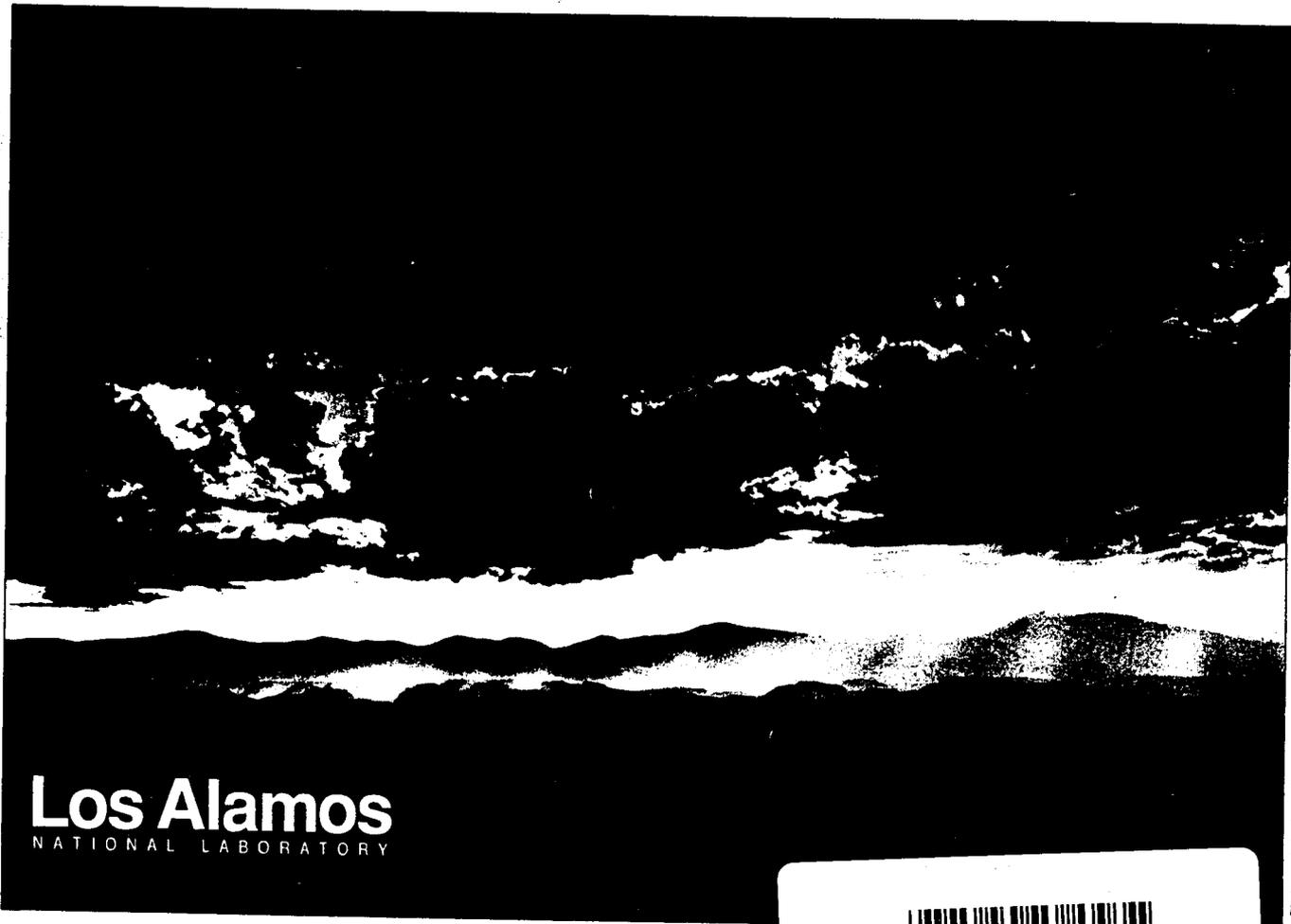


Title **Biological and Floodplain/Wetland
Assessment for Environmental
Restoration Program, Operable
Unit 1082, TAs 11, 13, 16, 24,
37, and 38**

Author **Delia F. Raymer**



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**BIOLOGICAL AND FLOODPLAIN/WETLAND
ASSESSMENT
FOR
ENVIRONMENTAL RESTORATION PROGRAM
OPERABLE UNIT 1082
TAs 11, 13, 16, 24, 25, 38, and 37**

**Los Alamos National Laboratory
Los Alamos, New Mexico**



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Prepared by: Delia F. Raymer, EM-8
Biological Resource Evaluations Team (BRET)
Environmental Assessments and Resource Evaluations
Environmental Protection Group, EM-8
September 1993 - DRAFT

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**BIOLOGICAL AND FLOODPLAIN/WETLAND ASSESSMENT
FOR ENVIRONMENTAL RESTORATION PROGRAM
OPERABLE UNIT 1082, TAs 11, 13, 16, 24, 25, 38, and 37**

by

Delia F. Raymer

ABSTRACT

The Los Alamos National Laboratory's (LANL) Biological Resource Evaluations Team (BRET) conducted Level 1 (reconnaissance), Level 2 (habitat evaluation) and Level 3 (species-specific) surveys during 1991 and 1992 to provide information for a site characterization plan. The purpose of the field surveys was threefold: to determine if species protected by the state or federal government were present before soil sampling took place; to determine if sensitive habitats were present; and to gather baseline data for future studies on plant and wildlife species in Operable Unit (OU) 1082. The information gathered from the field surveys was compared with habitat requirements of potentially occurring protected species (both threatened and endangered).

Vegetation consisted primarily of ponderosa pine series. Douglas fir series was found on the north-facing slope of Water Canyon. Following a search of BRET's threatened, endangered and sensitive (TES) species database, and after consulting with state and federal agencies, we listed several plant and wildlife species as potentially occurring in the OU. Four species; northern goshawk, spotted bat, Jemez Mountains salamander, and meadow jumping mouse, have moderate to high potential for occurring within OU 1082. If we monitor the sites and restrict the periods of sampling, the potential impacts should be minimal to TES species and to nonprotected species of both plants and wildlife in this OU.

EXECUTIVE SUMMARY

During September 1992, the Biological Resource Evaluations Team (BRET) of the Environmental Protection Group (EM-8) conducted field surveys for Operable Unit (OU) 1082, Technical Areas (TAs) 11, 13, 16, 24, 25, 28, and 37. The Environmental Restoration Program of Los Alamos National Laboratory (LANL) proposes to conduct site-characterization studies that consist primarily of soil sampling to determine the nature and extent of hazardous waste releases from solid waste management units (SWMUs).

The purpose of the surveys was three-fold. The first purpose was to determine before site-characterization sampling if there were state or federal threatened, endangered, or sensitive plant or wildlife species or critical habitat within the OU boundaries. Second, we conducted surveys to identify any sensitive habitats, such as floodplains and wetlands, within the proposed sample areas, the extent of these habitats and their general characteristics. The third purpose was to provide additional plant and wildlife data to help define habitat types (HT) within the OU. Data from these surveys will provide further baseline information about the biological components of the site for site characterization. The data will also aid in determining pre-sampling conditions, which can be compared to data collected at the same locations in future similar studies. Furthermore, this information is necessary to support the National Environmental Policy Act (NEPA) documentation and may possibly determine a Categorical Exclusion for the site-characterization sampling plan.

BRET conducted these surveys in order to comply with the Federal Endangered Species Act of 1973; New Mexico's Wildlife Conservation Act (WCA); New Mexico Endangered Plant Species Act; Federal Executive Orders 11990, "Protection of Wetlands," and 11988, "Floodplain Management"; Code of Federal Regulation 10 CFR 1022; and finally, Department of Energy (DOE) Order 5400.1.

BRET first conducted reconnaissance surveys (Level 1) within the OU to determine potential habitats, identify sample locations, and determine access. We initiated a habitat evaluation survey (Level 2) after searching a database maintained in EM-8 containing the habitat requirements for all state and federally listed threatened, endangered or sensitive (TES) plant and animal species known to occur within the boundaries of LANL and surrounding areas. For Level 2 surveys we used transects and Daubenmire plots. These techniques are designed to gather data on the percent cover, density, and frequency of both understory and overstory components of the plant community.

We then compared habitat information gathered through field surveys to the habitat requirements for the sensitive species identified in the TES database search. If habitat requirements were not met we initiated no further surveys and the site was considered cleared for impact on state and federally listed species. If habitat requirements were met, we conducted specific surveys (Level 3) for the species of concern. The species specific surveys were done in accordance with pre-established survey protocols (SOPs). These protocols often require certain meteorological and/or seasonal conditions to complete.

We noted all wetlands and floodplains within the OU using the National Wetland Inventory (NWI) maps and field checks. BRET also noted characteristics of wetlands, floodplains and riparian areas using criteria outlined in the "Federal Manual for Delineating Jurisdictional Wetlands". However, we did not conduct delineation of the wetland boundaries during these surveys because of their continual fluctuation. Therefore, we will delineate boundaries just prior to sampling to assure that sampling is outside of areas meeting the wetland criteria (hydrophytic plants, hydric soils and hydrology). Delineation are valid for only two years and are best done at time of sampling. We identified four wetlands using the NWI maps, three palustrine, scrub-shrub, broad-leaved deciduous, and temporarily flooded wetlands in Water Canyon and one palustrine, unconsolidated shore,

seasonally flooded, and diked/impounded pond in TA-16 behind building (Bldg.) 90. Additionally, 14 of the OUs 27 NPDES outfalls support hydrophytic flora.

BRET summarized databases containing historical information and biological reports of any previous surveys within the area to provide background information. These summaries provide inventory information that may be used in future ecological risk assessments and pathways analysis.

The Pajarito Plateau has a long history of human use prior to the Manhattan Project. Activities with long term impact to the area now known as OU 1082 began in 1742 with sheep grazing and subsistence farming. Later, in 1883, the area began to be used for cattle grazing, lumbering, and recreation. Between 1987 and 1903, 36 million board feet of lumber was removed from 32,000 acres in the TA-16 area. In fact, S-site got its name from a large pile of saw dust left from the sawmill located nearby (Fox and Tierney 1984).

Currently, approximately 60% of the area designated as OU 1082 contains man-made disturbances that include dirt roads, buildings and portable trailers, a perimeter fence, a borrow pit, outfalls and numerous SWMUs. OU 1082 also includes areas of natural disturbance from the 1977 La Mesa Fire and its associated man-made disturbances such as fire breaks. State Highway 4 and West Jemez road are border disturbances that separate OU 1082 from Bandelier National Monument and Santa Fe National Forest.

The terrain is characterized by essentially two types of topographic features: mesa top and moderately steep to steep canyons. The canyon systems include Cañon de Valle and Water Canyon. Level 2 surveys were conducted on TA-16 Mesa, in Cañon de Valle and in Water Canyon.

The dominant trees within the mesa overstory vegetation of OU 1082 are ponderosa pine (*Pinus ponderosa*) and aspen (*Populus tremuloides*). The mesa top shrub layer is primarily composed of Gambel oak (*Quercus gambelii*) and New Mexico locust (*Robinia neomexicana*). Dominant forbs and grasses include bluegrass (*Poa sp.*), mountain muhly (*Muhlenbergia montana*), blue grama (*Bouteloua gracilis*), pine dropseed (*Blepharoneuron tricholepis*), wormwood (*Artemisia ludoviciana*), false tarragon (*Artemisia dracunculus*), tall lupine (*Lupinus caudatus*) and cinquefoil (*Potentilla sp.*). In areas burned by La Mesa fire, there is extensive regeneration of New Mexico locust and Gambel oak.

The north-facing slopes of canyons within the OU had overstories dominated by ponderosa pine and Douglas fir (*Pseudotsuga menziesii*). Dominant shrubs were wax currant (*Ribes cerceum*) and New Mexico olive (*Forestiera neomexicana*). The understory layer was dominated by slender wheatgrass (*Agropyron trachycaulum*), mountain muhly, spike muhly (*Muhlenbergia wrightii*), western yarrow (*Achillea lanulosa*), mosses and wild chrysanthemum (*Bahia dissecta*).

South-facing slopes consisted of overstories dominated by ponderosa pine and juniper (*Juniperus monosperma*); shrub layers dominated by Gambel oak and New Mexico locust; and understories dominated by mountain muhly, little bluestem (*Andropogon scoparius*), pine dropseed and wormwood.

The canyon bottom of Cañon de Valle within OU 1082 shows ponderosa pine and Douglas fir as the dominant tree species; Gambel oak, New Mexico locust and cliff bush

(*Jamesia americana*) as the dominant shrub species; and bluegrass and inland rush (*Juncus interior*) as the dominant understory species.

A database search indicated that potential species of concern for this OU (based on habitat and known occurrences) are the northern goshawk, common black hawk, broad-billed hummingbird, willow flycatcher, spotted bat, peregrine falcon, bald eagle, Mississippi kite, pine marten, Say's pond snail, Jemez Mountains salamander, Mexican spotted owl, meadow jumping mouse, checker lily, Sandia alumroot, wood lily, and Pagosa phlox. As a result of habitat evaluation of the OU four of these species appear to have a moderate to high potential for occurrence in the area: northern goshawk (*Accipiter gentilis*), spotted bat (*Euderma maculatum*), Jemez Mountains salamander (*Plethodon neomexicanus*) and meadow jumping mouse (*Zapus hudsonius*).

Northern goshawk is known to occur in OU 1082 and is a probable breeder within the OU. Goshawk occurs in dense stands of ponderosa pine, mixed-conifer and spruce-fir forests. Extensive surveys for the goshawk will be conducted during the summer of 1993 and the operable unit leader will be notified of any pertinent results. To avoid any impact to the goshawk, (1) do not conduct sampling with heavy machinery between March 1 and September 31, (2) do not removed any trees (dead or alive) without approval from BRET, and (3) contact BRET for a presampling site specific survey if sampling will disturb an area over 0.1 acre and if any sampling with heavy machinery in necessary between March 1 and September 1.

The spotted bat is found in piñon-juniper, ponderosa pine, mixed-conifer, and riparian habitats. Its two critical requirements are a source of water and roost sites (caves in cliffs or rock crevices). Some of the canyons may have suitable roost sites, and some potential water sources exist within the OU (suitable water sources are defined as small ponds or pools of slow moving water). To date, no spotted bats have been mist-netted on LANL property. The proposed OU 1082 site characterization is not expected to affect the spotted bat if small caves and rock crevices are not disturbed and water sources are not altered.

Jemez Mountains salamanders inhabit cool, moist, shaded wooded habitats 7225-9250 ft (2799-2823 m) usually on north-facing slopes. They have been found to the west of the OU across west Jemez road and it is likely they may occur on north-facing slopes within OU 1082 boundaries. The proposed site characterization is not expected to affect the Jemez Mountains salamander if north-facing slopes are not sampled. If sampling does occurring on north-facing slopes BRET will be notified of specific sampling locations in order to conduct site specific surveys prior to sampling. Note that surveys for Jemez Mountains salamanders can only be conducted during the rainy season and BRET must have 60 days advance notice in order to conduct a survey.

Meadow jumping mouse preferred habitat consists of the vegetation zone along permanent streams (Morrison 1990). Suitable habitat may be present in the canyon bottoms of the OU. The proposed sampling is not expected to affect meadow jumping mouse if no sampling occurs in canyon bottoms or in wetlands. If sampling will occur in canyon bottoms and wetlands, BRET must be contacted 60 days prior to the sampling start date to conduct presampling site-specific surveys. Also note that surveys for the meadow jumping mouse can only be conducted during the rainy season, late June through mid August.

If conducted in accordance with this document, surface sampling and other associated disturbances in this OU should not cause adverse impacts to known critical habitat or sensitive areas (i.e., wetlands) or to nonprotected species.

1 INTRODUCTION

This biological assessment was conducted for the site characterization or "sampling phase" of the Environmental Restoration program for OU 1082, TAs 11, 13, 16, 24, 25, 28 and 37 to determine the presence or absence of threatened, endangered and sensitive species and of floodplains and wetlands. The sites will be sampled to characterize hazards, waste releases and constituents from SWMUs. The sampling will consist of removing soil samples with hand-held auger drills or auger-mounted heavy machinery; additional disturbances may occur. This assessment was also designed to provide baseline information for long-term monitoring of the plant and wildlife communities in the sites.

The proposed site sampling was evaluated as to its impact on threatened, endangered and sensitive species and floodplains and wetlands. This was done in accordance with the 1973 Federal Endangered Species Act, the New Mexico Wildlife Conservation Act (WCA), the New Mexico Endangered Plant Species Act (EPSA), Floodplain/Wetland Executive Orders (EOs) 11990 and 11988, DOE Order 5400.1 (Environmental Compliance), Code of Federal Regulation 10 CFR 1022 and the National Environmental Policy Act (NEPA).

Section 7 of the Federal Endangered Species Act requires every federal agency to insure its activities or programs will not jeopardize the continued existence of a federally listed TES species or its designated critical habitat (if applicable). New Mexico's WCA and EPSA also require each federal agency to insure its activities and programs will not jeopardize species that are state protected. Implementation of Section 7, as well as New Mexico's WCA and EPSA, is done within the framework of the NEPA.

There are three possible outcomes of a biological assessment for threatened or endangered species:

1. There are no threatened or endangered species utilizing habitat within the proposed project area;
2. There are threatened or endangered species utilizing habitat within the proposed project area, but there are no expected adverse impacts to the species; or
3. There are threatened or endangered species utilizing habitat within the proposed project area and adverse impacts to the species are expected as a result of the proposed project.

If the proposed project jeopardizes a listed species, we will initiate a consultation with the appropriate state or federal agency, which could result in modifications,

alternatives or complete abandonment of the proposed project to avoid impacting the protected species.

Two executive orders provide protection for floodplains and wetlands. Executive Order 11988, "Floodplain Management", calls for protection of floodplains and mandates that potential effects of any federally funded action in a floodplain be evaluated. Executive Order 11990, "Protection of Wetlands", requires all federally funded agencies to issue or amend procedures to insure the protection of wetlands from loss or degradation.

The US department of Energy's Code of Federal Regulation 10 CFR 1022 outlines the procedures compliance with the executive orders and provides the means for public review impacts to floodplains and wetlands. This CFR does not delineate a specific minimum size designation for floodplains or wetlands. Public review of potential impacts is provided through NEPA documentation or Federal Register Notification. If floodplains or wetlands could be impacted, an assessment must be conducted to determine if the impacts would be considered adverse.

Additionally, under Section 404 of the Clean Water Act, we must control the degradation of wetlands and floodplains by limiting the discharge of fill into them. The Corps of Engineers oversees fill and discharge limits and issues one of the two types of permits, nationwide and individual. Nationwide permits are most commonly issued and apply to areas of less than 10 acres. If the area is greater than 10 acres, individual permits must be issued before activities can be initiated.

In addition to the above regulations, DOE Order 5400.1 requires an environmental (preoperational) survey before the start up of a new site, facility or process that may adversely affect the environment. The survey should begin no less than one year, and preferably two years before start up date to allow for the evaluation of biotic communities under varied seasonal changes. These baseline data support the "Environmental Setting" portion of the work plans for site investigation and are also used for evaluating of the environmental impacts of corrective measures.

2 PROPOSED PROJECT DESCRIPTION

2.1 Background

Since LANL's inception, research activities conducted at the Laboratory have resulted in the formation of a large number of SWMUs. These SWMUs are located at various technical areas throughout the 43-square-mile facility and consist of various contaminants released from Laboratory facilities.

The US Environmental Protection Agency (EPA) is the regulatory authority in charge of SWMUs, deriving its authority from the Resource Conservation and Recovery Act (RCRA). SWMUs at LANL are defined as "any discernible unit at which solid wastes have been placed at any time, irrespective of whether the unit was intended for the management of solid or hazardous waste" (IT 1990). In accordance with RCRA requirements, LANL must develop corrective actions for all releases of hazardous waste into the environment.

The Laboratory's Environmental Restoration (ER) Group (EM-13) is responsible for the development and implementation of corrective actions for SWMUs at LANL. The

corrective action process is divided into four phases: (1) site assessment, (2) site characterization, (3) development of proposed corrective actions and (4) selecting and performing corrective actions (IT 1990).

This biological assessment has been prepared for use with the site characterization phase, which focuses primarily on soil sampling, although additional disturbances associated with the sampling could occur (Sec. 8-9). Biological assessments may be required for other phases.

2.2 SWMUs and Proposed Sampling

Solid waste management units are associated with the following:

TA-11

- firing pits
- burn site
- mortar impact areas
- drop tower complex
- septic systems
- sumps and catch basin systems
- surface disposal area
- boneyard
- material disposal areas
- container storage
- drainlines and outfalls
- former building sites

TA-13

- firing site
- landfills
- septic system
- burn sites

TA-16

- dry wells/tank
- tritium tank
- high explosive sumps
- sanitary waste treatment plant
- septic systems
- waste ponds
- surface impoundments
- burn areas
- incinerators
- waste storage areas
- off-gas process
- laundry and steam washing

- landfill
- high explosive facilities
- silver recovery
- pcb transformers
- outfalls
- magazines
- cooling towers/industrial lines
- fuel tanks
- bunkers

TA-24

- septic system

TA-25

- pit
- septic system

TA-28

(no SWMUs)

TA-37

- septic system

Sampling of the SWMUs and sites down gradient from the SWMUs will be conducted to determine the type, quantity and extent of any environment contamination (Bowers *et. al.* 1992). The sampling will be primarily on TA-16 Mesa. Surface and subsurface soils will be sampled from depths that range from <10 in for surface soil samples to >200 ft for subsurface soils samples.

3 ENVIRONMENTAL SETTING

3.1 General Setting

OU 1082 lies within the boundaries of LANL, Los Alamos, New Mexico. The Laboratory is located in north-central New Mexico approximately 62 miles (80 K) by air north of Albuquerque and 22 miles (32 K) west of Santa Fe (Fig. 1).

The Laboratory is located on the Pajarito Plateau, an apron of volcanic sedimentary rocks stretching north-south for 20-25 miles (32-40 K) and east-west for 5-10 miles (8-16 K). The 7500 ft (2250 m) plateau slopes gently eastward toward the Rio Grande

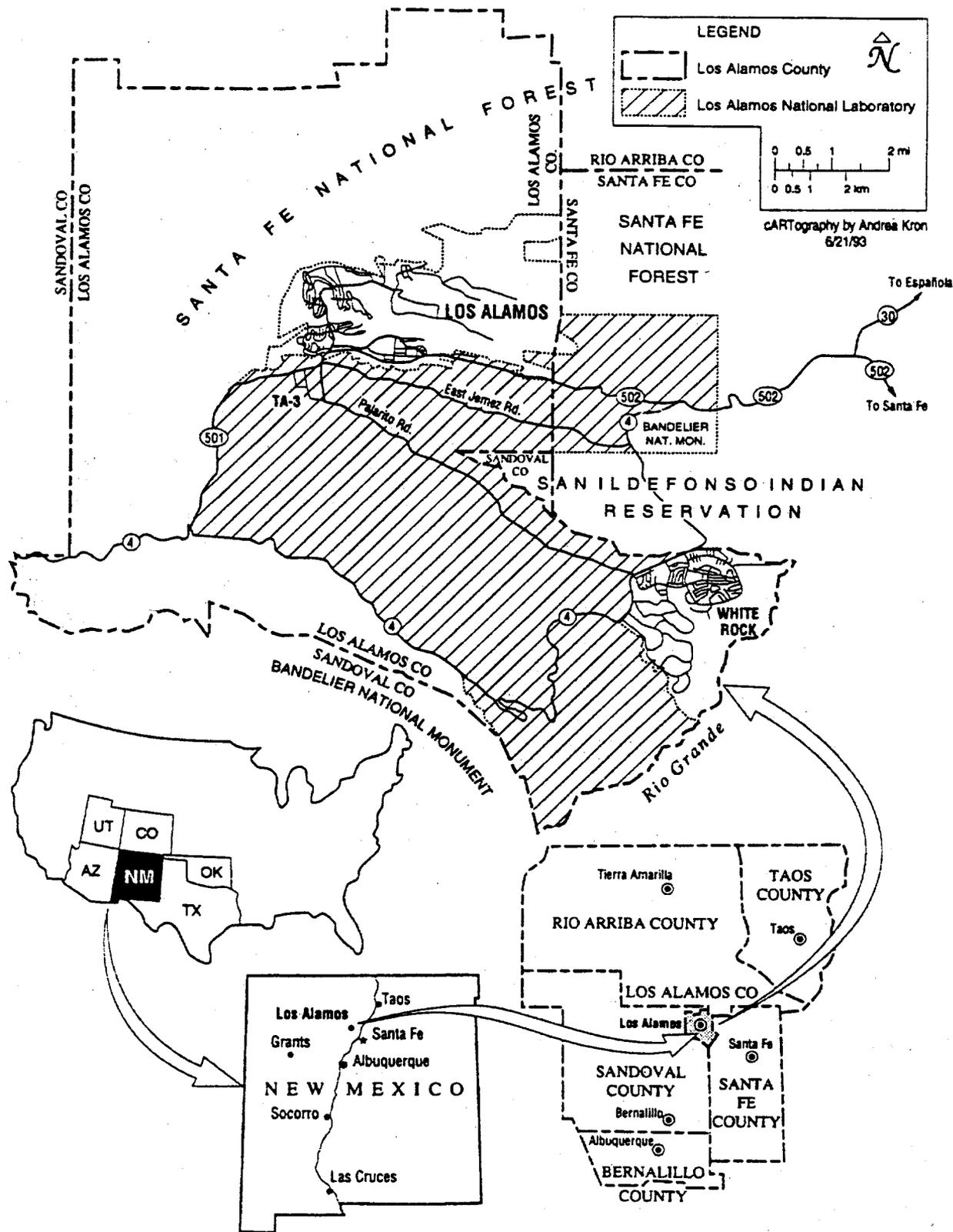


Fig. 1. The location of Los Alamos National Laboratory within New Mexico.

from the edge of the Jemez Mountains, a complex pile of volcanic rock along the northwest margin of the Rio Grande rift. At 6200 ft (1860 m), the plateau slopes steeply, a result of the down-cutting of the Rio Grande, which lies below at 5400 ft (1620 m). Intermittent streams flowing southeastward have dissected the plateau into a number of finger-like narrow mesas separated by deep canyons.

Geological substrate Bandelier Tuff was deposited from volcanic eruptions in the Jemez Mountains about 1.1 to 1.4 million years ago (Environmental Surveillance Group 1988). The tuffs overlap other volcanics which are underlain by the conglomerate of the Puye Formation (Environmental Surveillance Group 1988). This conglomerate intermixes with Chino Mesa basalts along the Rio Grande.

The area is characterized by a semiarid, temperate mountain climate with summer temperatures typically ranging from a low of 50° F (10° C) to a high of 80° F (27° C) during a 24-hour period (Bowen 1990). Winter temperatures generally range from the teen's (-12 to -7° C) to about 50° F (10° C) during a 24-hour period. The annual precipitation in the vicinity ranges from 13 to 18 inches (33 to 46 cm), with much of it occurring during summer rain showers in July and August. Meteorological conditions during the 1992 field season are summarized in Fig. 2.

3.2 Description of Operable Unit (OU) 1082

Located in the southwestern quadrant of LANL, OU 1082 is bounded on the north by Cañon de Valle, on the east by OUs 1086 (TA-15) and 1144 (TA-49), on the south by State Highway 4 and Bandelier National Monument and on the west by West Jemez Road and Santa Fe National Forest (Fig. 3). Unit 1082 is in an area of the Laboratory that has not been surveyed for specific Township, Range, and Section information but it can be inferred OU 1082 is located approximately within Township 19N, Range 6E. Universal Transverse Mercator (UTM) coordinates for the area are as follows (given for each corner of the OU):

Zone	Easting	Northing
13	377,850	3,968,500
13	381,300	3,967,400
13	382,300	3,965,750
13	377,150	3,966,200

The OU encompasses TA-16 Mesa and portions of Cañon de Valle and Water Canyon. Elevation ranges from approximately 7,700 ft (2347 m) at the west end of the unit to approximately 6,800 ft (2040 m) at the lower east end of the unit. Topography is varied ranging from steep precipitous canyon walls to gently sloping mesa tops.

The OU encompasses seven Technical Areas; 11, 13, 16, 24, 25, 28, and 37. Three of these areas (13, 24, and 25) have been decommissioned or fused into TA-16. All structures within the TA are located on the mesa top, TA-16 Mesa, which is bounded on the north by Cañon de Valle and on the south by Water Canyon. Field survey efforts were concentrated on the mesa top, Cañon de Valle, and Water Canyon.

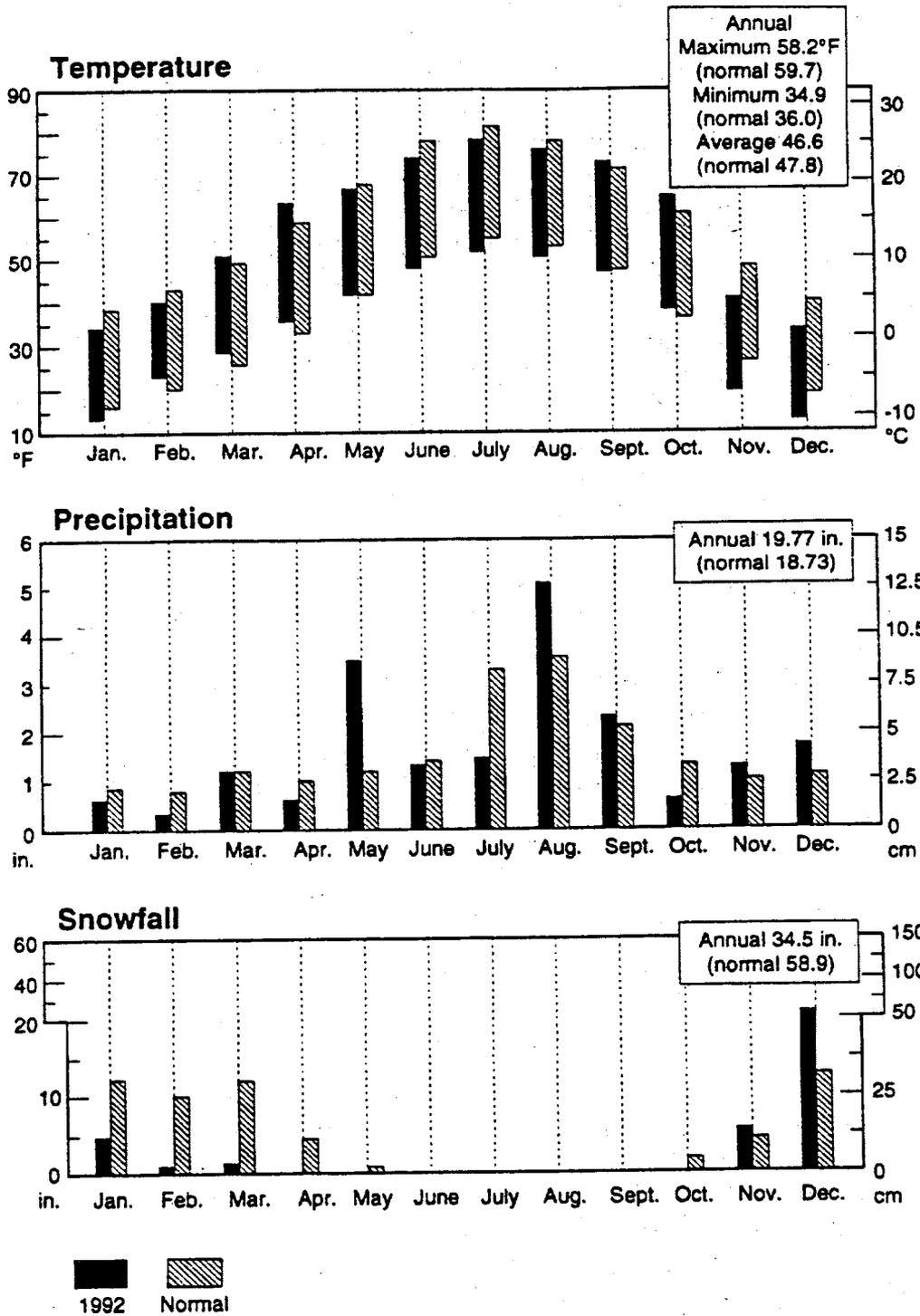


Fig. 2. Meteorological conditions for 1992.

