actions to discover the potential for contaminant releases to the environment. For many of the AREEs, the response actions will be the first investigations to be done. Table 4.1 summarizes the AREEs and salient facts characterizing them.

Some of the recommendations are for the analysis of specific contaminants. For convenience and standardization, the analytical parameters are given in the Appendix. For the initial phases of investigation, broad screening methods that allow a qualitative approach are recommended. In the subsequent phases of the investigation, more specific analytical methods are recommended in order to assess the extent of contamination. This approach is cost-effective because it allows the characterization efforts to focus initially on areas that have been identified as contaminated. All field investigations should be conducted in accordance with USATHAMA requirements to the extent possible.[22]

4.1 ADMINISTRATION AREA

The Administration Area (Fig. 4.1), as described and located (Fig. 2.2) in Sec. 2, contains administrative office buildings, housing and recreation facilities, general maintenance and warehouse buildings, a clinic, and several utility support facilities. A sewage treatment facility is in an adjacent limited-access area but is grouped with the Administration Area facilities for the purpose of this report. Two warehouses are leased to the Department of Agriculture for food storage and distribution. The principal facilities in the Administration Area are identified in Table 2.2. The activities associated with specific buildings have changed over time. Within the Administration Area, seven SWMUs are identified: Maintenance Shop (SWMU 8), Storage Yard (SWMU 9), POL Waste Discharge Area (SWMU 10), Septic Tanks and Cesspools (SWMU 14), Sewage Treatment Plant (SWMU 11), Old Landfill-Water Tower (SWMU 12), and Fire Training Ground (SWMU 17). Two additional areas of concern are the PCB transformer in Bldg. 11 and the Herbicide storage room in Bldg. 29.

TABLE 4.1 Summary of the AREEs, including the 18 Numbered SWMUs,[a] at Fort Wingate

SWMU No.	AREE Site Name	Period of Use	Current Activity	AREE Status	Type[b]
1	TNT Leaching Beds	1941-1967	Lagoons for disposal of explosive wastewater	Inactive	Lg
2	Acid Waste Holding Pond	1940-1960	Holding pond and disposal of pickling wastes	Inactive	Lg
3	Demolition Craters (pits)	1948-present	Detonation and disposal of explosives	Active	D
4a	Old Burning Ground	1948-1982	Open burning of explosive-contaminated waste	Inactive	D
4b	Current Burning Ground	1982-present	Burning of explosive-contaminated waste in trays and troughs	Active	D
5	Demolition Area Residue Piles	1955-present	Waste piles for disposal of residue from Burning Ground	Active	L
6	Current Landfill	1969-present	Sanitary landfill	Active	L
7	Deactivation Furnace	1950-1982 1982-1986	Metal recovery from munitions Conversion of white phosphorus to phosphoric acid	Inactive Inactive	I CP
8	Maintenance Shops	1941-present	Automotive maintenance, spray painting, battery handling, waste oil storage	Active	M,S

TABLE 4.1 (Cont'd)

SWMU No.	AREE Site Name	Period of Use	Current Activity	AREE Status	Type[b]
9	Storage Yard	1962-present	Storage of equipment and scrap items	Active	C,S
10	POL Waste Discharge area	Unknown-1975	Disposal of waste oil and solvents	Inactive	Sp,U
11	Sewage Treatment Plant	1941-present	Treatment of sanitary sewage	Active	W
12	Old Landfill-Water Tower	Unknown-1968	Disposal of industrial refuse; possibly pesticide containers and explosive-contaminated waste; Old Burning Ground	Inactive	B,D,L
13	Old Burning Ground and Demolition landfill	1948-1955	Explosive-contaminated waste	Inactive	D,L
14a	Septic tanks and cesspools	1970-Unknown	Treatment of sanitary sewage	Inactive	W
14b	Three septic tanks and a drainfield	Unknown-present	Treatment of sanitary sewage	Active	W
15	PCB-transformer storage area	Unknown	Storage of transformers containing PCB fluid	Inactive	S
16	Treated wood storage area	1985-1990	PCP-treated ammunition boxes	Inactive	S

TABLE 4.1 (Cont'd)

SWMU No.	AREE Site Name	Period of Use	Current Activity	AREE Status	Type[b]
17	Fire Training Ground	1925-present	Burning of solvents and oil for training	Inactive	D
18	Pesticide Storage bldg.	Unknown-present	Storage and mixing of pesticides and herbicides	Active	S
None	Old Demolition Area, Fenced-up Horse Valley	Unknown-1950 (?)	Destruction of various munitions and burning of explosive-contaminated waste	Inactive	D
None	Functional Test Range 1	Unknown	Explosives burned, mines tested	Inactive	D
None	Functional Test Range 2	Unknown	Rockets and morters tested	Inactive	D
None	Functional Test Range 3	Unknown	Testing of high explosives	Inactive	D
None	Building 11	Unknown	Transformers containing PCBs Stored	Inactive	S
None	Building 29	Unknown	Containers of herbicides stored	Inactive	S
None	Magazine/Igloo area, group C	Unknown-present	Munitions storage	Active	S

[a]As numbered by USATHAMA.

[b]B = burial; C = containers; CP = chemical processing; D = open burning, open detonation; I = incinerator; L = landfill; Lg = lagoon; M = maintenance activities; S = storage; Sp = spill; U = unauthorized dumping; W = wastewater treatment.

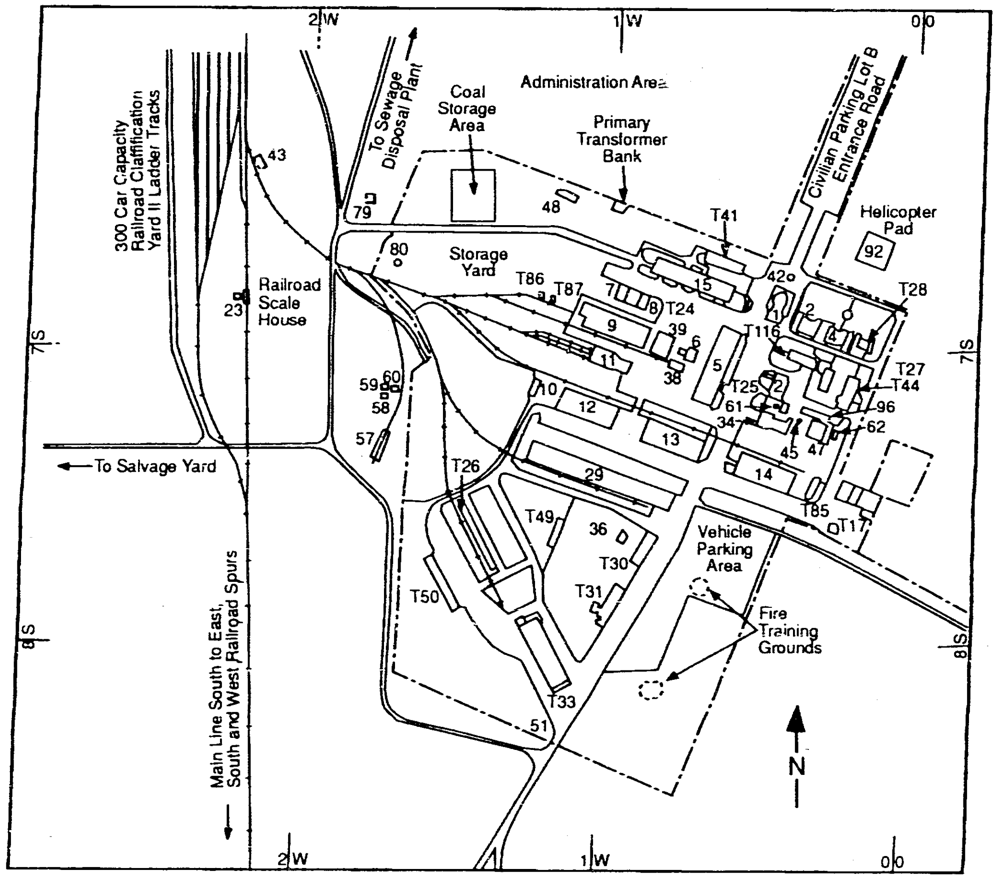


FIGURE 4.1 Facilities within FWDA Administration Area

Bldg. No.	Designation
1	Administration Bldg.
2	Family Quarters, Water Treatment Plant and Dispensary
3	Family Quarters
4	Family Quarters
5	Garage, Regimental
6	Motor Fuel Station
7	Paint Storage Warehouse
8	Bait Shop
9	Machine Shop
10	Salvage
11	Locomative Shop
12	Inert Storage Warehouse (West)
13	Inert Storage Warehouse (Center)
14	Inert Storage Warehouse (East)
15	Garage, now Storage
T-16	Bachelor Officers Quarters
T-17	Horse Stable
23	Railroad Scale House
T-24	Thermometer Shelter
T-25	Officers Garage
T-26	Lumber Shed
T-27	Storage Warehouse
T-28	Family Quarters
29	Inert Storage Warehouse
T-30	Billeting
T-31	Billeting
T-33	Dunnage Shop
34	Post Fire Station
36	Heating Plant, Admin. Area
38	Loading Dock (end)
39	Loading Dock (side)
42	Flag Pole
43	Railroad Tool House
T-44	Storage
45	Water Pump House Admin. Area
47	100 M Gallon Water Storage Tank
48	Heavy Implement Bldg.
T-49	Salvage Shed
T-50	Vacant Lot, formerly Dunnage Reclamation Bldg.
51	Match Guard Bldg.
57	Coal Chute, Line and Trestle
58	10 M Gallon Road Oil Storage Tank
59	5,500 Gallon Road Oil Storage Tank
60	2,079 Gallon Road Oil Storage Tank
61	Water Well House No. 1
62	Wading Pool
79	Storage Vaults
80	Storage Vaults
T-85	Instruction and Training Bldg.
T-86	Acelylene Storage Bldg.
T-87	Oxygen Storage Bldg.

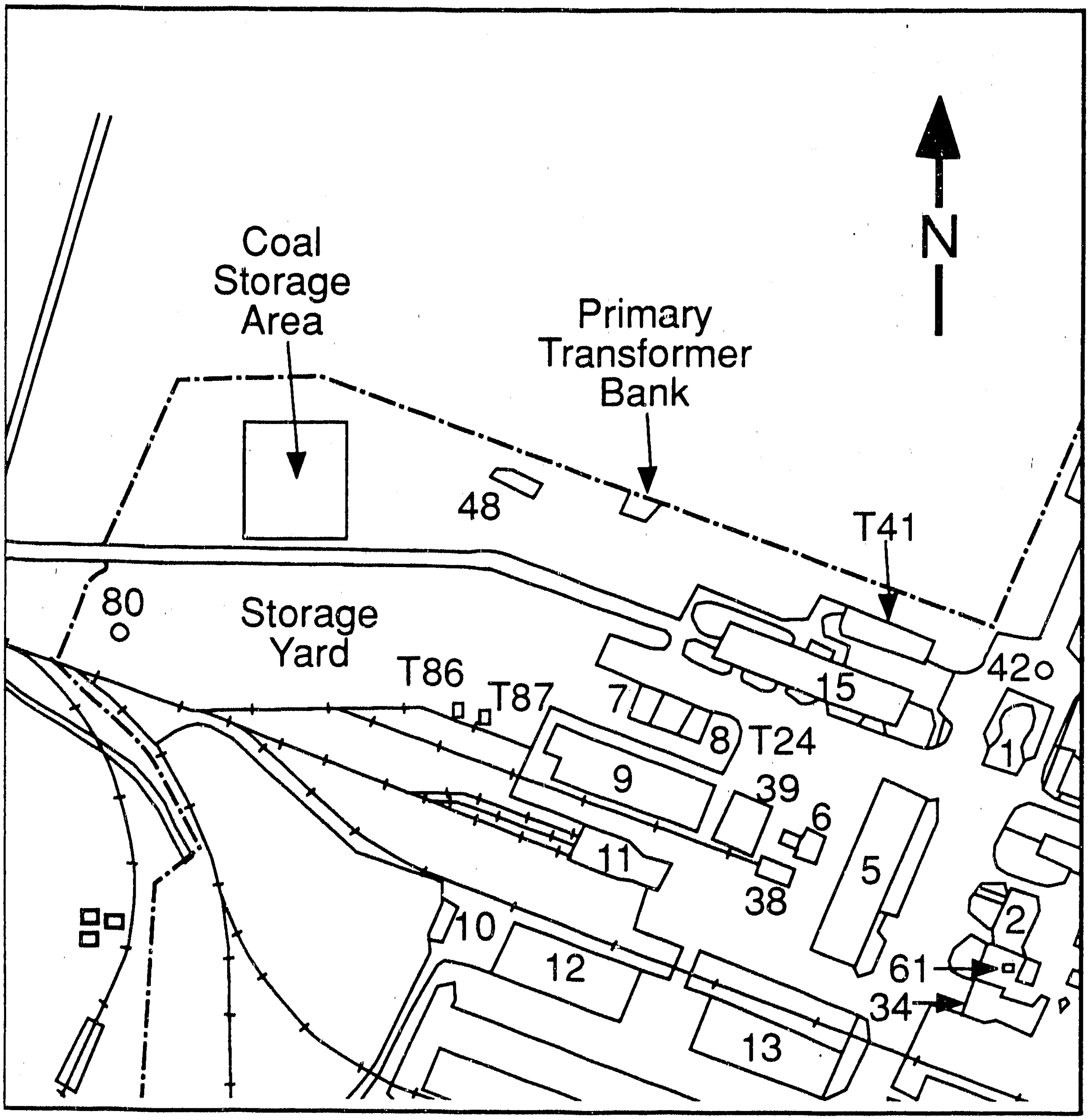


FIGURE 4.2 Location of Maintenance Shop, SWMU 8, and Storage Yard, SWMU 9

4.1.1 Maintenance Shops, SWMU 8

4.1.1.1 Site History

The two maintenance shops in Bldgs. 5 and 15 are both located in the Administration Area (Fig. 4.2). In the past, Bldg. 15 (previously identified as SWMU 8) was used for heavy equipment and automotive maintenance, spray painting, battery charging, plumbing and electrical works, and the mixing of pesticides.[5] Since 1980, Bldg. 15 has been reportedly used for general storage and waste oil storage. Currently, maintenance operations are performed in Bldg. 5. They include battery charging, automotive repair, arc and acetylene welding, and vehicle wash.

The machine shop, Bldg. 9, is also an area of concern. Solvents and petroleum products were used within this building. The way the floor is constructed suggests that solvents and petroleum products, if spilled, could migrate below the floor and into underlying soils.

4.1.1.2 Geology and Hydrology

The Maintenance Shop is situated on the alluvial deposits developed at the South Fork valley of the Puerco River in the installation. The thickness of the deposits at this site is approximately 70 ft, and their texture has been dictated by the nature of the bedrocks existing in the area. The deposits are silty and sandy, and their hydraulic permeability is moderate.[5,7]

Surface water runoff from the site drains northerly to the South Fork of the Puerco River. Surface water exists there from rainfall or snowmelt.

Groundwater under the site may be present in the alluvial aquifer, which is primarily recharged by surface runoff and secondarily by springs from the underlying San Andreas-Glorieta aquifer. Generally, the depth to water in the alluvial aquifer ranges from 20 to 30 ft.[5] The underlying aquifer is also present at a depth of about 1,100 ft below land surface near the site. This aquifer is the main source of groundwater in FWDA, and below the site it is under artesian pressure.

4.1.1.3 Nature and Extent of Contamination

Soda ash is used to neutralize battery acid in the battery service area inside the building. The neutralized solution is disposed of into a sump which leads to a storm drain. However, this operation has not been authorized under interim status or by a RCRA permit. It was estimated that 5 to 10 truck batteries and one forklift truck battery are serviced each year.[21] The waste mixture of water, oils, and greases from vehicle wash also goes to storm drains. There is no water/oil separator in the building. Detergents were not used.

In March 1987, three air samples were taken in Bldg. 5 for sulfuric acid analysis.[23] All three samples had less than 0.10 milligrams/cubic meter (mg/m^3) concentration of sulfuric acid. The value is below the federal permissible exposure limit for sulfuric acid of 1.0 mg/m^3.

Waste materials -- including waste oils, solvents, sulfuric acid, greases, and minor amounts of pesticides -- were generated in the two buildings. The possible chemicals being used in the past are listed in Table 4.2. In a visit by personnel of New Mexico Health and Environment Department on August 22, 1989,[24] 1,1,1-trichloroethane was identified being used in the past until about April 1989, when it was then replaced by naphtha.

TABLE 4.2 Industrial Activities and Possible Contaminants in the Maintenance Shop Area, SWMU 8

Bldg. No.	Activity	Possible Contaminants
5	Arc and acetylene welding, automotive repair, battery charging, cleaning metal parts	Greases, oils, metal dust, stoddard solvent, sulfuric acid
T15/15	Automotive maintenance, spray painting, battery charging, forging, plumbing and electric work, roads and grounds -mixing pesticides for roads and grounds	Oils, greases, sulfuric acid, stoddard solvent, paint, aldehyde, thinner, carbon tetrachloride, metal and abrasive dusts, metal and flux, Sanfax cleaner (methylene chloride, methyl chloroform, liquid detergent and emulsifier); Malathion, dieldrin, chlordane, DDT, diazinon, warfarin, dalapon, and sodium salt

Source: Ref. 5.

Solvents and petroleum products were used in the machine shop, Bldg. 9. They may have been spilled and may have subsequently entered the underlying soils.

4.1.1.4 Proposed Action

The Maintenance Shop site appears to be one of the locations in the Administration Area of known and/or suspected releases that require confirmation of suspected soil contamination and possible cleanup. It is suspected that the shallow alluvial groundwater aquifer may have received some of this contamination either through leaching or infiltration of surface runoff. The deep aquifer appears not to be threatened. However, because of the suspected releases to the surrounding soils and eventually to the alluvial aquifer (from other adjacent SWMUs, also), a comprehensive effort should be undertaken to investigate potential contamination.

This effort should be in a phased approach. The first phase should include shallow soil borings (to the shallow water table should one appear to exist at this location) and the collection of soil samples in the Maintenance Shop and Machine Shop areas. These samples should be analyzed for volatiles, semivolatiles, pH, pesticides, and total metals (see Appendix). The soil borings should be located in areas of visible staining around the building.

If the sewer outlet from the Maintenance Shop site is accessible (and on FWDA property), a sample of the sediment should be collected and analyzed for volatiles, semivolatiles, pesticides, pH, and total metals. If contamination is found, the sewer lines should then be cleaned. If the interior of the building is dust-laden, wipe samples should be collected and analyzed for metals.

If the initial soil samples indicate the presence of contamination, then a second phase should be initiated. During this phase, additional soil borings should be drilled, soil samples collected, and, if groundwater is present, groundwater monitoring wells installed in all contaminated areas identified during the initial phase.

Furthermore, during the initial phase, the storm drainage system in the vicinity of the Maintenance Shop buildings (5 and 15) drain inflows and any settling areas should be tested for volatiles, semivolatiles, pH, and metals contamination in the sediments and water. If these sediment and water samples indicate the presence of contamination within the storm drainage system, then a second phase should be initiated to determine the extent. Additional sediment and water samples should be collected downgradient of the Maintenance Shop Area.

Soils underlying and surrounding the Machine Shop, Bldg. 9, should be investigated for contamination. Samples should be collected from the soils underlying the floor within the building and from the near-surface soils immediately surrounding the building. These samples should be analyzed for volatiles, semivolatiles, and total metals.

4.1.2 Storage Yard, SWMU 9

4.1.2.1 Site History

The Storage Yard (SWMU 9) and outdoor coal storage area are located in the northwest part of the Administration Area (Fig. 4.2) and west of Bldg. 15. They were not active in 1948, but were visible in a 1962 aerial photo.[25] They exist in the same general open area and are separated by less than 50 ft. The Storage Yard is an area approximately 600 ft × 400 ft, with approximately 200 ft × 250 ft of the space used for storage.

Soils underlying and surrounding the machine shop, Bldg. 9, should be investigated for contamination. Samples should be collected from the soils underlying the floor within the building and from the near-surface soils immediately surrounding the building. These samples should be analyzed for volatiles, semivolatiles, and total metals.

The Storage Yard is used primarily to store items being turned in to DRMO or awaiting pickup by a recycling contractor. Items include scrap metals, pipes, radiators, hot water tanks, 55-gal drums of waste oils, solvents, and antifreeze, empty battery electrolyte containers, and full batteries. When enough waste solvents are accumulated, a recycle contractor is engaged for pickup.

The coal storage area was used to store coal for the power plant on FWDA. Coal was piled on a concrete pad. At the time that ANL personnel visited the site, the coal had been removed.

4.1.2.2 Geology and Hydrology

The Storage Yard and the outdoor coal storage area are situated on the alluvial deposits present at the area surrounding the South Fork of the Puerco River as mentioned above (Sec. 4.1.1.2). Surface water exists in the site only from rainfall, and it runs off from the site and drains into the South Fork of Puerco River. Groundwater may exist in the alluvial aquifer at a depth close to 20-30 ft.[5] At depths of 1,100 ft below the land surface of the site, the San Andreas-Glorieta aquifer is under artesian pressure.

4.1.2.3 Nature and Extent of Contamination

The Storage Yard has been used to store hazardous (waste oils, solvents, and batteries) and nonhazardous wastes (scrap metals). In August 1989, the Storage Yard was noted by the State of New Mexico to have several dozen 55-gal drums of waste oils, solvents, and antifreeze on bare ground or on wooden pallets.[24] Oil-stained soils were found around several drums, indicating spills or leaks. At that time, the solvent drums were reported to have been on site for at least four months, which exceeded the 90-day temporary storage limit allowed by RCRA. When ANL personnel visited the yard, the condition of the drums appeared unchanged. The contents of the drums were reported to have been sampled, but the results of the analysis were not available. Since the visit, installation operations personnel have reported that the waste has been disposed of through Army reclamation channels.

Spills or leaks appear to have occurred as evidenced by patches of stained soil near some of the drums. Oils and solvents could therefore migrate via surface flow toward the Puerco River. However, the volume of wastes stored here was relatively very small, and the low precipitation/high evaporation restrict contaminant movement. Furthermore, the deep aquifer is virtually inaccessible by such contaminant migration because of the underlying clay layers.

4.1.2.4 Proposed Action

The Storage Yard appears to be another site in the Administration Area of known and/or suspected releases that require cleanup or confirmation of suspected soil contamination. The oil-stained soils appear to be the result of leaky drums stored there. Mr. Adrian Bond, Fort Wingate Depot Activity, informed ANL that the contents of the drums had undergone laboratory analysis, however, and that they contained no hazardous constituents.[26] ANL did not receive copies of the laboratory analyses. Therefore, it is recommended that the soils, particularly in the stained areas, should be tested for contamination from oils, battery liquids, and solvents. Soil gas surveys, while of limited benefit, can be used to delineate areas for soil sampling. Near-surface soil samples should be collected in and around the visually stained areas within the storage yard. These samples should be analyzed for volatiles, semivolatiles, pesticides/PCBs, and total metals. If the initial soil samples indicate the presence of contamination, then a second phase should be initiated. During this phase, soil borings should be drilled and soil samples collected to determine the depth of soil contamination. Furthermore, better waste management practices are needed for waste battery acid to avert requirements for HW storage.

4.1.3 POL Waste Discharge Area, SWMU 10

4.1.3.1 Site History

In interviews with FWDA personnel, an area formerly used as a POL dump was identified. The site is located north of the fluorspar storage area in the Administration Area (Fig. 2.2, and item 9 [Machine Shop] in Fig. 4.1) and had been used until 1975. Waste oils and possibly some solvents were disposed of here. When the site was covered with soil in 1975, it was reported that the surface soil on the dump area was saturated with waste oils. Dumping on this site was discontinued at that time. When ANL personnel visited the site in the end of October 1989, no oil-stained soils were visible on the dump site surface.

Another former POL discharge area is reported in previous studies but was not confirmed by FWDA personnel during the interviews. It is suspected to be a mislocation of the only POL dump identified by current FWDA personnel. One environmental assessment report described a site location that matches the POL site that ANL personnel visited.[7] However, in that report, the location shown in a figure was different; item 1, Fig. 2.3, would locate it somewhere near the northern boundary of the site. The later location (SWMU 10) was apparently adopted in another 1988 report.[21] It is unclear whether this reported POL dump site represents a different site from that described above.

The POL dump location is further confused by a report dated September 1981.[7] In that report, a monitoring well was indicated as located north of the POL site, but it is shown on a map as south of the known POL dump visited by ANL personnel. This is thought to be another case of mislocation and not another POL dump site. Figure 4.3 indicates the various suspected locations of POL waste discharge (SWMU 10).

4.1.3.2 Geology and Hydrology

The land used for POL waste discharges is situated on the alluvial valley of the South Fork of the Puerco River, which has already has been described for SWMUs 8 and 9. Rainfall surface-water runoff from the site(s) drains to the Puerco River. Groundwater under the site may exist in the alluvial aquifer as well as in the very deep underlying San Andreas-Glorieta aquifer.

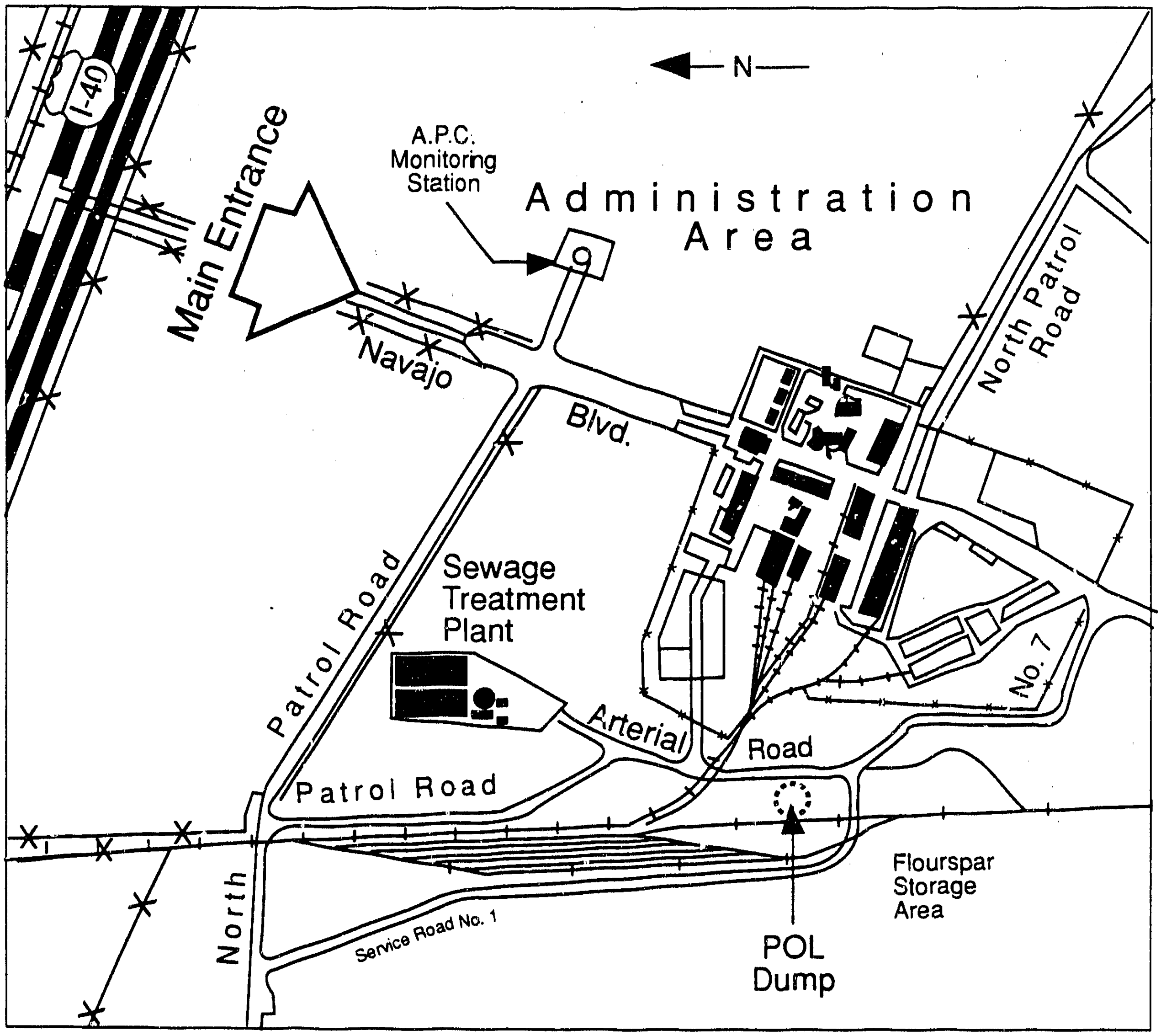


FIGURE 4.3 Location(s) of POL Waste Discharge Area(s), SWMU 10 (adapted from Ref. 21)

4.1.3.3 Nature and Extent of Contamination

Wastes from vehicle maintenance activities were dumped here over a period of about 4 yr and were never cleaned up. It is estimated that 200 gal/yr of POL wastes and possibly some solvents were disposed of here. POL products, possibly containing lead, could have been transported via surface water to the Puerco River. Organic solvents probably would have volatilized in the discharge area due to high evaporation. There is no evidence of release beyond the immediate area. A monitoring well installed downgradient did not intercept groundwater.

Although the site has not been used for many years, a number of factors contribute to the potential for contaminant migration off-post. The site is located in the northern part of the installation, and the direction of surface flow is toward the Puerco River, which lies offpost to the north. The unknown identity and quantity of waste and the location of the site in the more permeable alluvial deposits are also considerations. Factors limiting migration are the low precipitation and high evaporation of the area.

4.1.3.4 Proposed Action

The POL Waste Discharge Area requires environmental evaluation of suspected releases to the soil and to the shallow groundwater aquifer (if it is present). This area was reported to have contained soil saturated with oil prior to coverage with uncontaminated soil in 1975. Therefore, it is recommended that soil samples from the covered POL Waste Discharge Area should be tested for contamination. If the areas surrounding the POL Waste Discharge Area are believed to have received spills because of past practices, these areas should also be investigated. Soil gas surveys may be used to help define these surrounding areas only if solvents were discharged. Soil gas surveys are semiqualitative and should only be used as a screening tool to locate soil for sampling.

Initially, five shallow soil borings (to the water table) should be drilled and soil samples collected. These samples should be analyzed for volatiles, semivolatiles, pesticides/PCBs, and total metals. Four borings should be placed within the POL Waste Discharge Area and one boring downgradient of the known POL discharge area. This will help to determine if any lateral migration has occurred from the area.

If the initial soil samples indicate the presence of contamination, then a second study phase should be initiated. During this phase, additional soil borings should be drilled, soil samples collected, and groundwater monitoring wells installed. The wells should be screened to intercept the water table in the alluvium aquifer. Also, sediment sampling is recommended along the Puerco River to incorporate all SWMUs located in the alluvial basin.

4.1.4 Septic Tanks and Cesspools, SWMU 14

4.1.4.1 Site History

There are three abandoned septic tanks and associated cesspools near the Administration Area (Fig. 4.4). One septic tank (SWMU 14) is located at the entrance guardhouse, and another is located at the corral immediately east of the Administration Area.[13] These tanks have been abandoned, and there are no plans for future use. Near the tanks, cesspools are shown in some old maps (Wingate Ordnance Depot, General Utilities Map (Sewer), Drawing Numbers WOD 596F, 1965 and WOD 596D, 1954). The cesspool at the entrance guardhouse is lined with rubble in an area 6 ft square by 20 ft deep; the area has a sandy bottom. The cesspool east of the Administration building is of rock masonry construction with a diameter of 12 ft and a depth of 12 ft.

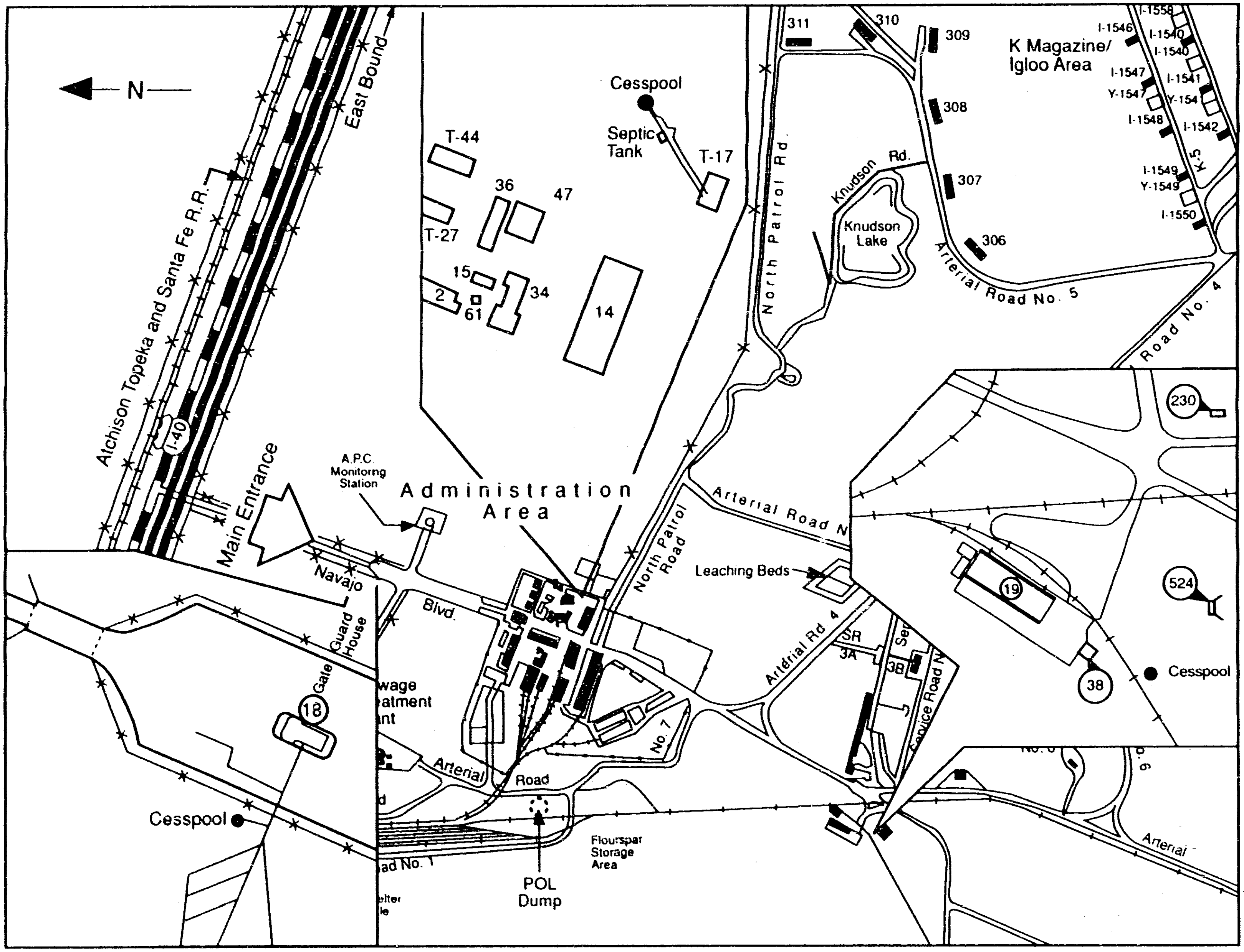


FIGURE 4.4 Location of Septic Tanks and Cesspools, SWMU 14

The third combination septic tank and cesspool is shown in a safety shelter location plan map (Drawing Number WOD 593, 1953), southwest of Bldg. 542 (designated Bldg. 19 on drawing) (Fig. 4.3). The septic tank is 4 ft by 11 ft and connected to a cesspool 8 ft in diameter and 17 ft deep.

This site is not considered to meet the SWMU definition established in the Code of Federal Regulations Title 40, Part 261.4(a)(1)(i-ii), because these units collect untreated sanitary waste.

Three active septic tanks/drainfield systems on FWDA provide septic disposal/treatment for isolated areas[2] (Fig. 4.4). They are located at Bldgs. 72, 745, and 746 with 2,000-gal (reported as 192,000-gal, probably incorrectly), 3,000-gal and 2,000-gal capacities, respectively. Flows and loading rates are generally low, allowing drainfields to rest and to minimize failures.

4.1.4.2 Geology and Hydrology

All septic tanks and cesspools or drainfields are situated on the alluvial deposits at the South Fork Valley of the Puerco River. Surface water from rainfalls flows to the adjacent creeks and finally drains to the river. Shallow groundwater exists in the underlying alluvial aquifer, and deep groundwater is present in the San Andreas-Glorieta aquifer.

4.1.4.3 Nature and Extent of Contamination

The main wastes from the septic tanks and cesspools are solid wastes, which are not regarded as hazardous wastes.

4.1.4.4 Proposed Action

Based on the nature of the operation, no further action is recommended for this SWMU. Since no action is recommended, the site should be removed from the list of Fort Wingate SWMUs. Because septic tanks and cesspools are not regulated and pose no threat, their removal is not necessary. However, they can be removed to avoid contaminating the surrounding soils with bacteria.

4.1.5 Sewage Treatment Plant, SWMU 11

4.1.5.1 Site History

The plant is a secondary sewage treatment facility (SWMU 11) established in 1941. It is located in a limited-access area northwest of the Administration Area near the installation northern boundary (Fig. 4.5). The plant includes a bar screen, a lift

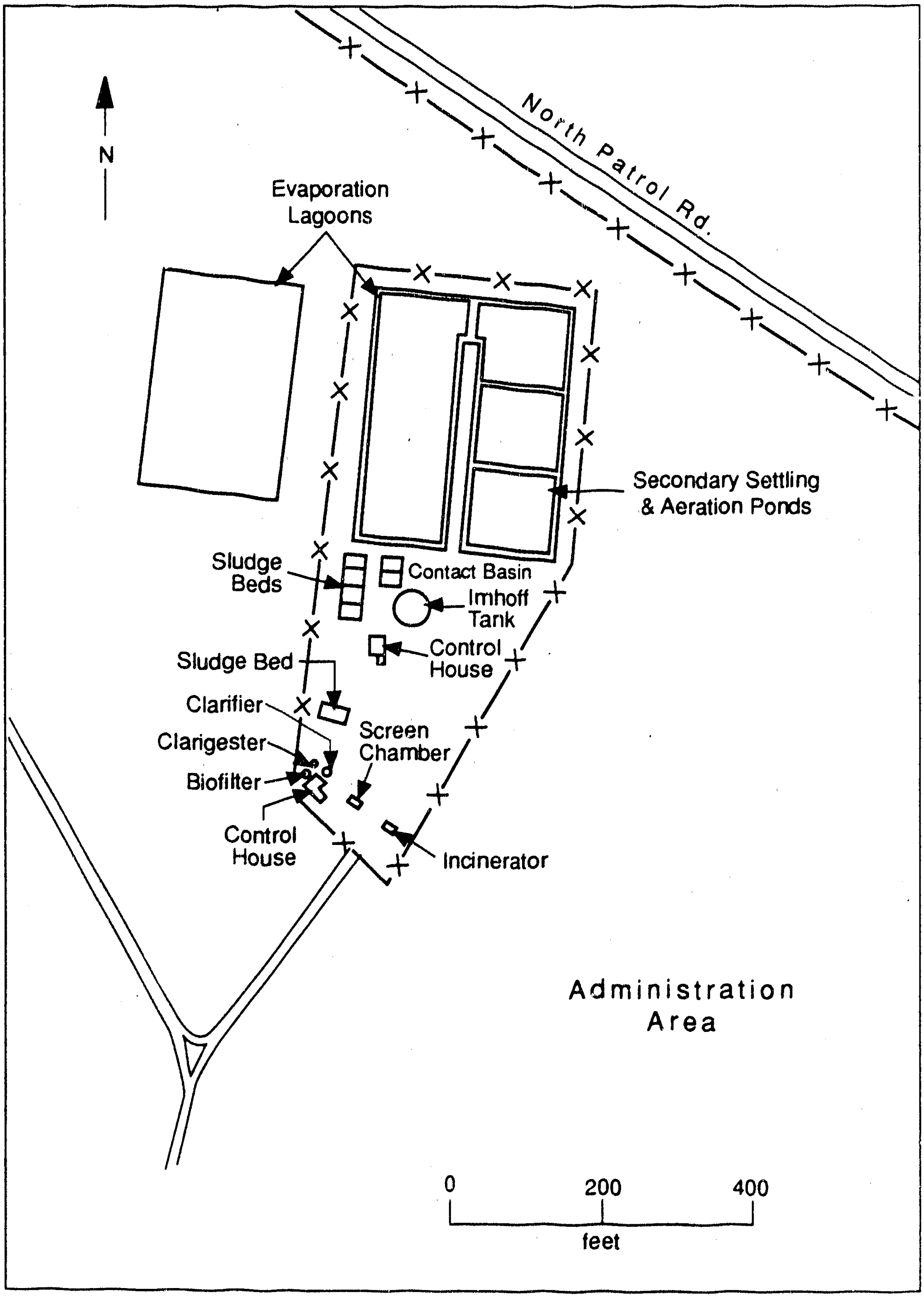


FIGURE 4.5 Location of Sewage Treatment Plant, SWMU 11 (adapted from Ref. 1)

station, a 192,000-gal/day Imhoff tank, four sludge drying beds, three stabilization lagoons in series, and two evaporation/infiltration ponds. The plant has a designed flow of 124,900 gal/day. The present flow ranges from 3,000 to 5,000 gal/day.[21]

Reportedly, only domestic sewage is treated in the plant. The sewage flows in by gravity. The liquid effluent, after a secondary treatment, is evaporated and infiltrated in the evaporation infiltration ponds. The sludge generated from the Imhoff tank is drained to the sludge drying beds. After the sludge is dry, it is reportedly skimmed off and disposed of in the current landfill.

Except during periods of heavy rain or snow storms, and except for the period between 1975 and 1977, there has been no discharge of treated effluent from the plant. This situation results from the evaporation/infiltration rate of discharge always being higher than the inflow rate. No NPDES permit was acquired except between 1975 and 1977. In that period, a water main was broken, apparently resulting in significant infiltration of water into the sewer system. An NPDES permit was obtained to allow discharge of effluent from the plant during that period.[21] The discharge was drained to an open drainage ditch north of the installation, and then to the South Fork of the Puerco River.

At the time ANL staff visited FWDA (October 1989), plant effluent was clear but a pink solution was found in a small, isolated pool in one of the two evaporation/infiltration ponds.

A small incinerator is located at the treatment plant. The incinerator is reportedly used only for burning classified documents.

4.1.5.2 Geology and Hydrology

The Sewage Treatment Plant is situated on the alluvial valley of the South Fork of the Puerco River, under which the shallow alluvial aquifer exists; also present is the much deeper San Andreas-Glorieta aquifer. During rainfalls and snowmelts, surface waters drain via adjacent creeks into South Fork of the Puerco River.

4.1.5.3 Nature and Extent of Contamination

The specific waste treated and disposed of through this plant is domestic sewage. No discharge appears to take place from this facility to surface waters, and the wastes are disposed of through evaporation/infiltration. In the past, however, occasional storms sent overflows to a tributary of the Puerco River. There is rarely a surface water discharge from this facility, and, therefore, no hazardous constituents are expected from this operation. Low precipitation/high evaporation restrict contaminant movement in this site, and the deep aquifer is virtually inaccessible because of depth and confining formations.

It is not clear whether the observed pink solution in one pool of the two evaporation/infiltration ponds was effluent or the result of a reaction of the effluent with the soil. According to FWDA personnel, the solution had not been seen in the treatment plant previously.

The Sewage Treatment Plant ponds used for settling and evaporation/infiltration are situated on alluvial sands and silts and may have released contaminants into the surrounding soils and possibly into the shallow groundwater aquifer. The soils at the bottom of the ponds and sludge drying areas are also suspected to have received contaminants. The Sewage Treatment Plant area is suspected of releases requiring cleanup or confirmation of suspected contamination.

4.1.5.4 Proposed Action

The sediments in the infiltration/evaporation ponds and the underlying soils of the sludge drying pits at the Sewage Treatment Plant should be tested for total metals. A minimum of one boring should be drilled in each pond and drying pit, and soil samples collected. Each boring should be drilled to the water table or bedrock, whichever occurs first.

An investigation should be conducted for the pink solution found in the pond, with sampling and analysis recommended if the solution is present. The pink solution should be analyzed for explosives, volatiles, semivolatiles, pesticides/PCBs, and metals.

4.1.6 Old Landfill-Water Tower, SWMU 12

4.1.6.1 Site History

The Old Landfill-Water Tower (also called Abandoned Landfill-North Patrol Road) is located on the side of a hill north of water storage tanks and off North Patrol Road (Fig. 4.6). It was a landfill and a suspected burn area that was in use until 1968. In this landfill, burial of garbage, trash, and debris generated in the installation was practiced. Today, overgrown grass and small brush cover the area.

Besides garbage, trash, and debris, some pesticide containers may have been disposed of in this landfill. It was reported that explosives-contaminated wastes were never disposed of here; these were taken to the Demolition Area.[21]

4.1.6.2 Geology and Hydrology

The Old Landfill-Water Tower (SWMU 12) is located on the alluvial deposits at South Fork Valley of the Puerco River, which is underlain by the Chinle Formation, of Triassic age, consisting primarily of calcareous silty claystone to fine-grained sandstone. As in most areas of the installation, surface water is present only during rainstorms and snowmelts and drains through creeks into the tributaries of the Puerco River. Groundwater may exist in the underlying alluvial aquifer and does exist in the very deep San Andreas-Glorieta aquifer.

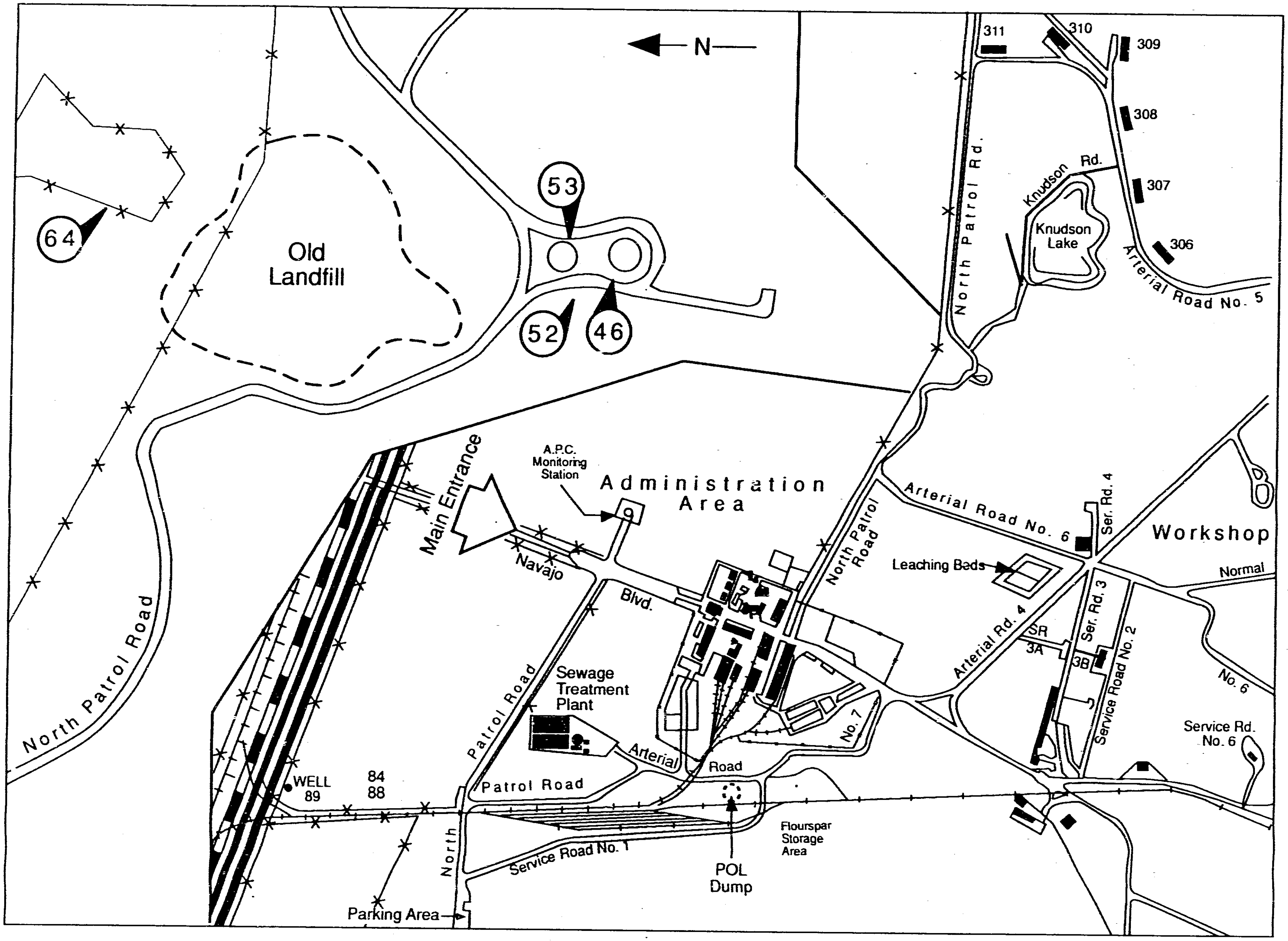


FIGURE 4.6 Location of Old Landfill-Water Tower, SWMU 12 (adapted from Ref. 21)

4.1.6.3 Nature and Extent of Contamination

Low precipitation and high evaporation prevalent in the area would severely limit the generation of leachate, especially since the landfill was on the side of a hill, and any precipitation would not have a chance to infiltrate. Any leachate generated would probably migrate to the northeast, following the topographic gradient.