SANTA FE NATIONAL FOREST

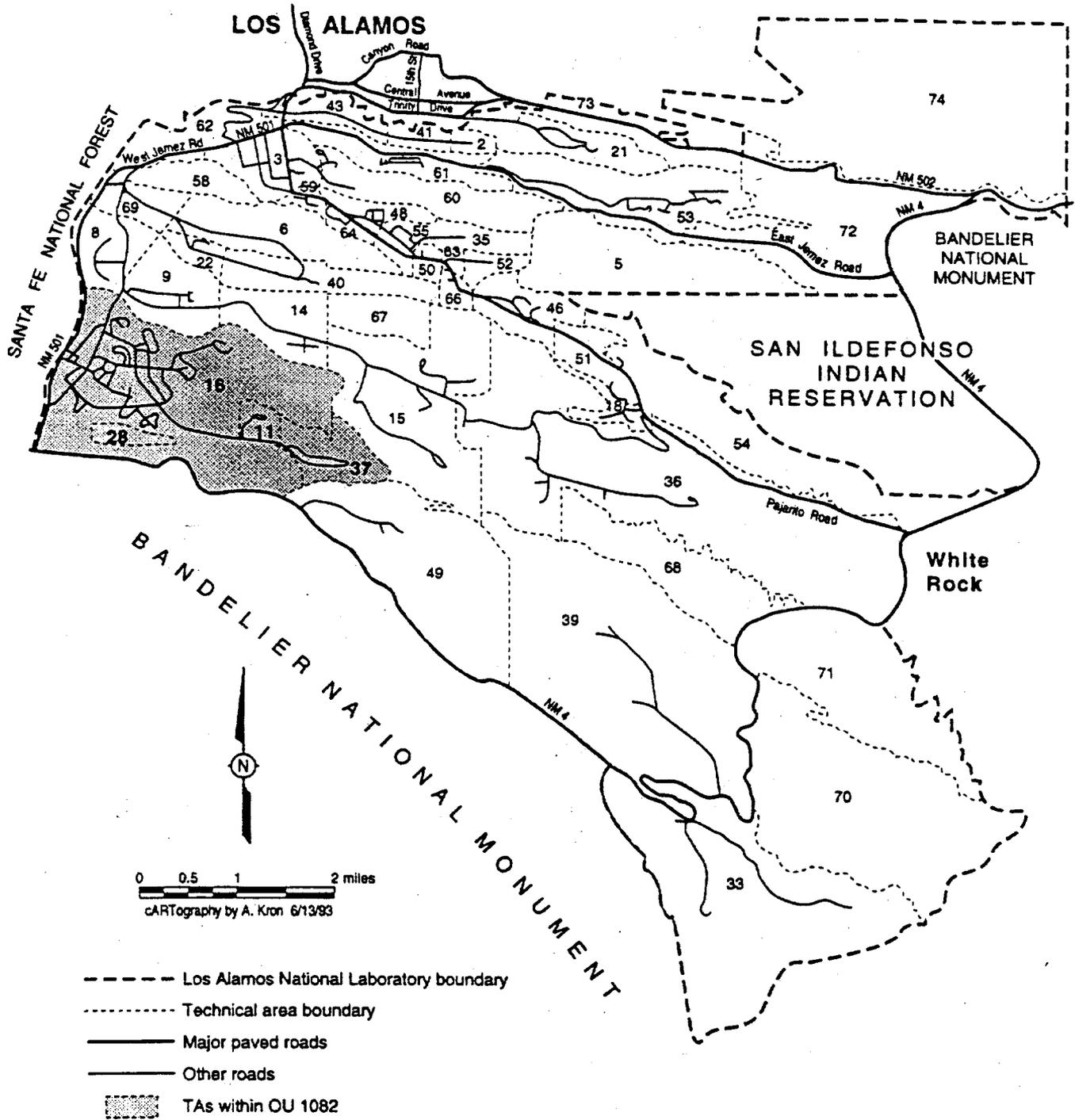


Fig. 3. Location of Operable Unit 1082 with respect to Laboratory technical areas and surrounding landholdings.

Geologic strata for OU 1082 is welded Bandelier Tuff with a soil composition grading from Pogna fine sandy loam at the western boundary to Typic Ustorthents-Rock outcrop complex (Fig. 4). The soil in TA-11 consists primarily of Tocal very fine sandy loam, Frijoles very fine sandy loam and some rock outcrop. Soil series in TA-16 include Pogna fine sandy loam, clayey-skeletal Typic Eutroboralfs, Tocal very fine sandy loam, Totavi gravelly loamy sand, Frijoles very fine sandy loam, Carjo loam, Sanjue-Arribe complex, and rock outcrop. TA-16 also has a borrow pit. Soil at TA-28 soil consists of Tocal very fine sandy loam, Carjo loam, and rock outcrop. TA-37 soil consists of Tocal very fine sandy loam, Frijoles very fine sandy loam, Carjo loam, Typic Ustorthents-Rock outcrop complex, and rock outcrop. Water Canyon and Cañon del Valle soils are primarily steep rock outcrop with Typic Ustorthents-Rock outcrop complex the canyon bottom at their confluence.

The Pajarito Plateau has a long history of human use prior to the Manhattan Project. Activities with long term impact to the area now known as OU 1082 began in 1742 when Pedro Sanchez received a Spanish Land Grant and began subsistence farming and grazing sheep. The Sanchez family owned the land for 100 years and then sold it Ramon Vigil. In 1883, the land known as the Ramon Vigil Grant fell into the hands of Winfield Smith and Edward P. Shelton who used the land for raising cattle, for lumbering, and recreation. The land was severely overgrazed while it was rented to a cattleman named Bishop who grazed 3000 head on 32,000 acres (12,800 Ha). The evidence of overgrazing is still found by the presence of indicator plants such as snakeweed, pinque and false tarragon. In the early 1900's the land was used simultaneously for grazing and lumbering. H. S. Buckman removed 36 million board feet from 32 thousand acres (12,800 Ha) between 1987 and 1903. In fact, S-site got its name from a large pile of saw dust left from the sawmill located nearby (Foxy and Tierney 1984).

3.3 Description of SWMUs

OU 1082 operations center around the production of high explosives for weapons and non-weapons research and development, the testing of explosive systems and components, and the storage of high explosives. TA-11, known as K-site, is the location of a drop tower and other equipment used to perform tests on explosive systems and components. In addition, the area has housed a betatron, burning area, gun firing area, a landfill, sumps, laboratory facilities, and storage buildings. TA-13, P-Site, was constructed in 1944 for x-ray work in connection with explosives experiments. TA-13 is no longer active and any buildings not removed by the 1950's were absorbed into the S-Site complex, TA-16. S-Site operations center around the production of high explosives for weapons and non-weapons research and development. Operations include explosive pressing, assembly, casting, coating, machining, development of new materials, and non-destructive testing. TA-24 was used for x-ray examination of high-explosive charges but is no longer active, and the TA was absorbed into TA-16. TA-25, V Site, was constructed in 1944 for experimental work with special assemblies. In 1945 it became a part of TA-16 and now is used for processing explosive charges. TA-28 consists of five magazines used to store high explosives. There are no SWMUs associated with TA-28.

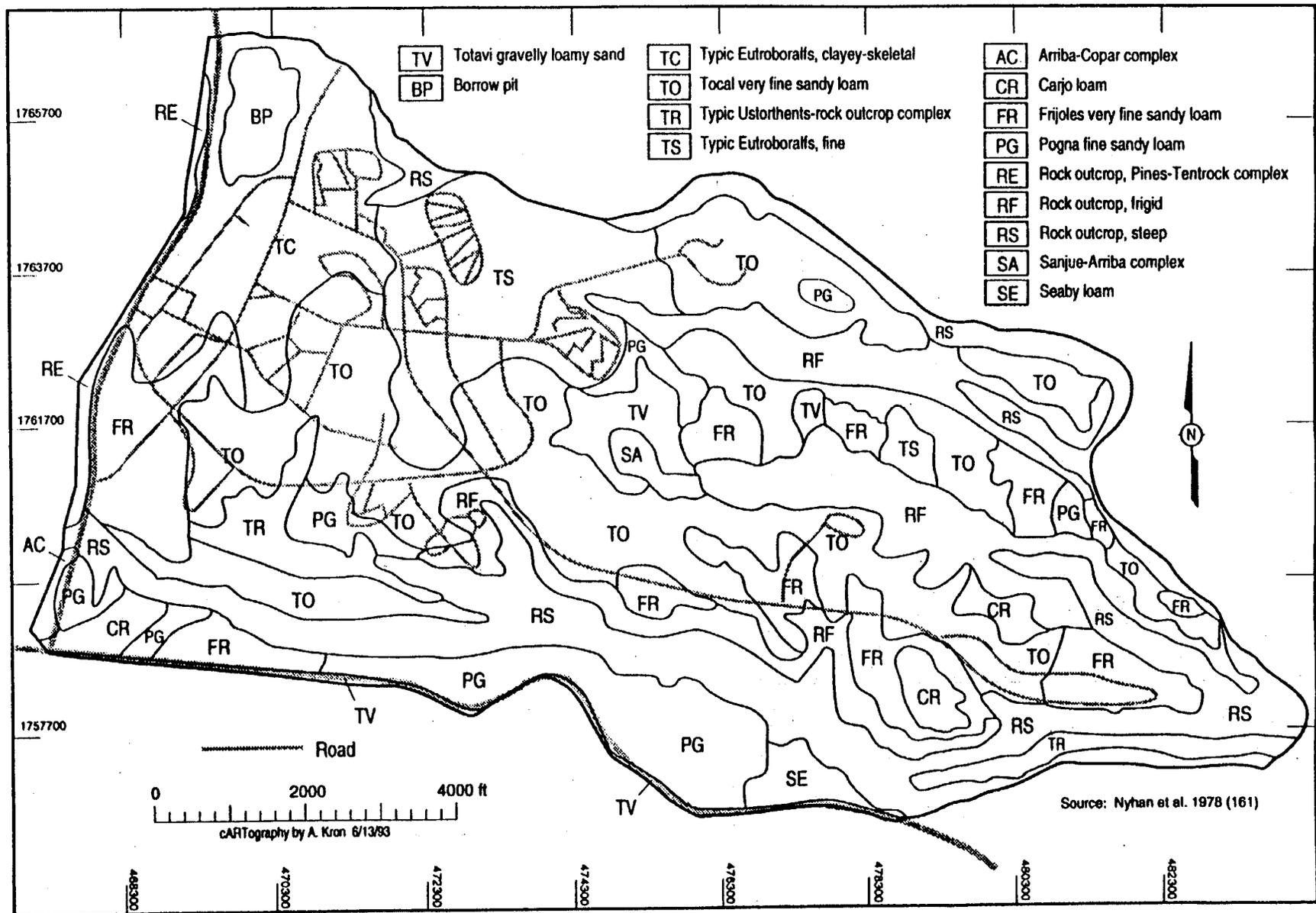


Fig. 4. Soil map for Operable Unit 1082.

TA-37, called the "Permanent Magazine Area," consists of 24 magazines used to store high explosives. The 57 SWMUs in OU 1082 (Fig. 5) are associated with the following:

TA-11

- 11-001 Firing pits
- 11-002 Burn site
- 11-003 Mortar impact areas
- 11-004 Drop tower complex
- 11-005 Septic systems
- 11-006 Sumps and catch basin systems
- 11-007 Surface disposal
- 11-008 Boneyard
- 11-009 Material disposal area S
- 11-011 Drainlines and outfalls
- 11-012 Soil contamination at former building sites

TA-13 (now TA-16)

- 13-001 Firing site
- 13-002 Landfills
- 13-003 Septic system
- 13-004 Burn sites

TA-16

- 16-001 Dry wells/tank
- 16-002 Tritium tank (deleted)
- 16-003 Active HE sumps
- 16-004 Sanitary waste treatment plant
- 16-005 Decommissioned septic systems
- 16-006 Active/inactive septic systems
- 16-007 Decommissioned waste ponds
- 16-008 Inactive surface impoundments
- 16-009 Decommissioned burn area
- 16-010 Active/inactive burn and treatment areas
- 16-011 Incinerators
- 16-012 Waste storage area
- 16-013 Decommissioned waste storage areas
- 16-014 Off-gas process (deleted)
- 16-015 Laundry and steam washing
- 16-016 Landfill/surface disposal
- 16-017 World War II HE complex
- 16-018 Material disposal area P
- 16-019 Material disposal area R
- 16-020 Silver recovery/outfall region
- 16-021 Operational releases
- 16-022 Soil contamination from decommissioned magazines

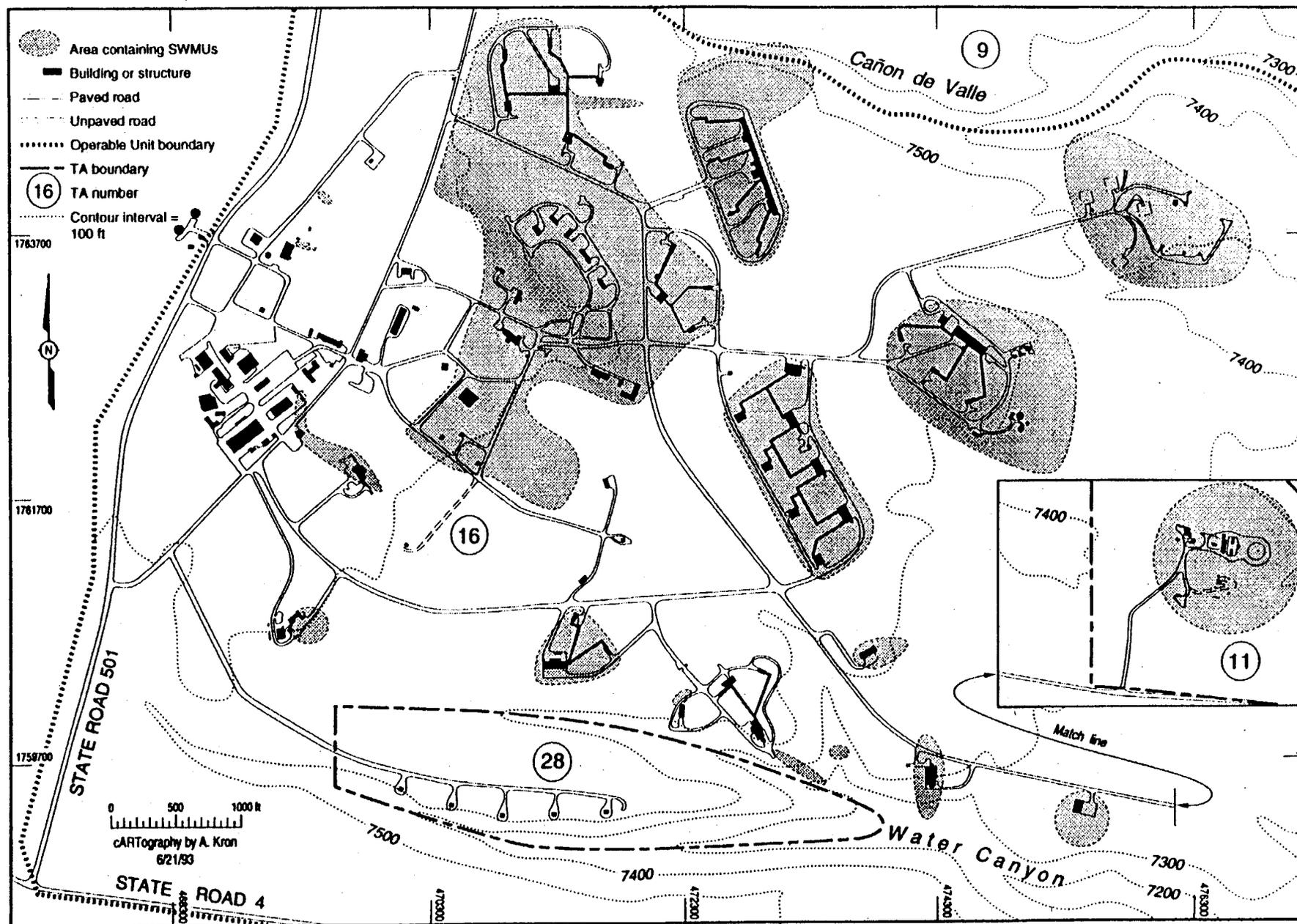


Fig. 5. Locations of SWMUs within Operable Unit 1082.

- 16-023 Decommissioned incinerators
- 16-024 Soil contamination from decommissioned magazines
- 16-025 Soil contamination at decommissioned HE facilities
- 16-026 Inactive outfalls from building drains
- 16-027 Leakage from PCB transformers
- 16-028 Active outfalls from cooling towers and tanks
- 16-029 Inactive HE sumps
- 16-030 Active outfalls from building drains
- 16-031 Inactive outfalls: cooling towers/industrial lines
- 16-032 Decommissioned HE sumps
- 16-033 Decommissioned fuel tanks
- 16-034 Soil contamination from miscellaneous buildings
- 16-035 Soil contamination from former control bunker
- 16-036 Soil contamination from battleship bunkers
- 16-037 Industrial waste tank

TA-24 (now TA-16)

- 24-001 Septic system (renumbered to 16-005)

TA-25 (now TA-16)

- 16-001 Pit
- 16-002 Septic system (renumbered to 16-006)

TA-28

no SWMUs

TA-37

- 37-001 Septic system

Many of the SWMUs are composed of several smaller SWMUs, each with a lettered subnumber. Detailed descriptions of location, type of unit, use, status, period of use, release information, and managed materials of each SWMU can be found in the "Solid Waste Management Unit Report, LAUR-90-3400.

3.4 Description of NPDES Outfalls

OU 1082 operations center around the production of high explosives for weapons and non-weapons research and development, the testing of explosive system and components, and storage of high explosives. There are 27 NPDES Outfalls in OU 1082 (Fig. 6) associated with the following:

- 02A-007 Boiler blowdown
- 03A-060 Treated cooling water
- 03A-130 Treated cooling water

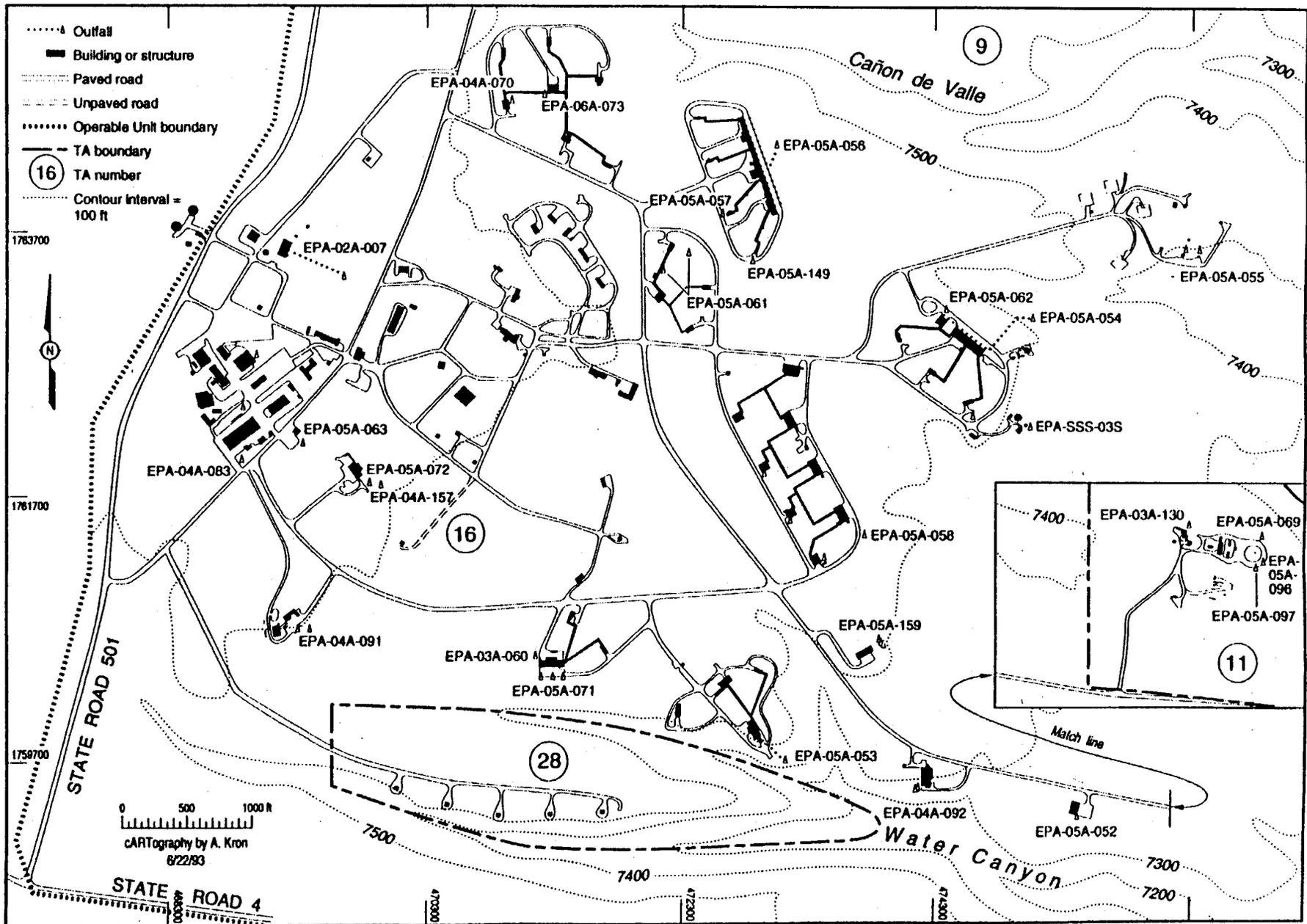


Fig. 6. Locations of NPDES outfalls within Operable Unit 182.

04A-070	Noncontact cooling water
04A-083	Noncontact cooling water
04A-091	Noncontact cooling water
04A-092	Noncontact cooling water
04A-157	Noncontact cooling water
05A-052	High explosive discharge
05A-053	High explosive discharge
05A-054	High explosive discharge
05A-055	High explosive discharge
05A-056	High explosive discharge
05A-057	High explosive discharge
05A-058	High explosive discharge
05A-061	High explosive discharge
05A-062	High explosive discharge
05A-063	High explosive discharge
05A-069	High explosive discharge
05A-071	High explosive discharge
05A-072	High explosive discharge
05A-096	High explosive discharge
05A-097	High explosive discharge
05A-149	High explosive discharge
05A-159	High explosive discharge
06A-073	Photo wastes
SSS-03S	Sewage Treatment Plant

The location (TA, closest building, and closest canyon), type of discharge, length of discharge before going subsurface, and presence or absence of hydrophytic vegetation for each outfall, are summarized below and in Appendix A. Hydrophytic vegetation indicates a possible wetland that may be classified as jurisdictional wetland.

02A-007: This outfall is in TA-16 near building (Bldg.) 540. Discharge is boiler blowdown that travels more than 1000 ft (305 m) before going subsurface. The channel also seems to receive storm water runoff. The outfall discharges on a mesa top and the flow does not reach a defined canyon. The discharge point has an overstory dominated by oak, but at 300 ft (91 m) from the discharge point the vegetation becomes meadow-like. No hydrophytic vegetation is associated with this outfall. The flow terminates in a wide fan of shallow standing water just beyond the S-site perimeter fence.

03A-060: The discharge from this outfall, found in TA-16 behind Bldg. 430, is treated cooling water. The flow only travels 11-50 ft (3.3-15.2 m) and does not reach the nearest canyon, Water Canyon. However, the channel does support hydrophytic vegetation and is joined by 05A-071 approximately 200 ft (61 m) from the discharge point. The dominate overstory at the discharge point is ponderosa pine.

03A-130: This outfall is located in TA-11, Bldg. 30, and discharges treated cooling water. Flow enters Water Canyon and the channel continues to the main water course, however, flow goes subsurface at approximately 100 ft (30.5 m). The channel also receives storm runoff. There is no dominate overstory at the discharge point, only disturbed grassland, and the channel does not support hydrophytic plants.

04A-070: Noncontact cooling water discharges from this outfall in TA-16, Bldg. 220. The discharge only flows 1-10 ft (.3-3 m) and goes subsurface before entering the nearest canyon, Cañon de Valle. The area is primarily disturbed and does not support hydrophytic vegetation.

04A-083: Located in TA-16 near Bldg. 202, this outfall discharges noncontact cooling water. Flow travels up to 200 ft (61 m) and supports hydrophytic vegetation. The flow does not seem to reach Water Canyon.

04A-091: This outfall is in TA-16. The nearest building is Bldg. number 450. Discharge from this outfall is noncontact cooling water which travels up to 10 ft (3 m). The overstory vegetation is ponderosa pine with an understory of willows and grass. The willows, a hydrophytic species, seem to be maintained by a substantial storm runoff channel rather than the outfall discharge.

04A-092: Also noncontact cooling water, this outfall is in TA-16 near Bldg. 370. This outfall was recategorized in 1990 and is 04A rather than 03A as the outfall sign claims. It discharges on the south-facing slope of Water Canyon and flows up to 50 ft (15 m), but the flow does not reach the main water course. Vegetation at the discharge point is primarily willows and cattails, both hydrophytic species.

04A-157: This outfall is behind Bldg. 460 in TA-16. It discharges noncontact cooling water and is joined immediately by 05A-072 which discharges high explosive discharge. Together these outfalls form a channel supporting hydrophytic vegetation that flows for over 1000 ft (305 m). Discharge flows onto Water Canyon and goes subsurface approximately 10 ft (3 m) before reaching the main water course.

05A-052: Located in TA-16 near Bldg. 380, this outfall puts out high explosive discharge. The outfall is no longer active; however the channel may receive storm runoff and supports hydrophytic vegetation.

05A-053: Also in TA-16, this outfall is near Bldg. 410. It outputs high explosive discharge. The channel is lined with willows but the water is contained in a culvert-type pipe. Discharge exits the pipe at the rim of Water Canyon and continues to flow 11-50 ft (3.3-15.2 m) down the slope. Hydrophytic vegetation exits along the channel, but the flow does not reach the main water course.

- 05A-054: This outfall is located in TA-16 behind Bldg. 340 on the rim of Cañon de Valle. The high explosive discharge flows through a 300 ft (91 m) fish ladder/sediment catcher. At the base of the fish ladder the discharge enters the main water course of the canyon and continues for over 1000 ft (305 m). The channel supports hydrophytic vegetation.
- 05A-055: This outfall is also in TA-16. It is near Bldg. 363 and outputs high explosive discharge. The flow goes subsurface at approximately 125 ft (38 m). And flow does not reach the main water course of Water Canyon although the channel does. The outfall channel does not contain hydrophytic vegetation.
- 05A-056: Near Bldg. 260 in TA-16, this outfall discharges high explosive discharge. The discharge flows for 400 ft (122 m) through a ponderosa pine and oak overstory. The channel does not contain hydrophytic vegetation and goes subsurface approximately 30 ft (9 m) from the main water course of Cañon de Valle.
- 05A-057: This outfall discharges on the TA-16 mesa near Bldgs. 265 and 267. The high explosive discharge flows for up to 200 ft (61 m) and does not reach a defined canyon. The outfall does not support any hydrophytic vegetation.
- 05A-058: Also in the high explosive discharge category, this outfall is in TA-16 near Bldg. 70. The overstory of the area is ponderosa pine, and the outfall channel supports hydrophytic vegetation. The flow is intermittent, alternating between surface and subsurface for 600 ft (183 m). The flow does enter a defined canyon, Water Canyon but probably does not enter the main water course.
- 05A-061: This outfall outputs high explosive discharge and is found in TA-16 near Bldg. 280. The channel passes through ponderosa pine overstory and cattails (a hydrophytic species). The discharge flows for approximately 400 ft (122 m) and does not seem to enter a defined canyon.
- 05A-062: This high explosive discharge outfall can be found in TA-16 near Bldg. 342. It discharges onto a Cañon de Valle slope in a mixed conifer, aspen and oak area. The flow is very minimal, no distinct channel has formed and no hydrophytic vegetation is present.
- 05A-063: This high explosive discharge outfall is also in TA-16, but is near Bldg. 400. It discharges on the mesa top and flows for approximately 10 ft (3 m). Overstory is ponderosa pine. No hydrophytic species are present.
- 05A-069: This outfall discharges in TA-11 behind Bldg. 25 (Tower). It is high explosive discharge that may flow to the main water course of Water Canyon. The main overstory species is ponderosa pine, and some hydrophytic species are present.

- 05A-071: The discharge from this outfall, found in TA-16 behind Bldg. 430, is high explosive discharge. The flow travels approximately 100 ft (30 m) to the rim of Water Canyon, goes over the rim and dissipates in a fan on the slope. The channel supports hydrophytic vegetation and is joined by 03A-060 almost immediately. The dominate overstory at the discharge point is ponderosa pine.
- 05A-072: This outfall is behind Bldg. 460 in TA-16. It outputs high explosive discharge and is joined immediately by 04A-157 which discharges noncontact cooling water. Together these outfalls form a channel supporting hydrophytic vegetation that flows for over 1000 ft (305 m). Discharge flows into Water Canyon and goes subsurface approximately 10 ft (3 m) before reaching the main water course.
- 05A-096: This outfall is high explosive discharge in TA-11 near tower 25. The discharge point is on an east-facing slope of Water Canyon in a catch basin. The area has disturbed vegetation but at approximately 50 ft (15.2 m) the overstory becomes New Mexico locust. The channel continues to the main water course but the outfall only flows once or twice a year.
- 05A-097: This outfall is high explosive discharge in TA-11 near Tower 25. The discharge point is on a south-facing slope of Water Canyon in a catch basin. The channel is lined with asphalt all the way to the canyon bottom. The last 40 ft (12 m) of the channel has collapsed. The area has disturbed vegetation with an overstory of ponderosa pine. The discharge system is a catch basin which flows during storm events and when the tower is washed once or twice a year.
- 05A-149: This outfall is high explosive discharge in TA-16 near Bldg. 267. It discharges on a mesa top in disturbed vegetation. The channel does not support hydrophytic vegetation and the flow does not seem to reach a defined canyon.
- 05A-159: This outfall is found in TA-16 near Bldg. 460. It previously discharged high explosive discharge, but currently is no longer active. The overstory in the area is ponderosa pine and oak.
- 06A-073: Photo wastes are discharged by this outfall in TA-16 near Bldg. 222. The outfall flow enters Cañon de Valle and becomes the main water course. It goes subsurface approximately 350 ft (107 m) from the discharge point. The overstory is comprised of ponderosa pine and the understory contains hydrophytic species.
- SSS-03S: The flow category of this outfall in TA-16 is Sewage Treatment Plant. The outfall is no longer active; however, it used to discharge out of a weir onto a rock pile. A channel begins at the base of the rocks and continues for approximately 500 ft (152 m) before joining another channel which continues for more than 1000 ft (305 m). The area is dominated by ponderosa pine.

4 PREVIOUS STUDIES

Prior to the 1992 surveys, very few site specific studies had been completed within OU 1082. The studies that were conducted previously focused on vegetation and small mammals (Fig. 7). However, several studies primarily associated with information gathered after the 1977 La Mesa fire have been done in areas immediately adjacent to OU 1082. The species information from these past studies can be extrapolated for use as a general description of the biological make-up of the project area. The 1992 surveys were necessary to determine more complete species information for plants and wildlife in the area.

4.1 Wetlands and Floodplains

In 1990, mapping of wetlands on LANL land, including OU 1082, was done by the US Fish and Wildlife Service (USFWS) using the methodology outlined by Cowardin (1979) in accordance with the National Wetlands Inventory (NWI). The national inventory of wetlands includes all wetlands and deepwater habitats throughout the US, including rivers, lakes, streams, marshes, bogs and ponds. The definition of wetlands used in this survey is "lands transitional between aquatic and terrestrial systems where the water table is usually at or near the surface, or the land is covered by shallow water" (Cowardin *et. al.* 1979). This definition requires that the land supports predominantly hydrophytes and that the substrate is drained hydric soil (Dunke *et. al.* 1989). The method used is a hierarchical system solely based on aerial photography. Small wetlands and those in deep canyons may not have been detected using this method. Four areas within OU 1082 were classified as possible palustrine wetlands.

OU 1082 is within the Water Canyon watershed and contains floodplains in Cañon del Valle and Water Canyon. McLin (1992) did floodplain computational mapping using the COE's computer-based Flood Hydrograph Package (HEC-1 and HEC-2). HEC-1 generates storm hydrographs at selected channel locations within each ungaged watershed and then HEC-2 defines the floodplain. McLin used HEC-1 and HEC-2 to define the 100-year, 6-hour design storm events for Los Alamos County (Fig. 8).

Edeskuty, Foxx and Raymer (1992) conducted a study to determine the potential use of NPDES outfalls by wildlife. A total of 27 outfalls were surveyed in OU 1082. Fourteen of these outfalls supported wetland vegetation. The plants and animals identified during this survey are included in the appendices and descriptions of each outfall are given in section 3.4.

Morrison (1990) conducted a biological evaluation for the proposed Weapon Subsystem Laboratory site. Her survey identified a small riparian (wetland) area with standing pools, cattails, grasses and forbs at the site.