Groundwater may exist in the alluvial deposits that underlie the area. If groundwater is not present, it is extremely doubtful that any contamination, if it exists, would migrate away from the immediate area. The major aquifer (San Andreas-Glorieta) is virtually inaccessible because of its depth and confining formation. It is unlikely that wastes containing hazardous constituents were placed in the landfill.

4.1.6.4 Proposed Action

The landfill site is an area where contamination may exist from past disposal practices. Therefore, an effort should be undertaken to investigate this potential contamination. This effort should be in a phased approach. The initial phase should include geophysical and gas surveys, and soil borings and the collection of soil samples. A geophysical survey should be used across the landfill to determine the area's lateral and vertical extent. A soil gas survey may be used to help place borings, but if methane is a problem in the landfill, the soil gas results may not be useable. To avoid this problem, a portable gas chromatograph should be used. Trenches should only be placed within the landfill as a last resort because trenching through a landfill is extremely dangerous. The borings should be drilled to the water table or to bedrock, whichever occurs first. Four borings should be drilled along the north and northeast boundaries of the landfill, because they lie in the most logical migration pathway. The samples should be analyzed for volatiles, semivolatiles, herbicides, pesticides/PCBs, explosives, and total metals.

If the initial soil samples indicate the presence of contamination, then a second phase should be initiated. During this phase, additional soil borings should be drilled, soil samples collected and, if groundwater was found during the first phase, groundwater monitoring wells should be installed.

4.1.7 Fire Training Ground, SWMU 17

4.1.7.1 Site History

The Fire Training Ground (SWMU 17) is located in the southwest of the Administration Area (Fig. 4.7). The U.S. Bureau of Indian Affairs has had a program to train fire fighters since the early 1970s, reportedly using the pit three times a year. Diesel fuel, gasoline, organic solvents, or oil was dumped onto an unlined pit with a diameter of 20 ft and burned. As much as one 55-gal drum of fuel might be used each time, according to FWDA personnel. Currently, the training ground is not used, but the soil has not been remediated.

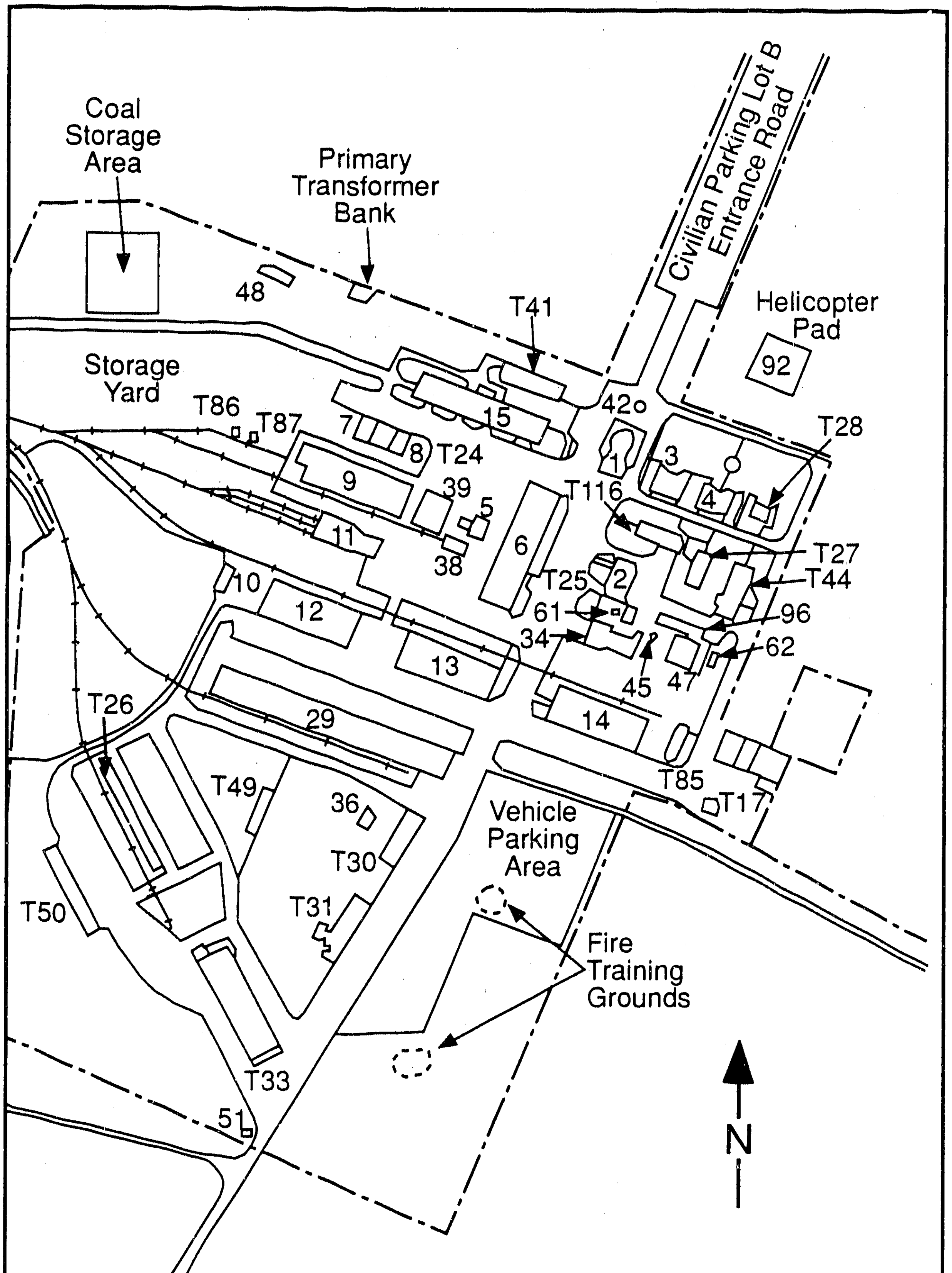


FIGURE 4.7 Location of Fire Training Ground, SWMU 17 (adapted from Ref. 21)

4.1.7.2 Geology and Hydrology

The Fire Training Ground is situated on the alluvial deposits present at the area surrounding the South Fork of the Puerco River. Groundwater may exist in the alluvial aquifer and in the deep San Andreas-Glorieta aquifer underlying the site. Surface water exists on the site only from rainfall or snowmelt, and it drains into the South Fork of the Puerco River via adjacent creeks.

4.1.7.3 Nature and Extent of Contamination

Specific wastes in the Fire Training Ground pit could be waste oil, solvents, and other fuels. The pit may fill with water after heavy rains. During the AEHA 1988 survey, it was noted that approximately 6 in. of water was contained in the pit. This water had a slight oil sheen floating on its surface.

Lead may be a contaminant of the waste oil, and fuel breakdown products may include several of the purgeable organic priority pollutants. However, with the small amount of gasoline used, its breakdown products are probably lost to volatilization. Lead may have settled in the base of the pit and contaminated surrounding soil. Petroleum hydrocarbons and acid and base/neutral extractable organics may also be present in the pit and surrounding soil. At the time of the environmental assessment, visible evidence of release included an oil sheen on the water in the pit and oil stains on the grass around the site, particularly where the drums are stored. There is also fuel odor in the area.

Along the edge of the Fire Training Ground are what appear to be delivery or drainage pipes. A small stained area, which may have resulted from past practices, is also visible at this site. These are areas of concern and should be investigated.

4.1.7.4 Proposed Action

At this site, organic solvents, diesel fuels, and oils may have been released to the surrounding soil and possibly to the alluvial aquifer. Furthermore, the pit is very close to the buildings of the Administration Area. The usage, lack of any containment mechanisms, and failure to clean up the area are also factors contributing to the potential for exposure. On the other hand, the limiting factors for exposure potential are the low precipitation and high evaporation, which are characteristic of the area, and the depth and confinement of the drinking water aquifer.

Soil sampling in and around the pit, and along the surface drainage route should be conducted. (Soil gas surveys or detection with a photoionizer may help define areas where soil samples should be collected.) Analysis of the samples must focus on total metals, volatiles, and semivolatiles. Surface soil samples should be collected from all visibly stained areas around the pit. If contamination is detected in these areas, it should be excavated and properly disposed of. From within the pit several borings should be drilled and soil samples collected. If contamination exists within the pit, the soils must be excavated and properly disposed of.

If the Fire Training Ground is to become active in the future, construction of an impervious liner for the fire training pit is recommended to provide a means for containing runoff and infiltration. Storage of drums in this area when the pit is not in use, is not recommended. Leaks and spills of oils and fuels should be cleaned up as they occur, as well as soil affected after each use of the pit.

As stated previously, sediment sampling and analysis are also recommended along the Puerco River to incorporate all SWMUs situated in the alluvial basin.

4.1.8 PCB Transformer, Bldg. 11

4.1.8.1 Site History

In the Administration Area, before 1986, a leaking transformer containing PCBs was located in the basement of Bldg. 11 (Locomotive Shop in Fig. 4.1). A TSCA non-compliance order was issued for the transformer in a 1986 environmental compliance audit report. The transformer fluid had been leaking to the concrete floor for several months, and the fluid running off the transformer had not been cleaned up. The building has a floor drain, posing a potential for leaks to migrate to surface water and sediments of the drainage system. The transformer has been replaced by a non-PCB transformer, but no sampling or cleanup has been conducted for the PCB spill area in Bldg. 11.

4.1.8.2 Geology and Hydrology

The Bldg. 11 area in which the PCB-containing transformer had been stored is situated on the alluvial deposits developed in the South Fork Valley of the Puerco River. The situation of surface and ground waters does not differ from that prevailing in the valley. Rainfall and snowmelt occasionally provide some surface water that drains via adjacent creeks into the river. Groundwater may exist in the underlying shallow aquifer and does exist in the deep San Andreas-Glorieta aquifer.

4.1.8.3 Nature and Extent of Contamination

The past leakage of PCB fluids for which a TSCA order was issued to the FWDA is described in Sec. 4.1.8.1.

4.1.8.4 Proposed Action

Transformers have been stored in the Administration Area (Bldg. 11), and this location may require environmental evaluation for possible PCB leaks. In Bldg. 11, the extent of residual contamination from the known pre-1986 leak should be determined.

Wipe samples of the floor in Bldg. 11 where PCB-transformers were stored should be taken and analyzed for PCB fluids. If contamination is found, the floor area should be cleaned and resampled. If contamination still exists, the floor should be cleaned once more and again sampled to verify the absence of PCBs.

4.1.9 Herbicide Storage, Bldg. 29

4.1.9.1 Site History

For many years pesticides and herbicides have been stored and used on the grounds of FWDA. Herbicides were used for weed control primarily on railroad tracks and along sewage and industrial lines. Today, only minor amounts of herbicides are stored and used at the FWDA. Herbicides were reported in 1982 to have been stored in leak-proof containers in Bldg. 29 (Inert Storage Warehouse, Administration Area) (Fig. 2.3), which has a concrete floor and is well ventilated. Currently, however, FWDA herbicides are not stored in Bldg. 29.[2]

4.1.9.2 Geology and Hydrology

The herbicide storage location in the Administration Area is situated on the alluvial deposits developed in the South Fork Valley of the Puerco River. The situation of surface water and groundwaters does not differ from that prevailing in the valley. Rainfall and snowmelt occasionally provide some surface water that drains via adjacent creeks into the river. Groundwater may exist in the underlying shallow aquifer and does exist in the deep San Andreas-Glorieta aquifer.

4.1.9.3 Nature and Extent of Contamination

Herbicides were formerly used for weed control primarily on railroad tracks and along sewage and industrial lines. Today only minor amounts of these materials are stored and used at FWDA.

Empty containers and waste material may have been disposed of in the landfills of the installation.

4.1.9.4 Proposed Action

Building 29 should be investigated for herbicide contamination. Both the interior surfaces and surrounding soils should be tested. Wipe samples should be taken from the rooms that were used to store the herbicides. If contamination is found, the rooms should be decontaminated and resampled to verify proper cleaning. Soils near the entrances of the building should be sampled and analyzed. Initially, only near-surface samples need to be collected. If contamination is found, borings should then be drilled and samples collected and analyzed to determine its extent.

4.2 WORKSHOP AREA, AMMUNITION

The Workshop Area (Fig. 4.8) was used for ammunition maintenance and renovation (Table 2.3). It includes seven SWMUs: the TNT Leaching Beds (SWMU 1), the Acid Waste Holding Pond (SWMU 2), the PCB Transformer Storage Area (SWMU 15), the PCP-Treated Wood Storage Area (SWMU 16), the Pesticide Storage Building (SWMU 18), the Deactivation Furnace (SWMU 7), and the Current Landfill (SWMU 6).

4.2.1 TNT Leaching Beds, SWMU 1

4.2.1.1 Site History

The TNT Leaching Beds (SWMU 1) are also referred to as Explosive Washout Lagoons or Wastewater Leaching Beds (Fig. 4.9). Beginning in 1949, explosive washout operations were conducted in the "500 series" area. Munitions were received in Bldg. 500, where they were unpacked and broken down. They were then transported to Bldg. 503 for a hot water washout. The contents (2,4,6-TNT, RDX, and Tritonal) were pumped into a storage and drying tank located in the flaker room on the second floor of the building, then flaked, dropped into a hopper in the room below, and boxed and shipped to various Army ammunition plants for reuse.[7]

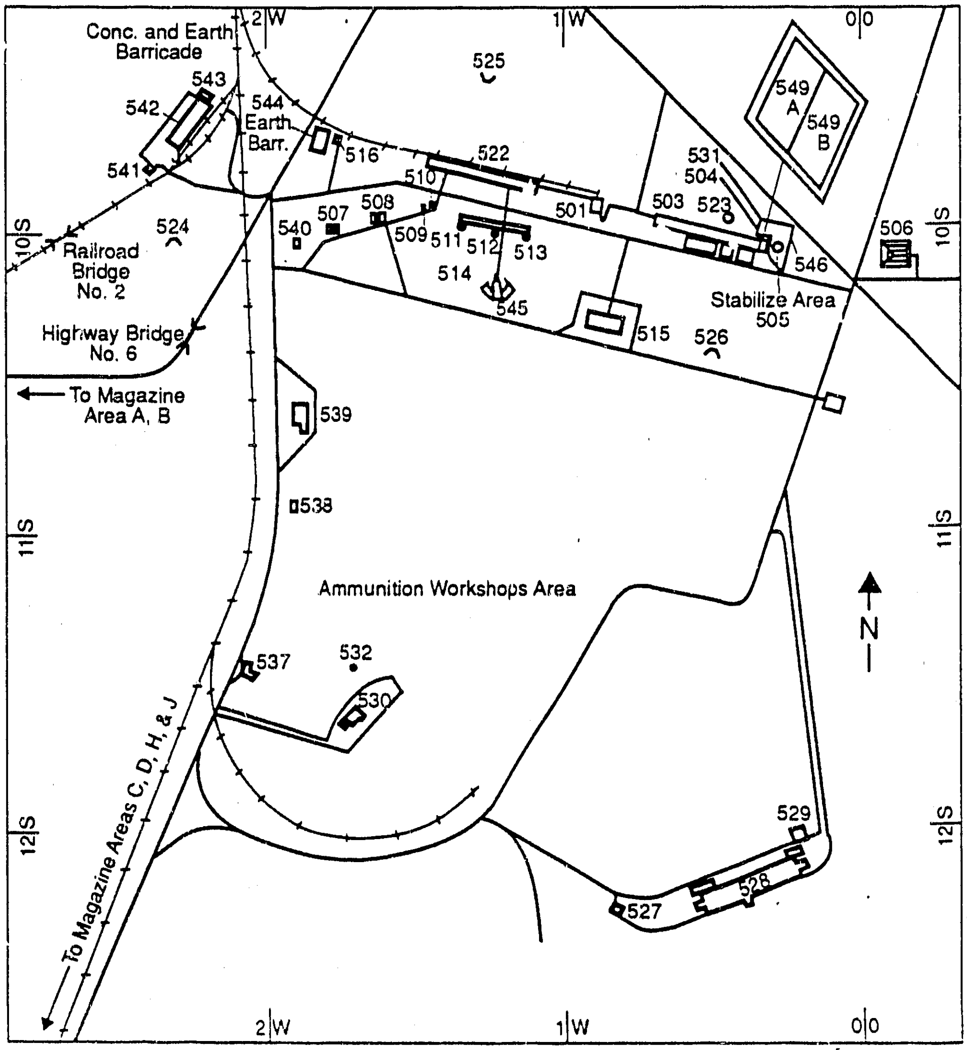
Pink water from the TNT washout was sent to three outside settling tanks (on the north side of Bldg. 503), which overflowed into a leaching bed immediately adjacent to the building. Residue from the settling tanks was periodically removed. The bed is on flat ground and is shaped like a triangle. The approximate dimensions are 100 ft. x 150 ft. x 150 ft. Between 1962 and 1967 (when the operation ceased) two beds north of Arterial Road No. 4 were used. These are referred to as the east pit and the west pit.[7] Each bed is about 3 ft deep and about 250 ft x 150 ft.

4.2.1.2 Geology and Hydrology

The TNT Leaching Beds are situated on the alluvial deposits developed at the South Fork valley of the Puerco River in the installation. The subsurface profile consists of silty, very fine sand to a depth of about 25 ft. The sand is underlain by massive clays. The aquifer is considered virtually inaccessible because of its depth and the massive clays, which form an upper confining layer.[27] Surface water results from rainfall or snowmelt and drains from the site northerly to the South Fork of the Puerco River. Groundwater under the site is present in the shallow alluvial aquifer and in the deep lying San Andreas-Glorieta aquifer. It appears that the sands would be capable of transmitting water laterally during wet seasons.[7] All of the wells that were installed in this area were dry during drilling and sampling (Nov. 1980 to Jan. 1981).

4.2.1.3 Nature and Extent of Contamination

In late 1949, approximately 2,400 gal/day of pink water from the TNT washout was disposed of in the leaching bed adjacent to Bldg. 503. Beginning in 1962,



Bldg. No.	Designation		
503	TNT Washout Flaker Bldg.	526	Safety Shelter
504	TNT Sump Tank	527	Heating Plant, Ammo. Normal Maint. Bldg.
505	1,000 BBL. Water Storage Tank	528	Ammunition Normal Maint. Bldg.
506	TNT Storage Barricade	529	Flammable Materials Storehouse
507	Smokeless Powder Magazines	530	Deactivation Bldg. & Barricade
508	Smokeless Powder Magazines	531	Concrete Sump Pit
509	Primary Collector Barricade	532	150 Gallon Fuel Storage Tank
510	Vacuum Producer Bldg.	537	Field Battery Bldg. (Currently Pesticide Storage)
511	Service Magazines	538	Safety Shelter
512	Service Magazines	639	Workshop Area Change House
513	Service Magazines	5[illegible]	Safety Shelter
514	Deboostering Barricade	5[illegible]	Heating Plant, Ammunition
515	Acid Waste Hiding Pond	542	Ammunition Workshop
516	Ammunition Rece[illegible]ing Bldg.	543	Concrete Barricade
522	Ammunition Renovatio[illegible] Bldg.	546	30 Feet Overhead Crane
523	1,000 BBL. Water Cir[illegible]ting Tank	549A	Leaching Bed
524	Safety Shelter	549B	Leaching Bed
525	Safety Shelter	601	Change House and Lunch Room

FIGURE 4.8 Facilities within FWDA Worksh[illegible]p Ar[illegible]

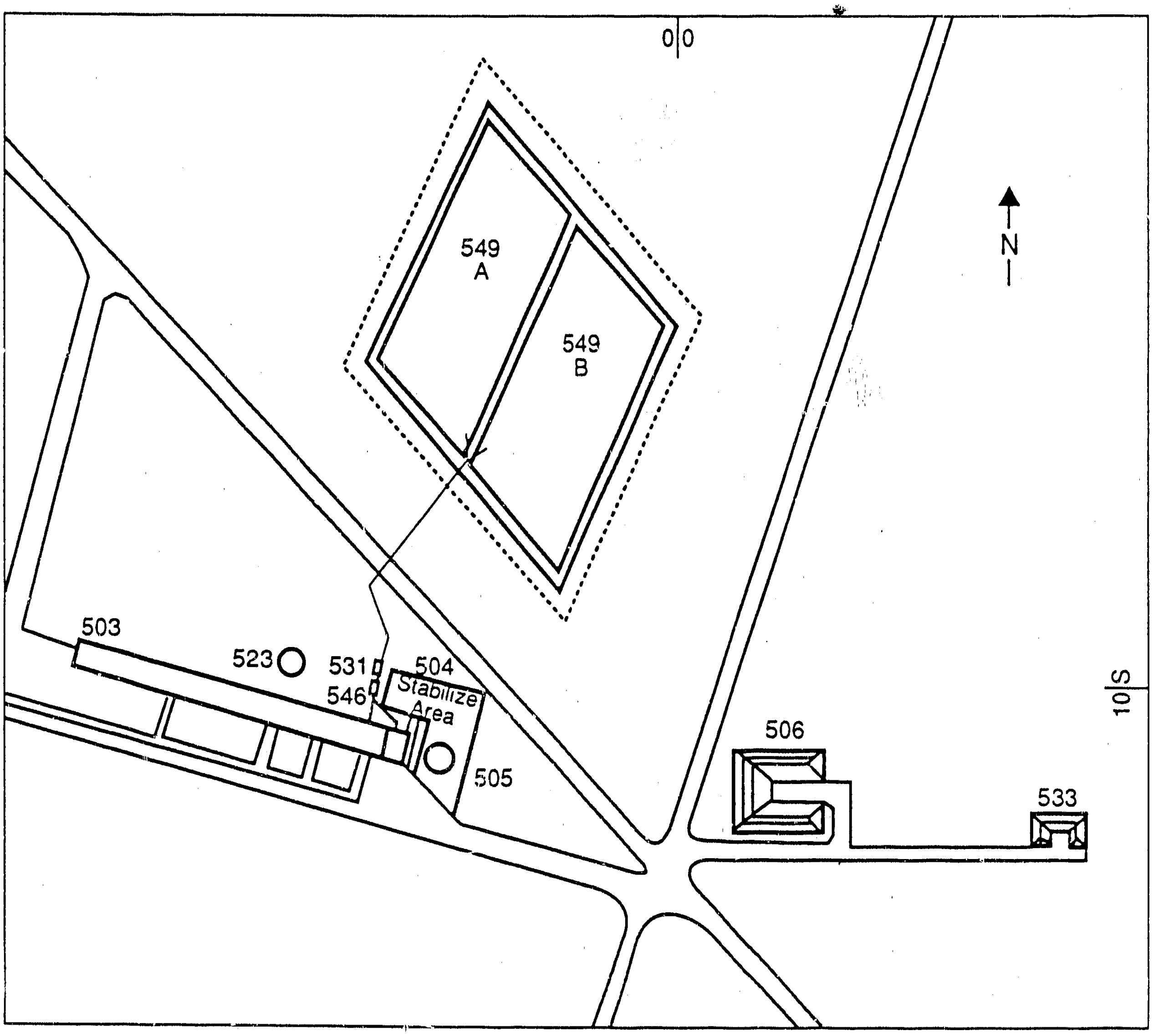


FIGURE 4.9 Location of TNT Leaching Beds, SWMU 1 (adapted from Ref. 21)

wastewater was sent to the newly constructed leaching beds. When the operation was shut down in 1967, the bottom soil from all beds was removed and burned at the old burning ground in the Demolition Area. This may have caused contamination of the burning ground. Soil from the leaching beds was analyzed in 1981. It was found to contain 2,4,6-TNT. 2,4-DNT, and 1,3,5-TNB. These results are presented in Table 4.3. These data indicate that even though the contents and some of the soil were removed, contaminants are still present. It should be noted that the 1981 investigation had a limited scope. According to the available data, although all of the samples were analyzed for explosives, sample FW14 was the only sample analyzed for volatile and semivolatile contaminants; none of the samples was analyzed for pesticides, PCBs, or metals.

TABLE 4.3 Contaminants Present in the Soil of the TNT Leaching Beds

Sample No.	Approximate Location	Compound	Concentration (mg/kg)
FW09	Triangular pit	TNT	0.917
FW09		2,4-DNT	0.300
FW14	East pit	TNT	8.290
FW15	West pit	TNT	0.872
FW15		2,4-DNT	0.265
FW15		TNB	7.830
FW17	Downgradient	TNT	0.548

Source: Ref. 7.

There was no available information regarding investigation of the settling tanks. Considering the volume of pink water treated over many years, there is a moderate to high potential that the settling tanks are also a source of contamination.

4.2.1.4 Proposed Action

A phased approach is recommended to determine the extent of contamination. A first phase should be conducted to delineate the extent of contamination. Appropriate background samples should be obtained. A grid should be constructed for each bed. At least 15 surface soil samples (6-12 in. deep) should be obtained across each bed and analyzed for explosives, semivolatiles, total metals, nitrate, and nitrite.

Three samples of sediment from the bottom of each tank should be obtained. Four samples from a depth of 2 ft should be obtained from the perimeter of each settling tank (one from each side). If necessary, samples should be obtained by coring through any cover material (sidewalk) surrounding the tanks. All of the samples should be analyzed for explosives, semivolatiles, total metals, nitrate, and nitrite.

If warranted by the results of the surface soil samples, a second phase of the investigation should be conducted. In each location where surface soil analyses contained elevated concentrations of contaminants, soil borings should be drilled. The borings should extend through the alluvium to the clay layer. Samples should be taken at 2.5-ft intervals and analyzed for all contaminants that were elevated in the surface soil samples. In order to determine the flow regime and to evaluate the likelihood of a groundwater contaminant migration pathway, the presence of groundwater should be noted and the borings should be logged.

If the soil boring samples contain elevated concentrations of contaminants, the feasibility and necessity for monitoring wells should be determined.

4.2.2 Acid Waste Holding Pond, SWMU 2

4.2.2.1 Site History

The Acid Waste Holding Pond (SWMU No. 2) is about 20 ft^2 and 3 ft deep. It is adjacent to the Ammunition Painting facility (Bldg. 515), in the Workshop Area (Fig. 4.10). From the late 1940s until the late 1960s, Bldg. 515 housed a paint shop where acid was used to pickle surfaces of metal parts prior to painting. The acid wastes from the pickling tanks were discharged to the acid waste holding pond just west of the building, where it evaporated and percolated into the ground. The spent acid and dissolved metals from pickling and metal cleaning were not treated prior to discharge to the holding pond.

4.2.2.2 Geology and Hydrology

The site-specific geology is similar to that discussed in Sec. 4.2.1.2. The pond is situated on the alluvial deposits developed at the South Fork valley of the Puerco River in the installation. The subsurface profile consists of silty, very fine sand to a depth of about 25 ft. The sand is underlain by massive clays. The aquifer is considered virtually inaccessible because of its depth and the massive clays, which form an upper confining layer.[21] Surface water results from rainfall or snowmelt and drains from the site northerly to the South Fork of the Puerco River. Groundwater under the site is present in the shallow alluvial aquifer and in the deep lying San Andreas-Glorieta aquifer. It appears that the sands would be capable of transmitting water laterally during wet seasons.[7] All of the wells that were installed in this area were dry during drilling and sampling (Nov. 1980 to Jan. 1981).

4.2.2.3 Nature and Extent of Contamination

The waste acid in the holding pond may have been partially neutralized by the alkaline soil. However, acid and heavy metal contaminants probably infiltrated the subsurface, and some potential exists for contamination of groundwater and soils. If the pond overflowed during heavy rains, heavy metals could have been transported via surface flow and deposited in the river bed.

In 1981, the pit was sampled. One soil sample was collected from the acid disposal pit. It contained elevated concentrations of beta-BHC (3.0 μg/L), chlordane (90.0 μg/L), DDD (8.0 μg/L), DDE (20.0 μg/L), DDT (20.0 μg/L), dieldrin (2.0 μg/L), alpha-endosulfan (4.0 μg/L), alpha-endosulfan sulfate (6.0 μg/L), endrin (9.0 μg/L), and Aroclor 1260 (100.0 μg/L).[7] No information was available that would explain the presence of pesticides in the pit.

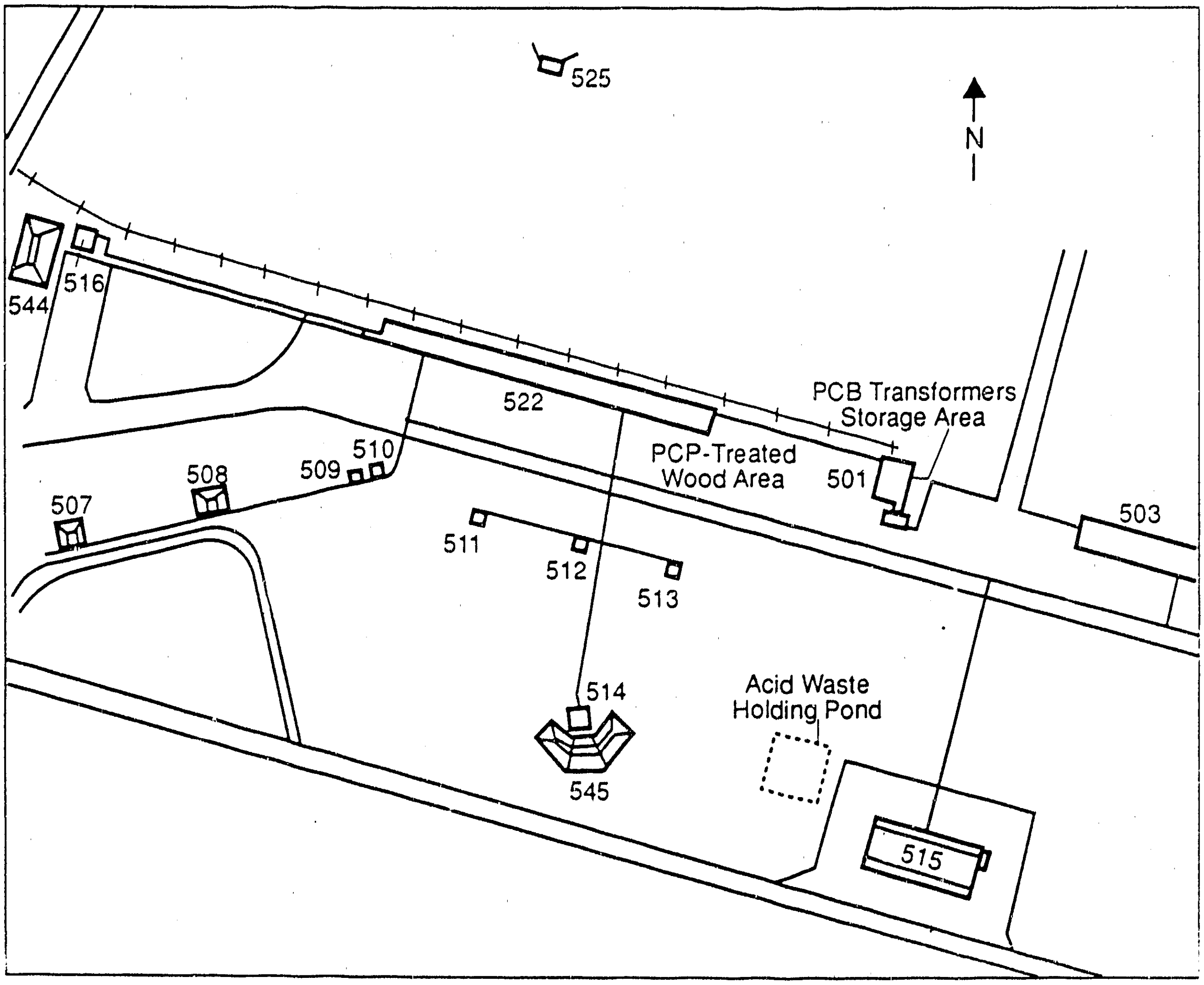


FIGURE 4.10 Location of Acid Waste Holding Pond, SWMU 2; PCB Transformer Storage Areas, SWMU 15; and PCP-Treated Wood Storage Area, SWMU 16 (adapted from Ref. 21)

4.2.2.4 Proposed Action

The Acid Waste Holding Pond is a potential source of heavy metal and pesticide contamination. Therefore, a phased investigation is recommended. Appropriate background samples should be obtained. To date, available information indicates that one sample from the center of the pit has been analyzed for pesticides. In order to more fully determine the type and extent of contamination, five soil samples should be obtained (one from the approximate center of the pit and one from the outer edge of each side). The samples should be obtained from a depth of 2 ft and analyzed for semivolatiles, pesticides/PCBs, explosives, and total metals.

If warranted by the results of the surface soil samples, a second phase should be conducted. In each location where surface soil analyses contained elevated concentrations of contaminants, soil borings should be drilled. The borings should extend through the alluvium to the clay layer. Samples should be taken at 2.5-ft intervals and analyzed for all contaminants that were elevated in the surface soil samples. In order to determine the flow regime and to evaluate the likelihood of a groundwater contaminant migration pathway, the presence of groundwater should be noted and the borings should be logged.

If the soil boring samples contain elevated concentrations of contaminants, the feasibility and necessity for monitoring wells should be determined.

4.2.3 PCB Transformer Storage Areas, SWMU 15

4.2.3.1 Site History

SWMU No. 15 is a former storage area in Bldg. 501, where two transformers, each containing between 50 ppm and 500 ppm PCBs, were located.[21] That section of the building has concrete floors without drains. Although there are no berms, the transformers were stored in overpacks with absorbent material. They have been removed and disposed of by the DRMO.

4.2.3.2 Geology and Hydrology

The site-specific geology is the same as that discussed in Sec. 4.2.1.2. The surface water and groundwater regime in this area is similar to that prevailing in the valley. Rainfall and snowmelt occasionally provide some surface water that drains via adjacent creeks into the river. The area is situated on the alluvial deposits developed at the South Fork valley of the Puerco River in the installation. The subsurface profile consists of silty, very fine sand to a depth of about 25 ft. The sand is underlain by massive clays. Groundwater under the site is present in the shallow alluvial aquifer and in the deep lying San Andreas-Glorieta aquifer. The aquifer is considered virtually inaccessible because of its depth and the massive clays, which form an upper confining layer.[21] It appears that the sands would be capable of transmitting water laterally during wet seasons.[7] All of the wells that were installed in this area were dry during drilling and sampling (Nov. 1980 to Jan. 1981).

4.2.3.3 Nature and Extent of Contamination

The possibility that spills and leaks occurred is considered low because there are no records of such events and no apparent evidence to indicate leakage.

4.2.3.4 Proposed Action

The area and the concrete flooring should be visually inspected in detail for any signs of spills and leaks. If detected, all visibly stained areas should be sampled and analyzed for PCBs. In the absence of staining, no action is recommended.

4.2.4 PCP-Treated Wood Storage Area, SWMU 16

4.2.4.1 Site History

SWMU 16 comprises several locations within the Workshop Area that were used to store about 2,000 wooden ammunition boxes, which may have been treated with pentachlorophenol (PCP) wood preservative. Starting in 1985, the boxes were stored near Bldgs. 501, 515, and 522 (Fig. 4.10). At the time of the site visit by ANL in May 1990, the boxes were gone. There was no available information regarding their disposition.

4.2.4.2 Geology and Hydrology

The site-specific geology can be characterized as alluvial deposits developed in the South Fork Valley of the Puerco River. The situation of surface and ground waters does not differ from that prevailing in the valley. Rainfall and snowmelt occasionally provide some surface water that drains via adjacent creeks into the river. Groundwater exists in the underlying shallow aquifer as well as in the deep San Andreas-Glorieta aquifer. The aquifer is considered virtually inaccessible because of its depth and the massive clays which form an upper confining layer.[21] It appears that the sands would be capable of transmitting water laterally during wet seasons.[7] All of the wells that were installed in this area were dry during drilling and sampling (Nov. 1980 to Jan. 1981).

4.2.4.3 Nature and Extent of Contamination

It has been shown that PCPs contribute to the formation of polychlorinated dibenzo-dioxins (PCDDs) and polychlorinated furans (PCDFs) under certain conditions. PCP (as F027, hazardous wastes from non-specific sources) is classified by the U.S. EPA as an acutely hazardous waste; however, PCP-treated material is not currently regulated. It is expected that PCP is relatively mobile in a soil-water system, largely because of its acidic property and molecular polarity. Even though the low precipitation and the high evaporation rate at the FWDA would limit the amount of PCP leaching and subsequent contaminant migration, the potential for PCP leaching into the soil exists.[28]

4.2.4.4 Proposed Action

A phased investigation is recommended in order to characterize the storage areas and determine the potential for contaminant migration. Background sampling should be conducted. All storage areas and associated loading areas should be inspected for signs of visible contamination. If warranted by significant staining, chip samples from concrete flooring and surface soil samples (6-12 in. deep) should be taken from each stained area and analyzed for semivolatile organics.

If the results show elevated concentrations, a second, more in-depth phase should be implemented to determine the extent of the contamination. Soil borings (where appropriate) and corings of the concrete surfaces should be obtained and analyzed for the contaminants that were elevated in the initial phase.

Based on the results of the second phase, the need for further action should be determined.

4.2.5 Pesticide Storage Building, SWMU 18

4.2.5.1 Site History

Pesticides are stored in Bldg. 537 (SWMU 18), located south of the Workshop Area (Figs. 4.8 and 4.11). This building has been used for storage for many years. It has a 4,200-ft^2 concrete floor and is well ventilated. All pesticides (mostly insecticides) are stored in leak-proof containers. Approximately 50 gal of chlordane was formerly stored in this building but had been disposed of at the time of the AEHA report in 1988.

4.2.5.2 Geology and Hydrology

In site-specific geology and hydrology, this area is similar to the rest of the Workshop Area. It is situated on alluvial deposits developed in the South Fork Valley of the Puerco River. Rainfall and snowmelt occasionally provide some surface water that drains via adjacent creeks into the river. Groundwater exists in the underlying shallow aquifer as well as in the deep San Andreas-Glorieta aquifer. The aquifer is considered virtually inaccessible because of its depth and the massive clays, which form an upper confining layer.[21] It appears that sands in the area would be capable of transmitting water laterally during wet seasons.[7]

4.2.5.3 Nature and Extent of Contamination

Pesticides are used mainly for for controlling insects and rodents in the buildings and adjacent areas. Herbicides are used mainly for weed control on railroad tracks and along sewage and industrial pipelines. The primary concerns for this SWMU are the storage and mixing areas. Since a variety of chlorinated products were used over a number of years, releases of concentrated chemicals could have occurred.

4.2.5.4 Proposed Action

A phased investigation is recommended in order to characterize the storage areas and determine the potential for contaminant migration. Background sampling should be conducted. All storage areas and associated loading areas should be inspected for signs of visible contamination. If warranted by significant staining, chip samples (from concrete flooring) and surface soil samples (6-12 in. deep) should be taken from each stained area and analyzed for pesticides and herbicides.

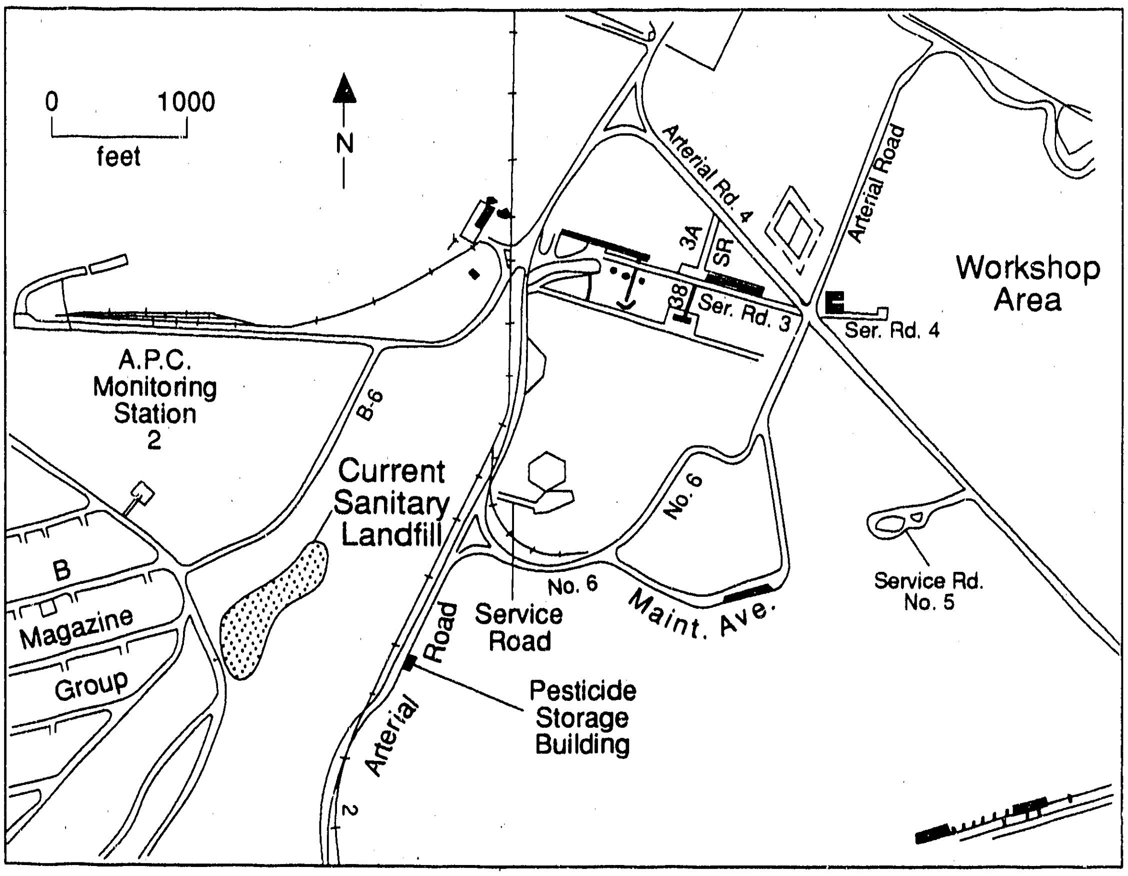


FIGURE 4.11 Location of Pesticide Storage Building, SWMU 18, and Current Landfill, SWMU 6 (adapted from Ref. 21)

If the results show elevated concentrations, a second, more in-depth phase should be implemented to determine the extent of the contamination. Soil borings (where appropriate) and corings of the concrete surfaces should be obtained and analyzed for the contaminants that were elevated in the initial phase.

Based on the results of the second phase, the need for further action should be determined.

4.2.6 Deactivation Furnace, SWMU 7

4.2.6.1 Site History

The Deactivation Furnace (SWMU 7) was located in Bldg. 530, in the southern part of the Ammunition Workshop Area (Figs. 4.8 and 4.12). Presently, the shell of the building, the former furnace foundation, and several associated concrete areas remain. There are two acid pits remaining on the south side of the building. It is reported that

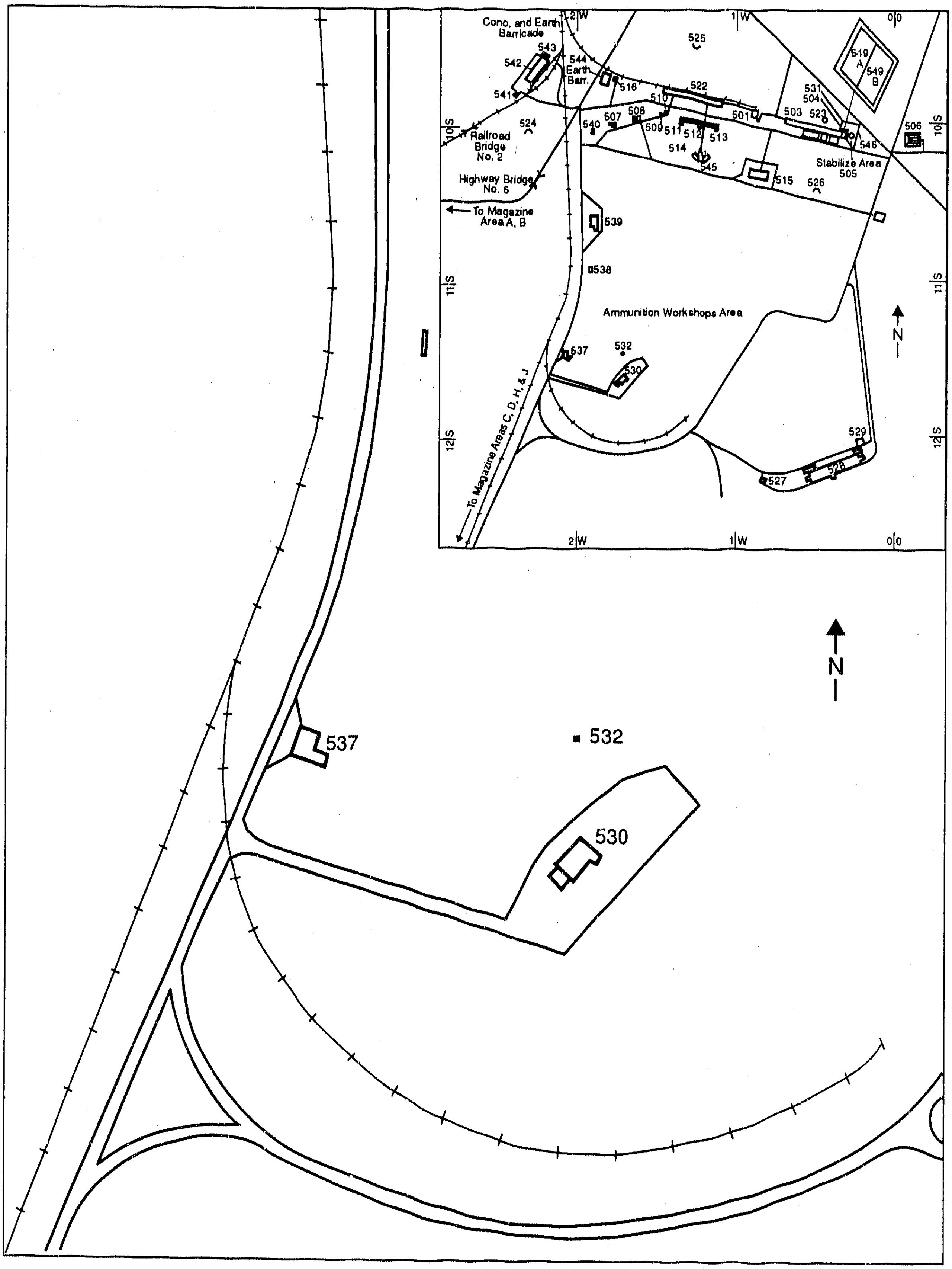


FIGURE 4.12 Location of Deactivation Furnace, SWMU 7

parts of the furnace were placed in the pits before filling them with gravel. The building covered about 4,000 ft^2. Between the late 1950s and the late 1960s, the furnace was used to melt cartridges and small arms ammunition to recover lead, brass, and steel. Residue and ash were collected and disposed of at the burning ground.[21] According to available information, the furnace was used very little between 1976 and 1979.[2,29]

In 1978, an application to modify the furnace was approved by the State of New Mexico Environmental Improvement Division. The plant was a prototype operated under U.S. Army Armament, Munitions and Chemical command (AMCCOM). It was used to demilitarize various white phosphorus munitions ranging in size from grenades to 155-mm shells. From 1982 until 1986, white phosphorus was removed from munitions and burned to produce phosphorus pentoxide. The phosphorous pentoxide was then sent through a water scrubbing system to produce phosphoric acid, which was sold commercially for the production of fertilizer.[29,30] When the operation was discontinued, the furnace was dismantled by AMCCOM, analyzed for hazardous contaminants, and disposed of by the DRMO.