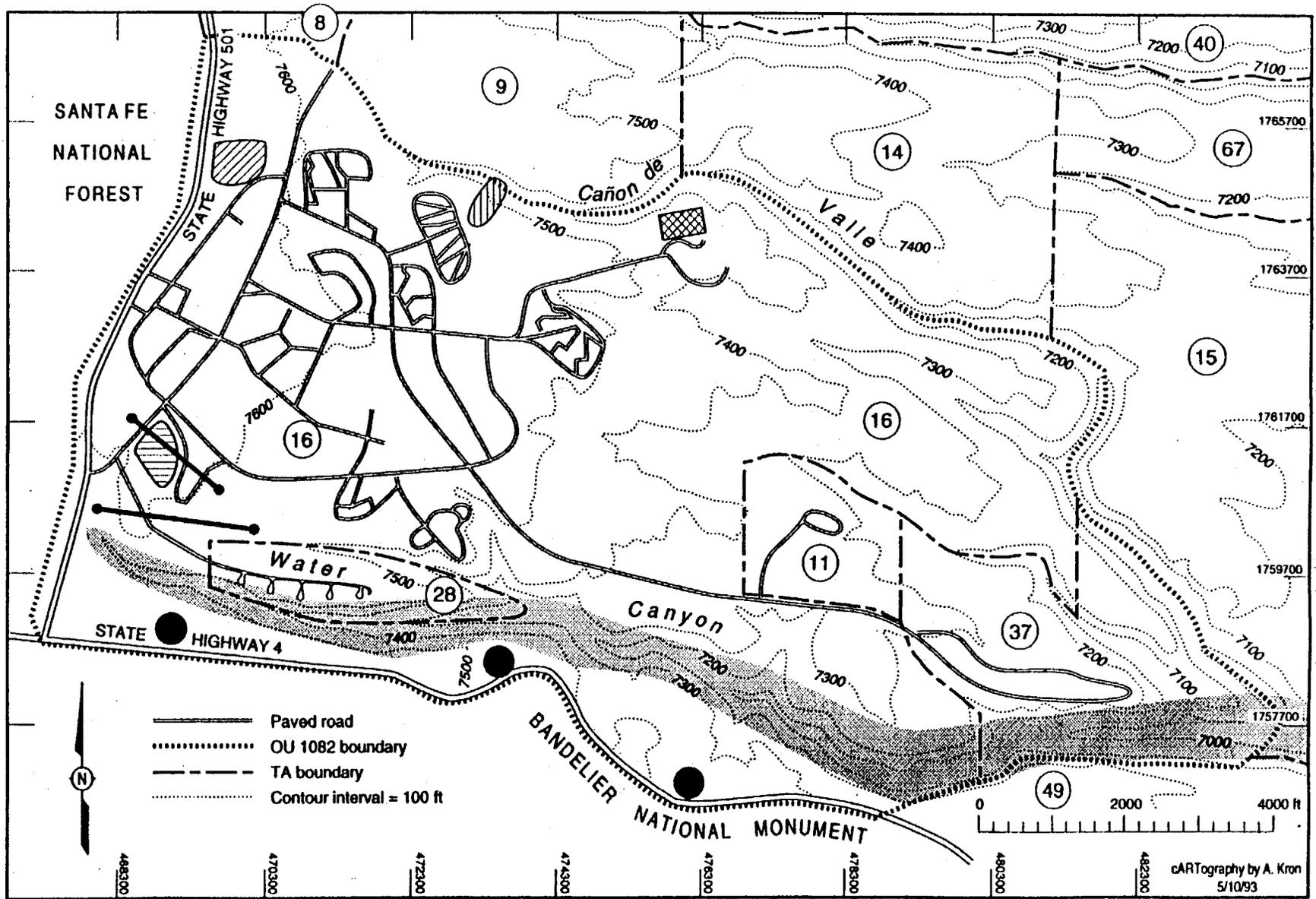


Fig. 7. Applicable studies and surveys prior to 1992 which have exact known locations within Operable Unit 1082.

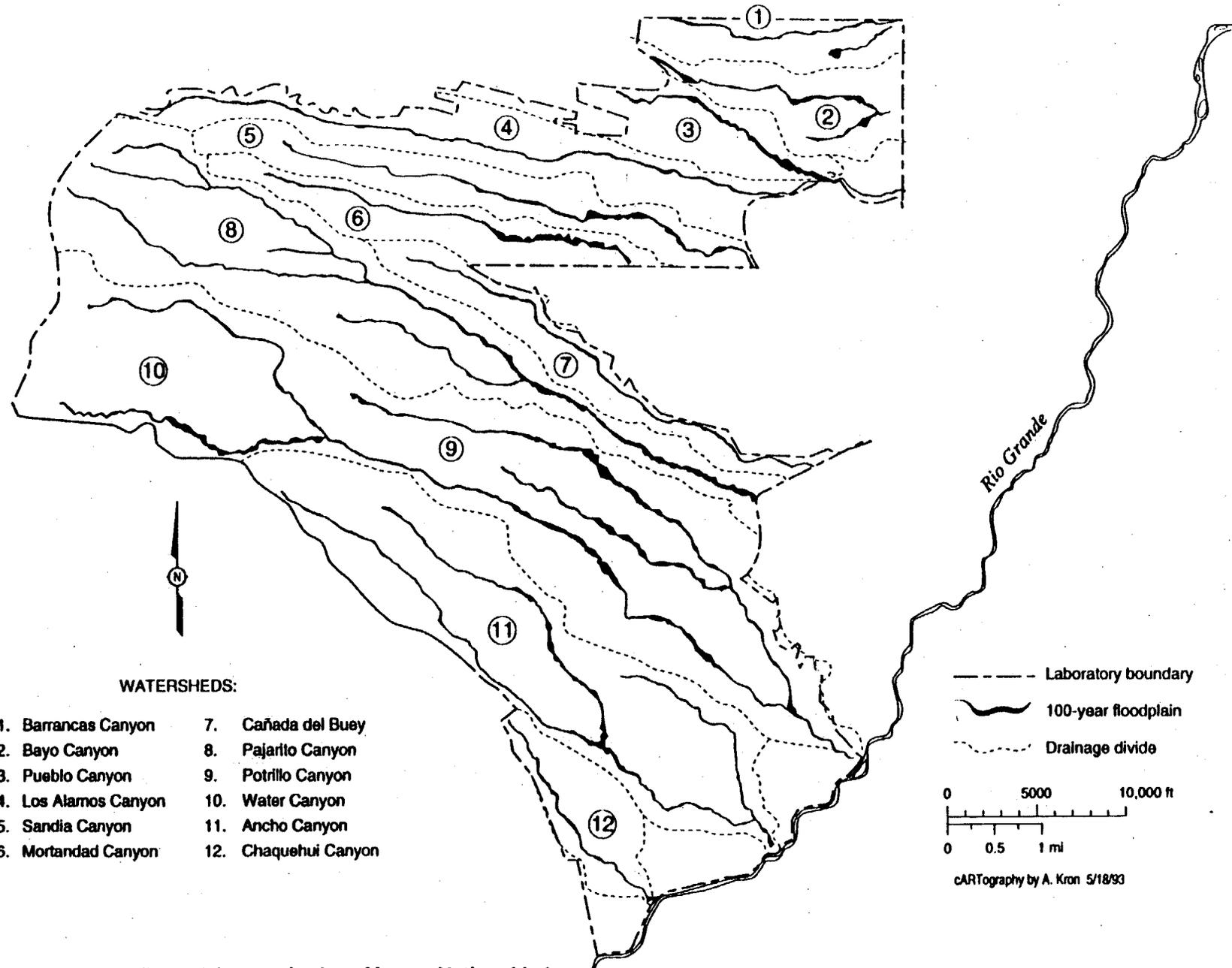


Fig. 8. 100-year floodplain map for Los Alamos National Laboratory.

4.2 Plants

In 1978, Foxx and Tierney conducted an extensive survey of the plants present on LANL lands, including Water Canyon. This information was published as "Status of the Flora of the Los Alamos National Environmental Research Park" (1980). The report defines locations of individual plant species and their habitat(s) within LANL lands and Water Canyon. The plant species that were found are included in Appendix B as a part of the plant species checklist. No currently listed TES species were found during their survey.

A smaller scale vegetation survey was done by Guthrie (1981) to determine HTs for wildlife studies. Guthrie conducted vegetation surveys in a ponderosa pine forest. He found no plant species that are listed as TES and no unusual plant species for those areas.

Foxx conducted a preliminary vegetation survey in 1985 for the revegetation of Area P located on the rim of Cañon de Valle in TA-16. Vegetation was mapped in detail illustrating the microhabitats created by the hazardous waste site; disturbed areas, compacted soils, invasion and colonization areas, and revegetated areas. Guidelines for revegetation included instructions for seedbed preparation, fertilization, species selection, planting methods, irrigation, and mulching. No currently listed TES species were found.

The Edeskuty, Foxx and Raymer (1992) study, "Potential Use of NPDES Outfalls for Wildlife Watering" included general surrounding vegetation information for each outfall in OU 1082, it showed 14 of the 27 OU outfalls supported wetland vegetation. The plants identified during this survey are included in the Appendix B and descriptions of each outfall are given in section 3.4.

These surveys are listed in Table 1 and a checklist of plant species identified during these surveys can be found in Appendix B.

4.3 Wildlife

A limited number of studies that characterize the fauna of the area have been completed. These studies are discussed below.

4.3.1 Insects

MacKay (1986) collected ants during the summer of 1986 in Los Alamos County and Bandelier National Monument. He also supplied data from previous studies in this area in order to construct a comprehensive key to the ants of Los Alamos County. While he did not actually collect ants within the boundaries of OU 1082, information on ant species can be extrapolated from information gained from areas of similar habitat and elevation. Appendix C contains a list of those species found in, but not limited to, habitats found in OU 1082: ponderosa pine, burned ponderosa pine, mixed-conifer, aspen, and disturbed communities. It also lists those species found in riparian habitats and ponderosa pine dominated riparian habitats.

The Edeskuty, Foxx and Raymer (1992) study, "Potential Use of NPDES Outfalls for Wildlife Watering" also included general observational data concerning terrestrial and

aquatic insects. The insects observed during their study include damselflies, damselfly larvae, dipterian larvae, earthworms, mosquito pupa, water striders, and whirligig beetles.

TABLE 1: A List of Documents and Surveys Previously Completed in or Adjacent to Operable Unit 1082: Title, Date, Type and Authors.

PROJECT	DATE	TYPE	AUTHORS
Inventory survey of bats.	unpublished	M (bats)	BRET
The amphibians and reptiles of the Los Alamos National Research Park.	1986	A, R	Bogart
Movements of mule deer on the Los Alamos National Environmental Research Park.	1979	M	Eberhart and White
Jemez mountains salamander survey behind building 16-260.	unpublished	A	Edeskuty, Raymer and Bennett
Potential use of NPDES outfalls for wildlife watering.	1992	W, I, B, A, R, M	Edeskuty, Foxx and Raymer
Preliminary vegetation survey of Area P.	1985	V, TES plants	Foxx
Vegetation survey of the Waste Fired Boiler site technical area (TA) 16.	1988	V, TES plants	Foxx
Status of the flora of the Los Alamos Environmental Research Park.	1980	V, TES plants	Foxx and Tierney
Status of the flora of the Los Alamos Environmental Research Park: A historical perspective.	1984	V, TES plants	Foxx and Tierney
Effects of fire on small mammals in Bandelier National Monument.	1981	V, SM	Guthrie
Mammals of Bandelier National Monument, New Mexico.	1980	M (inc. bats)	Guthrie and Large
Small mammal survey.	unpublished	SM	Kent
The ants of Los Alamos County, New Mexico (Hymenoptera: Formicidae).	1986	I	MacKay et. al.
Determination of 100-year floodplain elevations at Los Alamos National Laboratory.	1992	F	McLin
Biological evaluation of proposed Weapon Subsystem Laboratory site.	1990	V, TES plants, B, M	Morrison
Atlas of the breeding birds of Los Alamos County, New Mexico.	1991	B	Travis
Inventory and mapping of LANL's floodplains and wetlands.	1990	F, W	USFWS, NWI
Biotelemetry studies on elk	1981	M	White
Small mammal populations on Los Alamos National Laboratory land burned by the La Mesa fire.	1981	SM	Wright

F=floodplain
R=reptiles
M=all mammals

W=wetland
A=amphibians
TES plants=threatened, endangered and sensitive plants.

V=vegetation
R=reptiles

I=insects
SM=small mammals

B=birds

4.3.2 Mollusks

No extensive field surveys have been conducted for mollusks within OU 1082.

4.3.3 Reptiles and Amphibians

In 1978, Charles Bogart, consultant to LANL, conducted a baseline survey to establish general species distributions for reptiles and amphibians on Laboratory lands (Bogart 1986). Appendix C lists species known to be within OU 1082 and species likely to occur in OU 1082 based upon plant communities and general HTs. Any observations from Edeskuty, Foxx and Raymer (1992) and the joint LANL and Bandelier National Monument Wildlife Observation database were also included. Species found by Edeskuty, Foxx and Raymer (1992) include chorus frog, eastern fence lizard, ringneck snake, and short horned lizard.

4.3.4 Birds

Appendix C includes a list of potentially and actually occurring bird species within OU 1082. A list of bird species potentially and actually (confirmed) occurring in OU 1082 was extracted from the "Atlas of Breeding Birds of Los Alamos County, New Mexico" (Travis 1992). The *Breeding Bird Atlas* consolidates information from several years of intensive surveys by the Pajarito Ornithological Survey Club 1663. Morrison (1990) records Northern flicker, white-breasted nuthatch, pygmy nuthatch, Stellar's jay, solitary vireo, hairy woodpecker, acorn woodpecker, red crossbill, warbler species, Cooper's hawk and Northern goshawk as present in the area. Also any recorded observations from the joint LANL and Bandelier Wildlife Observation database were included in the appendix.

4.3.5 Fish

No extensive field surveys have been conducted for fish within OU 1082 because no fish habitats are found within OU 1082.

4.3.6 Mammals

Five studies and three surveys concerning mammals have been conducted within OU 1082 and surrounding lands. In addition, sightings at LANL and Bandelier are recorded in BRET's Wildlife Observation database. Appendix C contains the comprehensive mammal species list compiled from these studies and surveys.

Guthrie and Large (1980) compiled a list of all known mammals, their distributions and their status in Bandelier National Monument. Bandelier forms part of the southern border of OU 1082; many animals move freely across the border within the similar habitat types in OU 1082 and Bandelier's Frijoles, Burnt and Escobas mesas. For this reason the mammals occurring in Bandelier on Frijoles, Burnt and Escobas mesas are also potentially (and probably) found in OU 1082.

Wright (1981) conducted a study on Frijoles Mesa along State Road 4 just across Water Canyon from TA-16 mesa. The study concerned the impact of small mammals on ponderosa pine seeding efforts after the La Mesa fire. He found that reforestation efforts would not be significantly impacted by small mammals at the population density levels he estimated.

Guthrie of the Claremont Colleges was conducting a small mammal study in 1977 previous to the La Mesa fire. After the fire burned most of his study plots, he redirected his efforts to determine the effects of fire on small mammals. Several of his study areas are near OU 1082 both in Bandelier and on Santa Fe National Forest land. He found that initially the fire reduced populations of non-burrowing species and arboreal species. The fire also caused a decrease in populations dependent on evergreens (Guthrie 1981). Species that increased included deer mouse, montane vole, long-tailed vole, least chipmunk, and Colorado chipmunk.

The Edeskuty, Foxx and Raymer (1992) study, "Potential Use of NPDES Outfalls for Wildlife Watering" also included general observational data concerning mammals. The presence of a species in the vicinity of an outfall was noted using scat, tracks, calls, sign, and visual sightings. The study noted the presence of Abert's squirrel, black bear, chipmunk, coyote, elk, gopher, deer mouse, mule deer, porcupine, cottontail, raccoon, rock squirrel, shrew, and skunk species.

From 1975 to 1978 Eberhart and White (1979) conducted a study entitled "Movements of Mule Deer on the Los Alamos National Environments Research Park," on LANL land. They captured 36 deer, marked 11 with radio-collars and marked 24 with visual markings (ear tags, streamers, and neck collars). Deer home ranges tended to be elongated following the mesa and canyons of LANL. Average home range size was $13.7 \pm 5.0 \text{ km}^2$. The study showed deer did not make large seasonal migrations and are therefore considered a resident population. Eberhart and White found mule deer do not seem to avoid areas of high human activity but their movements are affected by the 2.6-m-high security fences.

Gary White conducted a biotelemetry study on elk from 1978 to 1980 (White 1981). He radio-collared 30 elk and found that, in general, elk use Cerro del Medio (Baca Land) for calving and nursing areas and other activities are concentrated on areas in early successional stages. In general, the radio-collared elk did not tend to use areas at LANL with high human activity. White also indicated that there was high winter grazing use on the revegetated barrow pit in TA-16.

During the summer of 1986, Kent piloted a sampling study to collect voucher specimens of small mammal species in Ancho, Sandia, Mortandad, and Potrillo Canyons, Cañada del Buey, upper Mesita del Buey between Ten-Site and Mortandad Canyons, the TA-16 mesa, and several areas in Bandelier. The area in TA-16 he surveyed is near Bldg. 460. He found deer mouse, white-footed mouse, brush mouse, western harvest mouse, least chipmunk, and long-tailed vole (Kent unpublished).

In a survey for the biological assessment for the proposed Weapon Subsystem Laboratory site, Morrison (1990) found Abert's squirrel and red squirrel.

A survey for spotted bat, *Euderma maculatum*, and inventory of other bat species was conducted on June 3, 1991 at a small pond on the east side of West Jemez Road in

TA-8 just north of OU 1082. Five species of bats were caught: big brown bat, silver-haired bat, hoary bat, long-eared myotis, and long-legged myotis (Appendix C).

And finally, observations from the Wildlife Observation database include elk, mule deer, raccoon, Abert's squirrel, cottontail, and deer mouse.

4.4 Threatened, Endangered and Sensitive (TES) Species

4.4.1 Plants

Foxx and Tierney conducted two extensive surveys (1980, 1984) of plants present on LANL lands (Appendix B). No currently listed TES plants (Table 2) were found during their surveys.

Foxx conducted a TES vegetation survey in June 1988 for the project location of the Waste Fired Boiler and its access road in TA-16. Species found in the area were consistent with those in similar communities at the same elevation. No currently listed TES species were found within the survey area.

Morrison conducted a biological assessment for the proposed Weapon Subsystem Laboratory site in September 1990. Species found in the area were consistent with those in similar communities at the same elevation. No currently listed TES plant species were found within the survey area.

4.4.2 Wildlife

Guthrie and Large (1980) compiled a list of the distribution and status of all known mammals in Bandelier National Monument. Their data included bat surveys, but they did not capture any spotted bats. A survey for spotted bat, *Euderma maculatum*, and inventory of other bat species was conducted on June 3, 1991 at a small pond on the east side of West Jemez Road in TA-8 just north of OU 1082. No spotted bats were captured during this study. Furthermore, no spotted bats have been caught previously in Los Alamos County, although they have been caught in Bandelier National Monument. Spotted bats have also been captured in the Jemez Mountains near the East Fork of the Jemez River (Altenbach, per. com.) and although not previously found anywhere on LANL property, it is considered as a potential species for OU 1082.

The Jemez Mountains salamander is another wildlife species of concern. Previous studies by BRET have shown the salamander occurs in Water Canyon west of West Jemez Road (Bennett per. comm.) and could potentially occur on the north-facing slopes of Water Canyon and Cañon de Valle. Bennett, Edeskuty and Raymer (1991) conducted a survey on the north-facing slope of Cañon de Valle behind Bldg. 16-260. No salamanders were found at that location.

Morrison (1990) found nesting Cooper's hawks in TA-16. She also noted that the area has been identified as a hunting area by a pair of northern goshawks nesting nearby (Kennedy 1988).

TABLE 2: Threatened, Endangered and Sensitive (TES) Species Potentially Occurring in Operable Unit 1082.

SCIENTIFIC NAME	COMMON NAME	STATUS*	HABITAT
ANIMALS			
<i>Accipiter gentilis</i>	Northern goshawk	FCC2	Ponderosa pine/Gambel's oak, ponderosa pine/gray oak, mixed conifer
<i>Buteogallus anthracinus</i>	Common black hawk	SPG2	Riparian areas with cottonwoods
<i>Cyananthus latirostris</i>	Broad-billed hummingbird	SPG2	Riparian woodland
<i>Empidonax trailii</i>	Willow flycatcher	FCC2 SPG2	Riparian areas with cottonwoods
<i>Euderma maculatum</i>	Spotted bat	FCC2 SPG2	Ponderosa, piñon-juniper, cliffs and rock crevices
<i>Falco peregrinus</i>	Peregrine falcon	FE SPG1	Ponderosa-piñon, cliffs and rock outcrops on cliffs
<i>Haliaeetus leucocephalus</i>	Bald eagle	FE SPG2	Riparian areas near streams and lakes
<i>Ictinia mississippiensis</i>	Mississippi kite	SPG2	Riparian and shelterbelts
<i>Martes americana</i>	Pine marten	SPG2	Mature old-growth spruce-fir communities with more than 30% canopy cover and fallen logs
<i>Lymnaea captera</i>	Say's pond snail	SPG1	Wetlands at Cerro la Jara in the Jemez Mountains
<i>Plethodon neomexicanus</i>	Jemez Mountains salamander	FCC2 SPG2	Spruce-fir, 7225-9250 ft, cool, moist and shaded woods
<i>Strix occidentalis lucida</i>	Mexican spotted owl	FPT	Mixed conifer, mountains and canyons, uneven-aged, multi-storied forest with closed canopy
<i>Zapus hudsonius</i>	Meadow jumping mouse	FCC2 SPG2	Grassy areas dominated by grasses and rushes next to permanent running water
PLANTS			
<i>Fritillaria atropurpurea</i>	Checker lily	SS	Mixed conifer
<i>Heuchera pulchella</i>	Sandia alumroot	SS	Mixed conifer, 8000-12000 ft, cliffs
<i>Lilium philadelphicum</i> var. <i>andium</i>	Wood lily	SE3	Ponderosa to mixed conifer, 6000-10000 ft
<i>Phlox caryophylla</i>	Pagosa phlox	SS	Ponderosa-piñon, 6500-7500 ft, open slopes in open woods

TABLE 2: Threatened, Endangered and Sensitive (TES) Species Potentially Occurring in Operable Unit 1082, cont.

***CODES FOR LEGAL STATUS**

- FE = Federally endangered
- FT = Federally threatened
- FPT = Federally proposed as threatened
- FCC2 = Federal candidate as a C2
- SE1 = State protected and listed as threatened or endangered under the Federal Endangered Species Act.
- SE2 = State protected, rare across its entire range with limited distribution and population size that unregulated collection could jeopardize its survival in New Mexico.
- SE3 = State protected, widespread in or adjacent to New Mexico, but its numbers are being significantly reduced to such a degree that its survival within New Mexico is jeopardized.
- SPG1 = State protected as a Group 1 species (endangered).
- SPG2 = State protected as a Group 2 species (threatened).
- SS = State sensitive.

A list of bird species potentially and actually (confirmed) occurring in OU 1082 was extracted from the "Atlas of Breeding Birds of Los Alamos County, New Mexico" (Travis 1992) including TES species. The *Breeding Bird Atlas* consolidates information from several years of intensive surveys by the Pajarito Ornithological Survey Club 1663. There were observations of northern goshawk within the OU. The survey also showed the OU supports breeding pairs of Cooper's hawk, red-tailed hawk, American kestrel, flammulated owl and great horned owl, which are species protected by the Migratory Bird Treaty Act.

5 METHODOLOGY

Three levels of surveys were conducted within or near this OU during the summer of 1991. The primary purpose of these surveys was to determine if there were any species of concern or sensitive habitats that could be impacted by the site characterization sampling.

5.1 Level 1 (Reconnaissance) Surveys

The Level 1 (reconnaissance) survey was the initial survey conducted to determine the placement of the vegetation transects, presence or absence of water and floodplains, and presence or absence of disturbance. After the initial field reconnaissance, we searched the TES species database (Appendix D) developed by BRET. To obtain a list of the potential species for OU 1082, we input the potential habitat criteria noted during reconnaissance surveys. The habitat match generated a list of state and federal threatened, endangered, candidate and sensitive species that could occur within the OU. The database contains the latest information concerning threatened and endangered species occurring in Los Alamos County and surrounding counties as supplied by the New Mexico Department

of Game and Fish (NMDG&F), New Mexico Energy, Minerals and Natural Resources Department, New Mexico Plants Protection Advisory Committee (1984), and the US Fish and Wildlife Service (50 CFR 17.11 and 17.12).

5.2 Level 2 (Habitat Evaluation) Surveys

Based on the Level 1 survey results, we conducted Level 2 surveys. Level 2 surveys were deemed necessary because portions of the mesa top and canyon slopes were relatively undisturbed and therefore potential habitat for TES species. After we generated a list of species of concern, we began Level 2 surveys to quantitatively measure the habitat, document the habitat parameters, and determine if habitat parameters for any known species of concern were present. Additionally, the habitat evaluation can be used for environmental settings to run habitat evaluation procedures (HEP) and to provide baseline information on the biotic communities. Once data from the vegetation transects are collected, we can use a hierarchical classification system to group species information into "mapping units." This will provide baseline information that we can use to map vegetation onto Geographic Information Systems such as ARC-INFO. We classified the following units using Brown (1982) and the US Forest Service (USFS) habitat types (Moir and Ludwig 1979; also see Appendix E). Definitions for each classification are as follow:

Vegetation Type: Vegetation established under existing climate zones; includes upland or wetland.

Formation Type: Formations that are vegetative responses to various environmental factors, primarily available soil moisture, and includes the following:

UPLAND	WETLAND
Tundra	Wet tundra
Forest and Woodland	Forest
Scrub land	Swamp scrub
Grassland	Marshland
Desert land	Strand
Nonvascular	Submergent

Climatic Zone: One of the four world climatic zones in which the minimum temperature is the primary factor in separation of formation types. These include Arctic-Boreal, Cold Temperature, Warm Temperate, and Tropical-Subtropical.

Biotic Community: A unit characterized by a distinct evolutionary history within a formation and centered in a biogeographical region that has a particular precipitation pattern or climatic regime.

Series: Principal plant and animal communities within each biotic community. These are based on distinct climax plant dominants.

Habitat Type: Occurrence of a particular dominate species that is local or regional in distribution.

Phase: A detailed data collection to determine codominants, understory species and other species information.

We used standard ecological techniques in the habitat evaluation for measuring cover, density, and frequency of the vegetative component and to calculate importance indexes for each species at the overstory and understory levels. The importance indexes given in the vegetation characteristic tables for tree and shrub species are calculated by averaging the relative cover, density, and frequency of each overstory species encountered. To obtain the importance index for understory species, we averaged only the relative cover and frequency.

BRET placed a total of 16 transects in OU 1082. The location of each transect is noted in Figure 9. We placed one understory and one overstory transect in a burned blue spruce-oak community on the north-facing slope of Water Canyon (summer 1991). We ran a second set of transects in a burned ponderosa pine community on the south-facing slope of Water Canyon. We placed three pairs of transects in Cañon de Valle; one set on the north-facing slope, one set on the south-facing slope, and one set in the canyon bottom. Finally, we placed three pairs of transects on TA-16 Mesa; one behind Bldg. 16-340, one in an old field behind Bldg. 16-460, and one in TA-28 behind bunker 1.

5.2.1 Overstory Evaluation

We used circular plot and line intercept techniques to measure the overstory components of forest and woodland communities found in OU 1082. Circular plots were used primarily in multi-stemmed piñon-juniper woodlands and riparian areas. The line intercept method was used primarily in taller, single-stemmed overstory habitats such as ponderosa pine and mixed conifer. The total length of each transect was based on a "species area curve" or when a maximum of 1000 ft (305 m) was reached. The species area curve is calculated by comparing the total number of individual plant species recorded along a transect by the total number of plots along the same transect. The total length of the transect is then considered adequate when the curve becomes relatively level, that is, when no new species are encountered. From previous surveys we have found a transect of 700 ft (210 m) to be sufficient to encounter 95 percent of all species in an area, assuming the area is of a single HT.

5.2.1.1 Circular Plots. We measured overstory components within riparian zones and canyon bottoms by the circular plot technique. We placed a transect line within each habitat to be evaluated, and established circular plots every 100 ft (30 m) along the transect (Fig. 10), starting at the first 50 ft (15 m) mark. We measured the basal diameter of all multi-stemmed trees within a 30 ft (10 m) radius of the center point (the transect line), and measured all single-stemmed trees for diameter at breast height (DBH). We determined the amount of cover of each species by dividing the circle into four equal subplots and estimating the individual species' cover within each of the subplots.

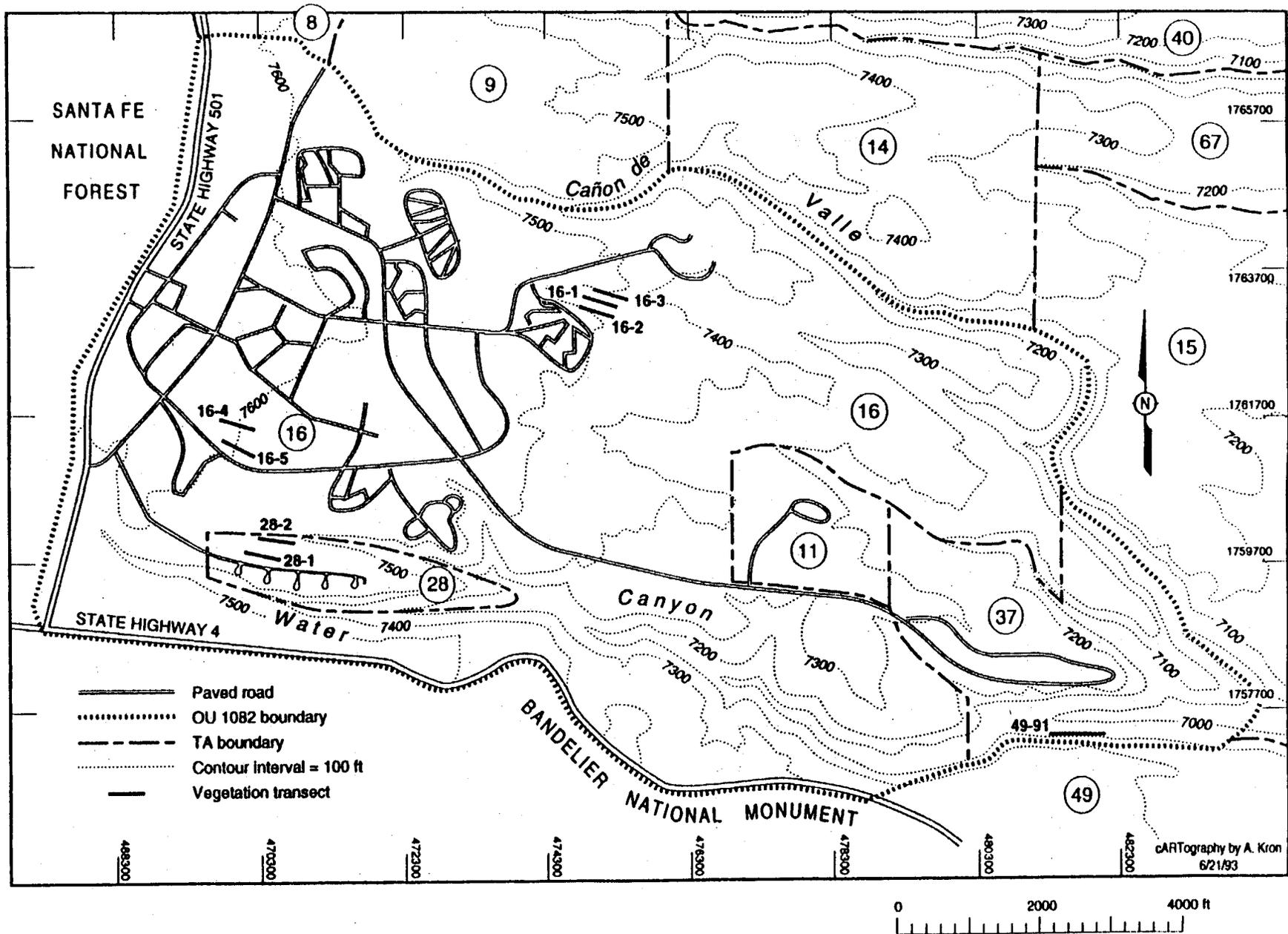


Fig. 9. Map of vegetation transect locations in Operable Unit 1082.