4.2.6.2 Geology and Hydrology

In site-specific geology and hydrology, this area is similar to the other parts of the Workshop Area. It is situated on alluvial deposits developed in the South Fork Valley of the Puerco River. Rainfall and snowmelt occasionally provide some surface water that drains via adjacent creeks into the river. Groundwater exists in the underlying shallow aquifer as well as in the deep San Andreas-Glorieta aquifer. The aquifer is considered virtually inaccessible because of its depth and the massive clays, which form an upper confining layer.[21] It appears that sands in the area would be capable of transmitting water laterally during wet seasons.[7]

4.2.6.3 Nature and Extent of Contamination

Very little is known regarding the operation of this SWMU, and there have been no previous investigations in the area. Based on the nature of the operations, releases to the environment could have occurred. White phosphorus ignites unless it is in an oxygen-deprived atmosphere, making its presence highly improbable at this site. The acid used was phosphoric acid; the soils of this area are alkaline and would essentially neutralize any acid, essentially leaving only phosphorus, which is commonly used as a fertilizer. Therefore, the contaminants of concern include metals, propellants and explosives, and wastes.

4.2.6.4 Proposed Action

A phased investigation is recommended in order to characterize the Deactivation Furnace and determine the potential for contaminant migration. Background sampling should be conducted. All operational areas and associated loading areas should be inspected for signs of visible contamination. If warranted by significant staining, chip samples (from concrete flooring) and surface soil samples (6-12 in. deep) should be taken from each stained area and analyzed for total metals and explosives.

At the time of the ANL site visit, water (as wet gravel) was visible in the acid pits. One sample from the bottom of each acid pit should be obtained and analyzed for phosphates, total metals, and explosives.

If the results show elevated contaminants, a second, more in-depth phase should be implemented to determine the extent of the contamination. Soil borings (where appropriate) and corings of the concrete surfaces should be obtained and analyzed for the contaminants that were elevated in the initial phase.

Based on the results of the second phase, the need for further action should be determined.

4.2.7 Current Landfill, SWMU 6

4.2.7.1 Site History

The Current Sanitary Landfill (SWMU 6) is located west of the Workshop Area and just east of Storage Area B (Fig. 4.11). It has been operated since 1969. It covers approximately 6 acres and presently is supposed to receive mostly construction and demolition rubble, land debris, paper wastes, and similar material. There is an agreement between FWDA and the city of Gallup whereby all garbage from the depot, particularly the Administration Area, is collected by the city and hauled to a city-owned landfill for disposal.

4.2.7.2 Geology and Hydrology

In site-specific geology and hydrology, this area is similar to the rest of the Workshop Area. It is situated on the alluvial deposits developed in the South Fork valley of the Puerco River. The surface water and groundwaters do not differ from those prevailing in the valley. Rainfall and snowmelt occasionally provide some surface water that drains via adjacent creeks into the river. Groundwater exists in the underlying shallow aquifer as well as in the deep San Andreas-Glorieta aquifer. The aquifer is considered virtually inaccessible because of its depth and the massive clays which form an upper confining layer.[21] It appears that the sands in the area would be capable of transmitting water laterally during wet seasons.[7]

4.2.7.3 Nature and Extent of Contamination

The Current Landfill, since its establishment, appears to have received mostly construction and demolition rubble, land debris, paper wastes, and similar material. In the past, pesticide containers were identified among other waste material disposed in landfill. A soil sample taken from the landfill in 1981 contained trace amounts of pesticides and Aroclor 1016.[7] The waste and soil cover may be as much as 20 ft deep in portions of the landfill, and the contents of older portions are believed to include garbage from the installation. It is suspected that sludge from the drying beds at the sewage treatment plant was disposed of here, too.

At the time of the ANL staff site visit (Oct. 1989), paint cans and asbestos-containing materials were observed in the active section of the landfill.

The landfill may generate and release leachate that may contain contaminants that may reach the shallow groundwater aquifer. The soil underlying and adjacent to the landfill, as well as that along the migration route of the leachate, is suspected of contaminant releases. The site requires environmental evaluation for soil and groundwater contamination.

4.2.7.4 Proposed Action

A phased approach is recommended to determine the extent of contamination at the landfill. To date, only one soil sample has been taken from the landfill; the sample had low ppb amounts of pesticides and PCBs. In order to more fully determine the type and extent of contamination, the following action sequence is recommended. A geophysical survey should be performed across the landfill to determine the lateral and vertical extent of buried material. A soil gas survey can be performed; however, based on the types of material disposed of and the condition of the landfill cover, the soil gas results may not be usable. Based on available information, trenching within the landfill would be useless. If possible, borings should be drilled within the landfill and samples collected and analyzed. Because of the type of material that has been disposed of, it may be difficult to complete these borings to the bottom of the landfill. Additional borings should be drilled along the perimeter of the landfill and soil samples collected. All soil samples should be analyzed for volatiles, semivolatiles, herbicides, pesticides/PCBs, and total metals.

If groundwater is found in the perimeter borings, monitoring wells should be installed. Groundwater samples should be collected and analyzed for volatiles, semivolatiles, herbicides, pesticides/PCBs, and total metals. Based on these results, a monitoring program may need to be established. If elevated contaminant levels are found in the samples, further investigation is recommended. (Further study will not be needed if contaminant levels are not elevated.)

4.3 MAGAZINE/IGLOO AREA

4.3.1 Site History

Most of the central portion of FWDA property is occupied by magazine facilities for storing ammunition -- approximately 7,400 acres, or about one-third of the installation land. The magazine facilities are shown in Figs. 2.3 and 4.13 as clusters of

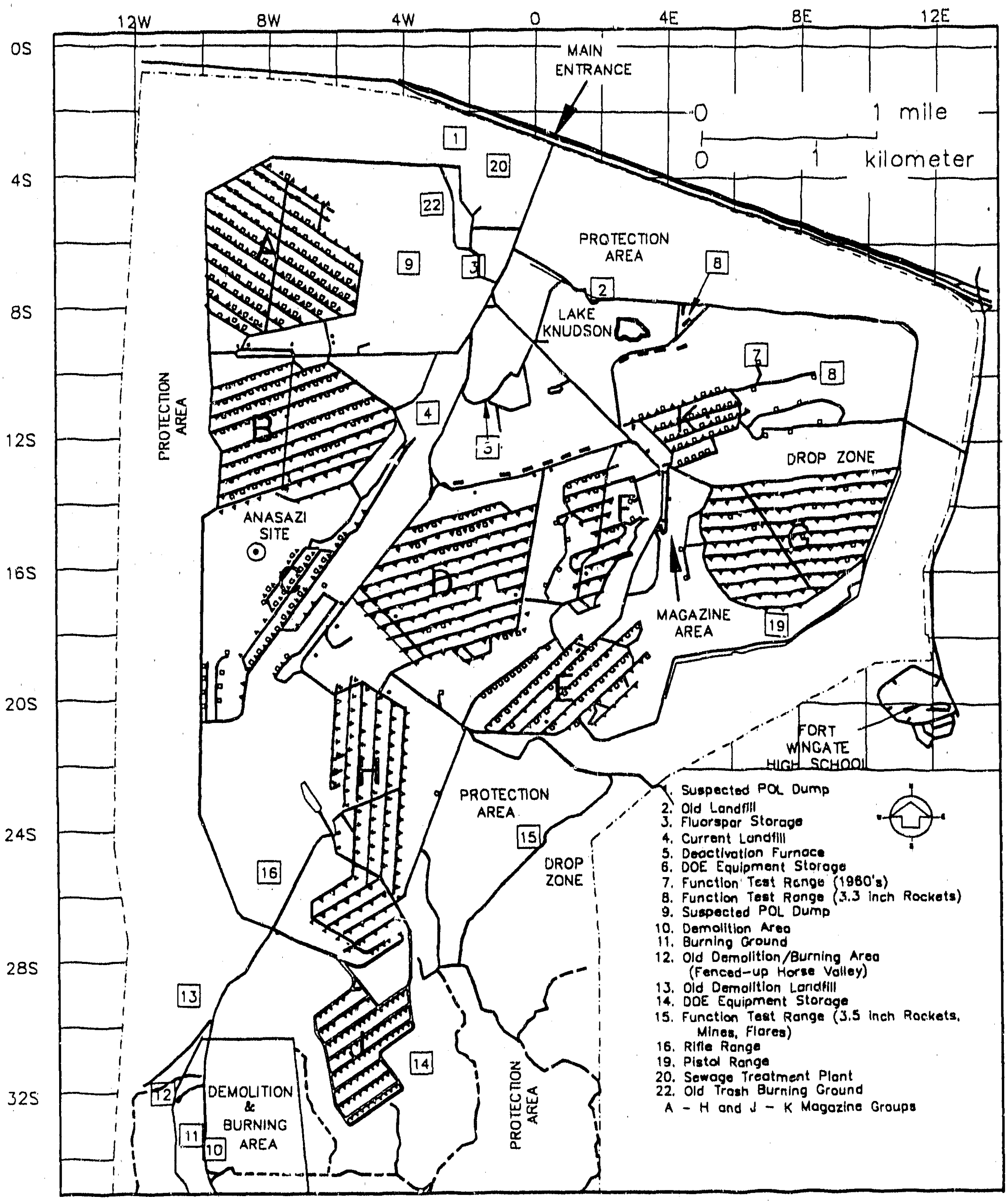


FIGURE 4.13 Specific Locations of Magazine/Igloo Groups

E

DE

Because the residue piles are in the vicinity of the
constitutes a major concern at this site. Very little inform
to document the amount and location of UXO that has
Incidents of unplanned UXO explosions in the general area
FWDA personnel.

4.4.3.4 Proposed Actions

lined areas. There are 731 earth-covered concrete igloos in 10 clusters designated A-H, J, and K). The igloos are about 60 ft deep with an exposed concrete face and earth-covered sides. They have been used since 1941 for storing high-explosive ordnance and other munitions. This area also contains several above-ground standard magazines for storing ammunition. The Magazine Area is served by a network of roads and railroads. Storage sites for fluorspar are scattered throughout this area.

4.3.2 Geology and Hydrology

Igloo group A and the northwestern portion of igloo group B are situated on the alluvium that has been described for the Workshop Area. Igloo group K is atop a much thinner alluvium. All others are located on bedrock. Since the igloos encompass such a large area, information regarding site-specific geology and hydrology is addressed more fully in Sec. 2.

4.3.3 Nature and Extent of Contamination

The igloos have been used for the storage of explosives and ammunition since 1941. No information has been found to suggest that other types of hazardous materials have been stored in these facilities. In 1989, two igloos reportedly used by the Atomic Energy Commission in the 1940s were surveyed for radioactivity. The results showed no elevated levels of radiation. The Department of Energy currently stores equipment in magazine J309. According to available information, there are no radioactive materials stored.

The stored explosives are containerized. No records were found to indicate that loose powder has ever been stored in the Magazine/Igloo Area or that any of the individual magazine units have had explosions or releases of explosives to the environment. Since they have been used for almost 50 years, there is a potential that the interiors contain fugitive dust comprised of explosive materials. Although this does not constitute widespread contamination, a conservative approach is recommended; before releasing any of the igloos for other uses, they should be thoroughly sampled.

4.3.4 Proposed Action

A phased investigation is recommended in order to characterize the Magazine/Igloo Area and determine the potential for contaminant release and migration. Background sampling should be conducted. All operational areas and associated loading areas should be inspected for signs of visible contamination. If warranted by significant staining, chip samples (from concrete flooring) and surface soil samples (6-12 in. deep) should be taken from each stained area and analyzed for explosives.

If the results show elevated concentrations, a second, more in-depth phase should be implemented to determine the extent of the contamination. Soil borings (where appropriate) and corings of the concrete surfaces should be obtained and analyzed for the contaminants that were elevated in the initial phase.

Based on the results of the second phase, the need for further action should be determined.

4.4 DEMOLITION AND BURNING AREA

In the west central portion of FWDA property, there are approximately 1,100 acres (close to 5% of the installation ground) fenced and designated as the Demolition and Burning Area (Figs. 2.3 and 4.14). This area contains several locations where demolition and open burning of munitions occur. The area also contains disposal grounds for explosive-contaminated material and old equipment from TNT drying and flaking facilities. At least two burning areas, one now closed, are located there. Demolition pits are currently used for demilitarization (demil) operations involving up to 5,000 lb of explosives above the ground and up to 10,000 lb of explosives with earth cover. The smaller amounts of explosives are detonated in uncovered areas, the larger ones in earth-covered areas. The western side of the hogback, in Fenced-Up Horse Valley, contains what appears to be former demolition or burning grounds.

Within the Demolition/Burning Area the following numbered SWMUs are identified: Demolition Craters (SWMU 3), Burning Ground (SWMU 4), Demolition Area Residue Piles (SWMU 5), and Old Burning Ground and Demolition Landfill (SWMU 13).

4.4.1 Demolition Craters, SWMU 3

4.4.1.1 Site History

The demolition craters, SWMU 3, are located inside a fenced area (Fig. 4.15) in the southwestern part of the FWDA. The Burning Ground (SWMU 4) and Demolition Area Residue Piles (SWMU 5) are also located within the fence. The craters have been used for destruction of various types of explosives, propellants, and pyrotechnics[29,31] on both sides of an arroyo since the early 1940s. The site includes many demolition craters, or pits, whose numbers may change from time to time. In an aerial photograph taken in 1948, three pits in the northern demolition area, two trenches to the south of the pits, and one trench in the western portion are identified. Three more pits are shown in one 1962 aerial photograph.[32] In 1981, 11 demolition craters were reported.[31]

Both open and covered demolition occurs under an interim permit issued by the New Mexico Environmental Improvement Division on the basis of a closure and post-closure plan submitted to the state. Explosives are placed in a trench. Open detonation is used for explosives of less than 2,250 kg (5,000 lb), while about 10 feet of earth cover blanket detonating of 4,500-kg (10,000-lb) explosives. The detonation procedure follows strict safety protocols. Until very recently, one detonation occurred every workday. (In the past, detonations may have occurred even more frequently.) Currently, there are reportedly no detonations. The FWDA schedule calls for detonation activity to begin approximately January 1991. A RCRA part B permit for open burning and detonation has been applied for.

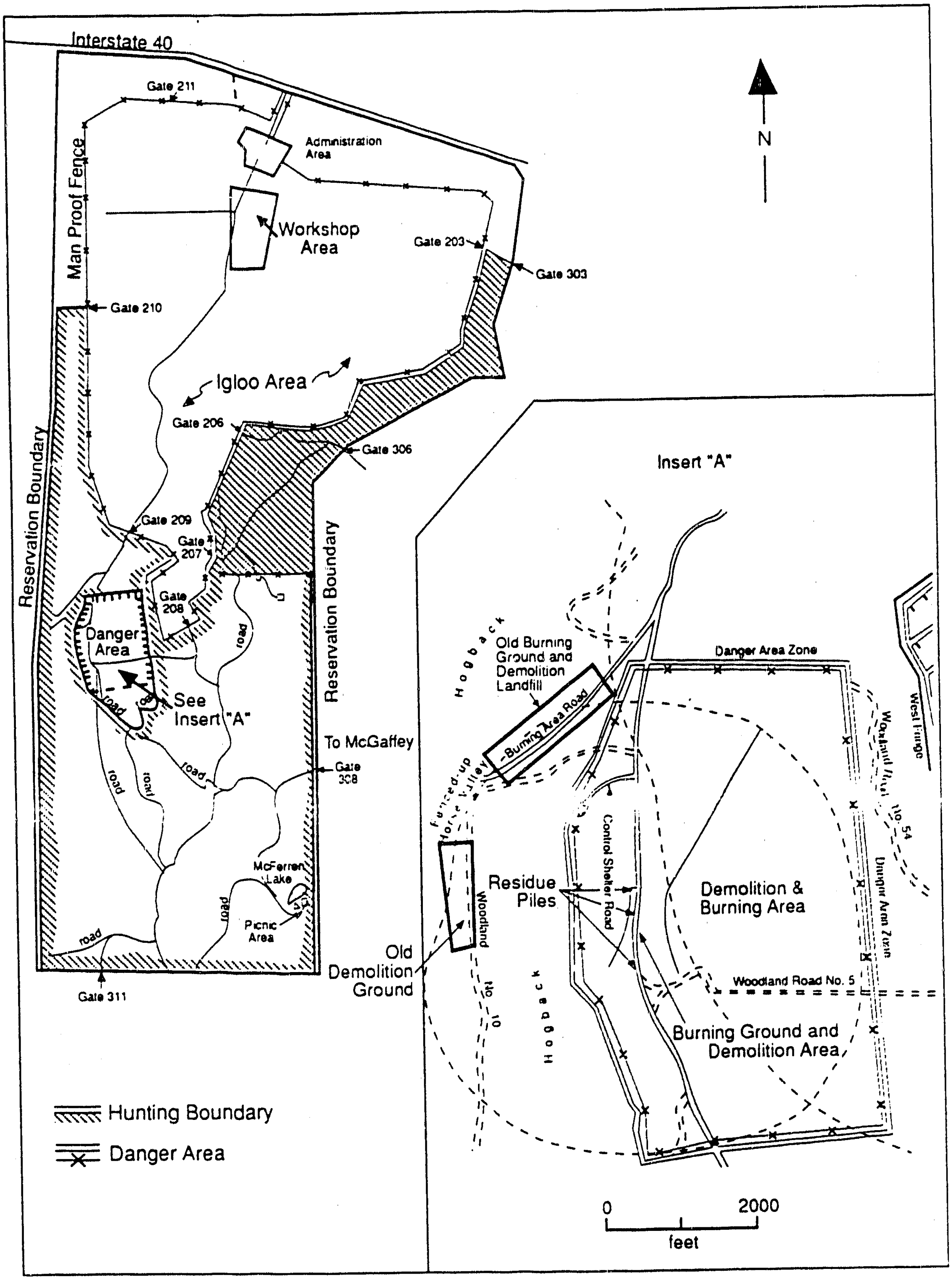


FIGURE 4.14 Locations of Demolition Craters, SWMU 3; Burning Ground, SWMU 4; Demolition Area Residue Piles, SWMU 5; and Old Burning Ground and Demolition Landfill, SWMU 13

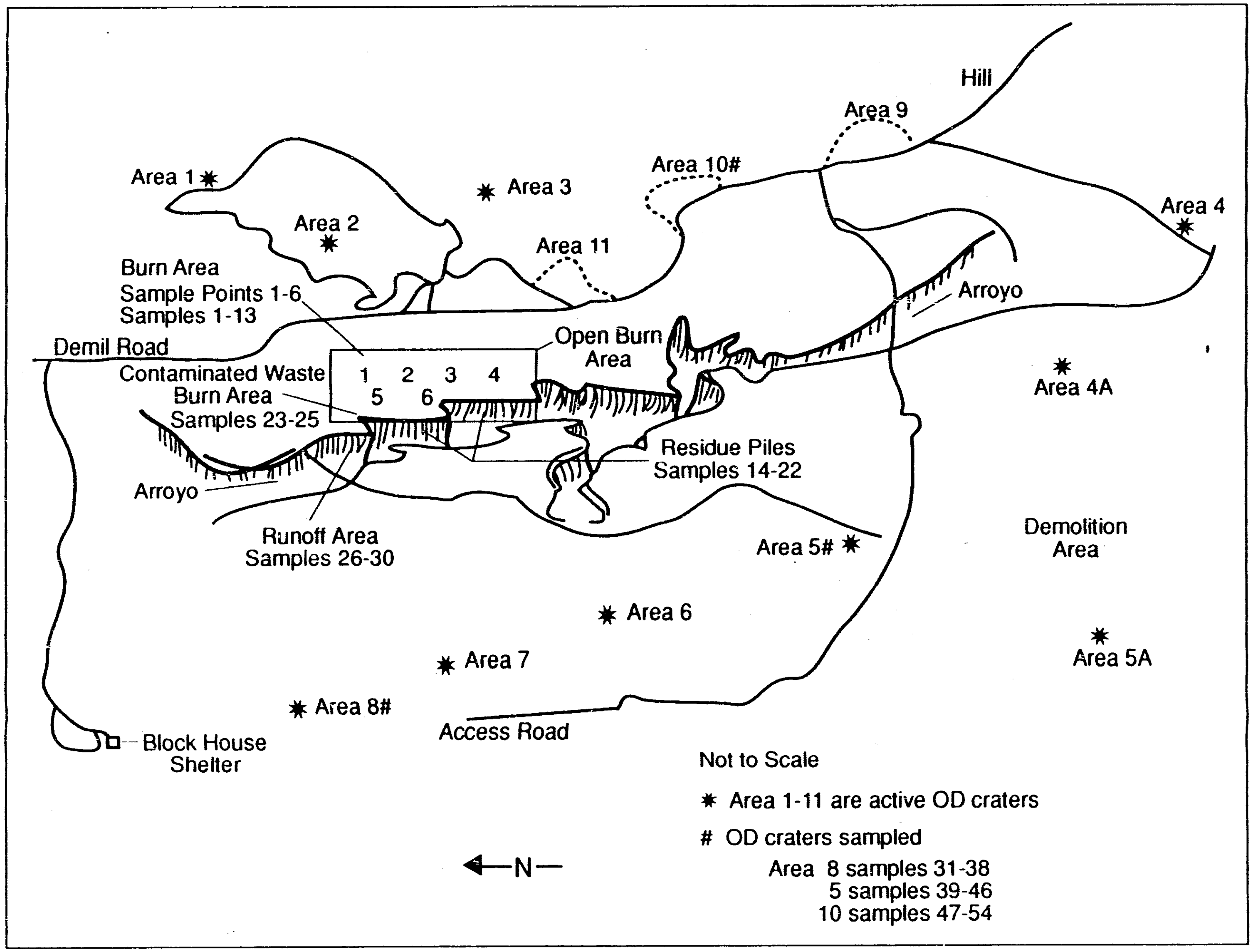


FIGURE 4.15 Approximate Locations of Demolition Craters, SWMU 3 (adapted from Ref. 21)

4.4.1.2 Geology and Hydrology

The crater site is situated on both sides of an arroyo running from south to north. A veneer of alluvium covers the Triassic Chinle Formation. The bedrock compositions of the banks of the arroyo differ from each other. Bedded calcareous sandstone dominates the eastern bank, massive mudstone the western bank. The different compositions lead to differences in the texture of the alluvium. Rock fragments are common in the alluvium of the eastern bank, and loamy clay in the alluvium of the western bank.

4.4.1.3 Nature and Extent of Contamination

Twenty-four soil samples were collected in 3 of the 11 demolition craters in 1981 and analyzed for EP toxicity metals and explosives. Of the three sampled craters (5, 8, and 10), two are located on the western side of the arroyo, one on the eastern side. Eight samples were taken from each crater. The results are listed in Table 4.4. Eight of 24 samples show cadmium concentrations ranging from 0.10 to 0.26 mg/L. One sample shows a selenium concentration at a level of 0.14 mg/L. These are below the RCRA EP toxicity regulatory levels. Minor amounts of explosives were also detected (Table 4.4). RDX (royal demolition explosive, hexohydro-1,3,5-trinitro-1,3,4-triazine) is found in 3 of 24 samples, ranging from 2.8 to 7.8 μg/g; in 2 of 24 samples, 2,4,6 TNT (trinitrotoluene) ranges from 1.1 to 1.9 μg/g; and one sample has HMX content of 1.4 μg/g.