5.2.1.2 Line Intercept. We measured the single-stemmed overstory components in most forest habitat types by the line intercept method. A transect line, placed within the habitat to be evaluated, was separated into 50 ft (15 m) quadrats. All trees and shrubs greater than or equal to 3 ft (1 m) in height that were within 10 ft (3 m) of either side of the transect line, were recorded (Fig. 11). We also recorded: transect distance at which the midpoint of the species occurred, a DBH, and canopy cover. To estimate canopy cover, we measured any species that overlapped the transect line. Canopy cover was measured separately within each 50 ft quadrat. Measurement of foliar cover started at the point at which a species first crossed the transect line and continued until there was a break in the cover of that species (Fig. 11). The canopy cover measurement of a particular species can include more than one individual, as long as individual cover overlaps and cover is continuous. If the canopy extended into the next 50 ft (15 m) section, we counted the measurement separately in the two sections.

5.2.2 Understory Evaluation

We used the quadrat method to measure the cryptogamic and herbaceous layer, the percent bare soil, litter, and woody species less than 3 ft (1 m) tall. A Daubermire plot of 20 x 50 cm was used (Daubermire 1959). Ocular estimates of foliar cover were used to determine percent cover and species composition. Quadrats were placed every 10 ft (3 m) along the same transect line established for overstory evaluation (Fig. 12). Again, these quadrats were read for 700 ft (210 m).

All plants were identified using Martin and Hutchins (1980), Foxx and Hoard (1984) and Foxx and Tierney (1984). When appropriate, we collected voucher specimens to be archived in the EM-8 herbarium. Any questionable identifications were taken to the University of New Mexico herbarium for confirmation.

5.3 Level 3 (Species Specific) Surveys

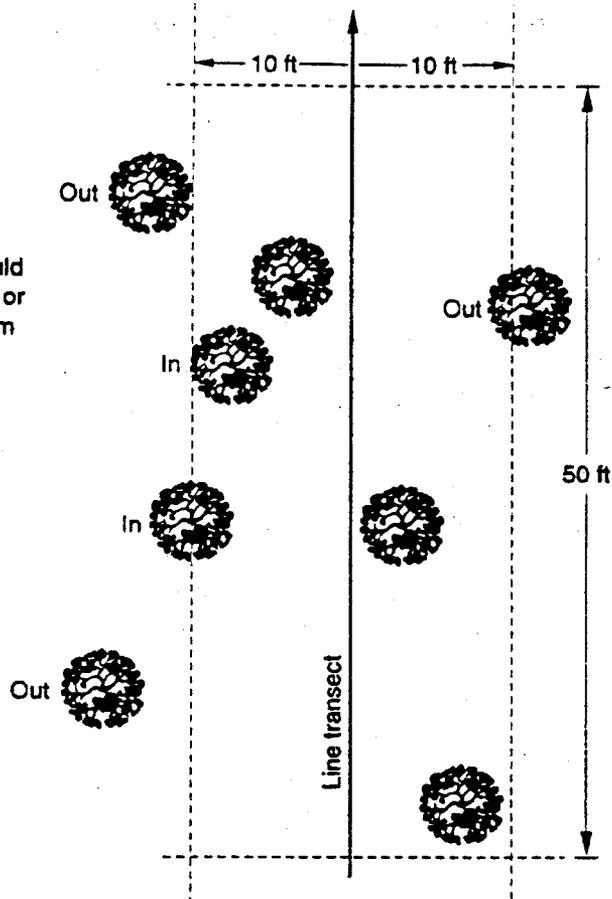
Based on the results of the Level 1 and 2 surveys, proposed project description and consultation with experts, we initiated Level 3 surveys for northern goshawk in OU 1082. These goshawk surveys will be conducted during the 1993 field season by EM-8 and Pat Kennedy, an expert on northern goshawk. An NPDES outfall study included nocturnal small mammal trapping in the OU.

5.3.1 Mammals

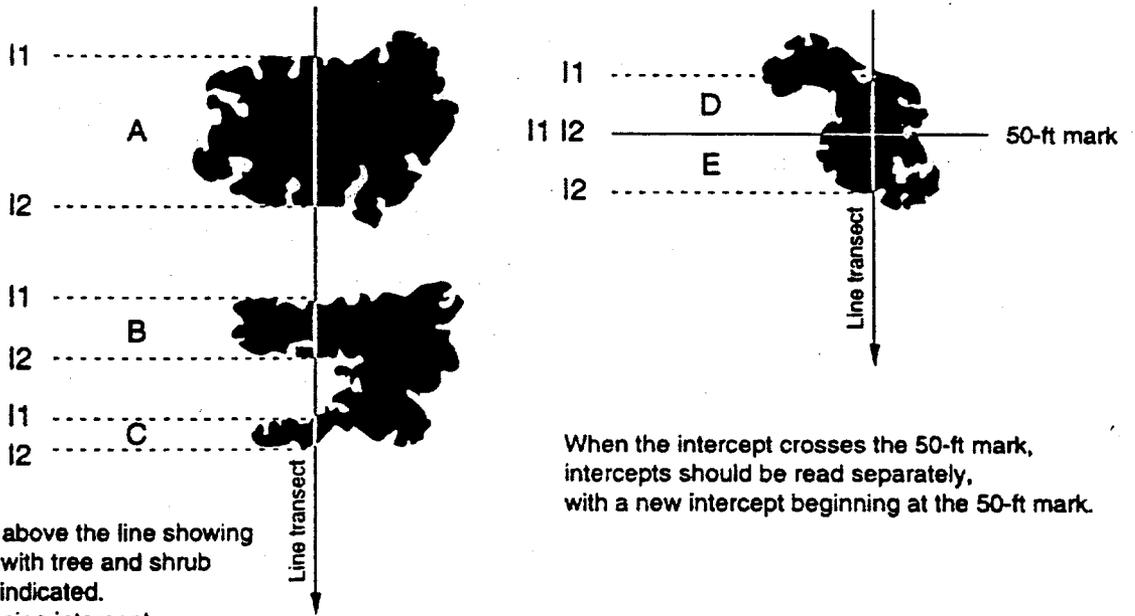
BRET used ventilated aluminum 9x3x12 inch Sherman live traps. A 5 x 20 trap grid was established at each site for a total of 100 traps. Traps were placed 10 m apart and covered or shaded to protect the animals from exposure to heat or precipitation. When appropriate each grid also contained 10 shrew pit traps, a 7" (18 cm) deep x 6" (15 cm) circumference plastic bucket, buried along logs or cattail ponds. We also recorded the dominant overstory, shrubstory and understory vegetation species within 7 m of each trap station. In the afternoon we baited the traps with adequate sweet feed to last the night. We then checked the traps early the next morning. Areas were trapped for two to

(a)

Tree boles or stems should be counted in when 50% or greater of the bole or stem is in the plot



(b)



View from above the line showing a transect with tree and shrub intercepts indicated.
I1 = beginning intercept
I2 = ending

When the intercept crosses the 50-ft mark, intercepts should be read separately, with a new intercept beginning at the 50-ft mark.

Fig. 11. (a) Line transect method of tree bole measurements and stem counts; (b) reading foliar intercepts.

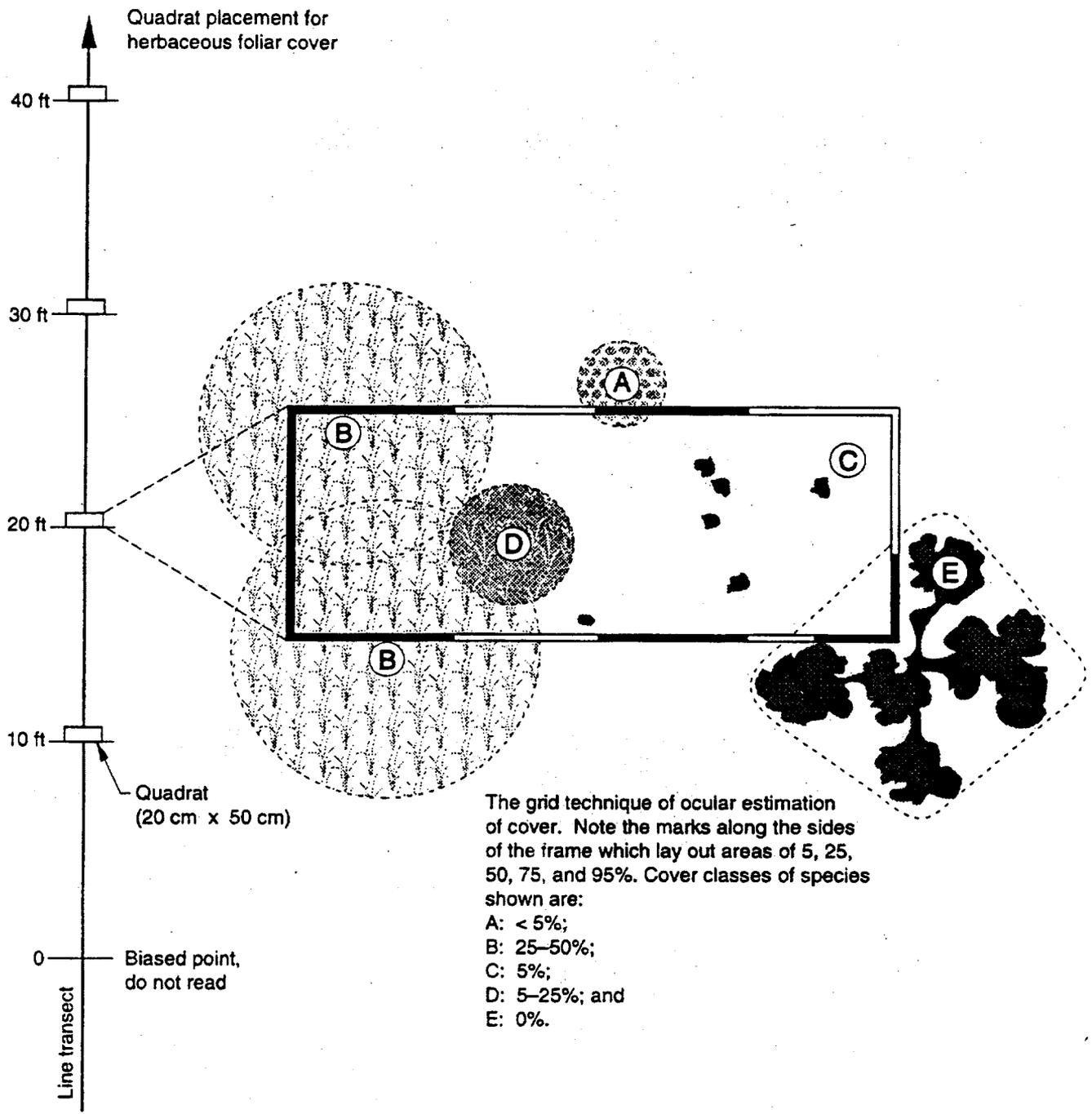


Fig. 12. Location of quadrats for understory transects of herbaceous foliar cover, and the grid technique of ocular estimation of cover (from Daubermire 1973).

three consecutive nights for a total of 300 trap nights. Captured animals were weighed in a plastic bag, identified to species, sexed, measured, marked and then released at the site of capture. Animals were marked with #FF rodent ear tags from Salt Lake Stamp Company, Salt Lake City, Utah. Identifications were made using Whitaker 1980 and Burt and Grossenheider 1976.

BRET conducted no diurnal small mammal surveys during 1992 in OU 1082. Nor did we do any medium or large mammal surveys, although several observations of black bear, deer, elk, and coyote were made (Appendix C).

5.3.2 Birds

BRET conducted no systematic surveys for birds within OU 1082, but all observations were noted.

5.3.3 Amphibians and Reptiles

There was neither pit trapping nor systematic surveys for amphibians or reptiles during the summer of 1992; however, any observations were noted.

5.3.4 Snails and Bivalves

We did no extensive searches for terrestrial snails, aquatic snails and bivalves.

5.3.5 Insects

No formal surveys were conducted for ground-dwelling terrestrial insects or for aquatic insects in OU 1082.

5.3.6 Fish

No suitable fish habitat exists within OU 1082; therefore, no fish surveys were conducted.

5.3.7 Threatened, Endangered and Sensitive (TES) Species

5.3.7.1 Spotted Bat. No spotted bat surveys were conducted in OU 1082 during the 1992 field season. However, data from a LANL-wide bat survey, and the methodology used, are incorporated into this report and described below.

Researchers conducted bat surveys using mist nets at several places throughout LANL and Bandelier (Tyrell and Brack 1992). This method is not specific to spotted bats; therefore, general inventory data on other bat species were gathered at the same time. At each site, mist nets were stretched over a stream, at the edge of a pond, or in other open areas likely to be used as flyways or travel corridors. Whenever possible, nets were arranged so they were bounded above and on both sides by vegetation. Net heights and widths were adjusted to maximize coverage of the flyway. Heights varied from 7 to

30 ft (2.1 to 10 m) and lengths were either 18, 30, 42, or 60 ft (5.4, 10, 12.6, or 18 m). Nets were opened and monitored from dusk until between 2:00 am and dawn. When a bat was caught, it was carefully removed from the net by holding it gently and pulling the net strands away from its body and wings. Data recorded included the species of each bat, its sex, age, reproductive status, forearm length, direction of flight, and height and time of capture. Only rabies-immunized researchers from 3-D Environmental and EM-8 handled the bats. We used Barbour and Davis (1969), Schmidly (1991), Whitaker (1980) and Burt and Grossenheider (1976) for identifications.

6 RESULTS

6.1 Wetlands and Floodplains

Three factors are needed to declare an area a wetland: (1) hydrology, (2) hydric soils, and (3) hydrophytic plants. Hydrophytic flora include cattails, bullrush, interior rush, duckweed, watercress, willows, and cottonwood. Plants that are indicators of wetland status are listed in Appendix B.

The wetlands in OU 1082 have been broadly mapped by US Fish and Wildlife Service using the methodology outlined by Cowardin (1979). The method is a hierarchical system based solely on aerial photography. Small wetlands and those in deep canyons may not have been detected using this method. OU 1082 has four wetlands delineated by USFWS on the National Wetlands Inventory (NWI) Maps (Fig. 13). Three are palustrine, scrub-shrub, broad-leaved deciduous, and temporarily flooded (PSS1A) wetland areas in Water Canyon. Palustrine systems include all nontidal wetlands dominated by trees, shrubs, persistent emergents, mosses or lichens (Cowardin, Carter, and Golet 1979). The fourth, a man-made pond in TA-16 behind Bldg. 90, is a palustrine, unconsolidated shore, seasonally flooded, and diked/impounded (PUSCh) wetland area. This pond is designated SWMU 16-008a and received liquid waste sometime between the 1940s and 1980s. Brad Martin (personal communication) indicated the pond had not been used for approximately 40 years. The pond receives seasonal water and may dry up for approximately four weeks each year.

Edeskuty, Foxx and Raymer (1992) found that of the 27 outfalls in OU 1082, 14 support wetland vegetation and may be considered jurisdictional wetlands. However, delineation of the wetland boundaries was not done during these surveys. Boundary delineation will be conducted just prior to sampling to assure that sampling is outside of areas meeting the wetland criteria (hydrophytic plants, hydric soils and hydrology). Delineations are valid for only two years and are best done at time of sampling.

McLin (1992) did floodplain computational mapping using the COE's computer-based Flood Hydrograph Package (HEC-1 and HEC-2). HEC-1 generates storm hydrographs at selected channel locations within each ungaged watershed; HEC-2 then defines the floodplain. McLin used HEC-1 and HEC-2 to define the 100-year, 6-hour design storm events for Los Alamos County. OU 1082 is within the Water Canyon watershed and contains floodplains in Cañon del Valle and Water Canyon.

6.2 Level 1 (Reconnaissance) Surveys

BRET conducted reconnaissance surveys in OU 1082 to determine potential habitats, to identify sampling locations, and to determine access for field surveys. All sampling locations were readily accessible, either by vehicle or by a relatively brief walk.

We reviewed the TES database to determine if any TES plant or animal species were within the project area. Appendix C provides a printout of the actual database. Table 2 provides a list of the species found in the database search, their status, habitat, and potential for occurrence (high, moderate or low) in the OU. A species designated as having a high potential for occurrence is one that has been reported within the OU in the past. A species with a moderate potential for occurrence, has not been encountered in the OU in the past, but all of the habitat requirements of the species can be met within the OU. Lastly, a species with a low potential for occurrence has not been encountered in the OU in recent times and not all of the habitat requirements for the species are present within the OU. Based on the reconnaissance surveys, we defined the following plant communities and used them as search criteria:

- Ponderosa-piñon
- Ponderosa
- Mixed-conifer
- Spruce-fir
- Riparian
- Wetland

6.2.1 Plants

Federally Listed Species: No federal endangered or threatened plant species were listed as potentially occurring in the OU.

State Listed Species: One plant species listed as state threatened or endangered met the search criteria (New Mexico's Natural Heritage Program 1991).

State Endangered

Wood lily

Lilium philadelphicum var. *andium*

6.2.2 Wildlife

Federally Listed Species: Two endangered, one threatened, and four candidate species met the search criteria (U. S. Fish and Wildlife Service 1990):

Endangered

Peregrine falcon

Falco peregrinus

Bald Eagle

Haliaeetus leucocephalus

Threatened

Mexican spotted owl	<i>Strix occidentalis lucida</i>
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Candidate

Northern goshawk	<i>Accipiter gentilis</i>
Willow flycatcher	<i>Empidonax trailii</i>
Spotted bat	<i>Euderma maculatum</i>
Meadow jumping mouse	<i>Zapus hudsonius luteus</i>

State Listed Species: Species listed as endangered or threatened in the State of New Mexico that met the search criteria are as follows (New Mexico Department of Game and Fish):

Endangered

Common black hawk	<i>Buteogallus anthracinus</i>
Broad-billed hummingbird	<i>Cyananthus latirostris</i>
Willow flycatcher	<i>Empidonax trailii</i>
Spotted bat	<i>Euderma maculatum</i>
Peregrine falcon	<i>Falco peregrinus</i>
Bald eagle	<i>Haliaeetus leucocephalus</i>
Mississippi kite	<i>Ictinia mississippiensis</i>
Jemez Mountains salamander	<i>Plethodon neomexicanus</i>
Pine martin	<i>Martes americana</i>
Mexican spotted owl	<i>Strix occidentalis lucida</i>
Meadow jumping mouse	<i>Zapus hudsonius luteus</i>
Say's pond snail	<i>Lymnaea captera</i>

The Migratory Bird Treaty Act (16 USC 703-711) provides federal protection for all wild birds except resident game birds, English sparrows, starlings and feral pigeons. The Bald Eagle Protection Act further protects eagles, including the golden eagle. These species are protected from being collected and maimed and from having their nests disturbed.

6.2.3 Sensitive Species

Under the Federal Endangered Species Act and state statutes, only species that are listed or are candidates for listing are protected. New Mexico has listed species occurring within the state that are considered rare because of restricted distribution or low numerical density. Because these plants are considered rare, they are sensitive to long-term or cumulative land-use impacts and are vulnerable to biological or climatic events that could threaten them. The state monitors these species to determine if they should be elevated to endangered status. The following species listed as state sensitive met the TES database search requirements:

State Sensitive

Checker lily
Sandia alumroot
Pagosa phlox

Fritillaria atropurpurea
Heuchera pulchella
Phlox caryophylla

6.3 Level 2 (Habitat Evaluation) Surveys

We established vegetation transects in OU 1082 to evaluate the understory and overstory components of the following general habitats and locations:

Location	Habitat
TA-16 Mesa	Mesa top: ponderosa pine forest Mesa top: old field Mesa top: burned ponderosa pine forest
Cañon de Valle	South-facing slope: ponderosa pine forest Canyon bottom: ponderosa pine forest North-facing slope: ponderosa pine forest
Water Canyon	South-facing slope: burned ponderosa pine forest North-facing slope: burned mixed-conifer forest

OU 1082 is located in the Rocky Mountain Montane Conifer forest community. More specifically, vegetation within the unit is characterized as being in the ponderosa pine series and Douglas fir series with varying habitat types (HTs) and phases. A further breakdown and discussion of vegetation is included in the following sections (see Appendix F for raw data summaries).

6.3.1 Overstory Evaluation

Following a reconnaissance survey of OU 1082, we placed vegetation transects in general habitats that displayed vegetational differences. Each site selected appeared to be representative of the overall habitat of OU 1082. Site-specific characteristics (i.e., dominant species, relative density, cover) are discussed and compared when possible.

Vegetation differences were not only observed between the varying terrain features (i.e., north-facing slopes, mesa tops) but also between areas burned and not burned by La Mesa fire.

6.3.1.1 Mesa Top. TA-16 Mesa can be described as having one main vegetation series, ponderosa pine. Although the series also contains areas burned by La Mesa fire, the series is based on the climax community species. Vegetation differences between burned and non-burned areas can be seen at the HT level. There were several different HTs found on the mesa because the HT is based on the actual components of the overstory. There are both burned and non-burned areas in OU 1082 within the ponderosa pine series, and both types of areas were sampled.

The non-burned transects yielded a ponderosa pine-Gambel oak HT (transect 16-5) and a ponderosa pine-bluegrass HT (transect 16-4). The non-burned areas had a tree overstory consisting only of ponderosa pine. In respect to shrub species, one non-burned area did not have any shrubs (16-4), while the other (16-5) had one species, Gambel oak, with only 4.36 trees per acre (Table 3).

The burned area (transect 28-1) yielded a ponderosa pine-aspen HT. The burned area had two tree overstory species, ponderosa pine and aspen. The ponderosa pines had an average DBH of only 0.76 in (1.93 cm), indicating small, regenerating trees (Table 4). Aspen are also considered regeneration species. The area is also characterized by large (average DBH = 15.7 in (70 cm)) ponderosa snags that were burned in La Mesa fire. The burned area had four shrub species; Gambel oak, New Mexico locust, creeping barberry, and raspberry. New Mexico locust had the highest importance index (57%) and Gambel oak had the second highest (40%) (Table 3). Both species had 1049 stems per acre, a marked increase of stems over the non-burned area. The higher diversity and density of shrubs in the burned area is probably the result of the elimination of the tree overstory by the fire which allows more sunlight to reach the shrub story and increase growth. Shrub species also regenerate at a higher rate than tree species.

6.3.1.2 North-facing Slopes. Typically, north-facing slopes have denser vegetation than south-facing slopes and other terrains because of their capacity to retain more moisture. North-facing slopes in the OU occur in Cañon de Valle and Water Canyon. Vegetation on these slopes can be placed in the ponderosa pine series with two HTs. The north-facing slope of upper Water Canyon contains non-burned and La Mesa burned areas. A transect was placed in a burned area, but not in a non-burned area. Information on non-burned areas can be extrapolated from a previous survey by Guthrie (1981) and a transect in OU 1157 (Banar 1993).

TABLE 3: Overstory Vegetation Characteristics of the Shrub Canopy Layer Species Recorded in Operable Unit 1082 on the Mesa Top and in the Canyon Bottom.

SPECIES	TRANSECT			
	Mesa top	Mesa top (Old field)	Mesa top (Burned)	Canyon bottom
Gambel oak				
Stems per Acre	4.36	4.62	1048.55	586.81
Relative Cover (%)	0.00	0.14	31.10	16.86
Relative Density (%)	100.00	100.00	48.98	41.46
Relative Frequency (%)	100.00	100.00	38.46	25.00
Importance Index (%)	66.67	100.00	39.52	38.33
New Mexico locust				
Stems per Acre	-	-	1048.55	162.64
Relative Cover	-	-	68.90	2.55
Relative Density	-	-	68.90	11.49
Relative Frequency	-	-	53.85	29.17
Importance Index	-	-	57.24	16.00

State Sensitive

Checker lily
Sandia alumroot
Pagosa phlox

Fritillaria atropurpurea
Heuchera pulchella
Phlox caryophylla

6.3 Level 2 (Habitat Evaluation) Surveys

We established vegetation transects in OU 1082 to evaluate the understory and overstory components of the following general habitats and locations:

Location	Habitat
TA-16 Mesa	Mesa top: ponderosa pine forest Mesa top: old field Mesa top: burned ponderosa pine forest
Cañon de Valle	South-facing slope: ponderosa pine forest Canyon bottom: ponderosa pine forest North-facing slope: ponderosa pine forest
Water Canyon	South-facing slope: burned ponderosa pine forest North-facing slope: burned mixed-conifer forest

OU 1082 is located in the Rocky Mountain Montane Conifer forest community. More specifically, vegetation within the unit is characterized as being in the ponderosa pine series and Douglas fir series with varying habitat types (HTs) and phases. A further breakdown and discussion of vegetation is included in the following sections (see Appendix F for raw data summaries).

6.3.1 Overstory Evaluation

Following a reconnaissance survey of OU 1082, we placed vegetation transects in general habitats that displayed vegetational differences. Each site selected appeared to be representative of the overall habitat of OU 1082. Site-specific characteristics (i.e., dominant species, relative density, cover) are discussed and compared when possible.

Vegetation differences were not only observed between the varying terrain features (i.e., north-facing slopes, mesa tops) but also between areas burned and not burned by La Mesa fire.

6.3.1.1 Mesa Top. TA-16 Mesa can be described as having one main vegetation series, ponderosa pine. Although the series also contains areas burned by La Mesa fire, the series is based on the climax community species. Vegetation differences between burned and non-burned areas can be seen at the HT level. There were several different HTs found on the mesa because the HT is based on the actual components of the overstory. There are both burned and non-burned areas in OU 1082 within the ponderosa pine series, and both types of areas were sampled.

The non-burned transects yielded a ponderosa pine-Gambel oak HT (transect 16-5) and a ponderosa pine-bluegrass HT (transect 16-4). The non-burned areas had a tree overstory consisting only of ponderosa pine. In respect to shrub species, one non-burned area did not have any shrubs (16-4), while the other (16-5) had one species, Gambel oak, with only 4.36 trees per acre (Table 3).

The burned area (transect 28-1) yielded a ponderosa pine-aspen HT. The burned area had two tree overstory species, ponderosa pine and aspen. The ponderosa pines had an average DBH of only 0.76 in (1.93 cm), indicating small, regenerating trees (Table 4). Aspen are also considered regeneration species. The area is also characterized by large (average DBH = 15.7 in (70 cm)) ponderosa snags that were burned in La Mesa fire. The burned area had four shrub species; Gambel oak, New Mexico locust, creeping barberry, and raspberry. New Mexico locust had the highest importance index (57%) and Gambel oak had the second highest (40%) (Table 3). Both species had 1049 stems per acre, a marked increase of stems over the non-burned area. The higher diversity and density of shrubs in the burned area is probably the result of the elimination of the tree overstory by the fire which allows more sunlight to reach the shrub story and increase growth. Shrub species also regenerate at a higher rate than tree species.

6.3.1.2 North-facing Slopes. Typically, north-facing slopes have denser vegetation than south-facing slopes and other terrains because of their capacity to retain more moisture. North-facing slopes in the OU occur in Cañon de Valle and Water Canyon. Vegetation on these slopes can be placed in the ponderosa pine series with two HTs. The north-facing slope of upper Water Canyon contains non-burned and La Mesa burned areas. A transect was placed in a burned area, but not in a non-burned area. Information on non-burned areas can be extrapolated from a previous survey by Guthrie (1981) and a transect in OU 1157 (Banar 1993).

TABLE 3: Overstory Vegetation Characteristics of the Shrub Canopy Layer Species Recorded in Operable Unit 1082 on the Mesa Top and in the Canyon Bottom.

SPECIES	TRANSECT			
	Mesa top	Mesa top (Old field)	Mesa top (Burned)	Canyon bottom
Gambel oak				
Stems per Acre	4.36	4.62	1048.55	586.81
Relative Cover (%)	0.00	0.14	31.10	16.86
Relative Density (%)	100.00	100.00	48.98	41.46
Relative Frequency (%)	100.00	100.00	38.46	25.00
Importance Index (%)	66.67	100.00	39.52	38.33
New Mexico locust				
Stems per Acre	-	-	1048.55	162.64
Relative Cover	-	-	68.90	2.55
Relative Density	-	-	68.90	11.49
Relative Frequency	-	-	53.85	29.17
Importance Index	-	-	57.24	16.00

TABLE 3 cont.

SPECIES	TRANSECT			
	Mesa top	Mesa top (Old field)	Mesa top (Burned)	Canyon bottom
Cliffbush				
Stems per Acre	-	-	-	443.96
Relative Cover	-	-	-	10.97
Relative Density	-	-	-	3.81
Relative Frequency	-	-	-	12.50
Importance Index	-	-	-	18.28
Chokecherry				
Stems per Acre	-	-	-	28.57
Relative Cover	-	-	-	14.39
Relative Density	-	-	-	2.02
Relative Frequency	-	-	-	8.33
Importance Index	-	-	-	8.25
Creeping barberry				
Stems per Acre	-	-	18.67	70.33
Relative Cover	-	-	0.00	14.39
Relative Density	-	-	0.87	4.97
Relative Frequency	-	-	3.85	4.17
Importance Index	-	-	1.57	7.84
Gooseberry				
Stems per Acre	-	-	-	6.99
Relative Cover	-	-	-	3.81
Relative Density	-	-	-	41.16
Relative Frequency	-	-	-	8.33
Importance Index	-	-	-	6.38
Wild rose				
Stems per Acre	-	-	-	17.58
Relative Cover	-	-	-	0.29
Relative Density	-	-	-	1.24
Relative Frequency	-	-	-	8.33
Importance Index	-	-	-	3.29
Raspberry				
Stems per Acre	-	-	24.89	6.59
Relative Cover	-	-	1.16	0.29
Relative Density	-	-	0.87	0.47
Relative Frequency	-	-	3.85	4.17
Importance Index	-	-	1.67	1.64

A dash (-) indicates the species was not recorded at this site.

TABLE 4: Overstory Vegetation Characteristics of the Tree Canopy Layer Species Recorded in Operable Unit 1082 on the Mesa Top and in the Canyon Bottom.

TABLE 4: Overstory Vegetation Characteristics of the Tree Canopy Layer Species Recorded in Operable Unit 1082 on the Mesa Top and in the Canyon Bottom.

SPECIES	TRANSECT			
	Mesa top	Mesa top (Old field)	Mesa top (Burned)	Canyon bottom
Ponderosa pine				
Average DBH (in)	4.06	4.62	0.76	7.98
Relative Cover (%)	100.00	0.14	0.00	55.57
Relative Density (%)	100.00	100.00	66.67	83.93
Relative Frequency (%)	100.00	100.00	80.00	53.85
Importance Index (%)	100.00	100.00	48.89	64.45
Aspen				
Average DBH	-	-	2.85	-
Relative Cover	-	-	0.00	-
Relative Density	-	-	33.33	-
Relative Frequency	-	-	20.00	-
Importance Index	-	-	17.78	-
Douglas fir				
Average DBH	-	-	-	13.15
Relative Cover	-	-	-	10.00
Relative Density	-	-	-	10.71
Relative Frequency	-	-	-	15.38
Importance Index	-	-	-	18.44
One-seed juniper				
Average DBH	-	-	-	0.10
Relative Cover	-	-	-	14.61
Relative Density	-	-	-	1.79
Relative Frequency	-	-	-	7.69
Importance Index	-	-	-	8.03
Rocky Mountain juniper				
Average DBH	-	-	-	2.50
Relative Cover	-	-	-	0.29
Relative Density	-	-	-	1.79
Relative Frequency	-	-	-	7.69
Importance Index	-	-	-	3.26
Snags				
Average DBH	-	-	15.70	1.79
Relative Cover	-	-	0.00	0.29
Relative Density	-	-	8.33	1.79
Relative Frequency	-	-	10.00	15.38
Importance Index	-	-	6.11	5.82

A dash (-) indicates the species was not recorded at this site.

6.3.1.2 North-facing Slopes. Typically, north-facing slopes have denser vegetation than south-facing slopes and other terrains because of their capacity to retain more moisture. North-facing slopes in the OU occur in Cañon de Valle and Water Canyon. Vegetation on these slopes can be placed in the ponderosa pine series with two HTs. The north-facing slope of upper Water Canyon contains non-burned and La Mesa burned areas. A transect was placed in a burned area, but not in a non-burned area. Information on non-burned areas can be extrapolated from a previous survey by Guthrie (1981) and a transect in OU 1157 (Banar 1993).

Non-burned north-facing slopes in OU 1082 can be characterized as ponderosa pine-Gambel HT. The transect in Cañon de Valle (16-2) had two tree overstory species: ponderosa pine with an importance index of 93%, and one-seed juniper with an importance index of 7% (Table 5). The shrub species found on the transect are Gambel oak (86%), Apache plume (4%), and New Mexico locust (10%) (Table 6). Although non-burned north-facing slopes in OU 1082 were not surveyed, information from Guthrie (1981) and from a transect in Pajarito Canyon indicate a ponderosa pine-Gambel oak HT. The transect in Pajarito Canyon had five tree overstory species: ponderosa pine (69%), Gambel oak (19%), Douglas fir (8%), white fir (3%), and one-seed juniper (2%) (Banar 1993). Shrub species found on the transect are Gambel oak (77%), creeping barberry (20%), and cliffbush (3%).

The burned areas of Water Canyon can be characterized as Douglas fir-Gambel oak HT in the ponderosa pine series. Although, the only tree species found on the transect was Douglas fir, the series is based on the climax community species (i.e., the climax community species found in non-burned areas.) Shrub species included Gambel oak (61%), New Mexico olive (20%), wax current (13%), and mock orange (6%) in order of importance index (Table 6). Gambel oak and New Mexico olive had the same relative frequency (33.33%) but Gambel oak had a higher relative density (66.58%) and relative cover (82.57%) than New Mexico olive (relative density = 16.17% and relative cover = 10.56%). New Mexico olive and wax current had very similar relative density (16.17 and 13.59 respectively), but very different relative cover (10.56 and 2.69 respectively).

6.3.1.3 South-facing Slopes. South-facing slopes are normally drier than adjacent north-facing slope and thus usually have a lower vegetative cover. Data collected on south-facing slopes were taken in Cañon de Valle and Water Canyon. Vegetation on these slopes can be placed in the ponderosa pine series with two HTs. The south-facing slope of upper Water Canyon contains non-burned and La Mesa burned areas. BRET placed a transect in a burned area, but not in a non-burned area. Information on non-burned areas of Water Canyon can be extrapolated from the south-facing slope transect in Cañon de Valle.

TABLE 5: Overstory Vegetation Characteristics of the Tree Canopy Layer Species Recorded in Operable Unit 1082 on the North-facing and South-facing Slopes.

SPECIES	TRANSECT			
	North-facing slope		South-facing slope	
	(Non burned)	(Burned)	(Non burned)	(Burned)
Ponderosa pine				
Average DBH (in)	8.83	6.30	5.18	-
Relative Cover (%)	21.31	1.00	100.00	-
Relative Density (%)	76.67	28.57	97.58	-
Relative Frequency (%)	49.80	25.00	82.35	-
Importance Index (%)	57.16	51.19	93.31	-
One-seed juniper				
Average DBH	0.10	-	1.60	-
Relative Cover	0.00	-	0.00	-
Relative Density	16.67	-	2.42	-
Relative Frequency	0.00	-	17.65	-
Importance Index	13.89	-	6.69	-
Douglas fir				
Average DBH	-	-	-	4.67
Relative Cover	-	-	-	100.00
Relative Density	-	-	-	100.00
Relative Frequency	-	-	-	100.00
Importance Index	-	-	-	100.00
Gambel oak				
Average DBH	13.50	-	-	-
Relative Cover	50.20	-	-	-
Relative Density	3.33	-	-	-
Relative Frequency	25.00	-	-	-
Importance Index	26.18	-	-	-
Snags				
Average DBH	20.10	11.22	-	-
Relative Cover	0.00	0.00	-	-
Relative Density	3.33	71.43	-	-
Relative Frequency	5.00	75.00	-	-
Importance Index	2.78	48.81	-	-

A dash (-) indicates the species was not recorded at this site.

**TABLE 6: Overstory Vegetation Characteristics of the Shrub Canopy Layer
Species Recorded in OU 1082 on the North-facing and South-facing Slopes.**

SPECIES	TRANSECT			
	North-facing slope		South-facing slope	
	(Non burned)	(Burned)	(Non burned)	(Burned)
Gambel oak				
Stems per Acre	591.17	3557.40	507.16	693.85
Relative Cover (%)	100.00	82.57	97.16	65.42
Relative Density (%)	95.48	66.58	56.21	77.97
Relative Frequency (%)	63.64	33.33	50.00	53.33
Importance Index (%)	86.37	60.83	67.79	65.57
New Mexico locust				
Stems per Acre	9.33	-	12.45	161.79
Relative Cover	0.00	-	0.00	34.58
Relative Density	1.51	-	1.38	18.18
Relative Frequency	27.27	-	12.50	33.33
Importance Index	9.59	-	4.63	28.70
New Mexico olive				
Stems per Acre	-	836.94	-	-
Relative Cover	-	10.56	-	-
Relative Density	-	16.17	-	-
Relative Frequency	-	33.33	-	-
Importance Index	-	20.02	-	-
Wax current				
Stems per Acre	-	726.00	-	-
Relative Cover	-	2.69	-	-
Relative Density	-	13.59	-	-
Relative Frequency	-	22.22	-	-
Importance Index	-	12.83	-	-
Mountain mahogany				
Stems per Acre	-	-	37.34	-
Relative Cover	-	-	0.00	-
Relative Density	-	-	4.14	-
Relative Frequency	-	-	8.33	-
Importance Index	-	-	4.16	-
Cliffbush				
Stems per Acre	-	-	65.34	-
Relative Cover	-	-	0.00	-
Relative Density	-	-	7.24	-
Relative Frequency	-	-	8.33	-
Importance Index	-	-	5.19	-

TABLE 6 cont.

SPECIES	North-facing slope		TRANSECT	
	(Non burned)	(Burned)	(Non burned)	(Burned)
Rubber rabbitbush				
Stems per Acre	-	-	-	18.67
Relative Cover	-	-	-	0.00
Relative Density	-	-	-	2.10
Relative Frequency	-	-	-	6.67
Importance Index	-	-	-	2.92
Raspberry				
Stems per Acre	-	-	-	15.56
Relative Cover	-	-	-	0.00
Relative Density	-	-	-	1.75
Relative Frequency	-	-	-	6.67
Importance Index	-	-	-	2.92
Mockorange				
Stems per Acre	-	196.02	-	-
Relative Cover	-	4.18	-	-
Relative Density	-	3.67	-	-
Relative Frequency	-	11.11	-	-
Importance Index	-	6.32	-	-
Apache plume				
Stems per Acre	18.67	-	-	-
Relative Cover	0.00	-	-	-
Relative Density	3.02	-	-	-
Relative Frequency	9.09	-	-	-
Importance Index	4.04	-	-	-

A dash (-) indicates the species was not recorded at this site.

Non-burned south-facing slopes in OU 1082 can be characterized as ponderosa pine-one-seed juniper HT. The transect in Cañon de Valle (16-3) had three tree overstory species: ponderosa pine (57%), Gambel oak (26%), and one-seed juniper (13%) (Table 5). The remaining cover consisted of snag trees. Gambel oak, normally considered a shrub species, had an average DBH of 13.5 in (34 cm) indicating very mature, old growth oak (Table 6). Shrub species found on the transect were Gambel oak (68%), New Mexico locust (5%), cliffbush (5%) and mountain mahogany (4%). The remaining 18% is an unidentified oak species, probably more Gambel oak or wavyleaf oak. This transect in Cañon de Valle is representative of the south-facing slopes of Water Canyon.

The burned areas of Water Canyon can be characterized as Gambel oak-mountain muhly HT. The only tree species found on the transect was ponderosa pine. The average DBH of the pines is 6.3 in (16 cm) indicating a relatively young, regenerative forest. Shrub species included Gambel oak (66%), New Mexico olive (29%), rubber rabbitbush (3%), and raspberry (3%) (Table 6).

6.3.1.4 Canyon Bottom/Riparian. Vegetation within the canyon bottoms contained overstory species typical of both north-facing and south-facing slopes. However, number of species (diversity) was greater in the canyon bottoms than on either slope. This is typical of riparian zones.

We placed a transect in a riparian area in the bottom of Cañon de Valle, in the ponderosa pine series and the ponderosa pine-Douglas fir HT. The most important tree species were ponderosa pine (65%) and Douglas fir (18%) (Table 3). Other tree overstory species include one-seed juniper (8%), Rocky Mountain juniper (3%), and snags (6%). Important shrub species include Gambel oak (38%), cliffbush (18%), and New Mexico locust (16%) (Table 3). Other shrub species include gooseberry, wild rose, choke cherry, creeping barberry, and raspberry.

6.3.2 Understory Evaluation

6.3.2.1 Mesa Top. TA-16 Mesa has areas in the ponderosa pine series. The ponderosa pine series contains three HTs: ponderosa pine-Gambel oak, ponderosa pine-blue grass, and ponderosa pine-aspen. The first two HTs represent non-burned areas while the third represents burned areas. The HTs can be further broken down into vegetation phases by examining the understory species.

The ponderosa-Gambel oak HT and the ponderosa pine-blue grass HT represent non-burned ponderosa pine areas. The first HT, ponderosa-Gambel oak (transect 16-5), represents the non-burned ponderosa pine forest areas of the OU. The dominant understory species in the area according to importance index (Table 7) were blue grama (27%), lupine (18%), and potentilla (10%). Other common species included bottlebrush squirreltail, wormwood, fleebane, false tarragon, and bluegrass. This area is in a blue grama phase.

The second HT, ponderosa pine-bluegrass (transect 16-4), represents the OU's old agricultural field areas. The dominant understory species in this HT were bluegrass (35%), wormwood (12%), and lupine (35%) (Table 7). These species are indicative of disturbed areas. Other common species include western wheatgrass, trailing fleabane, bursage, and potentilla. The area is in a bluegrass phase.

TABLE 7: Overstory Vegetation Characteristics of Plants Species Recorded in Operable Unit 1082 on the Mesa Top and in the Canyon Bottom.

SPECIES	TRANSECT			
	Mesa top	Mesa top (Old field)	Mesa top (Burned)	Canyon bottom
Bluegrass				
Relative Cover (%)	5.75	41.87	2.65	26.23
Relative Frequency (%)	6.70	27.40	2.63	20.14
Importance Index (%)	6.22	34.64	2.64	23.19
False tarragon				
Relative Cover	3.72	9.59	0.88	-
Relative Frequency	3.09	14.42	1.32	-
Importance Index	3.41	12.01	1.10	-
Tall lupine				
Relative Cover	23.00	14.13	-	-
Relative Frequency	12.37	10.58	-	-
Importance Index	17.69	12.35	-	-
Blue grama*				
Relative Cover	32.81	1.30	18.28	-
Relative Frequency	20.62	2.88	12.35	-
Importance Index	26.71	2.09	15.31	-
Potentilla				
Relative Cover	9.16	3.37	-	-
Relative Frequency	11.34	3.85	-	-
Importance Index	10.25	3.61	-	-
Pine dropseed				
Relative Cover	-	-	28.26	-
Relative Frequency	-	-	17.11	-
Importance Index	-	-	22.68	-
Mountain muhly				
Relative Cover	0.34	0.26	17.66	-
Relative Frequency	0.52	0.48	17.11	-
Importance Index	0.43	0.37	17.38	-
Other (woody species that were under 3 ft tall)				
New Mexico olive				
Relative Cover	-	-	21.19	8.58
Relative Frequency	-	-	22.37	7.19
Importance Index	-	-	21.78	7.89

A dash (-) indicates the species was not recorded at this site.

An asterisk (*) indicates a grass reseeded after 1977 La Mesa fire.

The ponderosa pine-aspen HT represents burned mesa-top area. The dominant understory species according to importance index (Table 7) were pine dropseed (23%), New Mexico locust (22%) and mountain muhly (17%). New Mexico locust had one of the highest relative cover values (21.19%) and the highest relative frequency (22.37%). When New Mexico locust, normally an overstory species, is recorded in the understory, it indicates seedling plants. Other common species included carex, mullein, fleabane, and horseweed. This area is in a New Mexico locust phase.

6.3.2.2 North-facing Slopes. Vegetation on these slopes can be placed in the ponderosa pine series with two HTs. The north-facing slope of upper Water Canyon contains non-burned and La Mesa burned areas. A transect was placed in a burned area, but not in a non-burned area. Information on non-burned areas can be extrapolated from a previous survey by Guthrie (1981) and a transect in OU 1157 (Banar 1993). Non-burned north-facing slopes in OU 1082 can be characterized as ponderosa pine-Gambel HT. The transect in Cañon de Valle (16-2) had three major understory species: mountain muhly (27%), western yarrow (14%), and pine dropseed (10%) (Table 8). Other common species include pussytoes, bluegrass, nodding brome, bottlebrush squirreltail, pine goldenpea, James geranium, and wormwood. Relevant data about non-burned areas in Water Canyon can be extrapolated from Guthrie (1981) and from a transect in OU 1157, TA-9, Pajarito Canyon. Both sources indicate a ponderosa pine-Gambel oak HT with a Gambel oak phase. The transect in Pajarito Canyon shows the dominant understory species as carex (26%), mountain muhly (16%), pussytoes (14%), and western yarrow (10%) (Banar 1993). Other common species were mutton grass, dandelion, little bluestem, tobacco root, wild strawberry, and Rocky Mountain clematis.

The burned areas of the north-facing slope of Water Canyon are in the Douglas fir series, Douglas fir-Gambel oak HT. The HT can be further evaluated to phase by looking at the understory components. The dominant understory species in the Douglas fir-Gambel oak HT was slender wheatgrass, a seeded grass (12%). Spike muhly, also a seeded grass, was co-dominant (9%). The third most common species was wild chrysanthemum (8%). Other common species included mountain muhly, moss, false tarragon, and American vetch. This can be classified as a Gambel oak-slender wheatgrass phase.

6.3.2.3 South-facing Slopes. Vegetation on these slopes can be placed in the ponderosa pine series with two HTs. The south-facing slope of upper Water Canyon contains non-burned and La Mesa burned areas. A transect was placed in a burned area, but not in a non-burned area. Information on non-burned areas of Water Canyon can be extrapolated from the south-facing slope transect in Cañon de Valle.

Non-burned south-facing slopes in OU 1082 can be characterized as ponderosa pine-one-seed juniper HT. The transect in Cañon de Valle (16-3) had three dominant understory species: little bluestem (35%), mountain muhly (26%), and wormwood (12%) (Table 8). Other common species include bluegrass, big bluestem, and nodding brome. The remaining cover consisted of snag trees. The area is in a Gambel oak phase. The transect in Cañon de Valle is representative of the south-facing slopes of Water Canyon.

The burned areas of Water Canyon can be characterized as Gambel oak-mountain muhly HT, mountain muhly phase. The area exhibits large amounts of litter and bare soil, and is dominated by grasses. The dominant understory species was mountain muhly with

a 50% importance index (Table 8). The second highest importance index (20%) belongs to pine dropseed. Other common understory species include New Mexico locust, buckbrush, bluegrass, and bursage.

TABLE 8: Understory Vegetation Characteristics of Plants Species Recorded in Operable Unit 1082 on the North-facing and South-facing Slopes.

SPECIES	TRANSECT			
	North-facing slope		South-facing slope	
	(Non burned)	(Burned)	(Non burned)	(Burned)
Mountain muhly				
Relative Cover (%)	28.91	10.56	24.05	52.99
Relative Frequency (%)	24.24	4.25	27.12	45.05
Importance Index (%)	26.58	7.41	25.58	49.02
Little bluestem				
Relative Cover	1.87	-	40.76	1.13
Relative Frequency	1.01	-	28.81	1.80
Importance Index	1.44	-	34.79	1.46
Wormwood				
Relative Cover	2.05	-	8.35	-
Relative Frequency	3.03	-	15.25	-
Importance Index	2.54	-	11.80	-
Pine dropseed				
Relative Cover	11.19	2.77	1.27	18.04
Relative Frequency	9.09	0.94	1.69	20.72
Importance Index	10.14	1.85	1.48	19.38
Western yarrow				
Relative Cover	0.12	-	-	0.56
Relative Frequency	14.55	-	-	0.90
Importance Index	13.84	-	-	0.73
Slender wheatgrass *				
Relative Cover	-	14.05	-	-
Relative Frequency	-	9.91	-	-
Importance Index	-	11.98	-	-
Spike muhly*				
Relative Cover	-	13.00	-	-
Relative Frequency	-	5.66	-	-
Importance Index	-	9.33	-	-
Wild chrysanthemum				
Relative Cover	0.19	6.36	-	0.68
Relative Frequency	1.01	10.38	-	1.80
Importance Index	0.60	8.37	-	1.24

A dash (-) indicates the species was not recorded at this site.

An asterisk (*) indicates a grass reseeded after 1977 La Mesa fire.

6.3.2.4 Canyon Bottom/Riparian. A transect was placed in the canyon bottom of Cañon de Valle to represent riparian areas within the OU. The transect was in an area of the ponderosa pine series, ponderosa pine-Douglas fir HT, Gambel oak phase. The area exhibits large amounts of litter and is dominated by grasses. The most important grass species is bluegrass with an importance index of 23% (Table 7). Unknown grasses (three species combined) make up the remaining 23% in the important index. Other common species include inland rush, New Mexico locust, cattails, brome, wild rose, and redtop bent.

6.4 Level 3 (Species Specific) Surveys

6.4.1 Plants

BRET conducted no species-specific surveys for plants in OU 1082. However, the NPDES outfall study by Raymer and Biggs (1993) included vegetation surveys. The plant species they recorded are include in the appendices.

6.4.2 Wildlife

J. Biggs and D. Raymer conducted extensive small mammal surveys during 1992 to compare small mammal species diversity (Raymer and Biggs 1993) and physical characteristics (Biggs and Raymer 1993) near NPDES outfall streams, natural streams, and dry streams. Trapping was conducted at 13 locations: three dry, seven outfall and three natural. Two of the outfall areas were in OU 1082, outfall 05A-054 in Cañon de Valle (Fig. 14) and outfalls 04A-157 and 05A-072 on TA-16 mesa (Fig. 15).

A total of four species were caught in Cañon de Valle: long-tailed vole (*Microtus longicaudus*), Mexican woodrat (*N. mexicana*), brush mouse (*Peromyscus boylii*), and deer mouse (*P. maniculatus*). Only two species were captured on TA-16 mesa, deer mouse and long-tailed vole. Forty three animals were captured in Cañon de Valle and 54 animals were capture on TA-16 mesa. Percent trap success was slightly higher on the mesa (19%) than in the canyon (14%). Species diversity, however, was much lower on the mesa (.41) than in the canyon (1.62). The species diversity indices used were the Shannon-Weiner Index (also called the Shannon-Weaver Method).

Raymer and Biggs also reported the historic and recent total average daily input of water in gallons per day (including all contributing outfalls) at each outfall site. The Cañon de Valle site has historic input (at 14 years ago) and recent input (at two years ago) of 47 gallons per day. The TA-16 mesa site has historic input of 0.04 gallons per day and recent input of 13.49 gallons per day.

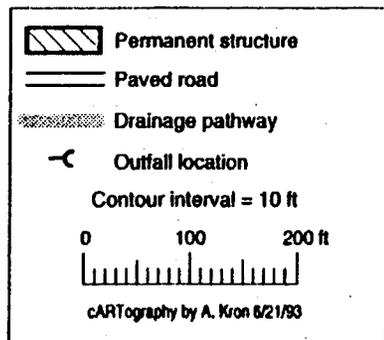
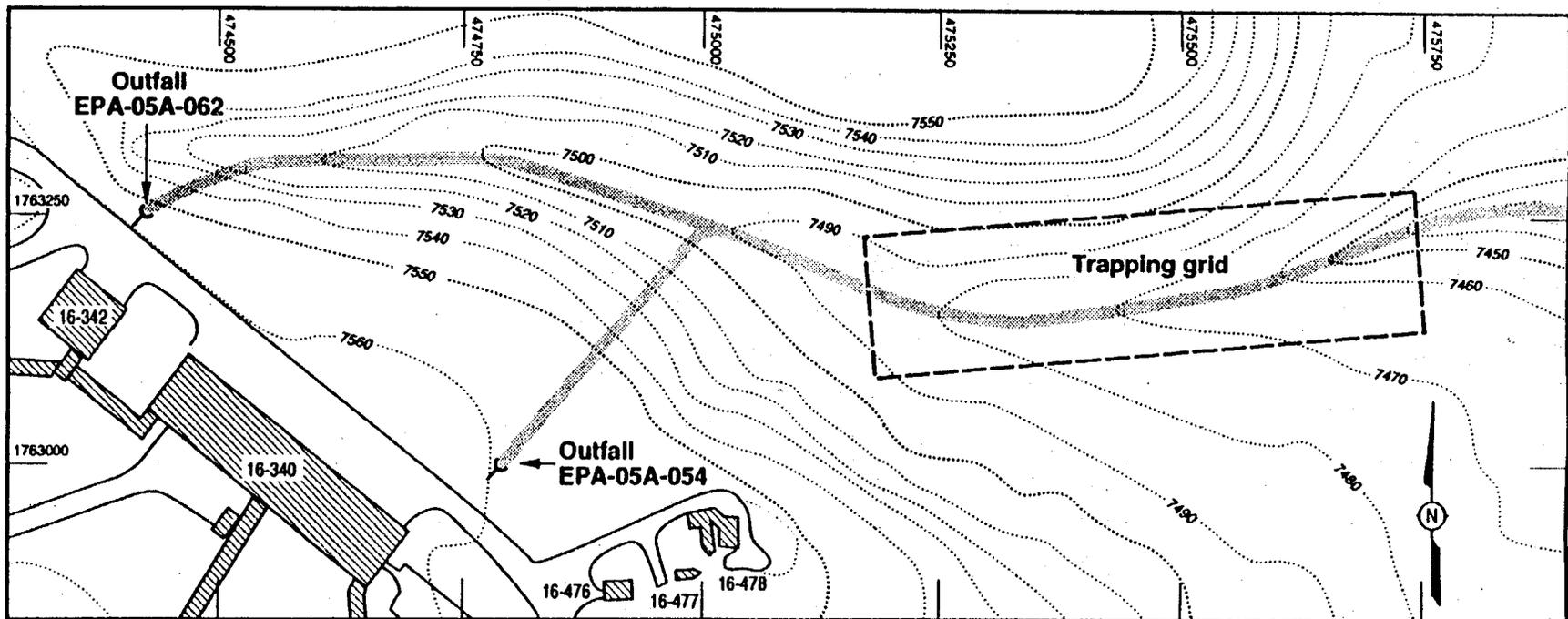


Fig. 14. Location of nocturnal small mammal trapping grid for outfall 05A-054, 1992.

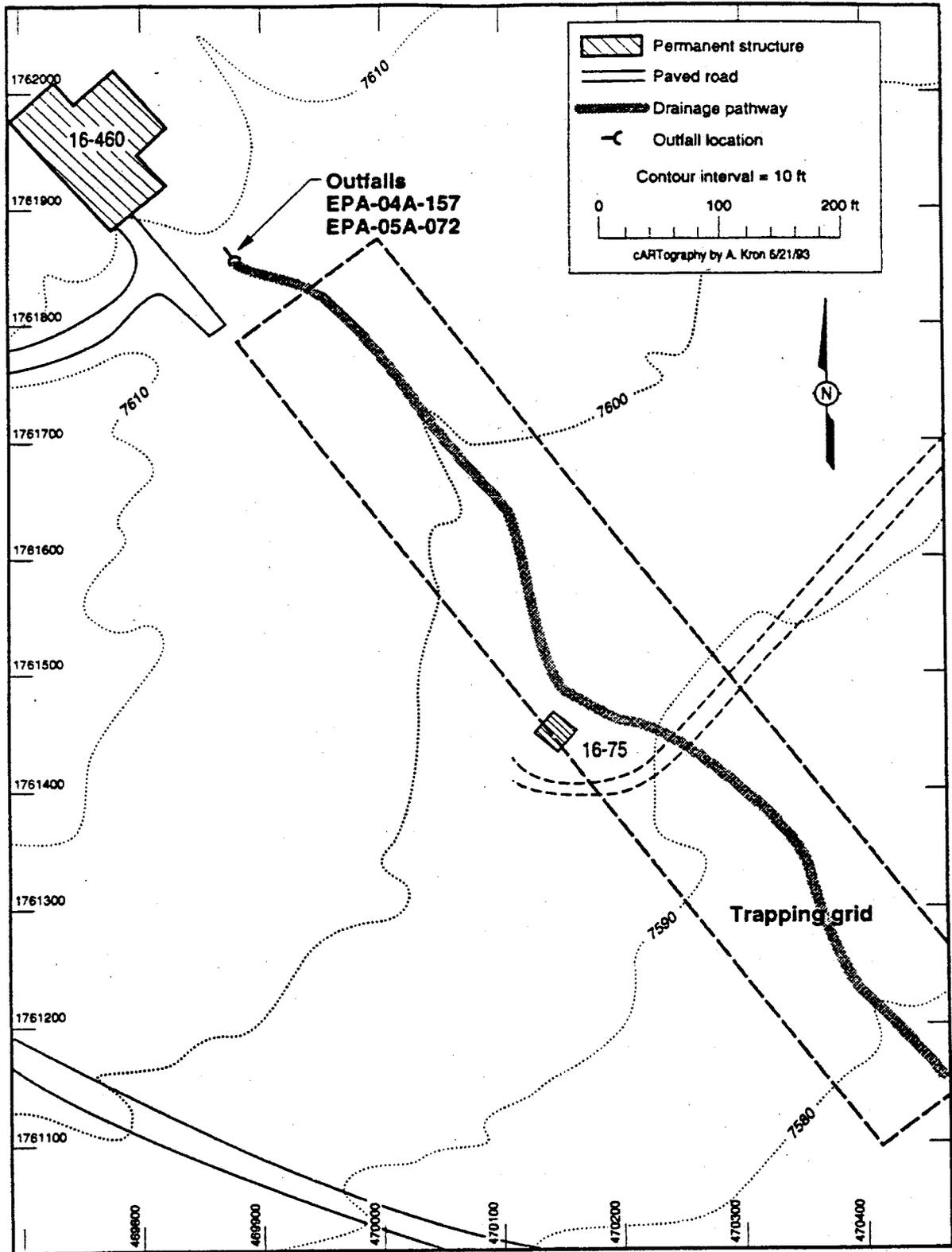


Fig. 15. Location of nocturnal small mammal trapping grid for outfalls 04A-157 and 05A-072, 1992.

In respect to small mammal physical characteristics (weight and length), Biggs and Raymer (1993) reported mean weights and lengths of long-tailed vole, deer mouse, and brush mouse at each site. The mean weights of long-tailed vole, deer mouse, and brush mouse in Cañon de Valle are 37.93 g, 16.8 g, and 30.25 g respectively. The mean lengths of long-tailed vole, deer mouse, and brush mouse are 9.4 cm, 7.59 cm, and 9.45 cm respectively. On TA-16 mesa, the mean weights of long-tailed vole and deer mouse are 32.67 g and 18.22 g, and the mean weights of long-tailed vole and deer mouse are 8.77g and 7.78g. No brush mice were captured on TA-16 mesa.

6.4.3 Sensitive Species

3D Environmental Services, Inc. (Tryell and Brack 1992) conducted a large-scale survey for spotted bat, *Euderma maculatum*, and an inventory of other bat species during the summer of 1992. One of the study sites was at a small pond on the east side of West Jemez Road in TA-8 just north of OU 1082. A total of 94 bats, 13 species, were captured in 16 net nights between June 30 and July 5. The pond site supported the highest number of unique species. Forty-four bats of ten species were captured in three net nights at the pond site: big brown bat, silver-haired bat, hoary bat, California myotis, long-eared myotis, small-footed myotis, fringed myotis, long-legged myotis, Yuma myotis, and Brazilian free-tailed. These species have been included in Appendix B. No spotted bats were captured during the study at this site or any sites. Furthermore, no spotted bats have been caught previously in Los Alamos County, although they have been caught in Bandelier National Monument.

7 DISCUSSION

7.1 Level 2 (Habitat Evaluation) Surveys

The classification breakdown for both upland and wetland vegetation types for the Pajarito Plateau is included in Appendix E. This list includes known and potential habitat types and phases and is based on Brown *et. al.* (1982), Moir and Ludwig (1979) and USFS (ND). No attempt was made to develop new habitat types for the area. If a study area did not fit within one of the designated habitat types previously defined for northern New Mexico, the habitat type was considered "potential." Further studies are necessary to make a complete and accurate determination.

The vegetation surveys indicated that OU 1082 is primarily in the Rocky Mountain Montane Conifer Forest Community. This community can further be divided into series and, more specifically, habitat types.

7.1.1 Rocky Mountain Montane Conifer Forest

This community consisted of two vegetation series, the ponderosa pine series and the Douglas fir series. Each of these series could be further divided into habitat types (HT). The ponderosa pine series can be further divided into six HTs. The ponderosa pine-Gambel oak HT is found on the mesa and north-facing slopes. Another HT on the

mesa is the ponderosa pine-bluegrass HT found in areas previously used as fields or pastures. Mesa areas burned in the 1977 La Mesa fire are characterized as ponderosa pine-aspen HT. Two HTs are found on south-facing slopes: ponderosa pine-one-seed juniper HT and in burned areas, Gambel oak-mountain muhly HT. Canyon bottoms in the OU exhibit ponderosa pine-Douglas fir HTs. The Douglas fir series contains the Douglas fir-Gambel oak HT which is found on the burned north-facing slopes of Water Canyon. Burned areas typically show proportionally more species of low succession stages and cannot be considered to be in the climax stage.

7.2 Level 3 (Species Specific) Surveys

We compared habitat information collected from the Level 1 and Level 2 field surveys with that in the database for each sensitive species and for threats to the taxon. Based on these comparisons, we either dismissed species from further consideration or conducted additional surveys (Level 3) to confirm the presence or absence of the species within that habitat. Additional surveys for some species were not completed during the 1992 field season but are scheduled to be conducted during the 1993 field season.

7.2.1 Species Dismissed from Further Consideration

Based on the information gained from the Level 1 and Level 2 field surveys and previous data, we concluded that the following species are not present in OU 1082 or are not expected to be impacted by the proposed project.

7.2.1.1 Plants. Checker lily (*Fritillaria atropurpurea*) occurs between 6000 and 9000 ft (1829 to 2743 m) on plains and slopes in wooded areas. It has been previously found in Los Alamos County but not within OU 1082 or Water Canyon. The plant was not found in the OU during Level 1 or Level 2 surveys.

Sandia alumroot (*Heuchera pulchella*) has previously been found in Bernalillo, Sandoval, San Miguel, Sierra, Socorro, and Torrance counties. It has not been found in Los Alamos County. It is a cliff loving plant found in mixed-conifer forests 8000-12,000 ft (2442 to 3658 m). The maximum elevation in OU 1082 is 7700 ft (2347 m). Sandia alumroot was not found during Level 1 or Level 2 surveys and is not likely to occur in OU 1082.

Pagosa phlox (*Phlox caryophylla*) is found on open slopes and open ponderosa-piñon woodlands between 6500 and 7500 ft (1981 to 2286 m). It has been found only in Rio Arriba County. No plants were encountered during Level 1 or Level 2 surveys.

7.2.1.2 Wildlife. The common black hawk (*Buteogallus anthracinus*) is found in cottonwoods and other woodlands along permanent streams. It has occurred in small numbers in the Rio Grande Valley. However, the canyons in OU 1082 contain limited riparian zones and do not support strong cottonwood communities, therefore the habitat is marginal at best. Additionally, there have been no sightings of this raptor within Los

Alamos County. This medium-sized raptor is primarily affected by destruction of riparian zones.

The willow flycatcher (*Empidonax trailii*) occurs statewide in spring and autumn migrations. Breeding, however, is confined to riparian areas dominated by cottonwoods. No cottonwood-dominated riparian areas are found in OU 1082.

Peregrine falcon (*Falco peregrinus*) breeding territories center on cliffs that are in wooded or forested habitats. Most of the areas in upper Water Canyon are not suitable for nesting and foraging.

Mexican spotted owl (*Strix occidentalis lucida*) occurs in mixed-conifer forests or ponderosa-Gambel oak forests with the following characteristics: multi-storied stands, moderately closed to closed canopy, large, mature trees, and stand decadence as indicated by the presence of mistletoes, broken tree tops, standing dead trees and fallen logs (US Fish and Wildlife Service 1990). They nest in trees, crevices, or small caves (Travis 1992). There are known occurrences and breeding of the spotted owl in Bandelier at higher elevations; however, there is no evidence they use OU 1082. Furthermore, the mixed conifer habitat characteristics within the OU do not fit the USFWS standards nor are they continuous enough to provide an adequately large area. Most of the mixed conifer within the OU was burned during the 1977 La Mesa fire.

Bald eagles (*Haliaeetus leuccephalus*) winter along the Rio Grande. Winter roosts have been observed at Cochiti Lake. Mortandad Canyon upriver from Water Canyon has some suitable roosting areas but no confirmed roosting sites. Suitable roosting sites consist of large trees and areas protected from wind. Within Water Canyon there are large trees associated with the stream in the canyon bottom. However, no bald eagles were seen within Water Canyon during the surveys or in any previous studies.