One sediment sample and one surface water sample were collected from a pond about 800 ft downstream from the demolition area in 1981 (Table 4.5).[7] The samples demonstrate insignificant contamination. The pond receives discharge from the demolition area, either through a spring in the area or from rain or snow precipitations. In the sediment sample, an insignificant amount of bis(2-ethylhexyl) phthalate was found, at a level of 3 mg/kg. The surface water sample contains a minor amount of toluene, 10 μg/L. All other explosives and semivolatiles are below detected limits in both samples.

From the above results, it is concluded that the soil in the demolition craters area has been contaminated with metal and explosives. Transport of the contaminant through surface water is limited. The soil contamination is not homogeneous within each crater. The potential contaminated area may include all the craters that have been used. In addition to metal and explosive contamination, unexploded ordnance is a potential problem at this site because of previous detonations.

Because no groundwater sample was collected in this site, the extent of groundwater contamination, if present is not known.

4.4.1.4 Proposed Actions

It is recommended that an ordnance reconnaissance survey be conducted by the Army to locate surface and subsurface UXO and metal objects using appropriate techniques available to the Army.

TABLE 4.4 Chemical Results of Soil Sampling in the Demolition Craters

Sample No.	EP Toxicity[a] Concentration (mg/L)								Explosives[a] Concentration (mg/kg)					
	Ag	As	Ba	Cd	Cr	Hg	Pb	Se	2,4 DNT	2,6 DNT	2,4,6 TNT	HMX	RDX	TETRYL
Crater 5														
039	BDL[b]	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
040	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
041	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
042	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
043	BDL	BDL	BDL	0.11	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
044	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
045	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
046	BDL	BDL	BDL	0.13	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Crater 8														
031	BDL	BDL	BDL	0.12	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
032	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
033	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
034	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
035	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
036	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
037	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
038	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	2.8	BDL
Crater 10														
047	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1.9	BDL	BDL	BDL
048	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.14	BDL	BDL	BDL	BDL	BDL	BDL
049	BDL	BDL	BDL	0.10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1.4	7.8	BDL
050	BDL	BDL	BDL	0.10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
051	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
052	BDL	BDL	BDL	0.15	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
053	BDL	BDL	BDL	0.16	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
054	BDL	BDL	BDL	0.26	BDL	BDL	BDL	BDL	BDL	BDL	1.1	BDL	6.2	BDL
Detection Limit	0.5	0.5	10	0.1	0.5	0.2	0.5	0.1	1.0	1.0	1.0	1.0	1.0	1.0

[a]See Table A.1 for identification of constituents. [b]Below detection limit. Source: Ref. 31.

TABLE 4.5 Selected Chemical Results of Sediment and Surface Water Sampling in Demolition Area

Compound[a]	Sediment (mg/kg), FW18S	Surface Water (μg/L), FW18W
Semivolatile		
Bis (2-ethylhexyl) Phthalate	3	< 2
Chrysene	< 1	< 2
Fluoranthene	< 2.0	< 1
Naphthalene	< 0.4	< 2
Phenol	< 0.4	< 20
Toluene	NA	10
Explosive		
13 DNB	< 0.317	< 4.8
24 DNT	< 0.223	< 3.0
26 DNT	< 0.419	< 3.8
135 TNB	< 1.08	NA
246 TNT	< 0.194	NA
Nitrobenzene	< 1.64	< 17
RDX	< 2.61	< 10.5
Tetryl	< 1.5	< 23.9
White P	< 0.07	< 0.7
Total P	NA	40

[a]See Table A.1 for identification of compounds.

Source: Ref. 7.

In order to better understand the source and transport route of contaminants from the demolition craters, at least two sediment samples should be collected from each of the washes in the demolition area; three surface soil samples from each of the eight demolition craters not sampled before should also be collected. In the main arroyo, at least six sediment samples should be collected. Each sample should be taken from between the surface and a depth of 1 ft and should be analyzed for metals, total phosphate, and explosives.

Two monitor wells should also be installed in the alluvium in the main arroyo, one immediately downstream of the demolition area and one immediately upstream of the area. Groundwater taken from the wells should be analyzed for explosives, total phosphate, and metals. The results should provide information on whether groundwater contamination is present.

4.4.2 Burning Ground, SWMU 4

4.4.2.1 Site History

The main burn area is located on the eastern side of a valley immediately adjacent to an arroyo (Fig. 4.14), and is situated below the general area of the demolition craters (Sec. 4.4.1). The site has been used since 1955.[21] Before 1982, explosives and explosive-contaminated wastes were burned in the open, and all residues from the operations were bulldozed into the adjacent arroyo, forming a series of residue piles (SWMU 5) stretching several hundred feet. Residues include burned-out jet-assisted takeoff (JATO) bottles, empty 55-gal drums, and small metal parts.[27]

Since 1982, open burning has been conducted in two burning troughs and two burning trays. The troughs and trays are located several hundred feet north of the previous burning ground and were built to Army specifications.[27] Explosives and explosive-contaminated wastes are burned following strict safety protocols. Part of the residue is sent to the DRMO, and the rest is disposed of in residue piles (SWMU 5). The dimensions of the current burning ground are approximately 750 ft × 150 ft. The area is operated under an interim permit issued by the New Mexico Environmental Improvement Division on the basis of a closure and post-closure plan submitted to the State. A RCRA part B permit for open burning and detonation has been applied for.

It should be mentioned also that wastes from the operation of the Deactivation Furnace (Workshop Area) were sent to the burning pit area.

4.4.2.2 Geology and Hydrology

The site is situated on a flood plain deposited by a drainage running from south to north. The flood plain is eroded, forming an arroyo in the demolition area. The arroyo is dry except during rainstorms or snowmelts (dry most of the year).

Alluvial deposits of clay, silt, and sand are expected in the floodplain. Under arid environments, alluvium is estimated to be poorly sorted. Cracks are well developed in the upper part of the soil column, especially during dry seasons. Under the alluvium is the Triassic Chinle Formation of mudstones and calcareous sandstones.

The hydrogeologic condition of the demolition area is not fully known. An unconfined aquifer may be present in the alluvium. A spring has been reportedly tapped in the demolition area. Therefore, recharge of groundwater from springs is possible, besides from rain or snow precipitations. Also, surface water flows reportedly disappeared in the demolition area.[7] However, there are no available data regarding the depth of groundwater table, which is expected to fluctuate from time to time.

4.4.2.3 Nature and Extent of Contamination

Based on past operations, semivolatile, metal, and explosive contamination, and unexploded ordnance are the major concerns of this site. The last becomes a concern because the site is in the vicinity of the detonation craters. Fuel may also have been used in the burning activities, causing semivolatile contamination.

In 1981, 13 surface soil samples were taken from the pre-1982 burning area, and 3 samples from immediately north of the burning area. Many samples are found with explosive contamination. The results are (1) 13 of 16 samples have 2,4,6-TNT ranging from 1.9 to 2,810 μg/g, (2) 7 of 16 samples have RDX at a level ranging from 2.4 to 3,110 μg/g, (3) 7 of 16 have HMX at a level ranging from 2.0 to 765 μg/g, (4) one sample has 2,6-DNT at a level of 2.2 μg/g, and (5) two samples contain 2,4-DNT up to levels of 7.7 μg/g (see Table 4.6).

Minor metal contamination is found in the 16 samples (Table 4.6). From the EP toxicity test, lead and cadmium are found in 4 of the 16 samples. They range from 0.5 to 2.6 mg/L for lead and from 0.1 to 0.33 mg/L for cadmium.

Because the burning ground is in the vicinity of the open demolition craters, UXO constitutes a major concern at this site. Very little information is available in the record to document the amount and location of UXO that has been discovered in the area. Incidents of unplanned UXO explosions in the general area were reported to ANL staff by FWDA personnel.

4.4.2.4 Proposed Actions

The Army should conduct an ordnance reconnaissance survey in this area using available technology.

The sampling plan for this site may be integrated with the plan in the demolition craters (Sec. 4.4.1) and the residue piles (Sec. 4.4.3). Besides soil sampling in the arroyo, as suggested in Sec. 4.4.1, surficial soil should be grid-sampled in the up slope of all residual piles and in the valley, and analyzed for the total phosphorous, explosives,

TABLE 4.6 Chemical Results of Soil Sampling in the Burning Ground Area

Sample No.	EP Toxicity[a] Concentration (mg/L)								Explosives[a] Concentration (μg/g)					
	Ag	As	Ba	Cd	Cr	Hg	Pb	Se	2,4 DNT	2,6 DNT	2,4,6 TNT	HMX	RDX	TETRYL
Burning Ground (SWMU 4a, Table 4.1)														
001	BDL[b]	BDL	13	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
002	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
003	BDL	BDL	113	BDL	BDL	BDL	BDL	BDL	BDL	BDL	2.1	BDL	BDL	BDL
004	BDL	BDL	45	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
005	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	4.6	BDL	BDL	BDL
006	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	10.0	BDL	BDL	BDL
007	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	8.9	BDL	BDL	BDL
008	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	51.0	BDL	BDL	BDL
009	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	88.0	2.0	2.4	BDL
010	BDL	BDL	735	0.33	BDL	BDL	2.1	BDL	BDL	BDL	1.9	12.0	32.5	BDL
011	BDL	BDL	38	0.30	BDL	BDL	2.6	BDL	BDL	BDL	5.9	9.3	30.2	BDL
012	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	7.7	2.2	810	680	3060	BDL
013	BDL	BDL	666	BDL	BDL	BDL	BDL	BDL	6.2	BDL	2020	765	3110	BDL
Immediately North of Burning Ground														
023	BDL	BDL	10	0.10	BDL	BDL	1.3	BDL	BDL	BDL	19.0	12.1	13.5	BDL
024	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	403.0	3.1	12.4	BDL
025	BDL	BDL	BDL	0.12	BDL	BDL	0.5	BDL	BDL	BDL	2.5	BDL	BDL	BDL
Detection Limit	0.5	0.5	10	0.1	0.5	0.2	0.5	0.1	1.0	1.0	1.0	1.0	1.0	1.0

[a]See Table A.1 for identification of constituents.

[b]Below detection limit.

Source: Ref. 31.

metals, and semivolatiles. Recommended spacing of the grid is 20 ft. The results of the sample should be useful for determining the nature and the extent of soil contamination caused by pre-1982 burning. If significant contamination is recognized in some areas, soil borings may be necessary to define the depth of the contamination.

In the active burning ground, soil samples should be collected around the burning troughs and the burning trays. The samples should be analyzed for total phosphorous, explosives, metals, and semivolatiles.

Two monitoring wells are also recommended for the demolition crater site (Sec. 4.4.1), and their results should be useful in evaluating groundwater contamination, if present, in the Burning Ground.

4.4.3 Demolition Area Residue Piles, SWMU 5

4.4.3.1 Site History

This site is situated in the demolition area immediately downslope from the pre-1982 burning area. Residues from the open burning of explosives and explosive-contaminated wastes were bulldozed downslope into an arroyo, forming a series of residue piles stretching for several hundred feet. At least three discernible areas were identified. Part of the scrap metal from the burning trays might have been disposed of in this site. Wastes include open burning residues, metal banding from ammunition packaging, 55-gal drums, small metal parts, and burned-out JATO bottles.[21]

4.4.3.2 Geology and Hydrology

The site is located on the slope of an arroyo downslope from the pre-1982 burning area. Alluvial deposits are exposed on both banks of the arroyo. In geology and hydrology, this site is similar to the Burning Ground (Sec. 4.4.2.2).

4.4.3.3 Nature and Extent of Contamination

Nine surficial soil were sampled in 1981 on the slope where the residue piles were located. Metal and explosive contamination were found (Table 4.7). All nine samples are contaminated with barium, HMX and RDX, barium from 11 to 759 mg/L, HMX from 13.4 to 107 mg/kg, and RDX from 16.6 to 492 mg/kg. Eight of the nine have 2,4,6-TNT at levels from 37.1 to 3180 mg/kg. Lead is found in five of nine samples ranging from 0.5 to 4.5 mg/L. Insignificant amounts of cadmium, 2,4-DNT, and tetryl are shown in a few samples.

The residue piles stretch discontinuously a few hundred feet in the demolition area. In some locations, they appear to be at least several feet thick.[21] The exact size and depth of the piles are not identified.

TABLE 4.7 Chemical Results of Soil Sampling in the Residue Pile Area

Sample No.	EP Toxicity[a] Concentration (mg/L)								Explosives[a] Concentration (mg/kg)					
	Ag	As	Ba	Cd	Cr	Hg	Pb	Se	2,4 DNT	2,6 DNT	2,4,6 TNT	HMX	RDX	TETRYL
014	BDL[b]	BDL	12	BDL	BDL	BDL	BDL	BDL	6.7	BDL	3180	62.1	204	BDL
015	BDL	BDL	69	0.94	BDL	BDL	4.5	BDL	BDL	BDL	337	102	241	BDL
016	BDL	BDL	208	BDL	BDL	BDL	BDL	BDL	BDL	BDL	75.4	13.4	29.5	BDL
017	BDL	BDL	449	0.13	BDL	BDL	2.8	BDL	BDL	BDL	37.1	22.8	25.8	BDL
018	BDL	BDL	119	BDL	BDL	BDL	BDL	BDL	BDL	BDL	485	14.4	37.5	1.8
019	BDL	BDL	11	BDL	BDL	BDL	BDL	BDL	BDL	BDL	755	32	137	1.3
020	BDL	BDL	13	BDL	BDL	BDL	0.70	BDL	BDL	BDL	320	48.1	16.6	BDL
021	BDL	BDL	122	BDL	BDL	BDL	1.8	BDL	NA[c]	BDL	BDL	107	492	21.7
022	BDL	BDL	759	BDL	BDL	BDL	0.50	BDL	2.0	BDL	447	15.1	46.6	BDL
Detection Limit	0.5	0.5	10	0.1	0.5	0.2	0.5	0.1	1.0	1.0	1.0	1.0	1.0	1.0

[a]See Table A.1 for identification of constituents.

[b]Below detection limit.

[c]Not available.

Source: Ref. 31.

Because the residue piles are in the vicinity of the open demolition craters, UXO constitutes a major concern at this site. Very little information is available in the record to document the amount and location of UXO that has been discovered in the area. Incidents of unplanned UXO explosions in the general area were reported to ANL staff by FWDA personnel.

4.4.3.4 Proposed Actions

We recommend that the Army conduct an ordnance reconnaissance survey in this area using available technology.

A field visual survey should also be conducted to delineate the boundaries of the residue piles. Once the boundaries are delineated, removal of the residue piles is recommended since they have been found to be hazardous. The wastes should be disposed of as hazardous waste.

Surficial soil samples should be collected along the stretch of the piles and at the toe of the piles. A spacing of 20 ft may be used. Precaution should be taken to avoid unexploded ordnance. The sampling plan may be integrated with the plans for the Demolition Craters and Burning Ground (Secs. 4.4.1.4 and 4.4.2.4). The results should help to delineate the extent of contamination caused by the residue piles.

4.4.4 Old Burning Ground and Demolition Landfill, SWMU 13

4.4.4.1 Site History

The site is located in the Fenced-Up Horse Valley (an arroyo) at the end of Burning Area Road and on both sides of the road (Figs. 4.14 and 4.16). According to Fort Wingate personnel, the site was used from about 1948 to probably 1955 to receive explosive-contaminated wastes from the Ammunition Washout Plant during and after the plant operation. Old equipment from the TNT drying and flaking operation was removed from Bldg. 503 during the renovation of the building. The equipment was reportedly dumped in the arroyo without being decontaminated or washed. Wastes were not decontaminated prior to land disposal.[1]

According to documents dated from late 1954 to early 1955,[33] the site might have included burning activities even after 1955. The burning ground covered an area about 1,400 long and 200 ft wide along the embankment of an arroyo. The site was permitted by the Department of the Army, Washington, D.C.,[34] as a burning site with an explosive limit of 30,000 lb. In maps from the later 1950s, only the western end of the site was marked as a burning ground. At the time ANL personnel visited the site in June 1990, bomb shells were found in the bottom of the arroyo in the western part of the site, while drums were found near the eastern part of the site.

The major concerns at this site are metal and explosive contaminations. Assuming that the operational practices at the site were the same as those now used at

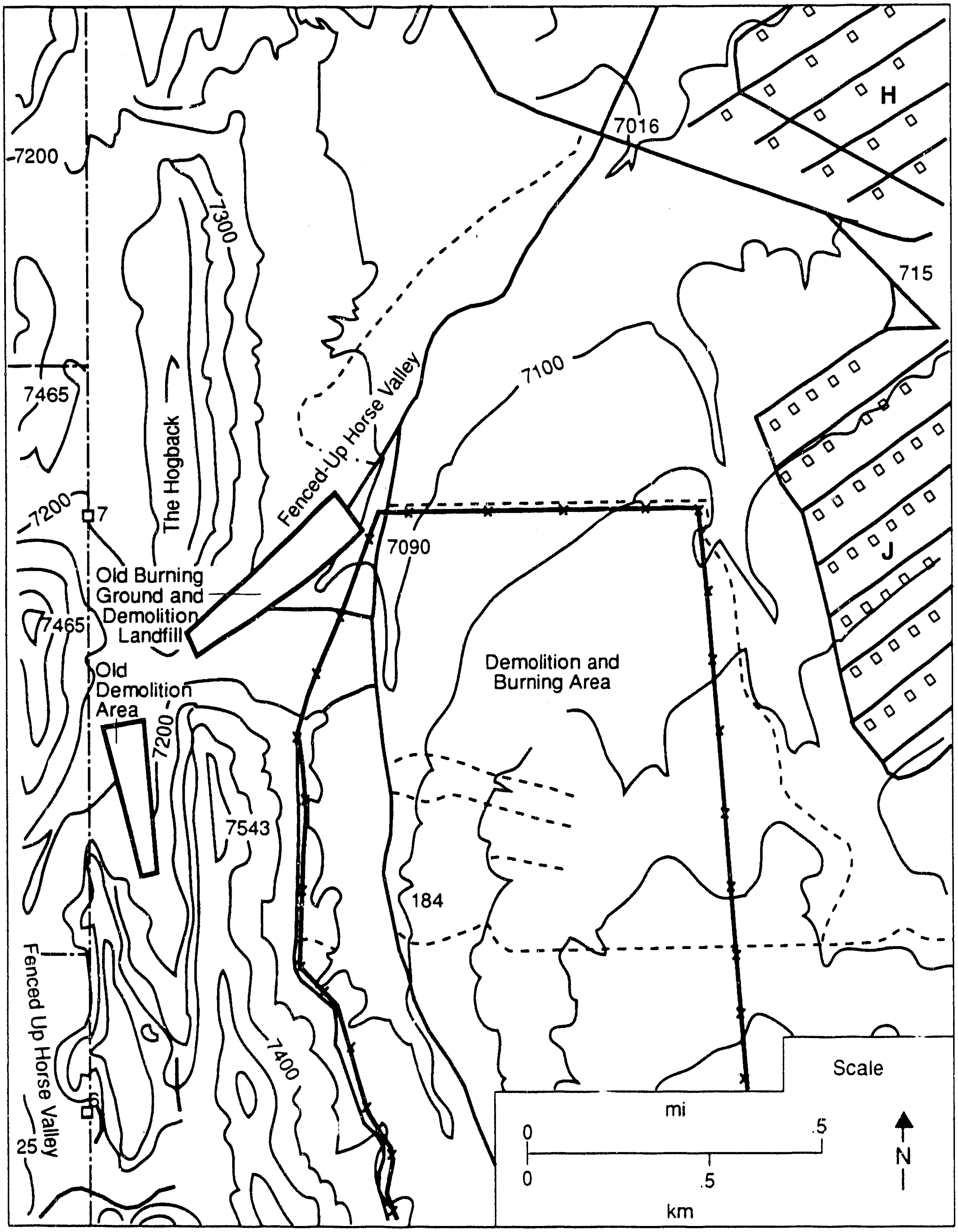


FIGURE 4.16 General Location of Old Demolition Area, and Old Burning Ground and Demolition Landfill

the current demolition area, components or explosives including out-of-date and obsolete explosives, propellants, munitions, and unsafe munition items, might have been disposed of at the site.

The old demolition landfill site shown in the Enhanced Preliminary Assessment Report[1] probably is incorrectly located north of Fenced-Up Horse Valley.

4.4.4.2 Geology and Hydrology

The site is located on the hill slope of the hogback and occupied both sides of an arroyo about 20 ft deep. Collapsed features in the alluvium have been observed on both banks of the arroyo. This implies that the alluvium is undergoing erosion. The thickness of the alluvium exposed in the arroyo is more than 20 ft.

Alluvial thickness may dramatically decrease at distances farther away from the arroyo. Bedrock of mudstone and calcareous sandstone are exposed less than 100 ft away in the hogback. It is estimated that a veneer of alluvium less than 10 ft thick covers most of the site. Rock fragments would be common among the clayey and sandy alluvium.

The arroyo is dry most of the year, with wetness only occurring during occasional rains or snowmelts. During that time, water from the arroyo discharges to the northeast, into another arroyo, and then flows north to the South Fork of the Puerco River. Groundwater may be present in the arroyo alluvium during the wet season. However, the alluvium probably remains dry most of the year.

4.4.4.3 Nature and Extent of Contamination

Two soil samples taken in the north side of the arroyo in June 1981 showed explosives contamination.[7] The chemicals analyzed include semivolatiles and explosives. In the sample located in the western site (FW20), the concentrations of 2,4,6-TNT and total phosphate were found at 4,940 mg/kg and 496 mg/kg, respectively, while the second sample located in the eastern site (FW21) contained 2,4,6-TNT and total phosphate at 5.03 mg/kg and 72.7 mg/kg, respectively (Table 4.8). In addition, anomalous high concentrations of nitrate and nitrite were found in the sample FW20. Because the detected limits of other kinds of explosives are set so high, their significance is not clear.

Because no sediment samples were taken in the alluvium within the arroyo, the extent of the contamination in the sediment cannot be justified. However, a sediment sample taken in an arroyo about 600 ft downstream from the site has a 2,4,6-TNT content of 1.940 mg/g. Since this arroyo receives discharge from both the demolition area and this site, the 2,4,6-TNT could be from both sources.

There are no metal data available for this site.

TABLE 4.8 Selected Chemical Results of Soil Sampling in the Old Burning Ground and Demolition Landfill

Compound[a]	Concentration (mg/kg) FW19	FW20	FW21
Semivolatile			
Bis (2-ethylhexyl) phthalate	0.6	0.6	1
Chrysene	< 1	< 1	< 1
Fluoranthene	< 0.4	< 0.4	< 0.4
Naphthalene	< 0.4	< 0.4	< 0.4
Phenol	< 0.4	< 0.4	< 0.4
Explosive			
1,3-DNB	< 0.317	< 31.7	< 0.317
2,4-DNT	< 0.223	< 22.3	< 0.223
2,6-DNT	< 0.419	< 41.9	< 0.419
1,3,5-TNB	< 1.08	< 1080	< 1.08
2,4,6-TNT	0.663	4940	5.03
Nitrobenzene	< 1.64	< 164	< 1.64
RDX	< 2.88	< 2.88	< 2.88
Tetryl	< 1.5	< 1.5	< 1.5
NO_2+NO_3	< 3	58	< 3
Total PO_4	307	496	72.7

[a]See Table A.1 for identification of compounds.

Source: Ref. 7.

In summary, the sampling results indicate that soil on the site has been contaminated with explosives. The extent of the contamination is not clear. Based on the site history and field evidence, landfill, open burning, and open detonation activities on the site in the past may have caused extensive soil contamination. Major concerns at the site include UXO and metal and explosive contamination in the soil, sediment, and probably groundwater. The proposed actions therefore are to better define the nature and the extent of the contamination.