The Mississippi kite (*Ictinia mississippiensis*) generally inhabits the lower Rio Grande and Pecos Valleys in riparian zones and shelter belts and frequents manicured environments such as parks and golf courses. This species has not been reported in the Los Alamos area.

The pine marten (*Martes americana*) occurs in the San Juan and Sangre de Cristo mountains and has been reported without verification in the Jemez Mountains. Optimum habitat for pine martin appears to be mature, old-growth spruce-fir communities with more than 30% canopy cover, a well-established understory of fallen logs and stumps, and lush shrub and forb vegetation (New Mexico Department of Game and Fish 1988). No communities of this type were found during Level 1 and Level 2 surveys.

7.2.2 Species for which Level 3 Surveys were Conducted

7.2.2.1 Plants. No species-specific surveys for plants were conducted. However, the wood lily (*Lilium philadelphicum*) has been found in Los Alamos County and is likely to occur in OU 1082, although none were found during Level 1 and Level 2 surveys. Wood lily grows in mixed-conifer forests between 6000 and 10,000 ft (1829 to 3048 m).

7.2.2.2 Wildlife. Based on the Level 1 (reconnaissance) and Level 2 (habitat evaluation) surveys and on data collected from previous studies, habitat requirements for the spotted bat (*Euderma maculatum*) were found within OU 1082. Spotted bat inhabits

a wide range of habitats including ponderosa pine and mixed-conifer plant communities. The bat roosts in cliffs or rock crevices and comes to open water (ponds or pools in streams) to drink. Reconnaissance surveys indicated that cliffs and rock crevices, and water sources are all available in the OU or immediately adjacent to the OU. 3D Environmental Services, Inc. (Tryell and Brack 1992) conducted a large scale survey for spotted bat, *Euderma maculatum*, and an inventory of other bat species during the summer of 1992. One of the study sites was at a small pond on the east side of West Jemez Road in TA-8 just north of OU 1082. Forty-four bats of ten species were captured in three net-nights at the site. The pond site supported a higher number of unique species than all other sites; however, the mist netting did not reveal any spotted bats at the site or at any sites. Furthermore, no spotted bats have been caught previously in Los Alamos County, although they have been caught in Bandelier National Monument. However, because some spotted bat habitat requirements exist with OU 1082, a Level 3 survey in OU 1082 must be conducted by BRET prior to any sampling that may disturb or alter the routes of existing water sources within the OU. Further studies and surveys on the distribution of spotted bats are being conducted.

Although no Level 3 survey was conducted for broad-billed hummingbirds (*Cynanthus latirostris*), they have been identified in the riparian woodlands in Bandelier National Monument and could potentially occur in the riparian areas of OU 1082. Although they breed primarily in the southern part of the state, they can occur as vagrants near Los Alamos.

J. Biggs and D. Raymer conducted extensive small mammal surveys during 1992 to compare small mammal species diversity (Raymer and Biggs 1993) and physical characteristics (Biggs and Raymer 1993) near NPDES outfall streams, natural streams, and dry streams. Raymer and Biggs reported differences in respect to total and daily number of unique species, total and daily percent capture rates, and total and daily species diversity. In respect to total number of unique species, two sites sampled, the Cañon de Valle outfall site the TA-16 mesa outfall site, were not significantly different from each other but were significantly different from both natural sites and dry sites. Tests showed a significant difference in percent capture rates between the two sites, with the Cañon de Valle outfall site similar to natural stream areas and the TA-16 mesa outfall site similar to other outfall areas.

While there were no significant differences found in species diversity among habitat types (dry, outfall and natural), analyses showed significant differences ($p=0.0008$) in species diversity between some sites. For example, the TA-16 mesa outfall site was significantly lower than natural areas in two variables (daily mean number of species and species diversity), but it was not significantly different in daily mean percent capture rate. The high mean percent capture rate was primarily due to the captures of one species, the deer mouse. Raymer and Biggs stated that a high density of a single species indicates an ability of the area to support high numbers of small mammals, but noted that the area's species diversity was extremely low. They suggest the area may be inaccessible to colonization. Edeskuty, Foxx and Raymer (1991) reported the outfall-created stream does not reach the main water course of any canyon.

In respect to the physical characteristics (weight and length) of small mammals, Biggs and Raymer (1993) reported that the outfall areas were not significantly different

from the natural stream areas, although they were significantly different from the dry areas. Based on these results, it appears that the dry areas are distinct from the wet areas in their productivity. The mean weights and lengths in the dry areas were, in many cases, lower than the same characteristics in the outfalls and naturally wet areas. It also appears that the outfalls and naturally wet areas are similar with respect to their productivity. The fact that physical characteristics of species captured are not significantly different between natural and outfall areas, may suggest that outfalls are not adversely impacting the wildlife species utilizing them.

8 IMPACTS

8.1 Wetlands and Floodplains

Impacts are associated primarily with soil sampling and related soil sampling activities. Therefore, BRET must be notified prior to any other sampling activities so that they can review and assess potential impacts on biological resources. Sampling within the OU may include surface samples to a depth of 6 in (15 cm) or deep core drilling to a depth of more than 200 ft (60 m). If any sampling with heavy equipment, coring or other disturbances take place near wetlands and floodplains, the following impacts could occur:

- Disturbance to stream channels or smaller drainages leading into stream channels could result in an alteration of existing wetlands, which could cause partial or complete loss of those wetlands.
- Excessive disturbance to the vegetation and soil surface could result in an alteration of water flow or a widening of a channel.
- Disturbance along the drainages as well as to the steeper slopes could result in an initiation of or increase in soil erosion. This could also cause localized alterations in wetlands.
- Hazardous fuel spills or leaks from vehicles could negatively affect water quality in drainages, streams and wetlands and could result in negative changes to vegetation.

8.2 Threatened, Endangered and Sensitive Species

8.2.1 Plants

The wood lily (*Lilium philadelphicum*) has been found in Los Alamos County and is likely to occur in OU 1082, although none were found during Level 1 and Level 2 surveys. Wood lily grows in mixed-conifer forests between 6000 and 10,000 ft (1829 to 3048 m). The proposed site characterization is not expected to affect the wood lily if riparian areas, wetlands, stream channels, and moist woodlands are not sampled. However, any type of vehicle activity or use of heavy equipment in riparian areas, along

stream channels, and in moist woodlands could impact the wood lily and its habitat by destroying both the plant and its habitat.

8.2.2 Wildlife

Surveys conducted for raptors in OU 1082 have not revealed any nesting goshawks; however, goshawks are known to occur in Bandelier National Monument directly adjacent to OU 1082. Additionally, the habitat components necessary to goshawks exist within OU 1082 and it is a known hunting area. Impacts to goshawk include human disturbance and disturbance by heavy equipment during the mating and nesting season, May through October.

Jemez Mountains salamanders inhabit cool, moist, shaded, wooded habitats 7225-9250 ft (2201 to 2720 m) usually on north-facing slopes. They have been found to the west of the OU across West Jemez road and may occur on north-facing slopes within OU 1082 boundaries. The proposed site characterization is not expected to affect the Jemez Mountains salamander if north-facing slopes are not sampled. However, if sampling occurs near the rim or on the north-facing slopes of Cañon de Valle or Water Canyon, activities could impact salamanders and their habitat. Impacts to the salamander and its habitat include tree removal, soil disturbance and removal of downed logs.

Spotted bats are not known to occur in Los Alamos County, but enough habitat components are present in OU 1082 to potentially support the species. The spotted bat is found in piñon juniper, ponderosa pine, mixed-conifer, and riparian habitats. Its two critical requirements are a source of water and roost sites (caves in cliffs or rock crevices). Some of the canyons may have suitable roost sites, and some potential water sources exist within the OU (suitable water sources are defined as small ponds or pools of slow moving water). To date, no spotted bats have been mist-netted on LANL lands. No adverse impact is expected to occur to the spotted bat if small caves and rock crevices are not disturbed and water sources are not altered. However, if any sampling takes place that disturbs small caves or rock crevices or alters water sources, BRET personnel must be notified to conduct a survey of roosting sites prior to sampling.

The preferred habitat of the meadow jumping mouse consists of the vegetation zone along permanent streams (Morrison 1990). They use areas immediately adjacent to streams up to 150 ft (46 m) from streams (Brown 1970). Suitable habitat may be present in the canyon bottoms of the OU. Any impacts to wetlands and floodplains (including an area of 150 ft (46 m) on each side of the stream channel, wetland or floodplain), will impact meadow jumping mouse. Also, any type of vehicle activity within 150 ft (46 m) of a riparian area, stream, wetland, or floodplain will impact the meadow jumping mouse.

Cooper's hawk, red-tailed hawk, American kestrel, flammulated owl and great horned owl are known to breed in and adjacent to OU 1082. While these species do not have threatened or endangered status, they are protected from harassment and collection. Impacts to these species include excessive activity or noise, especially near canyon rims, during the mating and nesting periods of May through October.

Broad-billed hummingbirds (*Cyananthus latirostris*) have been identified in the riparian woodlands in Bandelier National Monument and could potentially occur in the riparian areas of OU 1082. Although they breed primarily in the southern part of the state,

they can occur as vagrants near Los Alamos. Impacts to these birds would be disruption of habitat by any vehicular activity or soil sampling with heavy equipment along in canyons, along riparian areas, stream channels, and wetlands.

8.3 Nonsensitive Species

8.3.1 Plants

Heavy machinery could impact topographic features and drainage zones of OU 1082 in the following ways:

- Removal or excessive disturbance to existing vegetative cover could result in an initiation of or increase in erosion or alterations of drainage patterns, both within the canyon bottoms (including stream channels) and along the canyon slopes.
- Disturbance or damage to riparian vegetation could result in partial or complete loss of wetlands, which could further result in the partial loss of associated riparian vegetation.

8.3.2 Wildlife

The habitat in OU 1082 is suitable for nesting, foraging and perching for a variety of bird species, large mammals and other wildlife species. Excessive disturbance or disturbance during critical periods could result in one or more of the following:

- Direct removal of nesting, perching, cover and similar habitats both along canyon slopes and on mesas.
- Nest abandonment by birds, which would result in nest failure.
- An interference with critical periods such as the breeding period.
- Contamination of wildlife water sources from fuel spills or leaks from vehicle and machinery.

9 MITIGATION

No significant release of contaminants into the environment is expected to occur during sampling. However, should release of contaminants rise above the predetermined action level, workers must cease operations, shut down the site, and reassess the sampling.

9.1 Floodplains and Wetlands

Sampling for site characterization could range from surface sampling to core drilling. Sampling should remain outside designated wetlands. Delineation of the wetland boundaries will be completed before sampling to ensure that sampling occurs outside those designated areas. Delineations should be done within two years of the sampling; after two years, the delineation is no longer valid and must be repeated. Wetlands are found in the bottom of Water Canyon, behind Bldg. 16-90, and along the streams created by 14 OU outfalls: 03A-060, 04A-083, 04A-091, 04A-092, 04A-157, 05A-052, 05A-053, 05A-054, 05A-058, 05A-061, 05A-069, 05A-071, 05A-072, and 06A-073 (see Section 3.4 for descriptions).

9.2 Threatened, Endangered and Sensitive Species

9.2.1 Plants

The wood lily could possibly occur along riparian areas, stream channels, and in moist woodlands in the OU. Mitigation measures include:

- Restrict vehicle activity and use of heavy equipment within these areas.
- If larger equipment other than hand augers is used in any canyon bottom or riparian area, a biologist from EM-8 will be present prior to sampling and will conduct a survey of the area. Please note that these surveys must be done during the flowering period occurring between May and August.
- Prior to any disturbance BRET must approve sampling that may alter any existing water source.
- Avoid unnecessary disturbance (i.e., parking areas, equipment storage areas, off-road travel) to surrounding vegetation during actual sampling and when traveling into the sampling sites.
- Avoid removal of vegetation along riparian areas, drainage systems and stream channels.
- Avoid disturbance to vegetation along canyon slope and especially to drainages.

9.2.2 Wildlife

9.2.2.1 Northern goshawk. There is evidence that goshawks nest in OU 1082. Many of the habitat components required for the goshawk are present and nests are known to occur immediately adjacent to OU 1082 in Bandelier National Monument. In

order to provide some protection of this possible goshawk habitat the following mitigation measures are required:

- Any machine sampling occurring between March 1 and September 31 must be cleared through BRET. BRET must be contacted 60 days prior to sampling to evaluate possible nest sites in and around the sampling area.
- If any sampling area over one-tenth acre will be disturbed, BRET must be contacted for a presampling site specific survey.
- Any tree removal (live or snag) must be approved by BRET.

9.2.2.2 Jemez Mountains salamander. The following mitigation measures are required for sampling on the north-facing slopes of Cañon de Valle and Water Canyon within OU 1082:

- A biologist from EM-8 will be present during sampling. If any salamanders are discovered, all ground-disturbing activities at that site will cease.
- Any trees that are cut will be left to enhance habitat.
- Activity will not be permitted when the soil surface has a high moisture content.
- All disturbed areas will be revegetated with native plants.

9.2.2.3 Spotted bat. There is no known occurrence of the spotted bat in Los Alamos County. However, potential habitat exists in OU 1082. In order to avoid adverse impacts to spotted bat habitat the following mitigation measures are required:

- If equipment larger than hand augers is used on any canyon slopes, a biologist from EM-8 will be present prior to sampling and will conduct a survey of all rock crevices in the sampling area. If any evidence of bats is found in the sampling area, all sampling with heavy equipment will be canceled.
- BRET must approve sampling that may alter any existing water source prior to any disturbance of that source.

9.2.2.4 Broad-billed hummingbirds. No broad-billed hummingbirds were found in the 1992 surveys, however they could potentially occur in the riparian areas of OU 1082. Mitigation measures include the following:

- Before any machine sampling can be done in canyon bottoms and riparian areas between May 1 and September 15, BRET must be notified in order to survey the area. If evidence of the bird is found in the sampling area, all sampling with heavy equipment will be postponed until mid-September.
- Prior to any disturbance of wetlands, riparian areas, or stream channels, BRET must approve sampling that may alter any existing water source.

9.2.2.4 Meadow jumping mouse. The preferred habitat of the meadow jumping mouse consists of the vegetation zone along permanent streams (Morrison 1990). Suitable habitat may be present in the canyon bottoms of OU 1082. The proposed sampling is not expected to affect the meadow jumping mouse if no sampling occurs in canyon bottoms or in wetlands. However, if sampling will occur in canyon bottoms, floodplains, or wetlands, the following mitigation measures must be followed:

- If any sampling occurs in canyon bottoms, floodplains or wetlands BRET must be contacted 60 days prior to the sampling start date in order to conduct site-specific surveys. Also note: surveys for the meadow jumping mouse can only be conducted during the rainy season, late June through mid August.
- BRET must approve sampling that may alter any existing water source prior to any disturbance of that source.

9.2.2.5 Sensitive species. Cooper's hawk, red-tailed hawk, American kestrel, flammulated owl and great horned owl are known to occur in OU 1082. To prevent adverse impacts on these raptors, sampling along the edge of canyons and in canyons should be done between September 1 and February 28, a period outside the critical mating, nesting and fledging times. Mitigation measures for the northern goshawk will also help protect these species.

9.3 Nonsensitive Species

9.3.1 Plants

Site sampling and subsequent corrective actions could require mitigation by revegetation if the loss of vegetation initiates or increases erosion. Survey results indicate that a mixture of native grasses, forbs and other herbaceous plants are a few of the species that could be used for revegetation; consultation with BRET or state or federal agencies can help determine more specific species.

Additional mitigation measures include the following:

- Avoid unnecessary disturbance (i.e., parking areas, equipment storage areas, off-road travel) to surrounding vegetation during actual sampling and when traveling into the sampling sites.

- Avoid removal of vegetation along riparian areas, drainage systems and stream channels.
- Avoid disturbance to vegetation along canyon slope and especially to drainages.

In addition to the previously discussed measures, BRET requests notification before disturbances other than soil sampling so that more accurate and effective mitigation measures can be provided.

9.3.2 Wildlife

Most potential impacts to wildlife species should not be adverse and it is projected that only during the period of actual disturbance will wildlife avoid the area. However, if heavy machinery is to be used, the following mitigation measures should further reduce the potential for impact:

- Avoid crossing drainages where there is water; use existing roads or cross level areas that are dry or less vegetated.
- When possible, avoid sampling from March 1 to August 1.

Disturbances to wintering species should be minor, and the mitigation measures provided will help to reduce the impact to wildlife species.

10 CONCLUSION

We summarized historical and biological reports of previous site surveys to provide background information on OU 1082. These summaries provide inventory information that may be used in future ecological risk assessments and pathway analyses.

We conducted Level 1 and 2 field surveys within OU 1082. Level 3 surveys were conducted for nocturnal small mammals, and a LANL-wide survey was conducted for spotted bat. In addition, we searched the TES database for species that could occur within the site habitats. As a result, a number of species on the state and federal protection list were shown as occurring in the habitats described for Los Alamos County and the surrounding areas.

We conducted a habitat evaluation (Level 2) survey to determine if the specific requirements of the listed species could be met in the sampling locations. Habitat requirements were found in OU 1082 for Jemez Mountains salamander, northern goshawk, spotted bat and meadow jumping mouse. These species need special consideration while sampling in OU 1082. Mitigation to avoid impact to the Jemez Mountains salamander includes monitoring of sampling activity by BRET, leaving any cut trees as logs to enhance habitat, restriction of sampling activity when soil moisture content is high, and revegetation. Mitigation to avoid impact to the goshawk include presampling

surveys to determine presence, restrictions on tree removal, and sampling outside sensitive periods (March 1 to September 31). Mitigation measures that protect the goshawk will also avoid impact to Cooper's hawk, red-tailed hawk, American kestrel, flammulated owl and great horned owl. Mitigation to avoid impact to the spotted bat or meadow jumping mouse includes presampling surveys to determine presence of, and restrictions on, altering existing water courses.

We used the National Wetland Inventory Maps in combination with field checks to record all wetlands and floodplains in OU 1082. There are four areas within OU 1082 that have been classified by the National Wetland Inventory as possible palustrine wetlands. There are also 27 NPDES outfalls within the OU and at least 14 have wetland vegetation associated with them. These areas may be classified as jurisdictional wetlands. Delineation of wetland boundaries was not completed during these surveys because of the continual changes of wetland systems. However, boundaries will be delineated prior to sampling to assure that sampling is outside of areas meeting the wetland criteria (hydrophytic plants, hydric soils and hydrology). Delineation's are valid for only two years.

Mitigation measures (or best management practices) to help reduce the impact to nonsensitive plant and wildlife species include (1) determining when sampling should be conducted, (2) using preventative measures to avoid excessive disturbance to the habitat, and (3) notifying BRET before initiating any disturbances other than soil sampling.

11 DEFINITIONS

Biological Resource Evaluation Team (BRET): Persons within the Environmental Protection group (EM-8) responsible for the biological assessments.

Biotic Community: A term used for Biotic Community Classification that refers to a unit characterized by a distinct evolutionary history within a formation and are centered in a biogeographical region that has a particular precipitation pattern or climatic regime.

Biotic Community Classification: The categorization of biogeographical regions into communities based on evolutionary history, precipitation patterns, and climatic regimes.

Climatic Zone: A term used for Biotic Community Classification that refers to one of the four world climatic zones where minimum temperature is the primary determining factor in separation of Formation Types. These include Arctic-boreal, Cold Temperature, Warm Temperate, and Tropical-subtropical.

Critical habitat: Air, land or water area and constituent elements, the loss of which would appreciably decrease the likelihood of survival and recovery of a listed species or a distinct segment of its population.

Facultative (FAC): Plants equally likely to occur in wetlands or nonwetlands (estimated probability 34%-66%).

Facultative Upland (FACU): Plants that usually occur in nonwetlands (estimated probability 67%-99%), but occasionally are found in wetlands (estimated probability 1%-33%).

Facultative Wetland (FACW): Plants that usually occur in wetlands (estimated probability 67%-99%), but occasionally are found in nonwetlands.

Federal Candidate (C1) Species: Taxa for which substantial USFWS data concerning the biological vulnerability and threat(s) to that species support proposals to list that species as endangered or threatened.

Federal Candidate (C2) Species: Taxa for which USFWS information indicates that proposing to list the species as endangered or threatened is possibly appropriate, but for which conclusive data on biological vulnerability and threat(s) are not currently available.

Federal Endangered Species: Any species which is in danger of extinction throughout all or a significant portion of its range.

Federal Threatened Species: Any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

Floodplains: Lowlands adjoining inland and coastal waters and relatively flat areas and flood-prone areas of offshore islands including, at a minimum, that area inundated by 1.0% or greater chance of flood in any given year. The base floodplain is defined as the 100-year (1.0%) floodplain. The critical action floodplain is defined as the 500 year (0.2%) floodplain.

Formation Type: A term used for Biotic Community Classification that refers to the formations that are vegetative responses to various environmental factors, primarily available soil moisture, and include the following: Tundra, Forest and Woodland, Scrubland, Grassland, Desertland and Non-vascular (in the Upland Vegetation Type) and Wet Tundra, Forest, Swamp-scrub, Marshland, Strand, and Submergent (in the Wetland Vegetation Type).

Habitat Type: A term used for Biotic Community Classification that is based on the occurrence of particular dominant species that are local or regional in distribution.

High potential of occurrence: The species is known to occur in the area.

Hydric soil: A soil that is saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions in the upper part.

Hydrology: The presence of, distribution of, and circulation of water.

Hydrophyte: Any plant that grows in water or on a substrate that is at least periodically deficient in oxygen as a result of excessive water content; plants typically found in wetlands and other aquatic habitats.

Level 1 Survey: A reconnaissance survey to determine if a proposed project is in a developed Technical Area or an area that is otherwise disturbed. Non-quantitative data about the area is obtained.

Level 2 Survey: A detailed quantitative vegetation survey that is used to evaluate whether critical habitat requirements for a threatened and endangered species are present at a proposed project area.

Level 3 Survey: A survey aimed at obtaining information on a specific threatened or endangered species, floodplain or wetland.

Low potential of occurrence: The area does not have species habitat components.

Medium potential of occurrence: The area has some species habitat components.

National Environmental Policy Act (NEPA): A major environmental law which became effective in 1970. The law requires all projects/programs which receive federal funds to be evaluated for environmental impacts.

Nationwide Permits (NWP): Permits issued by the Corps of Engineers that pertain to specific conditions concerning impacts to wetlands as stated in the regulations.

Obligate Upland (UPL): Plant species almost always occurring (estimated probability >99%) under natural conditions in nonwetlands in the region specified, but can also occur in wetlands in another region. If a species does not occur in wetlands in any region, it is not on the "National List".

Obligate Wetland (OBL): Plant species almost always occurring (estimated probability >99%) under natural conditions in wetlands.

Palustrine: A forested wetland, usually adjacent to a lake; having to do with a marsh, bog or swamp.

Phase: A term used for Biotic Community Classification that is based on detailed data collection in determining co-dominants, understories and other species.

Riparian: Green-belts along streams, lakes, or other wet areas. These areas are presently only marginally protected by State and Federal law but have become areas of concern.

Series: A term used for Biotic Community Classification that refers to principal plant-animal communities within each biotic community. These are based on distinct climax plant dominants.

Solid Waste Management Unit (SWMU): Any discernible unit at which solid wastes have been placed at any time, irrespective of whether the unit was intended for the management of solid or hazardous waste.

Species Area Curve: Calculated by comparing total number of individual plant species recorded along a transect to total number of plots.

State Endangered Group 1: Any wildlife species or subspecies whose prospect of survival or recruitment in New Mexico are in jeopardy.

State Endangered Group 2: Any wildlife species or subspecies whose prospect of survival or recruitment in New Mexico may be in jeopardy. These species are protected by State law.

State Endangered Plant: A plant which has been listed on New Mexico's state endangered list. The plant is rare in numbers or occurrences and its further existence in the state is threatened without protection.

State Endangered Plant (1): This taxon is listed as threatened or endangered under the provisions of the Federal Endangered Species Act or is being considered under the tenets of the act.

State Endangered Plant (2): This taxon is rare across its entire range and is of such limited distribution and population size that unregulated collection could have adverse impacts and jeopardized its survival in New Mexico.

State Endangered Plant (3): This taxon may be widespread in its distribution and may occur in adjacent states or Mexico, but because its numbers are being significantly reduced, the survival of this species in New Mexico is jeopardized.

State Sensitive Plant: A plant species whose numbers or occurrences are low in the state. These species are monitored by the state to see if their status needs to be upgraded to endangered. Currently, state sensitive plants are not protected by State law.

Threatened, Endangered and Sensitive (TES) Species Database: A database constructed by LANL that lists and provides information on all state and federal endangered/threatened species occurring or potentially occurring in Los Alamos County and surrounding counties.

Vegetation Type: A term used for Biotic Community Classification that refers to vegetation established within an existing climatic zone and includes one of the two Types: Upland and Wetland.

Wetlands: Lowland areas that when inundated by surface or ground water can support a prevalence of vegetative or aquatic life that requires saturated or seasonally saturated soil conditions for growth and reproduction. Wetlands generally include swamps, marshes, bogs, and similar areas such as sloughs, potholes, wet meadows, river overflow, mudflats, and natural ponds.

12 SUMMARY OF PERTINENT REGULATIONS

Bald Eagle Protection Act: Provides guidelines and requirements for the protection of Bald Eagles and their habitat.

Code of Federal Regulations 10 CFR 1022: Establishes policy and procedures for discharging the Department of Energy's responsibilities with respect to compliance with EO 11988 and EO 11990.

Department of Energy Order 5400.1: Establishes the environmental protection program for DOE operations.

The Endangered Species Act (16 USC 1531 *et. seq.*): Declares the intention of Congress to conserve threatened and endangered species and the ecosystems on which those species depend.

Executive Order (EO)11990: Protection of Wetlands. In furtherance of the National Environmental Policy Act of 1969, this EO calls for avoidance, "to any extent possible, the long and short term adverse impacts associated with the destruction or modification of wetlands...avoid direct or indirect support of new construction in wetlands.. "

Executive Order 11998: Floodplain Management. This EO was initiated to "protect lives and property with the need to restore and preserve natural and beneficial floodplain values..."

Migratory Bird Treaty Act (16 USC 703-711): Declares the protection of wild birds from collecting and maiming. Wild birds exclude resident game bird, English sparrows, starlings, and feral pigeons.

National Environmental Policy Act: Declares a national policy to encourage a productive and enjoyable harmony between man and his environment. Section 102 requires "that presently unquantified environmental amenities and values may be given appropriate consideration in decision-making along with economic and technical considerations..."

New Mexico Endangered Plant Species Act Provides protection for all threatened and endangered plant species as listed by the state of New Mexico.

New Mexico Wildlife Conservation Act: Gives jurisdiction to the New Mexico Department of Game and Fish over all indigenous, nondomestic vertebrate species, crustaceans, and mollusks. Also states that federal activities that result in harassment or attempted harassment are prohibited.

Resource Conservation and Recovery Act: Public Law 94-80. Outlines requirements for hazardous waste storage and improvement of solid waste systems, and promotes recycling.

Section 404 Clean Water Act: Provides for issuance of "permits", after notice and opportunity for public hearings of discharged or dredged or fill materials into navigable waters...

ACKNOWLEDGMENTS

This survey was funded and completed in cooperation with the Environmental Restoration Program, Los Alamos National Laboratory.

The study was directed by Teralene Foxx, Project Ecologist for the Biological Resource Evaluations Team (BRET). BRET is a part of the Environmental Assessments and Resource Evaluations section of the Environmental Protection Group, EM-8.

Field personnel included Teralene Foxx, BRET Supervisor and Project Leader; Alethea Banar, Ecologist, Graduate Research Assistant; Kathryn Bennett, Environmental Scientist; James Biggs, Wildlife Biologist; Saul Cross, Botanist; Dan Dunham, Botanist; David Lawrence, Undergraduate Research Student; Mary Salisbury, Technician; and Delia F. Raymer, Wildlife Biologist, Graduate Research Assistant. Additional information was gathered in cooperation with Bandelier National Park and the New Mexico Department of Game and Fish. Editorial comments and advice was provided by Jody Benson.

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APPENDIX A

**SUMMARY OF OUTFALL INFORMATION FOR OUTFALLS
WITHIN OPERABLE UNIT 1082.**

Summary of NPDES outfall information for outfalls in OU 1082

EPA #	LOCATION			Type of Discharge	Length of (ft)	Hydrophytic Vegetation
	TA	Building	Canyon			
02A-007	16	540		Boiler blowdown	1000	N
03A-060	16	430	Water	Treated cooling water	50	Y
03A-130	11	30	Water	Treated cooling water	100	N
04A-070	16	220	de Valle	Noncontact cooling water	10	Y
04A-083	16	202	Water	Noncontact cooling water	200	Y
04A-091	16	450	Water	Noncontact cooling water	10	N
04A-092	16	370	Water	Noncontact cooling water	50	Y
04A-157	16	460	Water	Noncontact cooling water	1000	Y
05A-052	16	380	Water	High explosive discharge		Y
05A-053	16	410	Water	High explosive discharge	50	Y
05A-054	16	340	de Valle	High explosive discharge	1000	N
05A-055	16	363	de Valle	High explosive discharge	125	N
05A-056	16	2601	de Valle	High explosive discharge	450	N
05A-057	16	267		High explosive discharge	200	N
05A-058	16	370	Water	High explosive discharge	600	Y
05A-061	16	280	de Valle	High explosive discharge	400	Y
05A-062	16	342	de Valle	High explosive discharge		N
05A-063	16	400		High explosive discharge	10	N
05A-069	11	25	Water	High explosive discharge		Y
05A-071	16	430	Water	High explosive discharge	100	Y

05A-072	16	460	Water	High explosive discharge	1000	Y
05A-096	11	25	Water	High explosive discharge	50	N
05A-097	11	25	Water	High explosive discharge	40	N
05A-149	16	267		High explosive discharge		N
05A-159	16	460	Water	High explosive discharge		N
06A-073	16	222	de Valle	Photo wastes	350	Y
SSS-03S	16	340	Water	Sewage Treatment Plant	500	Y

APPENDIX B

PLANT SPECIES ACTUALLY (CONFIRMED) AND POTENTIALLY
OCCURRING WITHIN OPERABLE UNIT 1082.