4.4.4.4 Proposed Actions

It is recommended that an ordnance reconnaissance survey be conducted by the Army to locate surface and subsurface UXO and metal objects using appropriate techniques available to the Army. The results may also be used to derive the locations of different past activities and the area boundaries of those activities.

In order to determine the extent of contamination, at least 15 surficial soil samples, to a depth of 1 ft, should be taken from each side of the arroyo (a total of 30 samples). The samples should be analyzed for semivolatiles, metals, and explosives. These results should also provide information about the past activities.

Because it is believed that the arroyo on the site was used as a landfill, at least five sediment samples should be collected in the bottom of the arroyo to a depth of 1 ft. The arroyo is an ideal route for contaminant transport by surface water during rains or snowmelts. The samples should be analyzed for semivolatiles, explosives, and metals.

A monitoring well should be installed in the alluvium at the east end of the site in the arroyo. This would provide information on the characteristics of the alluvium, its thickness, the elevation of groundwater table (if it is present), and the quality of groundwater. If groundwater is present, it should be sampled quarterly and analyzed for metals, explosives, and semivolatiles.

Further sampling may be required, depending on the above results.

4.4.5 Old Demolition Area

4.4.5.1 Site History

The site is located about 2,000 ft south of the Old Burning Ground and Demolition Landfill (Sec. 4.4.4) adjacent to the western boundary of FWDA (Fig. 4.16). It was identified in 1981 as an old demolition ground.[7] The site has scattered metal parts on the surface. Three earth mounds are identified. The history of the site is not well known. According to FWDA personnel, the site was actively used before 1950. Even in the early 1950s, explosives from the holding tank of the washout plant in the Workshop Area were shipped to this site and burned in the open. The exact boundary of the site is not known.

4.4.5.2 Geology and Hydrology

The site is situated across a wash and near the confluence of two washes in the hogback (Fig. 4.16) and covered with alluvial deposits, which in turn are underlain by the Mancos Shale of Cretaceous age. The alluvium is sandy in texture. The wash is dry most of the time but occasionally wet during rainstorms or snowmelts. The surface of the site slopes gently toward the wash.

4.4.5.3 Nature and Extent of Contamination

Only one soil sample has been taken from this site (FW19).[7] The sample contains small amount of 2,4,6-TNT explosive (0.663 mg/kg). Other explosives were below detection limits. However, significant concentration of total phosphate at a level of 307 mg/kg is found. No metal data are available.

From a 1948 aerial photograph, three mounds are identified on the west side of the wash. These mounds remained in a 1962 aerial photograph. The mounds may represent part of the past activities on the site. As the site history is not known and only one soil sample was analyzed, the nature and extent of contamination on this site are not clear.

4.4.5.4 Proposed Actions

It is recommended that an ordnance reconnaissance survey be conducted by the Army to locate surface and subsurface UXO and metal objects using appropriate techniques available to the Army. The results may also be useful for deriving the boundaries of past activities.

Surficial soil samples should be collected to a depth of 1 ft. The sample locations should include the area near the mounds on the west side of the wash and other areas that can be determined in the field, as indicated by metal residues. Also, five sediment samples should be collected in the bottom of the wash, as deposition of contaminants is likely to have occurred. All the samples should be analyzed for metals, explosives, total phosphate, and semivolatiles.

4.4.6 Functional Test Range 1

4.4.6.1 Site History

This is one of the three functional test areas at the FWDA. The site is located in the east-central section of the depot (Fig. 4.17) and seems to have had different uses in the past. From a map dated 1949, the site was listed as a powder burning area. In an aerial photograph taken in 1948, the site was shown being actively used. It is possible that burning activities may have occurred in the early 1940s. In a 1955 map, the

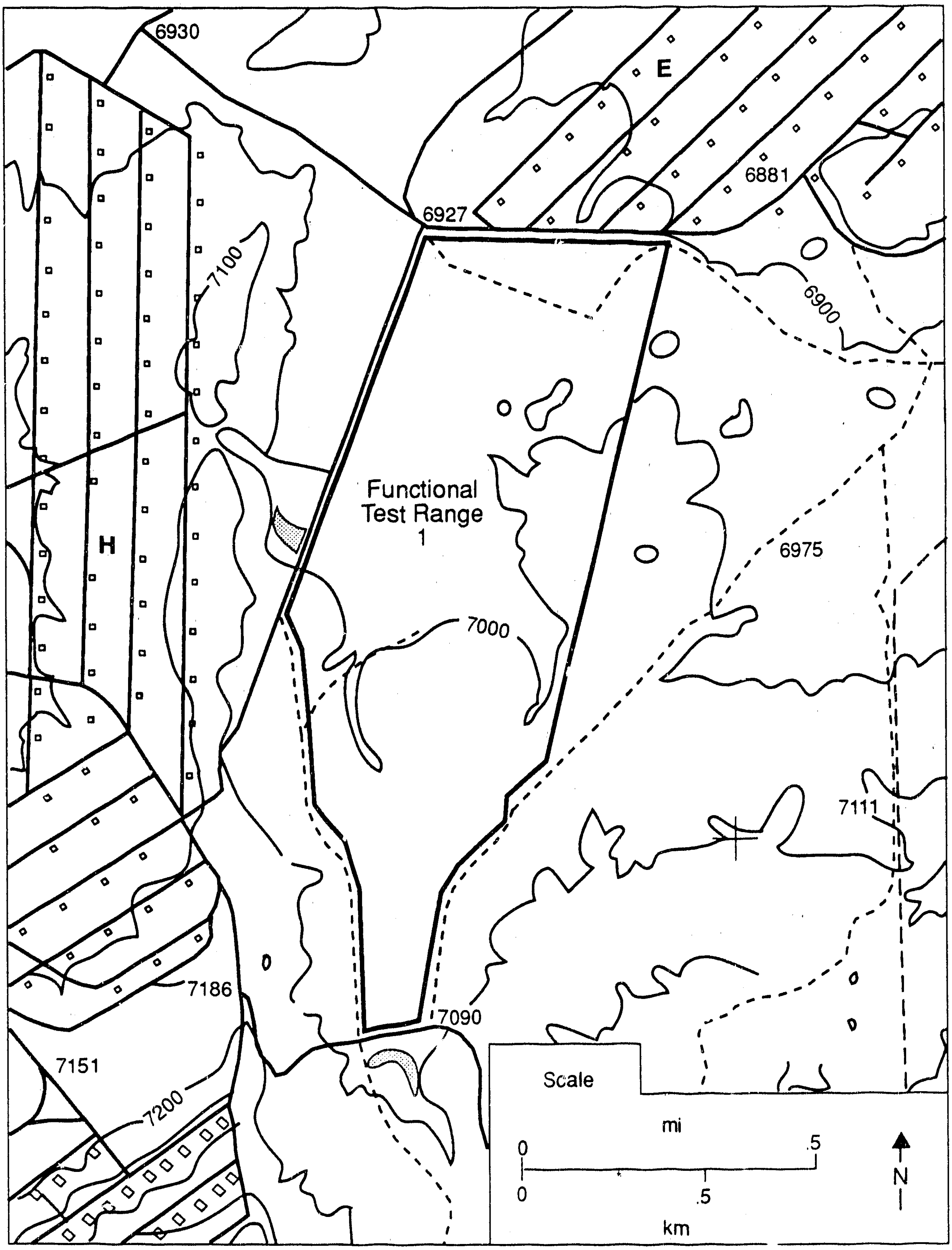


FIGURE 4.17 Location of Functional Test Range 1

designation of the "powder burning area" shown in the 1949 map disappeared, implying that the site was not active. However, the area was noted as a site for flare and signal grenade testing during the late 1950s.[1] The site currently is covered with grasses. Scrap metal and shrapnel are spread over a large area. Residues were piled by the bank of an arroyo near the eastern part of the site.

The boundary of the site in Fig. 4.17 is derived from two aerial photographs dated in 1948 and 1962. Currently, the site is used as a drop zone for military training.

4.4.6.2 Geology and Hydrology

The site is located in a drainage basin. Triassic bedrock remnants fringe the east and west portions of the site. A wash enters the site from the south and branches into two major washes, which run parallel to the eastern and western site boundaries. The washes may represent part of a past braided river system. The washes in the site remain dry except during rainstorms and snowmelts.

Except near the eastern boundary, where the Triassic Chinle Formation is exposed, the site is covered with Quaternary alluvium deposited by a system of braided rivers originating from the slopes of Zuni Mountain. The exact thickness of the alluvium is not known since no information is available. It is estimated to be in the range of 30 to 40 ft. The thickness may vary laterally. Cracks are common in the upper part of the alluvium. This facilitates water percolation during rainstorms. The texture of the alluvium ranges from clayey sand in most of the area to sand and gravel in the washes. The bedrock underlying the site is the Chinle Formation of Triassic age.

The depth to groundwater, if present in the site, is not clear. It may be present during the wet season and fluctuates over time.

4.4.6.3 Nature and Extent of Contamination

Based on information about past activities, the major environmental concerns in the site are metal and explosives contamination. However, no soil, sediment, and water samples have been taken from the area. Therefore, the nature and extent of the contamination remains to be investigated.

The 1948 and 1962 aerial photographs show that major activities were located in the central area of the site and at the area where two major washes intersect. From field observation, the eastern wash was also used for landfill for metal parts and residual wastes.

4.4.6.4 Proposed Actions

A visual reconnaissance survey should be conducted at the site to delineate the boundaries of past activities. Using geophysical methods that are available, the Army should also conduct an explosive ordnance reconnaissance to recover unexploded ordnance and other buried metals. The results should be useful in better defining past activities in the area. At least 10 soil samples should be taken from the western bank of the eastern wash (arroyo). At least 20 soil samples should be collected in the middle of the site and near the northern intersection of the two washes. Five sediment samples should be collected in the bottom of each of the two major washes. The suggested depth of each sample is 1 ft. All samples should be analyzed for metals, semivolatiles, and explosives.

4.4.7 Functional Test Range 2

4.4.7.1 Site History

This site and Functional Test Range 3 (Sec. 4.4.8) are both in the northeastern part of FWDA (Fig. 4.18) and are adjacent to each other. Range 2 was reportedly used between 1960 and 1967 to test a variety of projectiles, including 3.5-in. rockets and 4.2-in. mortar rounds. In a 1962 aerial photograph, scattered craters are seen on the site. The only visible indications of its former use is a small area at the extreme northeast end, where relatively less vegetation exists than in the surrounding areas.[1]

4.4.7.2 Geology and Hydrology

The site can be geologically divided into two parts: an alluvial plain created by the South Fork of the Puerco River in the north and a drainage basin between two bedrock ridges in the south. The northern area is primarily composed of alluvial deposits of a combination of clay, silt, sand, and gravel underlain by the Chinle Formation of Triassic age. The alluvial thickness increases from a veneer near the bedrock ridge in the south to probably 100+ ft toward the channel of the South Fork of the Puerco River in the north. Many washes have been developed on the alluvium. They remain dry most of the year. Groundwater may be present near the channel of the Puerco River, especially during rainstorms or snowstorms.

The southern part of the site is situated on a small drainage basin between two bedrock remnants. The drainage flows to the northeast and joins the South Fork of the Puerco River. A veneer of alluvium was deposited by drainage on top of the mudstone and calcareous sandstone bedrock. The drainage remains dry except during rainstorms or snowstorms.

4.4.7.3 Nature and Extent of Contamination

The major concerns on this site are UXO and potential explosives and metal contamination. This conclusion is based on known past activities at the site. As there are no chemical data on the soil on the site, the seriousness of metal contamination is not clear. Also, UXO was not marked and reported in the past. It is difficult to evaluate the potential UXO problem. From the 1962 aerial photograph, the site may have covered quite a large area (Fig. 4.18).

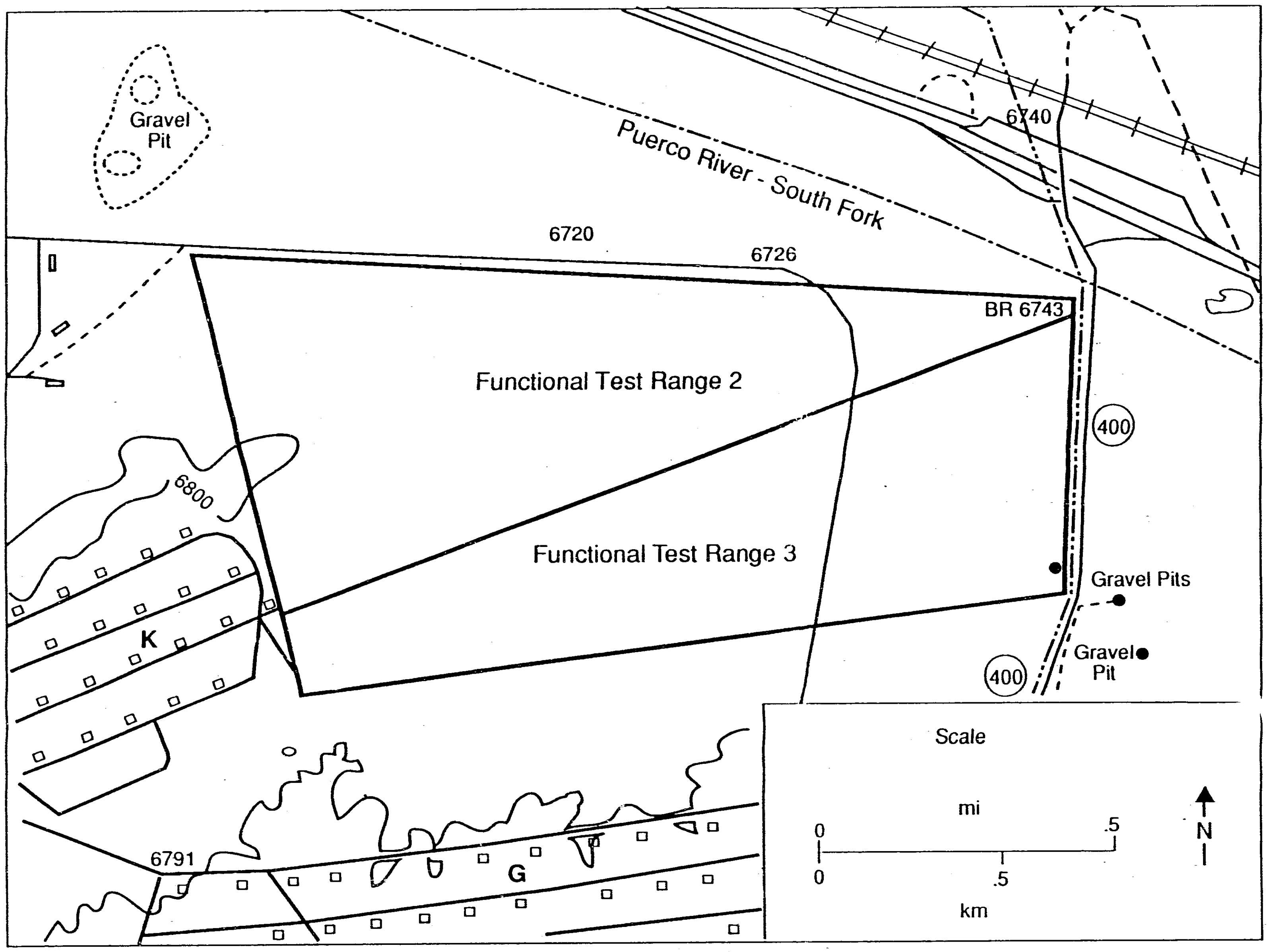


FIGURE 4.18 Locations of Functional Test Ranges 2 and 3

4.4.7.4 Proposed Actions

A visual reconnaissance survey should be conducted at the site to delineate the boundaries of past activities. Using geophysical methods that are available, the Army should also conduct an ordnance reconnaissance to recover UXO. The results should be useful in better defining past activities in the area.

At least one sediment sample should be taken from each wash in the northern part of the site and five sediment samples from the drainage in the southern part of the site. The suggested depth of each sample is 1 ft. All samples should be analyzed for metals and explosives.

4.4.8 Functional Test Range 3

4.4.8.1 Site History

The site is located southeast of Functional Test Range 2 (Sec. 4.4.7, Fig. 4.18) in the northeastern corner of FWDA. The site was used in the 1960s to test high explosives.[33] In a 1962 aerial photograph, the site is dotted with craters and covers an area about 0.5 mi × 1 mi.

4.4.8.2 Geology and Hydrology

The site is covered by a veneer of alluvium in a drainage basin between bedrock remnants. The alluvium was supplied by drainage running north of the site and by washes in the south. Underlying the alluvium is the Chinle Formation of mudstone and calcareous sandstone. Groundwater is expected to be absent in the alluvium.

4.4.8.3 Nature and Extent of Contamination

The major concerns at this site are UXO and potential explosive and metal contamination. This conclusion is based on the site's known past activities. As there are no chemical data about the soil, the seriousness of explosive and metal contaminations is not clear. Also, UXO was not marked and recorded in the past. It is difficult to evaluate the potential UXO problem. From the 1962 aerial photograph, the site may have covered an area 0.5 mi × 1 mi (Fig. 4.18).

4.4.8.4 Proposed Actions

A visual reconnaissance survey should be conducted at the site to delineate the boundaries of past activities. Using geophysical methods that are available, the Army should also conduct an ordnance reconnaissance to recover UXO. The results should be useful in better defining past activities in the area.

Surficial soil samples should be collected in the craters created by past explosives testing. The locations of the craters can be identified from the 1962 aerial photograph. In addition, sampling of the drainage north of this site can be integrated with the sampling plan in Functional Test Range 2. The suggested depth of each sample is 1 ft. All samples should be analyzed for metals and explosives.

4.4.9 Igloo Group C Dump Area

4.4.9.1 Site History

The site is in southern part of Igloo group C area in an arroyo (Fig. 4.19). Scrap metal and railroad logs are the major wastes scattered on the slopes and in the bottom of the arroyo. A few tires and some ammunition shells are also present. The history of the site is not clear.

4.4.9.2 Geology and Hydrology

The site is situated in an arroyo running from the hogback to the South Fork of the Puerco River. In the arroyo, more than 10 ft of an alluvial deposit of clayey loam is exposed. The arroyo is dry most of the time. Groundwater is not expected in the alluvium except during rainstorms or snowmelts. Under the alluvium is the Triassic Chinle Formation, which is primarily composed of mudstone and calcareous sandstone.

4.4.9.3 Nature and Extent of Contamination

The majority of the waste, except for ammunition shells, on this site seems not to be hazardous. No soil samples have been taken. The nature and extent of contamination, if present, are not known.

4.4.9.4 Proposed Actions

Soil should be sampled at the toe of the slope where wastes and ammunition shells are accumulated. Also, a sediment sample should be collected immediately downstream from the landfill. All samples should be analyzed for metals and explosives. If contamination is found, further sampling or remediation would be necessary.

4.4.10 Unexploded Ordnance

Unexploded ordnance is a major problem at the FWDA because of its danger. However, UXO is not a solid waste management unit and therefore does not fall into the SWMU definition of RCRA. For the completeness of this report, UXO is addressed, however, because it relates to base closure.

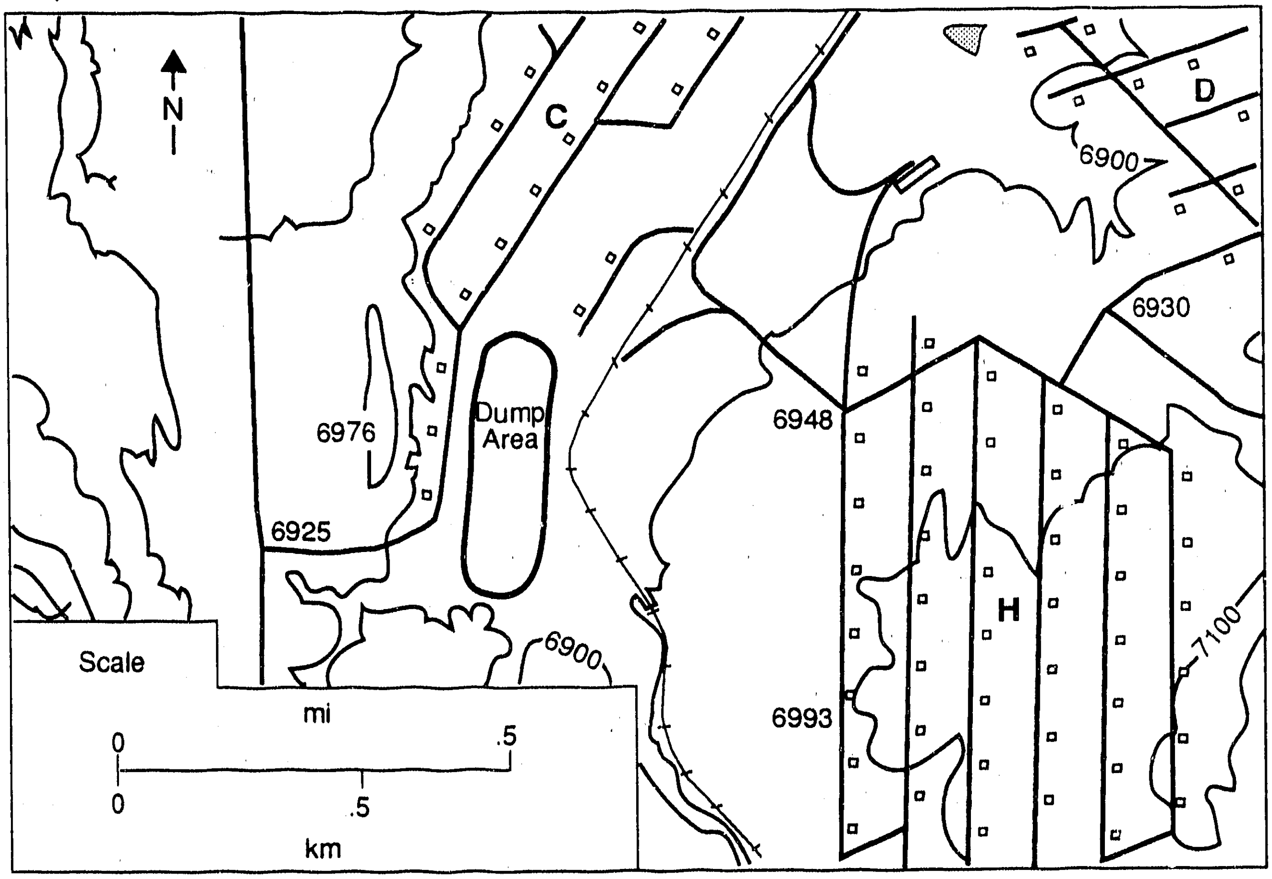


FIGURE 4.19 Igloo Group C Dump Area

The UXO problem exists because different types of explosives might have failed to ignite when they were tested or destroyed. They were likely left in the field. Also, explosives may have been improperly disposed of, such as in landfills on site. The problem is complicated by (1) demolition sites and functional test sites not being precisely delineated, (2) activity records for the sites being incomplete or unavailable, (3) landing locations of unexploded ordnance being unpredictable, and (4) unrecorded locations of UXO even when it was reported. Because of these difficulties, a boundary within which the UXO problem exists cannot be delineated.

Fortunately, locations of major demolition activities at the FWDA are known. These locations can be considered as potential "centers" of UXO. The probability of encountering UXO decreases with the distance from these centers. Hence, within certain distances from the apparent boundaries of the demolition sites or functional test ranges, zones can be defined that reflect the probabilities of encountering UXO. Since different types of explosives would have different traveling distances, the Army should determine the zoning distances based on the types of explosives tested on the sites. The zoning of UXO would help in adopting strategies for cleanup and land management. For example, cleanup of UXO can be set up in stages according to the zoning and the sufficiency of funding. The UXO zoning may be taken into consideration when different levels of restricted use of land are designated on FWDA.

4.5 OTHER AREAS AND FACILITIES REQUIRING ENVIRONMENTAL EVALUATION

Other areas and facilities on the FWDA property that require additional environmental evaluation are:

- Asbestos-containing materials in several buildings,
- Radon release in buildings,
- Underground and aboveground fuel storage tanks,
- Missile launch sites (three sites),
- Pistol range areas, and
- Old Trash Burning Ground.