APPENDIX B: Plant species actually (confirmed) and potentially occurring within Operable Unit 1082

FAMILY	SCIENTIFIC NAME	COMMON NAME	INDICATOR STATUS**
ACERACEAE	<i>Acer glabrum neomexicanum</i>	New Mexico maple	FAC
	<i>Acer negundo</i>	Box elder	FACU
ANACARDIACEAE	<i>Rhus radicans</i>	Poison ivy	-
	<i>R. trilobata</i>	Squawbush	-
APOCYNACEAE	<i>Apocynum androsaemifolium</i> var. <i>androsaemifolium</i>	Spreading dogbane	-
ASCLEPIADACEAE	<i>Asclepias tuberosa</i>	Butterflyweed	-
BERBERIDACEAE	<i>Berberis fendleri</i>	Colorado barberry	-
BETULACEAE	<i>Betula occidentalis</i>	Water-birch	FACW
BORAGINACEAE	<i>Hackelia hirsuta</i>	Beggerlice	-
	<i>Lappula texana</i>	Stickseed	-
	<i>Lithospermum incisum</i>	Fringed puccoon	-
	<i>L. multiflorum</i>	Many-flowered stoneseed	-
	<i>Mertensia lanceolata fendleri</i>	Bluebells	-
	<i>M. lanceolata secundorum</i>	Bluebells	-
CACTAEAE	<i>Echinocereus triglochidiatus</i>	Claret-cup cactus	-
	<i>Campanula rotundifolia</i>	Harebell	FAC
CAMPANULACEAE	<i>Arenaria fendleri</i>	Fendler sandwort	-
CARYOPHYLLACEAE	<i>Cerastium</i> sp.	Chickweed	-
	<i>Stellaria jamesiana</i>	James starwort	-
CELASTRACEAE	<i>Pachystima myrsinites</i>	Myrtle boxleaf	-
CHENOPODIACEAE	<i>Chenopodium album</i>	Lamb's quarters	FAC, FACU
	<i>C. fremontii</i>	Fremont goosefoot	-
	<i>C. gigantospermum</i>	Chenopodium	-
	<i>C. graveolens</i>	Chenopodium	-
COMPOSITAE	<i>Achillea lanulosa</i>	Western yarrow	-
	<i>Ambrosia coronopifolia</i>	Ragweed	-
	<i>A. psilostachya</i>	Western ragweed	FAC
	<i>Anaphalis margaritaceae</i>	Pearly-everlasting	-

	<i>Antennaria parvifolia</i>	Pussytoes	-
	<i>Artemisia bigelovii</i>	Bigelow sagebrush	-
	<i>A. carruthii</i>	Wormwood	-
	<i>A. dracunculus</i>	False tarragon	-
	<i>A. franserioides</i>	Ragweed sagebrush	-
	<i>A. frigida</i>	Estafiata	-
	<i>A. ludoviciana</i>	Wormwood	-
	<i>A. sp.</i>	Wormwood	-
	<i>Aster bigelovii</i>	Bigelow aster	-
	<i>A. laevis</i>	Smooth aster	-
	<i>A. sp.</i>	Golden aster	-
	<i>Bahia dissecta</i>	Wild chrysanthemum	-
	<i>Brickellia californica</i>	California brickellia	FACU
	<i>B. grandiflora</i>	Tassel flower	-
	<i>B. sp.</i>	Bricklebush	-
	<i>Chrysopsis villosa</i>	Golden aster	-
	<i>Chrysothamnus nauseosus</i>	Chamisa, Rubber rabbit brush	-
	<i>Cirsium neomexicanum</i>	New Mexico thistle	-
	<i>C. pallidum</i>	Thistle	FACW
	<i>C. sp.</i>	Thistle	-
	<i>Conyza canadensis</i>	Horseweed	FAC, FACU
	<i>Erigeron divergens</i>	Fleabane daisy	-
	<i>E. flagellaris</i>	Trailing fleabane	FAC
	<i>E. nudiflorus</i>	Fleabane	-
	<i>E. philadelphicus</i>	Common fleabane	-
	<i>E. sp.</i>	Daisy	-
	<i>E. subtrinervis</i>	Three-nerve fleabane	-
	<i>Franseria acanthicarpa</i>	Bursage	-
	<i>Grindelia aphanactis</i>	Gumweed	-
	<i>G. sp.</i>	Gumweed	-
	<i>Gutierrezia sarothrae</i>	Snakweed	-
	<i>Helianthus petiolaris</i>	Prairie sunflower	-
	<i>Hymenopappus filifolius</i>	White ragweed	-

	<i>Hymenoxys argentea</i>	Perky Sue	-
	<i>H. richardsonii</i>	Bitterweed	-
	<i>Pericome caudata</i>	Taperleaf	-
	<i>Ratibida columnifera</i>	Prairie coneflower	-
	<i>R. sp.</i>	Coneflower	-
	<i>Rudbeckia hirta</i>	Black-eyed Susan	FACU
	<i>R. lanciniata</i>	Cutleaf coneflower	FACW
	<i>R. sp.</i>	Black-eyed Susan	-
	<i>Senecio bigelovii</i>	Bigelow groundsel	-
	<i>S. cymbalarioides</i>	Groundsel	-
	<i>S. dimorphophyllus</i>	Groundsel	-
	<i>S. eremophilus</i> var. <i>macdougalii</i>	Groundsel	-
	<i>S. fendleri</i>	Groundsel	-
	<i>S. mutabilis</i>	Groundsel	-
	<i>Solidago sp.</i>	Goldenrod	FACU
	<i>Taraxacum officinale</i>	Dandelion	FACU
	<i>Thelesperma trifidum</i>	Greenthread	-
	<i>Townsendia escapa</i>	Easter daisy	-
	<i>T. incana</i>	Townsend's aster	-
	<i>Tragopogon dubius</i>	Salsify, Goatsbeard	-
	<i>T. sp.</i>	Salsify	-
	<i>Verbesina encelioides</i>	Crownbeard	FAC
	<i>Viguiera multiflora</i>	Showy goldeneye	-
CRUCIFERAE	<i>Arabis fendleri</i>	Fendler's rockcress	FACU
	<i>Capsella bursa-pastoris</i>	Shepherd's purse	FAC
	<i>Descurainia richardsonii</i> subsp. <i>incisa</i>	Tansy mustard	-
	<i>D. sophia</i>	Tansy mustard	-
	<i>Erysimum capitatum</i>	Western wallflower	-
	<i>Rorippa nasturtium-aquaticum</i>	Watercress	-
	<i>Thlaspi alpestre</i>	Mountain candytuft	FACU
CUPRESSACEAE	<i>Juniperus monosperma</i>	One-seeded juniper	-
	<i>J. scopulorum</i>	Rocky Mountain juniper	-

CYPERACEAE	<i>Carex spp.</i>	Sedge	FACW/FAC/O BL
	<i>Cyperus esculentus</i>	Nutsedge	FACW
	<i>Scirpus sp.</i>	Bulrush	-
EQUISETUM	<i>Equisetum hiemale</i>	Horsetail	-
	<i>E. laevigatum</i>	Smooth Horsetail	FACU
ERICACEAE	<i>Arctostaphylos uva-ursi</i>	Bearberry	-
	<i>Pterospora andromedea</i>	Pinedrop	-
FAGACEAE	<i>Quercus gambelii</i>	Gambel oak	-
	<i>Q. sp.</i>	Oak	-
	<i>Q. undulata</i>	Wavyleaf oak	-
FUMARIACEAE	<i>Corydalis aurea</i>	Golden smoke	-
GENTIANACEAE	<i>Gentiana bigelovii</i>	Bigelow gentian	-
	<i>G. sp.</i>	Gentian	-
GERANIACEAE	<i>Geranium caespitosum</i>	James geranium	-
	<i>G. richardsonii</i>	Richardson geranium	FAC
	<i>G. sp.</i>	Geranium	FAC
GRAMINEAE	<i>Agropyron cristatum</i>	Crested wheatgrass	-
	<i>A. desertorum</i>	Russian wheatgrass	-
	<i>A. sp.</i>	Wheatgrass	-
	<i>A. smithii</i>	Western wheatgrass	FAC
	<i>A. trachycaulum</i>	Slender wheatgrass	FAC
	<i>Agrostis alba</i>	Redtop bent	FACW
	<i>Andropogon gerardii</i>	Big bluestem	FAC
	<i>A. scoparius</i>	Little bluestem	-
	<i>Aristida sp.</i>	Threeawn	-
	<i>Blepharoneuron tricholepsis</i>	Pine dropseed	-
	<i>Bouteloua curtipendula</i>	Side-oats grama	-
	<i>B. gracilis</i>	Blue grama	-
	<i>Bromus anomalus</i>	Nodding brome	-
	<i>B. inermis</i>	Smooth brome	-
	<i>B. japonicus</i>	Japanese brome	FACU
	<i>B. sp.</i>	Bromegrass	FACU
	<i>B. tectorum</i>	Downy chess	-

	<i>Dactylis glomerata</i>	Orchard grass	-
	<i>Echinochloa colonum</i>	Junglegrass	-
	<i>E. crusgalli</i>	Barnyard grass	-
	<i>Elymus canadensis</i>	Canada wildrye	FAC
	<i>Festuca ovina</i>	Sheep fescue	-
	<i>Koeleria cristata</i>	Junegrass	-
	<i>Muhlenbergia montana</i>	Mountain muhly	-
	<i>M. wrightii</i>	Spike muhly	FACU
	<i>Phleum pratense</i>	Common timothy	FACU
	<i>Poa fendleriana</i>	Mutton grass	-
	<i>P. interior</i>	Inland bluegrass	-
	<i>P. pratensis</i>	Kentucky bluegrass	FACU
	<i>P. sp.</i>	Bluegrass	FAC/FACU
	<i>Sitanion hystrix</i>	Bottlebrush squirreltail	-
	<i>Stipa sp.</i>	Needle grass	-
JUNCACEAE	<i>Juncus interior</i>	Inland rush	FACW
	<i>J. spp.</i>	Rush	FACW
LABIATAE	<i>Moldavica parviflora</i>	Dragonhead	-
	<i>Monarda menthaefolia</i>	Beebalm, Horsemint	-
	<i>M. pectinata</i>	Ponymint	-
LEGUMINOSAE	<i>Lathyrus arizonicus</i>	Peavine	-
	<i>Lotus wrightii</i>	Deervetch	-
	<i>Lupinus caudatus</i>	Tall lupine	-
	<i>L. sp.</i>	Lupine	-
	<i>Medicago sativa</i>	Alfalfa	-
	<i>Melilotus albus</i>	White sweet clover	FACU
	<i>M. officinalis</i>	Yellow sweet clover	FACU
	<i>M. sp.</i>	Clover	-
	<i>Robinia neomexicana</i>	New Mexico locust	-
	<i>Thermopsis pinetorum</i>	Pine goldenpea	-
	<i>Trifolium procumbens</i>	Clover	-
	<i>T. repens</i>	White clover	-
	<i>Vicia americana</i>	American vetch	-

LILIACEAE	<i>Allium cernuum</i>	Nodding onion	-
	<i>A. sp.</i>	Wild onion	-
LINACEAE	<i>Linum neomexicana</i>	New Mexico yellow flax	-
LOASACEAE	<i>Mentzelia pumila</i> var. <i>pumila</i>	Blazing star	-
LORANTHACEAE	<i>Phoradendron juniperinum</i>	Juniper mistletoe	-
MORACEAE	<i>Humulus americanus</i>	Hop	-
NYCTAGINACEAE	<i>Mirabilis linearis</i>	Four-o'clock	-
	<i>Oxybaphus linearis</i>	Desert four-o'clock	-
OLEACEAE	<i>Forestiera neomexicana</i>	New Mexico olive	FACU
ONAGRACEAE	<i>Epilobium angustifolium</i>	Fireweed	FAC
	<i>E. ciliatum</i>	Willowweed	FACW
	<i>E. sp.</i>	Fireweed	-
	<i>Gaura coccinea</i>	Gaura	-
	<i>Oenothera coronopifolia</i>	Cutleaf evening primrose	-
	<i>O. hookeri</i>	Hooker's primrose	-
ORCHIDACEAE	<i>Corallorhiza maculata</i>	Spotted coralroot	-
	<i>Habenaria sparsiflora</i>	Bog orchid	-
		Violet wood-sorrel	-
OXALIDACEAE	<i>Oxalis violacea</i>	White fir	-
PINACEAE	<i>Abies concolor</i>	Piñon pine	-
	<i>Pinus edulis</i>	Limber pine	-
	<i>P. flexilis</i>	Ponderosa pine	FACU
	<i>P. ponderosa</i>	Douglas fir	-
	<i>Pseudotsuga menziesii</i>	Woolly indianwheat	-
PLANTAGINACEAE	<i>Plantago purshii</i>	Desert trumpet	-
POLEMONIACEAE	<i>Ipomopsis aggregata</i>	Antelope sage	-
POLYGONACEAE	<i>Eriogonum jamesii</i>	Wild buckwheat	-
	<i>E. racemosum</i>	Wild buckwheat	-
	<i>E. sp.</i>	Black bindweed	FACU
	<i>Polygonum convolvulus</i>	Dock	FACW
	<i>Rumex sp.</i>	Brittle fern	-
POLYPODIACEAE	<i>Cystopteris fragilis</i>	Rock-jasmine	FAC
PRIMULACEAE	<i>Androsace septentrionalis</i> var. <i>subulifera</i>		

RANUNCULACEAE	<i>Actaea arguta</i>	Western baneberry	-
	<i>Clematis pseudoalpina</i>	Rocky Mountain clematis	-
	<i>Pulsatilla ludoviciana</i>	Pasque flower	-
	<i>Rununculus cardiophyllus</i>	Buttercup	FACW
	<i>Thalictrum fendleri</i> var. <i>fendleri</i>	Meadowrue	FACU
RHAMNACEAE	<i>Ceanothus fendleri</i>	Buckbrush	-
ROSACEAE	<i>Agrimonia striata</i>	Agrimony	FAC
	<i>Cercocarpus montanus</i>	Mountain mahogany	-
	<i>Fallugia paradoxa</i>	Apache plume	-
	<i>Fragaria americana</i>	Wild strawberry	-
	<i>Potentilla fruticosa</i>	Shrubby potentilla	FACW
	<i>P. hippiana</i>	Cinquefoil	-
	<i>P. norvegica</i>	Norway potentilla	FAC
	<i>P. pulcherrima</i>	Beauty cinquefoil	-
	<i>P. sp.</i>	Cinquefoil	OLB/FACU/ FACW
	<i>Prunus virginiana</i>	Chokecherry	FAC
	<i>Rosa woodsii</i> var. <i>fendleri</i>	Fendler's rose	FACU
	<i>Rubus strigosus</i>	Wild raspberry	FAC
RUBIACEAE	<i>Galium asperrimum</i>	Rough-stemmed bedstraw	-
	<i>G. boreale</i>	Northern bedstraw	FAC
	<i>G. sp.</i>	Bedstraw	-
SALICACEAE	<i>Populus tremuloides</i>	Aspen	FACU
	<i>Salix exigua</i>	Sandbar willow	-
	<i>S. spp.</i>	Willow	FACW
SAXIFRAGACEAE	<i>Heuchera parvifolia</i>	Alumroot	-
	<i>Jamesia americana</i>	Cliff bush	FACU
	<i>Philadelphus microphyllus</i>	Mockorange	-
	<i>Ribes cereum</i>	Wax current	-
	<i>R. inerme</i>	Gooseberry	FACW
SCROPHULARIACEAE	<i>Castilleja integra</i>	Indian paintbrush	-
	<i>Orthocarpus luteus</i>	Yellow owl-clover	FACU
	<i>Penstemon barbatus</i> var. <i>torreyi</i>	Scarlet bugler	-
	<i>P. sp.</i>	Penstemon	-

	<i>P. secundiflorus</i>	Beardstongue	-
	<i>P. virgatus</i>	Variegated penstemon	FACU
	<i>Verbascum thapsus</i>	Mullein	-
	<i>Veronica americana</i>	American brooklime	OBL
SOLANACEAE	<i>Physalis neomexicana</i>	Ground cherry	-
TYPHACEAE	<i>Typha angustifolia</i>	Narrow-leaved cattail	OBL
	<i>T. latifolia</i>	Cattail	OBL
UMBELLIFERAE	<i>Heracleum lanatum</i>	Cow parsnip	OBL
	<i>Ligusticum porteri</i>	Lovage	-
	<i>Pseudocymopterus montanus</i>	Mountain parsley	-
VALERIANACEAE	<i>Valeriana acutiloba</i>	Valeriana	-
	<i>V. capitata</i>	Tabacco root	-
	<i>V. sp.</i>	Valeriana	-
VIOLACEAE	<i>Viola adunca</i>	Western dog violet	FAC
	<i>V. canadensis</i>	Canada violet	-
	<i>V. pedatifida</i>	Larkspur violet	-
VITACEAE	<i>Parthenocissus inserta</i>	Virginia creeper	-

LICHEN			
	<i>Usnea sp.</i>	Old man's beard lichen	
	<i>Xanthoparmelia sp.</i>	Green rock lichen	

****INDICATOR STATUS definitions:**

- FAC = Facultative: Equally likely to occur in wetlands or nonwetlands.
 FACU = Facultative Upland: Usually occur in nonwetlands, but occasionally found in wetlands.
 FACW = Facultative Wetland: Usually occur in wetland, but occasionally found in nonwetlands.
 OBL = Obligate Wetland: Occur almost always under natural conditions in wetlands.
 UPL = Obligate Upland: Occur in wetland in another region, but occur almost always under natural conditions in nonwetlands in the region specified. If a species does not occur in wetlands in any region, it is not on the *National List*.

APPENDIX C

**Wildlife species actually (confirmed) and potentially
occurring within Operable Unit 1082.**

Ant species actually (confirmed) and potentially occurring within Operable Unit 1144.

SUBFAMILY	SCIENTIFIC NAME	HABITAT TYPE	AUTHORITY
DOLICHODERINAE	<i>Acanthomyops interjectus</i>	Ponderosa	Mayr
	<i>A. latipes</i>	Ponderosa-riparian	Walsh
	<i>Brachymyrmex depilis</i>	Ponderosa	Emery
	<i>Camponotus herculeanus</i>	Aspen, spruce and riparian	Linnaeus
	<i>C. laevigatus</i>	Ponderosa-riparian	F. Smith
	<i>C. sansabeanus</i>	Ponderosa	Buckley
	<i>C. vicinus</i>	Ponderosa and ponderosa-riparian	Mayr
	<i>Formica altipetens</i>	Disturbed	Wheeler
	<i>F. argentea</i>	Disturbed and ponderosa-riparian	Wheeler
	<i>F. densiventris</i>	Ponderosa-riparian	Viereck
	<i>F. fusca</i>	Ponderosa-riparian	Linnaeus
	<i>F. hewitti</i>	Ponderosa-grass, ponderosa-riparian, riparian and aspen	Wheeler
	<i>F. lasioides</i>	Ponderosa-riparian	Emery
	<i>F. limata</i>	Ponderosa-riparian	Wheeler
	<i>F. microgyna</i>	Aspen	Wheeler
	<i>F. neogagates</i>	Disturbed	Emery
	<i>F. neorufibarbis</i>	Riparian, spruce and aspen	Emery
	<i>F. obscuripes obscuripes</i>	Ponderosa-riparian	Forel
	<i>F. obscuriventris clivia</i>	Ponderosa-riparian	Creighton
	<i>F. obtusopilosa</i>	Aspen	Emery
	<i>F. occulta</i>	Ponderosa-riparian and aspen	Francoeur
	<i>F. pergandei</i>	Disturbed and aspen	Emery
	<i>F. planipilis</i>	Ponderosa-riparian	Creighton
	<i>F. podzolica</i>	Disturbed, riparian, spruce and aspen	Francoeur
	<i>F. subnuda</i>	Ponderosa	Emery
	<i>Lasius alienus</i>	Ponderosa-riparian	Foerster
	<i>L. crypticus</i>	Ponderosa-riparian	Wilson
<i>L. flavus</i>	Ponderosa-riparian	Fabricius	
<i>L. neoniger</i>	Ponderosa-riparian	Emery	
<i>L. niger</i>	Ponderosa-riparian	Linnaeus	

	<i>L. pallitarsis</i>	Ponderosa and ponderosa-riparian	Provancher
	<i>L. sitiens</i>	Ponderosa	Wilson
	<i>L. subumbratus</i>	Ponderosa-riparian	Viereck
	<i>Liometopum apiculatum</i>	Ponderosa-riparian	Mayr
	<i>L. luctuosum</i>	Ponderosa-riparian	Wheeler
	<i>Polyergus breviceps</i>	Ponderosa	Emery
	<i>Tapinoma sessile</i>	Ponderosa-riparian	Mayr
MYRMICINAE	<i>Crematogaster cerasi</i>	Ponderosa and riparian	Fitch
	<i>C. colei</i>	Disturbed	Buren
	<i>Leptothorax crassipilis</i>	Ponderosa-riparian	Wheeler
	<i>L. muscorum</i>	Ponderosa and ponderosa-riparian	Nylander
	<i>L. nitens</i>	Disturbed and ponderosa-riparian	Emery
	<i>L. obliquicanthus</i>	Disturbed	Cole
	<i>L. provacheri</i>	Riparian	Emery
	<i>L. texanus texanus</i>	Ponderosa-riparian	Wheeler
	<i>L. tricarinatus</i>	Ponderosa-riparian	Emery
	<i>Monomorium cyaneum</i>	Disturbed	Wheeler
	<i>M. minimum</i>	Ponderosa-riparian	Buckley
	<i>Myrmecina americana</i>	Ponderosa-riparian	Emery
	<i>Myrmica brevispinosa</i>	Riparian	Wheeler
	<i>M. emeryana</i>	Ponderosa-riparian	Forel
	<i>M. hamulata</i>	Ponderosa-riparian	Weber
	<i>M. incompleta</i>	Riparian and aspen	Provancher
	<i>Pheidole ceres</i>	Ponderosa, disturbed, burned ponderosa and ponderosa-riparian	Wheeler
	<i>P. soritis</i>	Disturbed	Wheeler
	<i>P. wheelerorum</i>	Disturbed and ponderosa-riparian	MacKay
	<i>Pogonomyrmex occidentalis</i>	Ponderosa and ponderosa-riparian	Cresson
	<i>Solenopsis molesta</i>	Disturbed, ponderosa-riparian and riparian	Say
	<i>Stenamma occidentale</i>	Ponderosa-riparian	M. R. Smith

Amphibian and Reptile species actually (confirmed) and potentially occurring with Operable Unit 1144

FAMILY	SCIENTIFIC NAME	COMMON NAME	SOURCE
AMPHIBIANS:			
HYLIDAE	<i>Hyla arenicolor</i>	Canyon treefrog	3
	<i>Pseudacris triseriata</i>	Striped chorus frog	3
REPTILES:			
COLUBRIDAE	<i>Diadophis punctatus</i>	Ringneck snake	3
IGUANIDAE	<i>Phrynosoma douglassi</i>	Short-horned lizard	3
	<i>Sceloporus undulatus</i>	Eastern fence lizard	1, 3
VIPERIDAE	<i>Crotalus atrox</i>	Western diamondback rattlesnake	1

1= Bogart 1986

2= Observations from the joint Bandelier National Monument/Los Alamos National Laboratory Wildlife Observation Database

3= Edeskuty, Foxx, and Raymer 1992

Bird species actually (confirmed) and potentially occurring within Operable Unit 1144

FAMILY	SCIENTIFIC NAME	COMMON NAME	SOURCE
ACCIPITRIDAE	<i>Accipiter gentilis</i>	Northern goshawk	1
	<i>Buteo albonotatus</i>	Zone-tailed hawk	1
	<i>B. jamaicensis</i>	Red-tailed hawk	1
APODIDAE	<i>Aeronautes saxatalis</i>	White-throated swift	1
CAPRIMULGIDAE	<i>Chordeiles minor</i>	Common nighthawk	1
	<i>Phalaenoptilus nuttallii</i>	Common poorwill	1
CARTHARTIDAE	<i>Cathartes aura</i>	Turkey vulture	1
CERTHIDAE	<i>Certhia americana</i>	Brown creeper	1
COLUMBIDAE	<i>Columba fasciata</i>	Band-tailed pigeon	1
	<i>Zenaida macroura</i>	Morning dove	1
CORVIDAE	<i>Amphelocoma coerulescens</i>	Scrub jay	1
	<i>Corvus corax</i>	Common raven	1
	<i>Cyanocitta stelleri</i>	Steller's jay	1
	<i>Nucifraga columbiana</i>	Clark's nutcracker	1
	<i>Pica pica</i>	Black-billed magpie	2
EMBERIZIDAE	<i>Agelaius phoeniceus</i>	Red-winged blackbird	1
	<i>Dendroica coronata</i>	Yellow-rumped warbler	1
	<i>D. graciae</i>	Grace's warbler	1
	<i>Junco hyemalis</i>	Dark-eyed junco	1
	<i>Molothrus ater</i>	Brown-headed cowbird	1
	<i>Oporornis tolmiei</i>	MacGillivray's warbler	1
	<i>Pheucticus melanocephalus</i>	Black-headed grosbeak	1
	<i>Pipilo chlorurus</i>	Green-tailed towhee	1
	<i>P. erythrophthalmus</i>	Rufous-sided towhee	1
	<i>Piranga flava</i>	Hepatic tanager	1
	<i>P. ludoviciana</i>	Western tanager	1
	<i>Pooecetes gramineus</i>	Vesper sparrow	1
	<i>Spizella passerina</i>	Chipping sparrow	1
<i>Sturnella neglecta</i>	Western meadowlark	1	
<i>Vermivora celata</i>	Orange-crowned warbler	1	
<i>V. virginiae</i>	Virginia's warbler	1	

FALCONIDAE	<i>Falco sparverius</i>	American kestrel	1
FRINGILLIDAE	<i>Carduelis pinus</i>	Pine siskin	1
	<i>C. psaltria</i>	Lesser goldfinch	1
	<i>Coccothraustes vespertina</i>	Evening grosbeak	1
	<i>Loxia curvirostra</i>	Red crossbill	1
HIRUNDINIDAE	<i>Hirundo pyrrhonota</i>	Cliff swallow	1
	<i>Tachycineta thalassina</i>	Violet-green swallow	1
MUSCICAPIDAE	<i>Catharus guttatus</i>	Hermit thrush	1
	<i>Myadestes townsendii</i>	Townsend's solitaire	1
	<i>Poliopitila caerulea</i>	Blue-grey gnatcatcher	1
	<i>Regulus calendula</i>	Ruby-crowned kinglet	1
	<i>Sialia currucoides</i>	Mountain bluebird	1
	<i>S. mexicana</i>	Western bluebird	1
	<i>Turdus migratorius</i>	American robin	1
PARIDAE	<i>Parus gambeli</i>	Mountain chickadee	1
	<i>P. inornatus</i>	Plain titmouse	1
PICIDAE	<i>Colaptes auratus</i>	Northern flicker	1
	<i>Melanerpes formicivorus</i>	Acorn woodpecker	1
	<i>M. lewis</i>	Lewis' woodpecker	1
	<i>Picoides pubescens</i>	Downy woodpecker	1
	<i>P. tridactylus</i>	Northern three-toed woodpecker	1
	<i>P. villosus</i>	Hairy woodpecker	1
SITTIDAE	<i>Sitta carolinensis</i>	White-breasted nuthatch	1
	<i>S. pygmaea</i>	Pygmy nuthatch	1
STURNIDAE	<i>Sturnus vulgaris</i>	European starling	1
TROCHILIDAE	<i>Selasphorus platycercus</i>	Broad-tailed hummingbird	1
TROGLODYTIDAE	<i>Salpinctes obsoletus</i>	Rock wren	1
	<i>Thryomanes bewickii</i>	Bewick's wren	1
	<i>Troglodytes aedon</i>	House wren	1
TYRANNIDAE	<i>Contopus sordidulus</i>	Western wood-pewee	1
	<i>C. borealis</i>	Olive-sided flycatcher	1
	<i>Empidonax hammondi</i>	Hammond's flycatcher	1
	<i>E. oberholseri</i>	Dusky flycatcher	1
	<i>E. occidentalis</i>	Cordilleran flycatcher	1
	<i>Myiarchus cinerascens</i>	Ash-throated flycatcher	1
	<i>Sayornis saya</i>	Say's Phoebe	1

	<i>Tyrannus vociferans</i>	Cassin's kingbird	1
STRIGIDAE	<i>Bubo virginianus</i>	Great horned owl	1
	<i>Otus flammeolus</i>	Flammulated owl	1
	<i>Strix occidentalis lucida</i>	Mexican spotted owl	1
VIREONIDAE	<i>Vireo gilvus</i>	Warbling vireo	1
	<i>V. solitarius</i>	Solitary vireo	1

1=Breeding Bird Atlas

2=Wildlife Observation Database

Mammal species actually (confirmed) and potentially occurring within Operable Unit 1082

FAMILY	SCIENTIFIC NAME	COMMON NAME	SOURCE
CANIDAE	<i>Canis latrans</i>	Coyote	1,5
	<i>Vulpes vulpes</i>	Red fox	1
CERVIDAE	<i>Cervus elaphus</i>	Elk	1,5,10
	<i>Odocoileus hemionus</i>	Mule deer	1,5,10
CRICETIDAE	<i>Neotoma mexicana</i>	Mexican woodrat	1,6
	<i>Microtus longicaudus</i>	Long-tailed vole	3,4,6
	<i>M. montanus</i>	Montane vole	1,2,3
	<i>Peromyscus boyleyi</i>	Brush mouse	4,6
	<i>P. difficilis</i>	Rock mouse	3
	<i>P. leucopus</i>	White-footed mouse	4,6
	<i>P. maniculatus</i>	Deer mouse	1,2,3,4,6,10
	<i>P. truei</i>	Piñon mouse	1,3
	<i>Reithrodontomys megalotis</i>	Western harvest mouse	1,4
	ERETHIZONTIDAE	<i>Erethizon dorsatum</i>	Porcupine
FELIDAE	<i>Felis concolor</i>	Mountain Lion	1,7
	<i>Lynx rufus</i>	Bobcat	1
GEOMYIDAE	<i>Thomomys bottae</i>	Bottae's pocket gopher	1,5
HETEROMYIDAE	<i>Perognathus flavus</i>	Silky pocket mouse	1
LEPORIDAE	<i>Sylvilagus sp.</i>	Cottontail	1,5,10
MUSTELIDAE	<i>Mustela frenata</i>	Long-tailed weasel	1
	<i>Mephitis mephitis</i>	Striped shunk	5
	<i>Taxidea taxus</i>	Badger	1
PROCYONIDAE	<i>Procyon lotor</i>	Raccoon	5,10
SCIURIDAE	<i>Eutamias minimus</i>	Least chipmunk	5
	<i>E. quadrivittatus</i>	Colorado chipmunk	1,3,4,5
	<i>Sciurus aberti</i>	Abert's squirrel	1,5,10
	<i>Spermophilus lateralis</i>	Golden-mantled ground squirrel	3,5
	<i>Tamiasciurus hudsonicus</i>	Red squirrel	9
SORICIDAE	<i>Sorex vagrans</i>	Vagrant shrew	5

URSIDAE	<i>Ursus americanus</i>	Black bear	1,5,7
VERSPERTILIONIDAE	<i>Eptesicus fuscus</i>	Big brown bat	1,8,9
	<i>Lasionycteris noctivagans</i>	Silver-haired bat	1,8,9
	<i>Lasiurus cinereus</i>	Hoary bat	1,8,9
	<i>Myotis californicus</i>	California myotis	1,8
	<i>M. evotis</i>	Long-eared myotis	1,8,9
	<i>M. leibii</i>	Small-footed myotis	8
	<i>M. thysanodes</i>	Fringed myotis	1,8
	<i>M. volans</i>	Long-legged myotis	1,8,9
	<i>M. yumanensis</i>	Yuma myotis	8
	MOLOSSIDAE	<i>Tadarida brasiliensis</i>	Brazilian free-tailed bat

- 1=Guthrie and Large 1980
 2=Wright 1981
 3=Guthrie 1981
 4=Kent 1981
 5=Edeskuty, Foxx and Raymer 1992
 6=Raymer and Biggs 1992
 7=Warner 1992
 8=3D/Environmental Services, Inc. 1992
 9=BRET observation (1990 to 1992)
 10=Wildlife Observation Database

APPENDIX D

Threatened and Endangered Species (TES) Database
printout for Operable Unit 1082.

ENDANGERED SPECIES PRINTOUT FOR OU 1082

HABITATS: PONDEROSA-PINON, PONDEROSA PINE, MIXED-CONIFER
WETLANDS AND RIPARIAN

+-----+
| ANIMALS |
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BIRD

FAMILY ACCIPITRIDAE

SCIENTIFIC NAME: *Accipiter gentilis*

COMMON NAME: NORTHERN GOSHAWK

STATUS: CANDIDATE FOR FEDERAL REGISTER

FEDERAL/STATE REFERENCE: CURRENTLY, CANDIDATE FOR FEDERAL LISTING, FEDERAL REGISTER, 1991, VOL. 56, NO. 225, PP.58810.

DISTRIBUTION:

SPECIFIC REQUIREMENTS: DENSE, MATURE, OR OLD GROWTH CONIFEROUS FOREST.

HABITAT: PONDEROSA BREEDING HABITAT: PONDEROSA

MINIMUM ELEVATION: 0 MAXIMUM ELEVATION: 0

THREATS TO TAXON: LOGGING

BRIEF KEY DESCRIPTION: A LARGE ROBUST HAWK WITH A LONGISH TAIL, ROUNDED WINGS. CROWN AND CHECK BLACKISH; BROAD WHITE STRIPE OVER THE EYE. UNDER PARTS PALE GRAY, FINELY BARRED. SIZE = 20-26".

HAS THE SPECIES PREVIOUS BEEN FOUND IN LOS ALAMOS COUNTY?: YES
LA REFERENCE OF OCCURRENCE: KENNEDY, P.L., 1987
GENERAL MAP LOCATION:

COMMENTS: STUDIES BY PAT KENNEDY INDICATE THE HIGHEST PERCENTAGE OF NEST WERE IN PONDEROSA PINE/GAMBEL'S OAK, PONDEROSA PINE/GRAY OAK, AND MIXED CONIFER (ABIES CONCOLOR-PSEUDOTSUGA MENZIESII-PINUS PONDEROSA/QUERCUS GAMBELII) HABITAT TYPES.

REFERENCE: KENNEDY, P.L., 1987, FED.REGISTER, 1991, VOL.56, NO.225

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| ANIMALS |
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BIRD

FAMILY ACCIPITRIDAE

SCIENTIFIC NAME: Buteogallus anthracinus

COMMON NAME: COMMON BLACK HAWK

STATUS: STATE-ENDANGERED

FEDERAL/STATE REFERENCE: New Mexico Endangered (Group 2). First listed
1/24/75 (NMGF Reg. 563).