These are areas that require either sitewide surveys, such as for asbestos or radon, or limited reconnaissance sampling. Consequently, they are not included in the actions discussed in Secs. 5 and 6.

4.5.1 Asbestos

Asbestos-containing materials were used in several buildings and for insulating pipes between buildings in the 500 area. The nature of the asbestos used and the extent of the hazard it represents are not known. There is reason to believe that some asbestos material in the Workshop Area may be contaminated with explosives. An asbestos survey has been conducted; survey results are pending.

An asbestos survey of all buildings and facilities should be conducted. The results of the survey can be used to provide the basis for removal or remediation where appropriate or for disclosure upon property transfer.

4.5.2 Radon Release

No radon survey of buildings at FWDA has been completed. Ongoing surveys of buildings in the Administration Area have been completed, but the results have not been reported. Actions cannot be proposed until those results are available for review.

4.5.3 Fuel Storage Tanks

According to FWDA personnel, there are six underground fuel storage tanks and six aboveground tanks on FWDA.

Three (two for gasoline and one for diesel fuel) of the underground fuel tanks are located near Bldg. 6, a gas station, which provides diesel and gasoline fuels for vehicles.

Old fuel tanks installed in the early 1940s were replaced in the early 1970s.[35] The other three underground diesel fuel tanks were located in Bldgs. 35, 36, and 536.[2] They were reportedly installed in the 1960s. The fuel tank at Bldg. 35 was used to store kerosene and was reportedly used later for diesel fuel storage. All six underground fuel tanks are still actively used. No leak testing of the fuels tanks has been reported. Leak testing is recommended.

Among the six aboveground fuel tanks, two asphalt tanks near the old coal field in the Administration Area were installed in the 1950s; they were abandoned in the mid-1960s. Two diesel tanks were installed near Bldg. 530 about 1964. They were used to supply fuel for powering the Deactivation Furnace in Bldg. 530 and have been removed to the Gate 209 area. The other two tanks (at Bldg. 11 and Gate 209) were installed in the 1960s and are still actively used to store fuel for heating purposes.

Tanks not currently in use should be removed, and any stained soil found below them remediated by appropriate procedures.

4.5.4 Missile Launch Sites

Pershing and Sergeant missiles were launched from FWDA as part of a test program in the 1960s. From Oct. 1963 to Feb. 1964, 14 missiles were launched from this area. The three known missile launch sites are all in the southern section of FWDA (Fig. 2.3). Missiles were launched from FWDA into the White Sands Missile Range to the southeast.

The Ballistic Missile Testing Site (BMTS) (Site #17 in Fig. 2.3) contains much debris left over from the launchings, including a concrete pad, communication wire, old tires, and two "headstones" that reportedly mark the spot where two missile engines are buried. This BMTS area contains a launch pad and, when operational, contained quarters for the launching team and their equipment.

The Pershing missile site (Site #18 in Fig. 2.3) is located near Lake McFerren. A launching pad is visible, but few other signs remain that this was a missile launch site. This area is currently used for recreation.

A third missile launch site (Site #21 in Fig. 2.3) that was reportedly never used exists to the north of the BMTS and Pershing launch sites, near the eastern border of FWDA. This site has a launch pad but little other visible evidence of missile launch activities.

It is recommended that the Missile Launch Sites be sampled for explosives, especially at the Ballistic Missile Testing Site (Site #17 in Fig. 2.3). Soil samples should be collected in the area where the two missile engines are buried. Near-surface soil samples should be collected and analyzed for explosives. The two missile engines should be excavated and disposed of properly.

4.5.5 Pistol Range

The New Mexico Army National Guard has leased 600 acres of land for bivouac and tank maneuver training. Training has occurred sporadically in the past. Firing of weapons reportedly took place during training. The U.S. Army Reserve Engineers also periodically trains personnel on the installation in the use of construction equipment and techniques. As shown in Fig. 2.3 (Site #19), there is a 25-m pistol range located 2-1/2 mi to the southeast of the Administration Area. Information is not available as to the length of time the pistol range has been in use.

A site reconnaissance should be conducted to inspect for debris and to remove it. It is recommended that the target area be sampled and analyzed for total metals. A minimum of five soil samples should be collected from the target area embankment. These samples should be collected with a trier or a hand auger.

4.5.6 Old Trash Burning Ground

A map from 1944 identified an area in the northern portion of the installation as a trash burning area. It is located about 2,000 ft west of the sewage disposal plant and south of the road and manproof fence (item 22 in Fig. 2.3 and Fig. 4.13). The area was not known as a burning ground to present FWDA personnel, but a visual inspection revealed that a significant portion lacked vegetation.

A few soil samples should be collected from the area lacking vegetation and analyzed for metals and semivolatiles to screen for evidence of contamination from trash burning.

5 SUMMARY OF PROPOSED ACTIONS

This section summarizes (Table 5.1) recommendations for all of the AREEs included in this MEP. Where AREEs have been previously designated SWMUs by the Army, the corresponding SWMU number is provided. Details of the recommendations and supporting rationale can be found in Sec. 4.

TABLE 5.1 Summary of Proposed AREE Actions at Fort Wingate

SWMU No.	AREE Site Name	Proposed Actions	Chemical Category
1	TNT Leaching Beds	15 soil samples from each leaching bed, 3 sediment samples from the bottom of each tank, 4 soil samples from the perimeter of each tank	Explosives, semivolatiles, total metals, nitrate and nitrite
2	Acid Waste Holding Pond	Background sampling, 1 soil sample from the center of the pit, 4 soil samples from the outer edge of each side	Semivolatiles, pesticides/PCBs, explosives, total metals
3	Demolition Craters (pits)	UXO reconnaissance, 24 surface soil samples from 8 craters, 2 sediment samples from each wash, 6 sediment samples from the main arroyo, and 2 monitoring wells in the alluvium	Total metals, phosphate, explosives
4a	Old Burning Ground	UXO reconnaissance, grid-sampling (spacing 20 ft) surficial soil upslope of all residue piles	Total metals, total phosphorous, explosives, semivolatiles
4b	Current Burning Ground	UXO reconnaissance, soil samples around current burning troughs and trays	Total metals, total phosphorous, explosives, semivolatiles
5	Demolition Area Residue Piles	UXO reconnaissance, field survey to delineate site boundary, soil sampling under the piles and at the toe of the piles using a spacing of 20 ft	Tctal metals, total phosphorous, explosives, semivolatiles

TABLE 5.1 (Cont'd)

SWMU No.	AREE Site Name	Proposed Actions	Chemical Category
6	Current Landfill	Geophysical survey to delineate lateral and vertical extent of landfill; soil borings within the landfill and along its perimeter, collect soil samples in the boring; if contamination found and groundwater present in perimeter borings, install monitoring wells for further investigation	Volatiles, semivolatiles, pesticides/PCBs, herbicides, total metals
7	Deactivation Furnace Deactivation Furnace (converted)	Background sampling, site inspection for signs of visible contamination, chip or surface soil sample on stained areas; one sample from the bottom of each acid pit	Total metals, explosives Phosphates, total metals, explosives
8	Maintenance Shops (Bldgs. 5, 9, 15)	Soil borings in visibly stained areas, collect soil samples; if above results are positive, need additional soil borings, groundwater monitoring, sediment and water samples, and remedial action; soil samples under machine shop floor	Volatiles, semivolatiles, pesticides/PCBs, explosives, herbicides, total metals

TABLE 5.1 (Cont'd)

SWMU No.	AREE Site Name	Proposed Actions	Chemical Category
9	Storage Yard	Soil gas survey, delineate sampling areas; sample near-surface soil in and around borings and collect soil samples; better waste management practices for waste battery acid	Volatiles, semivolatiles, pesticides/PCBs, total metals
10	PCL Waste Discharge Area	Soil gas survey to delineate sampling area; collect soil samples from five shallow soil borings, four in the POL dump, and one outside the known area; if contamination found, need additional soil borings, soil samples, groundwater monitoring wells	Volatiles, semivolatiles, pesticides/PCBs, total metals
11	Sewage Treatment Plant	Sediment samples from each infiltration/evaporation pond, at least 1 boring in each pond and drying pit, soil samples collected in borings	Total metals
		Collect pink solution sample (if present) and sediment samples at the outflow area of the treatment plant	Total metals, volatiles, semivolatiles, pesticides/PCBs

TABLE 5.1 (Cont'd)

SWMU No.	AREE Site Name	Proposed Actions	Chemical Category
12	Old Landfill - Water Tower	Geophysical survey to delineate vertical and lateral extent of landfill; soil borings along the north and northeast boundary of the landfill, and collect soil samples in the borings; if contamination found, drill additional soil boring and install groundwater monitoring wells	Volatiles, semivolatiles, pesticides/PCBs, explosives, total metals
13	Old Burning Ground and Demolition Landfill	UXO reconnaissance, at least 15 soil samples in each side of the arroyo, 5 sediment samples collected in the bottom of the arroyo, 1 monitoring well at the east end of the site in arroyo	Semivolatiles, explosives, total metals
14a	Septic tanks and cesspools	Remove and check soil for any evidence of contamination	
14b	Three septic tanks and a drainfield	Remove and check soil for any evidence of contamination	
15	PCB Transformer Storage Area	Site inspection to detect spills and leaks, sample stained areas	PCBs
16	PCP-Treated Wood Storage Area	Background sampling, field-inspect for signs of contamination, either chip or surface soil sample in stained area	Semivolatiles

TABLE 5.1 (Cont'd)

SWMU No.	AREE Site Name	Proposed Actions	Chemical Category
17	Fire Training Ground	Soil sampling in and around the pit, any other stained areas, and along the surface drainage route and pipes; construct impervious liner for the pit, discontinue drum storage in the area; clean up spills and affected soil; collect samples along the Puerco River and its tributaries	Total metals, volatiles, semi-volatiles
18	Pesticide Storage Bldg.	Background sampling, sample areas with signs of visible contamination	Pesticides and herbicides
None	Old Demolition area	UXO reconnaissance, sample surficial soil from the mounds, in area where metal residues are shown, 5 sediment samples from the bottom of the wash	Total metals, explosives, total phosphate, semivolatiles
None	Functional Test Range 1	Field visual reconnaissance to define site boundary, UXO reconnaissance, 10 soil samples in the western bank of the eastern wash, at least 20 samples in the middle and northern part of the site, five sediment samples in the bottom of each two major washes	Total metals, explosives, semi-volatiles

TABLE 5.1 (Cont'd)

SWMU No.	AREE Site Name	Proposed Actions	Chemical Category
None	Functional Test Range 2	Field visual reconnaissance to define site boundary, UXO reconnaissance, one sediment sample from each wash in the northern part of the site	Total metals, explosives
None	Functional Test Range 3	Field visual reconnaissance to define site boundary, UXO reconnaissance, surficial soil samples in the craters of past tests	Total metals, explosives
None	Bldg. 11	Wipe samples in the floor areas in Bldg. 11 where PCB transformers were stored; if contamination found, clean up the area	PCBs
None	Bldg. 29	Wipe samples in the rooms in which herbicides were stored, soil samples near the entrances of the building; if contamination found, soil borings drilled in the contaminated area and decontamination	Herbicides
None	Igloos	Background sampling, inspect loading area and operational areas for signs of visible contamination, collect surface soil samples in stained areas	Explosives

TABLE 5.1 (Cont'd)

SWMU No.	AREE Site Name	Proposed Actions	Chemical Category
None	Igloo Group C dump area	Soil samples collected at the toe of the waste piles, 1 sediment sample downstream of the landfill	Total metals, explosives

6 ORDER OF PRIORITY FOR RESPONSE ACTIONS

As a result of the age of Fort Wingate, the records of some depot activities were not available, and some of the AREEs could not be located with complete accuracy. Several factors must be considered when establishing priorities for investigative action and possible remediation. The FWDA mission has always been distribution of ammunition components and other supplies and the storage and decommissioning of munitions. Only limited industrial activities have been conducted; therefore, many environmental problems associated with industrial activities do not exist. Another important factor is climate; desert conditions limit the potential for migration from many of the AREEs. As a result, past investigations have not obtained enough groundwater and surface water data to determine whether contamination is present in these media.

The rationale for assigning an order of priority to the AREEs is outlined in the following paragraphs. Table 6.1 presents the priority category of each AREE and the rationale.

Six types of waste generation occur at the depot: (1) landfilling activities; (2) wastewater treatment; (3) waste explosives storage and disposal; (4) chemical, pesticide, and herbicide storage; (5) incineration; and (6) miscellaneous activities. The impacts from these activities have been considered based on available information. Priorities have been developed according to existing or potential impacts to public health and the environment. AREEs have been placed in one or more of the following categories:

A. AREEs with moderate to high potential for adverse impacts to public health and the environment,

B. AREEs with moderate to high potential for releasing contaminants to groundwater and surface water,

C. AREEs with known soil contamination,

D. AREEs with moderate to high potential for soil contamination,

E. AREEs with low potential for releasing contaminants to groundwater and surface water,

F. AREEs with low potential for soil contamination,

G. AREEs with no potential for releasing contaminants, and

H. Unit does not meet the definition of a solid waste management unit.

The characteristics associated with some of the categories indicate AREEs with a higher priority for action than others. Priorities were developed to address protection

TABLE 6.1 Priority Categories for Response Actions

AREE	Priority Category	Comments
Numbered SWMU[a]		
1	B,C	Unlined lagoons were used for evaporation and percolation of wastewater containing explosives; may have allowed some contaminant dispersion
2	B,C	Unlined ponds were used for disposal of waste pickle liquor and possibly pesticides
3	A,B,C	UXO reported; soils contain low levels of explosives and metals; downstream surface water and sediment contain contaminant trace levels
4,5	A,B,C,	High potential for UXO; soil contains significant concentrations of explosives and low levels of metals
6	C,E	Soil contains low concentrations of pesticides and PCBs
7	B,D	Metal recovery operations may have released contaminants to soil; acid pits used for disposal of waste streams
8	F	High volumes of petroleum products and solvents were handled; potential for spills and releases
9	C	Visibly contaminated areas found; the unit has stored solids and drummed wastes
10	B,C	Moderate to high potential for runoff to surface water or infiltration to groundwater
11	D,B	Potential for contaminant migration from the infiltration ponds
12	D,B	Disposal of pesticides and explosives reported
13	A,B,C	High potential for UXO from disposal and burning of explosives; soil and downstream sediment contains elevated concentrations of explosives
14	H	Does not meet definition of SWMU
15	F	Transformers were stored in overpack containers

TABLE 6.1 (Cont'd)

AREE	Priority Category	Comments
Numbered SWMU (Cont'd)		
16	F	Boxes were stored on concrete flooring in sheltered areas
17	D,E	Groundwater and soil potentially contaminated with priority pollutants because of training activities conducted directly on the ground
18	F	Past operating practices may have released pesticides and herbicides into the environment; pesticides may have been released to the ground from the mixing area
Unnumbered		
Old Demolition Area	A,B,C	Open burning and detonation; potential for UXO; evidence of explosives in the sediment
Functional Test Range 1	A,B,D	Burning of explosives and testing of mines; potential for UXO and soil contamination
Functional Test Range 2	A,F	Rocket and morter testing; potential for UXO and soil contamination
Functional Test Range 3	A,F	High explosives testing; potential for UXO and soil contamination
Bldg. 11	F	Transformers containing PCBs were stored; reports of leaking
Bldg. 29	F	Past operating practices may have released herbicides into the environment
Igloos	F	Potentially contaminated with explosives

[a]SWMU numbers assigned by AEHA.

of human health and the environment from contaminant migration via all of the media. Potential impacts on groundwater were considered a serious threat because groundwater subsequently affects other media and provides a source of drinking water. Surface water was a concern for similar reasons. The potential impacts resulting from contamination of soil depend on the amount of potential direct contact and migration via water and air. These considerations led to the use of the following priority groups.

- Priority Group 1 - *High* priority for action. All group 1 AREEs have a high potential for containing UXO. Those that have been previously sampled all have known contamination.

- Priority Group 2 - *Moderate to high* priority for action. AREEs in this group have known soil contamination and a moderate to high potential for releasing contaminants to groundwater or surface water.

- Priority Group 3 - *Moderate* priority for action. AREEs in this group have a moderate potential for releasing contaminants. These AREEs are ranked lower than those in group 2 because contamination has not been confirmed.

- Priority Group 4 - *Low* priority for action. AREEs in this group have low potential for releasing contaminants.

- Priority Group 5 - *No* Action. Sites in group 5 do not meet the definition of a SWMU or have little potential for contamination of regulatory concern.

Sampling and investigation are recommended for the first four priority groups. For this reason, AREEs have not been assigned individual priorities within a group. As the AREEs are further characterized, individual priorities may develop. Table 6.2 summarizes the FWDA solid waste management units by priority group. These priorities are subject to change based on the availability of new information.

TABLE 6.2 AREEs by Priority Groups

Priority Group	AREEs Included in the Group	
	AREE No.	AREE Description
Group 1	3	Demolition Craters (pits)
	4a	Old Burning Ground
	4b	Current Burning Ground
	5	Demolition Area (residue piles)
	13	Old Burning Ground and Demolition Landfill
	-[a]	Old Demolition Area
	-	Functional Test Range 1
	-	Functional Test Range 2
	-	Functional Test Range 3
Group 2	1	TNT Leaching Beds
	2	Acid Waste Holding Pond
	6	Current Landfill
	9	Storage Yard
	10	POL Waste Discharge Area
	17	Fire Training Ground
Group 3	7	Deactivation Furnace
	11	Sewage Treatment Plant
Group 4	8	Maintenance Shops
	15	PCB-Transformer Storage Area
	16	PCP-Treated Wood Storage Area
	-	Bldg. 11
	-	Bldg. 29
	-	Magazine Igloos Area
Group 5	14	Septic Tanks and Cesspools

[a] signifies unnumbered.

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APPENDIX:

ANALYTICAL PARAMETERS

TABLE A.1 Selected RCRA and Priority Pollutant Contaminants

Compound	USATHAMA Name
Volatiles	
Acetone	ACET
Acrolein	ACROLN
Acrylonitrile	ACRYLO
Benzene	C6H6
Bromoform	CHBR3
Bromodichloromethane	BRDCLM
Bromomethane	CH3BR
2-Butanone	MEK
Carbon Tetrachloride	CCL4
Chlorobenzene	CLC6H5
Chloroethane	C2H5CL
Chloromethane	CH3CL
2-Chloroethyl Vinyl Ether	2CLEVE
Chloroform	CHCL3
1,1-Dichloroethane	11DCLE
1,2-Dichloroethane	12DCLE
1,1-Dichloroethylene	11DCE
Trans-1,2-Dichloroethylene	T12DCE
1,2-Dichloropropane	12DCLP
Cis-1,3-Dichloropropylene	C13DCP
Trans-1,3-Dichloropropylene	T13DCP
Ethylbenzene	ETC6H5
Methylene Chloride	CH2CL2
1,2,4,-5 Tetrachlorobenzene	TCB1
1,1,2,2-Tetrachloroethane	TCLEA
Toluene	MEC6H5
Total Xylenes	TXYLEN
1,1,1-Trichloroethane	111TCE
1,1,2-Trichloroethane	112TCE
Trichloroethylene	TRCLE
Vinyl Chloride	C2H3CL

TABLE A.1 (Cont'd)

Compound	USATHAMA Name
<u>Semivolatiles</u>	
Acenaphthene	ANAPNE
Acenaphthylene	ANAPYL
Anthracene	ANTRC
Benzo (a) Anthracene	BAANTR
Benzo (a) Pyrene	BAPYR
Benzidine	BENZID
Benzo (b) Fluoranthene	BBFANT
Benzo (ghi) Perylene	BGHIPY
Benzo (k) Fluoranthene	BKFANT
Bis (2-chloroethoxy) Methane	B2CEXM
Bis (2-chloroethyl) Ether	B2CLEE
Bis (2-chloroisopropyl) Ether	B2CIPE
Bis (2-ethylhexyl) Phthalate	B2EHP
4-Bromophenyl Phenyl Ether	4BRPPE
Butyl Benzyl Phthalate	BBZP
4-Chloro-3-Methylphenol (P-Chloro-M-Cresol)	4CL3C
2-Chloronaphthalene	2CNAP
2-Chlorophenol	2CLP
4-Chlorophenyl Phenyl Ether	4CLPPE
Chrysene	CHRY
Di-n-Butylphthalate	DNBP
Di-n-Octylphthalate	DNOP
Dibenz (a,h) Anthracene	DBAHA
1,2-Dichlorobenzene	12DCLB
1,3-Dichlorobenzene	13DCLB
1,4-Dichlorobenzene	14DCLB
3,3-Dichlorobenzidine	33DCBD
2,4-Dichlorophenol	24DNP
Diethyl Phthalate	DEP
Dimethyl Phthalate	DMP
2,4-Dimethylphenol	24DMPN
4,6-Dinitro-2-Methylphenol	46DN2C
2,4-Dinitrophenol	24DNP
2,4-Dinitrotoluene	24DNT
2,6-Dinitrotoluene	26DNT
1,2-Diphenylhydrazine	12DPH
Fluoranthene	FANT
Fluorene	FLRENE
Hexachlorobenzene	CL6BZ
Hexachlorobutadiene	HCBD
Hexachlorocyclopentadiene	CL6CP
Hexachloroethane	CL6ET
Indeno (1,2,3,-cd) Pyrene	ICDPYR

TABLE A.1 (Cont'd)

Compound	USATHAMA Name
Semivolatiles (Cont'd)	
Isophorone	ISOPHR
2-Methylnaphthalene	2MNAP
N-Nitrosodipropylamine	NNDNPA
N-Nitrosodimethylamine	NNDMEA
N-Nitrosodiphenylamine	NNDPA
Naphthalene	NAP
Nitrobenzene	NB
2-Nitrophenol	2NP
4-Nitrophenol	4NP
Pentachlorophenol	PCP
Phenanthrene	PHANTR
Phenol	PHENOL
Pyrene	PYR
1,2,4-Trichlorobenzene	124TCB
2,4,5-Trichlorophenol	245TCP
2,4,6-Trichlorophenol	246TCP
Pesticides/PCBs	
Aldrine	ALDRN
Dieldrin	DLDRN
Chlordane	CLDAN
4,4'-DDT	PPDDT
4,4'-DDD	PPDDD
Endosulfan I	AENSLF
Endosulfan II	BENSLF
Endosulfan Sulfate	ESFSO4
Endrin	ENDRN
Endrin Aldehyde	ENDRNA
Heptachlor	HPCL
Heptachlor Epoxide	HPCLE
Alpha-BHC	ABHC
Beta-BHC (HCH)	BBHC
Gamma-BHC (HCH, Lindane)	LIN
Delta-BHC (HCH)	DBHC
Toxaphene	TXPHEN
PCB 1242	PCB242
PCB 1254	PCB254
PCB 1221	PCB221
PCB 1232	PCB232
PCB 1248	PCB248
PCB 1260	PCB260
PCB 1016	PCB016

TABLE A.1 (Cont'd)

Compound	USATHAMA Name
Metals	
Antimony	SB
Arsenic	AS
Beryllium	BE
Cadmium	CD
Chromium	CR
Cobalt	CO
Copper	CU
Lead	PB
Magnesium	MG
Manganese	MN
Mercury	HG
Nickel	NI
Selenium	SE
Silver	AG
Thallium	TL
Zinc	ZN

TABLE A.2 Explosives

Compound	USATHAMA Name
1,3-Dinitrobenzene	13DNB
1,3,5-Trinitrobenzene	135TNB
2,4-Dinitrotoluene	24DNT
2,6-Dinitrotoluene	26DNT
2,4,6-Trinitrotoluene	246TNT
Cyclotetramethylenetetranitramine	HMX
Hexahydro-1,3,5-trinitro-1,3,4-triazine	RDX
N-methyl-N,2,4,6-tetranitroaniline	TETRYL
Nitrocellulose	NC
Nitroglycerine	NG

TABLE A.3 Herbicides

Compound
2,4-D
2,4,5-TP (Silvex)
Simazine
Dalapon
Monuron

Source: Ref. 1.

END

DATE FILMED

03 / 05 / 91