DISTRIBUTION: Lower elevations in Gila, San Francisco and
Mimbres drainage. Has also occurred in smaller
numbers in Rio Grande Valley.

SPECIFIC REQUIREMENTS: In the Southwest, in cottonwoods and other
woodlands along permanent streams.

HABITAT: RIPARIAN ZONES BREEDING HABITAT: RIPARIAN ZONES

MINIMUM ELEVATION: 0 MAXIMUM ELEVATION: 0

THREATS TO TAXON: DESTRUCTION OF RIPARIAN HABITAT AND SHOOTING HAWK.

BRIEF KEY DESCRIPTION: Medium-sized raptor, mainly black. Broader wings
than the Zone-Tail. Adults have bill black, iris
dark brown and cere and legs yellow. Length is
500-600 m.

HAS THE SPECIES PREVIOUS BEEN FOUND IN LOS ALAMOS COUNTY?: NO
LA REFERENCE OF OCCURRENCE: N/A
GENERAL MAP LOCATION: N/A

COMMENTS:

REFERENCE: NM DEPT. OF GAME AND FISH, HANDBOOK OF SPECIES ENDANGERED.

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| ANIMALS |
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BIRD

FAMILY ACCIPITRIDAE

SCIENTIFIC NAME: *Haliaeetus leucocephalus*

COMMON NAME: BALD EAGLE

STATUS: FEDERALLY-ENDANGERED

FEDERAL/STATE REFERENCE: New Mexico endangered (group 2). First listed 1/24/75 (NMGF Reg. 563). Federally protected since 03/11/67.

DISTRIBUTION: Migrates and winters from the northern border, southward regularly to Gila, Lower Rio Grande, Middle Pecos and Candian Valleys, Rio Arriba and Sandoval Co.

SPECIFIC REQUIREMENTS: Found near streams, lakes and sometimes dry land. Also found in riparian areas.

HABITAT: RIPARIAN ZONES BREEDING HABITAT: RIPARIAN ZONES

MINIMUM ELEVATION: 0 MAXIMUM ELEVATION: 0

THREATS TO TAXON: PESTICIDES AND STREAM DEGRADATION.

BRIEF KEY DESCRIPTION: Huge wingspan 2-2.4 m, white head and tail, iris, cere, bill and legs yellow. Immature resemble golden eagles.

HAS THE SPECIES PREVIOUS BEEN FOUND IN LOS ALAMOS COUNTY?: YES
LA REFERENCE OF OCCURRENCE: FIELD SIGHTINGS, 1991-1992
GENERAL MAP LOCATION: NEAR ANCHO CANYON IN WHITE ROCK CANYON

COMMENTS: Winter roost at Cochiti Lake and in Montoso Canyon. Mortandad Canyon appears to have some suitable roosting areas, but no confirmed roost. Suitable roost sites consist of protection from wind and large trees.

Potential roosting area has been found on LANL property near the Rio Grande River. A bald eagle was seen in the area in February 1992. Survey efforts are underway to confirm.

REFERENCE: NM DEPT. OF GAME AND FISH, HANDBOOK OF SPECIES ENDANGERED.

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| ANIMALS |
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BIRD

FAMILY ACCIPITRIDE

SCIENTIFIC NAME: *Ictinia mississippiensis*

COMMON NAME: MISSISSIPPI KITE

STATUS: STATE-ENDANGERED

FEDERAL/STATE REFERENCE: New Mexico Endangered (Group 2). First listed in
Jan. 24, 1975 (NMGF Reg. 563).

DISTRIBUTION: In New Mexico summers regularly and breeds in the
Covis region, Portales, and Hobbs. Small numbers
occur in middle and lower Rio Grande and lower
Pecos valleys.

SPECIFIC REQUIREMENTS: Riparian zones, shelterbelts and golf courses.

HABITAT: RIPARIAN ZONES BREEDING HABITAT: RIPARIAN ZONES

MINIMUM ELEVATION: 0 MAXIMUM ELEVATION: 0

THREATS TO TAXON: DESTRUCTION OF RIPARIAN ZONES.

BRIEF KEY DESCRIPTION: Small raptor with length 335 mm and wingspan 1 m,
long. Has long pointed and notched wings. Has
whitish to black plumage.

HAS THE SPECIES PREVIOUS BEEN FOUND IN LOS ALAMOS COUNTY?: NO

LA REFERENCE OF OCCURRENCE: N/A

GENERAL MAP LOCATION: N/A

COMMENTS:

REFERENCE: NM DEPT OF GAME AND FISH, HANDBOOK OF SPECIES ENDANGERED.

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| ANIMALS |
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BIRD

FAMILY FALCONIDAE

SCIENTIFIC NAME: Falco Peregrinus

COMMON NAME: PEREGRINE FALCON

STATUS: FEDERALLY-ENDANGERED

FEDERAL/STATE REFERENCE: NM: Endangered (group 1), 1/24/75, (NM Reg. 563);
Federal "American", F.p. antum, Endangered 6/2/70;
Tundra F.P. tundrius, Threatened 3/20/84.

DISTRIBUTION: New Mexico subspecies "American" breeds locally in
mountainous areas, and it occurs in migration and
winter statewide.

SPECIFIC REQUIREMENTS: Breeding territories center on cliffs that are
wooded/forested habitats.

HABITAT: PONDEROSA-PINON BREEDING HABITAT: PONDEROSA-PINON

MINIMUM ELEVATION: 0 MAXIMUM ELEVATION: 0

THREATS TO TAXON: DDT, DESTRUCTION OF HABITAT

BRIEF KEY DESCRIPTION: Typical falcon, long pointed wings and long tails,
moderate size, 380-500 mm in length, wingspan
1.0-1.5 m, gray above, whitish below, tail is
dark gray.

HAS THE SPECIES PREVIOUS BEEN FOUND IN LOS ALAMOS COUNTY?: YES
LA REFERENCE OF OCCURRENCE: LA-6898-PR, PP.94
GENERAL MAP LOCATION: PUEBLO CANYON

COMMENTS: Two young males seen in the spring of 1990.

REFERENCE: NM DEPT. OF GAME AND FISH, HANDBOOK OF SPECIES ENDANGERED

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| ANIMALS |
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BIRD

FAMILY STRIGIDAE

SCIENTIFIC NAME: *Strix occidentalis lucida*

COMMON NAME: MEXICAN SPOTTED OWL

STATUS: FEDERALLY-THREATENED

FEDERAL/STATE REFERENCE: Currently listed as federaly threatened, 50 CFR PART 17, Vol. 58, No. 49, March 16, 1993, "Endangered and Threatened Wildlife and Plants: Final Rule to list Mexican Spotted Owl as Threatened Species, pp.14248-14271.

DISTRIBUTION: New Mexico, Arizona, Texas, Colorado, Utah and Mexico.

SPECIFIC REQUIREMENTS: The owl inhabits forested mountains and canyons. Its habitat is primarily uneven-aged, multi-storied forest with closed canopies.

HABITAT: MIXED-CONIFER

BREEDING HABITAT: MIXED-CONIFER

MINIMUM ELEVATION: 0

MAXIMUM ELEVATION: 0

THREATS TO TAXON: LUMBERING

BRIEF KEY DESCRIPTION:

HAS THE SPECIES PREVIOUS BEEN FOUND IN LOS ALAMOS COUNTY?: NO

LA REFERENCE OF OCCURRENCE: N/A

GENERAL MAP LOCATION: N/A

COMMENTS:

REFERENCE: FEDERAL REGISTER 50 CFR PARTT 17, VOL.55, NO.60, 3/28/90.

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| ANIMALS |
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BIRD

FAMILY TROCHILIDAE

SCIENTIFIC NAME: *Cynanthus latirostris*

COMMON NAME: BROAD-BILLED HUMMINGBIRD

STATUS: STATE-ENDANGERED

FEDERAL/STATE REFERENCE: New Mexico: Endangered (Group 2), 1/24/75 (NMGF Reg. 563).

DISTRIBUTION: Summers in Guadalupe Canyon (Hidalgo co.), Vagrants near Los Alamos, Bandelier National Monument, Las Vegas, Truth of Consequences, Las Cruces and Carlsbad Caverns.

SPECIFIC REQUIREMENTS: Riparian woodlands, low to moderate elevations.

HABITAT: RIPARIAN ZONES BREEDING HABITAT: RIPARIAN ZONES

MINIMUM ELEVATION: 0 MAXIMUM ELEVATION: 0

THREATS TO TAXON: DESTRUCTION OF HABITAT

BRIEF KEY DESCRIPTION: Adult males have orange-red bills. Females and immatures similar to the violet-crowned hummingbird, but have small white line behind the eye. Upperparts of the hummingbird are greenish, the wings are blackish, and feet and eyes are dark. The tail is slightly forked.

HAS THE SPECIES PREVIOUS BEEN FOUND IN LOS ALAMOS COUNTY?: YES
LA REFERENCE OF OCCURRENCE: NM DEPT. OF GAME AND FISH, HANDBOOK OF ENDANGERED
GENERAL MAP LOCATION:

COMMENTS:

REFERENCE: NM DEPT. OF GAME AND FISH, HANDBOOK OF SPECIES ENDANGERED

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| ANIMALS |
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BIRD

FAMILY TYRANNIDAE

SCIENTIFIC NAME: Empidonax traillii

COMMON NAME: WILLOW FLYCATCHER

STATUS: CANDIDATE FOR FEDERAL REGISTER

FEDERAL/STATE REFERENCE: New Mexico: "Southwestern", E.T. extimus, only.
Endangered , Group 2, 01/09/88 (NMGF reg 657).
Federal: Notice of Review as
Endangered/Threatened. Listed as a C1 species

DISTRIBUTION: Breeds through central New Mexico. Species occurs
statewide in spring and autumn migration. E.t.
extimus breeds in Chama, Rio Grande, Zuni, Gila,
San Francisco.

SPECIFIC REQUIREMENTS: Confined to riparian woodlands in breeding
seasons. Riparian areas are dominated by
cottonwoods.

HABITAT: RIPARIAN ZONES BREEDING HABITAT: RIPARIAN ZONES

MINIMUM ELEVATION: 3700 MAXIMUM ELEVATION: 8900

THREATS TO TAXON: LOSS OF RIPARIAN HABITAT

BRIEF KEY DESCRIPTION: Small, double wingbars and eyering. Upperparts
are dark olive-brown, crown paler and more grayish
or brownish. Breast is light grayish-olive and
post. is pale yellow.

HAS THE SPECIES PREVIOUS BEEN FOUND IN LOS ALAMOS COUNTY?: NO
LA REFERENCE OF OCCURRENCE: N/A
GENERAL MAP LOCATION: N/A

COMMENTS:

REFERENCE: NM DEPT OF GAME AND FISH, HANDBOOK OF SPECIES ENDANGERED

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| ANIMALS |
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MAMMAL

FAMILY VESPERTILIONIDAE

SCIENTIFIC NAME: *Euderma maculatum*

COMMON NAME: SPOTTED BAT

STATUS: STATE-ENDANGERED

FEDERAL/STATE REFERENCE: New Mexico :Endangered (Group 2), 01/09/88 (NMGF Reg. 657). Federal: Notice of review as endangered/threatened.

DISTRIBUTION: Rio Grande Valley westward, occurring regularly in the Jemez Mountains and on Mt. Taylor. Records also at Ghost Ranch and Lake Roberts.

SPECIFIC REQUIREMENTS: Riparian, Pinon-juniper, ponderosa, spruce-fir. Roost in cliffs or rock cervices. Needs a good source of water, a small area of standing water to slow moving water. Key food is moths.

HABITAT: MULTIPLE

BREEDING HABITAT: MULTIPLE

MINIMUM ELEVATION: 0

MAXIMUM ELEVATION: 0

THREATS TO TAXON: POSSIBLY PESTICIDES

BRIEF KEY DESCRIPTION: Upperparts are black with large white, roughly circular spots on the shoulders and another at the base of the tail, plus a small patch at the posterior base of each ear. Has very large ears (45-50 mm). Ears are naked, pinkish-red in color.

HAS THE SPECIES PREVIOUS BEEN FOUND IN LOS ALAMOS COUNTY?: NO
LA REFERENCE OF OCCURRENCE: N/A
GENERAL MAP LOCATION: N/A

COMMENTS: Note: Habitat can be varied--Riparian, Ponderosa, Spruce-Fir and Pinon Juniper.

REFERENCE: NM DEPT. OF GAME AND FISH, HANDBOOK OF SPECIES ENDANGERED.

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| ANIMALS |
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MAMMAL

FAMILY ZAPODIDAE

SCIENTIFIC NAME: *Zapus hudsonius*

COMMON NAME: MEADOW JUMPING MOUSE

STATUS: STATE-ENDANGERED

FEDERAL/STATE REFERENCE: New Mexico: Endangered (Group 2), 07/22/83 (NMGF Reg. 624). Federal (Subspecies "New Mexico" *Z.H. luteus*) notice of review as endangered/threatened.

DISTRIBUTION: Localities in San Juan, Jemez and Sacramento Mountains in central-northern and central Rio Grande Valley. Has been recorded once in the Sangre de Cristo Mountains.

SPECIFIC REQUIREMENTS: Confined to holarctic region, mesic habitats, permanent streams and wet meadows.

HABITAT: WETLAND

BREEDING HABITAT: WETLANDS

MINIMUM ELEVATION: 0 MAXIMUM ELEVATION: 0

THREATS TO TAXON: HABITAT DESTRUCTION-GRAZING

BRIEF KEY DESCRIPTION: Well developed hind legs, long tail, jumping ability. Shades of brownish above and whitish below, sides yellow/orange brown. Feet are whitish. Length is 188-216 mm.

HAS THE SPECIES PREVIOUS BEEN FOUND IN LOS ALAMOS COUNTY?: YES
LA REFERENCE OF OCCURRENCE: NM DEPT. OF GAME AND FISH, HANDBOOK OF SPECIES EN
GENERAL MAP LOCATION:

COMMENTS: Reports for Los Alamos are unsubstantiated or pre-1960 records.

REFERENCE: NM DEPT. OF GAME AND FISH, HANBOOK OF SPECIES ENDANGERED

ANIMALS

MOLLUSK

FAMILY LYMNAEIDAE

SCIENTIFIC NAME: *Lymnaea caperata*

COMMON NAME: SAY'S POND SNAIL

STATUS: STATE-ENDANGERED

FEDERAL/STATE REFERENCE: New Mexico: Endangered (Group 1), first listed
07/22/83 (NMGF Reg. 624).

DISTRIBUTION: The species is known to occur only in the Cerro la
Jara area, Jemez Mountains (Sandoval Co.).

SPECIFIC REQUIREMENTS:

HABITAT: WETLAND

BREEDING HABITAT: WETLANDS

MINIMUM ELEVATION: 3700

MAXIMUM ELEVATION: 8600

THREATS TO TAXON: OVERGRAZING, POLLUTION, DEVELOPMENT AND DEATERING

BRIEF KEY DESCRIPTION: Medium sized (20 mm), absence of operculum on the
foot, shell is elongated and right spiralled.
Spiral length is greater than width of aperture.
Color is brown to brown-gray.

HAS THE SPECIES PREVIOUS BEEN FOUND IN LOS ALAMOS COUNTY?: NO
LA REFERENCE OF OCCURRENCE: N/A
GENERAL MAP LOCATION: N/A

COMMENTS:

REFERENCE: NM DEPT. OF GAME AND FISH, HANDBOOK OF SPECIES ENDANGERED

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| PLANTS |
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FORB

FAMILY LILIACEAE

SCIENTIFIC NAME: *Fritillaria atropurpurea*

COMMON NAME: CHECKER LILY

STATUS: STATE-SENSITIVE

FEDERAL/STATE REFERENCE:

DISTRIBUTION: Los Alamos county??

SPECIFIC REQUIREMENTS:

HABITAT: MIXED-CONIFER

BREEDING HABITAT: N/A

MINIMUM ELEVATION: 0

MAXIMUM ELEVATION: 0

THREATS TO TAXON:

BRIEF KEY DESCRIPTION:

HAS THE SPECIES PREVIOUS BEEN FOUND IN LOS ALAMOS COUNTY?: YES

LA REFERENCE OF OCCURRENCE: TIERNERY, G.D., 1987

GENERAL MAP LOCATION:

COMMENTS:

REFERENCE: TIERNERY, G.D., 1987

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| PLANTS |
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FORB

FAMILY LILIACEAE

SCIENTIFIC NAME: *Lilium philadelphicum* var. *andium*

COMMON NAME: WOOD LILY

STATUS: STATE-ENDANGERED

FEDERAL/STATE REFERENCE:

DISTRIBUTION: OT, RA, SA, SF, SM

SPECIFIC REQUIREMENTS:

HABITAT: MIXED-CONIFER

BREEDING HABITAT: N/A

MINIMUM ELEVATION: 6000

MAXIMUM ELEVATION: 10000

THREATS TO TAXON: COLLECTION AND HABITAT DESTRUCTION.

BRIEF KEY DESCRIPTION: Stems to 2 ft, leaves linear to lance-shaped, margin smooth, lower leaves alternate. flowers large, showy red or orange-red with purplish-black spots at base.

HAS THE SPECIES PREVIOUS BEEN FOUND IN LOS ALAMOS COUNTY?: YES

LA REFERENCE OF OCCURRENCE: KOELLE, A., 1978; FOXX, T., 1979; KOSIEWICZ

GENERAL MAP LOCATION: UPPER PAJARITO, WATER AND FRIJOLES CANYON

COMMENTS: can be found in ponderosa to mixed-conifer.

REFERENCE: FOXX & HOARD, 1984; NRIS, 1986; HARRINGTON, 1964

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| PLANTS |
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FORB

FAMILY ORCHIDACEAE

SCIENTIFIC NAME: *Epipactis gigantea*

COMMON NAME: HELLEBORINE ORCHID

STATUS: STATE-ENDANGERED

FEDERAL/STATE REFERENCE:

DISTRIBUTION: Montana to British Columbia, southern to western Texas, New Mexico and California.

SPECIFIC REQUIREMENTS: Damp woods, seepage slopes, springs, streams and riparian areas.

HABITAT: RIPARIAN ZONES BREEDING HABITAT: N/A

MINIMUM ELEVATION: 6000 MAXIMUM ELEVATION: 8500

THREATS TO TAXON:

BRIEF KEY DESCRIPTION: STEMS ALONG STEM. STEMS TO 2 1/2 FT. LEAVES TO 15 CM, OVAL. SEPALS GREENISH, PETALS PURPLE, LIP MARKED WITH PURPLE LINES.

HAS THE SPECIES PREVIOUS BEEN FOUND IN LOS ALAMOS COUNTY?: YES

LA REFERENCE OF OCCURRENCE: FOXX, T.S., 1984

GENERAL MAP LOCATION: SPRING IN WHITE ROCK CANYON

COMMENTS:

REFERENCE: FOXX, T.S. & HOARD, D, 1984, NM DEPART. OF NATURAL RES., 1993

PLANTS

FORB

FAMILY POLEMONIACEAE

SCIENTIFIC NAME: Phlox caryophylla, Wherry

COMMON NAME: PAGOSA PHLOX

STATUS: STATE-SENSITIVE

FEDERAL/STATE REFERENCE:

DISTRIBUTION: Rio Arriba County, New Mexico.

SPECIFIC REQUIREMENTS: Open slopes in open woods in mountains.

HABITAT: PONDEROSA-PINON BREEDING HABITAT: N/A

MINIMUM ELEVATION: 6500 MAXIMUM ELEVATION: 7500

THREATS TO TAXON: NONE KNOWN

BRIEF KEY DESCRIPTION: Erect perennial, leaves narrow, 50 mm long;
flowers in loose clusters, bright pink or purple,
flower parts united in a tube. Flowers from late
May to July.

HAS THE SPECIES PREVIOUS BEEN FOUND IN LOS ALAMOS COUNTY?: NO
LA REFERENCE OF OCCURRENCE: N/A
GENERAL MAP LOCATION: N/A

COMMENTS:

REFERENCE: NM NATIVE PLANTS PROTECTION ADVISORY COMMITTEE, 1984.

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| PLANTS |
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FORB

FAMILY SAXIFRAGACEAE

SCIENTIFIC NAME: *Heuchera pulchella*, Woot. and Standl.

COMMON NAME: SANDIA ALUMROOT

STATUS: STATE-SENSITIVE

FEDERAL/STATE REFERENCE:

DISTRIBUTION: Bernalillo, Sandoval, San Miguel, Sierra, Socorro,
and Torrance Counties, New Mexico.

SPECIFIC REQUIREMENTS: Cliff-loving plant, endemic to the Mountains of
Central New Mexico.

HABITAT: MIXED-CONIFER

BREEDING HABITAT: N/A

MINIMUM ELEVATION: 8000

MAXIMUM ELEVATION: 12000

THREATS TO TAXON: NONE KNOWN

BRIEF KEY DESCRIPTION: Perennial herb with leaves clustered at the base;
leaf blades wide, toothed, upper surface with
hairs; low glandular flowers crowded along one
side. Flowers from July through September.

HAS THE SPECIES PREVIOUS BEEN FOUND IN LOS ALAMOS COUNTY?: NO

LA REFERENCE OF OCCURRENCE: N/A

GENERAL MAP LOCATION: N/A

COMMENTS:

REFERENCE: NM NATIVE PLANTS PROTECTION ADVISORY COMMITTEE, 1984.

APPENDIX E

Known and potential vegetation classifications for the Pajarito Plateau
based on Brown (1982), Moir and Ludwig (1979) and USFS (undated).

PLANT CLASSIFICATION OUTLINE- LOS ALAMOS NATIONAL LABORATORY

HIERARCHY ORDER

Vegetation Type

Formation Type

Climatic (Thermal) Zone

Biotic Community

Series

Habitat Type (Association)

Phase

DEFINITIONS

Vegetation Type: Refers to vegetation established under existing climate and includes one of two types: Upland and Wetland.

Formation Type: Refers to formations that are vegetative responses to various environmental factors, primarily available soil moisture, and include the following:

UPLAND

Tundra
Forest and Woodland
Scrubland
Grassland
Desertland
Non-vascular

WETLAND

Wet Tundra
Forest
Swamp-Scrub
Marshland
Strand
Submergent

Climatic Zone: Refers to one of the four world climatic zones where minimum temperature is the primary determining factor in separation of formation types. These include Arctic-Boreal, Cold Temperate, Warm Temperate, and Tropical-Subtropical.

Biotic Community: Refers to a unit characterized by a distinctive evolutionary history within a formation and are centered in a biogeographical region that has a particular precipitation pattern or climatic regime.

Series: Refers to principal plant-animal communities within each of the Biotic Communities. These are based on distinctive climax plant dominants.

Habitat Type: This is based on the occurrence of particular dominant species that are local or regional in distribution.

Phase: Based on detailed data collection in determining dominants, understories, and other species.

For purposes of BRET application, only those Formations, Climatic zones, Communities, etc. that occur at Los Alamos National Laboratory will be provided in this classification system. For a more complete description of all Formations, etc. see Brown, Lowe, and Pase (1980).

The following classification system is separated into the two vegetation types, Upland and Wetland.

UPLAND VEGETATION

Formation

Climatic Zone

Community

Series

Habitat Type (HT)

Phase

Forest and Woodland Formation

Boreal Forests and Woodlands Climatic Zone

Rocky Mountain Subalpine Conifer Forest and
Woodland Community

Picea engelmannii Series

Picea engelmannii (Pien)/Moss HT

Pien/*Vaccinium scoparium*/*Polemonium* HT

Picea engelmannii Phase

Abies lasiocarpa Phase

Pien/*Erigeron eximius* HT

Pien/*Geum rosii* HT

Pien/*Ribes montigenum* HT

Pien/*Elymus* sp. HT

Pien/*Acer glabrum* HT

Abies lasiocarpa Series

Abies lasiocarpa (Abla)/*Acer glabrum* HT

Abla/*Erigeron eximius* HT

Abla/*Vaccinium* HT

Typic Phase

Linnae borealis Phase

Rubus parviflora Phase

Abla/*Vaccinium*/*Linnae borealis* HT

Abla/*Rubus parviflorus* HT

Vaccinium Phase

Acer glabrum Phase

Abla/*Erigeron superbus* HT

Abla/*Juniperus communis* HT

Abla/*Sanjuisorboides* HT

Abla/*Lathyrus arizonicus* HT

Abla/*Mertensia ciliata* HT

Abla/Moss HT

Cold Temperate Forests and Woodlands Climatic Zone

Rocky Mountain Montane Conifer Forest Community

Picea pungens Series

Picea pungens (Pipu)/*Carex foenea* HT

Pipu/*Cornus stolonifera* HT

Pipu/Arctostaphylos uva-ursi HT
Pipu/Erigeron eximius HT
 Typic Phase
 Pinus ponderosa Phase
Pipu/Festuca arizonica HT
Pipu/Linnaea borealis HT
Pipu/Poa pratensis HT
Abies concolor Series
Abies concolor (Abco)/Acer glabrum HT
Abco/Quercus gambelii HT
 Quercus gambelii Phase
 Festuca arizonica Phase
Abco/Arctostaphylos uva-ursi HT
Abco/Berberis repens HT
Abco/Erigeron eximius HT
Abco/Festuca arizonica HT
 Festuca arizonica Phase
 Poa fendleriana Phase
 Quercus gambelii Phase
Abco/Lathyrus arizonicus HT
Abco/Robinia neomexicana HT
 Robinia neomexicana Phase
 Carex foenea Phase
Abco/Symphoricarpos HT
 Pinus ponderosa Phase
 Pinus flexilis Phase
Abco/Vaccinium myrtillus HT
Pseudotsuga menziesii Series
Pseudotsuga menziesii (Psme)/Berberis
 repens HT

Psme/Bromus ciliatus HT
Psme/Festuca arizonica HT
 Typic Phase
 Pinus aristata Phase
 Pinus flexilis Phase
 Populus tremuloides Phase
Psme/Muhlenbergia montana HT
 Pinus edulis Phase
 Pinus flexilis Phase
Psme/Quercus gambelii HT
 Quercus gambelii Phase
 Festuca arizonica Phase
 Muhlenbergia virescens Phase
Psme/Physocarpus monogynus HT
Pinus flexilis (Pifl) Series
Pifl/Arctostaphylos uva-ursi HT
Pinus ponderosa (Pipo) Series
Pipo/Artemisia arbuscula HT
Pipo/Arctostaphylos uva-ursi HT
Pipo/Bouteloua gracilis HT
 Bouteloua gracilis Phase
 Schizachyrium scoparium Phase
 Andropogon hallii Phase
 Artemisia tridentata Phase

Scrubland Formation

- Arctic-Boreal Scrubland Climatic Zone
 - Rocky Mountain Alpine and Subalpine Scrub Community
 - Willow Series
 - Spruce elfinwood Series
 - Bristle cone pine elfinwood Series
- Cold Temperate Scrubland Climatic Zone
 - Great Basin Montane Scrub Community
 - Oak scrub Series
 - Mountain mahogany Series
 - Maple scrub Series
 - Serviceberry Series
 - Bitterbrush Series
 - Mixed Deciduous Series
 - Plains Deciduous Scrub Community
 - Oak scrub Series
 - Sumac Series
 - Mixed Deciduous Series

Grassland Formation

- Arctic-Boreal Grassland Climatic Zone
 - Rocky Mountain Alpine and Subalpine Grassland Community
 - Sedge-Forb-Grass Series
- Cold Temperate Grasslands Climatic Zone
 - Plains Grassland Community
 - Blue grama (Bogr) grass Series
 - Bogr/Western wheatgrass HT
 - Bogr/Buffalo grass HT
 - Bogr/Galleta HT
 - Bogr/Black grama HT
 - Bogr/Needlegrass HT
 - Bogr/Winterfat HT
 - Mixed grama Series
 - Sideoats grama (Bocu)/Bluestem/Jumo HT
 - Bocu/Bogr HT
 - Bocu/Black grama HT
 - Bocu/Curly mesquite HT
 - Bocu/Metcalf muhly/Jumo HT
 - Bocu/Bluestem HT
 - Mixed grama/Jumo HT
 - Buffalo grass/Blue grama Series
 - Shrub-Grass Disclimax Series
 - Great Basin Shrub Grassland Community
 - Wheatgrass Series
 - Mixed Bunchgrass Series
 - Ricegrass/Galleta Series
 - Galleta/Ricegrass/Jumo HT
 - Ricegrass/Sagebrush Series
 - Galleta/Sagebrush HT
 - Western wheatgrass/Sagebrush HT
 - Sacaton/Saltbush Series
 - Sacaton/Shadscale/Fourwing HT

Swamp-Scrub Formation

Arctic-Boreal Swamp Scrub Climatic Zone

Rocky Mountain Alpine and Subalpine Swamp and
Riparian Scrub Community

Alnus tenuifolia Series

Alnus tenuifolia/Mixed deciduous Series

Salix bebbiana Series

Salix exigua Series

Salix irrorata Series

Salix scouleriana Series

Plains and Great Basin Riparian Scrub Community

Willow Series

Hymenoclea monogyra Series

Juglans microcarpa Series

Salt cedar disclimax Series

Rocky Mountain Riparian Scrub Community

Willow/Dogwood Series

Marshland Formation

Arctic-Boreal Marshland Climatic Zone

Rocky Mountain Alpine and Subalpine Marshland
Community

Rush Series

Manna Grass Series

Plains Interior Marshland Community

Rush Series

Bur-reed Series

Cattail Series

Bulrush Series

Rocky Mountain Montane Marshland Community

Rush Series

Great Basin Interior Marshland Community

Rush Series

Saltgrass Series

Strand Formation

Arctic-Boreal Strand Climatic Zone

Rocky Mountain Alpine and Subalpine Stream and
Lake Strand Community

Cold Temperate Strand Climatic Zone

Plains Interior Strand Community

Annual Series

Rocky Mountain Montane Stream and Lake Strand
Community

Annual Series

Great Basin Interior Strand Community

Annual Series

APPENDIX F

Plant species code list and data summaries for 1991 and
1992 surveys in Operable Unit 1082.

Plant species code list for 1992 surveys in Operable Unit 1082

SCIENTIFIC NAME	CODE	COMMON NAME
<i>Achillea lanulosa</i>	Acla	Western yarrow
<i>Agrostis alba</i>	Agal	Redtop bent
<i>Agropyron desertorum</i>	Agde	Russian wheatgrass
<i>Agropyron sp.</i>	Agox	Wheatgrass
<i>Agropyron smithii</i>	Agsm	Western wheatgrass
<i>Allium cernuum</i>	Alce	Nodding onion
<i>Andropogon gerardii</i>	Ange	Big bluestem
<i>Anaphalis margaritaceae</i>	Anma	Pearly-everlasting
<i>Antennaria parvifolia</i>	Anpa	Pussytoes
<i>Andropogon scoparius</i>	Ansc	Little bluestem
<i>Artemisia carruthii</i>	Arca	Wormwood
<i>Artemisia dracunculus</i>	Ardr	False tarragon
<i>Aristida sp.</i>	Arix	Threeawn
<i>Artemisia ludoviciana</i>	Arlu	Wormwood
<i>Bahia dissecta</i>	Badi	Wild chrysanthemum
<i>Berberis fendleri</i>	Befe	Colorado barberry
<i>Blepharoneuron tricholepis</i>	Bltr	Pine dropseed
<i>Bouteloua gracilis</i>	Bogr	Blue grama
<i>Bromus anomalus</i>	Bran	Nodding brome
<i>Bromus sp.</i>	Brox	Bromegrass
<i>Campanula rotundifolia</i>	Caro	Harebell
<i>Carex sp.</i>	Carx	Sedge
<i>Ceanothus fendleri</i>	Cefe	Buckbrush
<i>Cercocarpus montanus</i>	Cemo	Mountain mahogany
<i>Chrysothamnus nauseosus</i>	Chna	Chamisa, Rubber rabbit brush
<i>Chrysopsis villosa</i>	Chvi	Golden aster
<i>Cirsium sp.</i>	Cirx	Thistle
<i>Clematis pseudoalpina</i>	Clps	Rocky Mountain clematis
<i>Conyza canadensis</i>	Coca	Horseweed
<i>Cyperus esculentus</i>	Cyes	Nutsedge
<i>Epilobium sp.</i>	Epix	Fireweed
<i>Erigeron divergens</i>	Erdi	Fleabane daisy
<i>Erigeron flagellaris</i>	Erfl	Trailing fleabane
<i>Erigeron philadelphicus</i>	Erph	Common fleabane
<i>Fallugia paradoxa</i>	Fapa	Apache plume
<i>Franseria acanthicarpa</i>	Frac	Bursage
<i>Fragaria americana</i>	Fram	Wild strawberry
<i>Geranium caespitosum</i>	Geca	James geranium
<i>Gentiana sp.</i>	Genx	Gentian
<i>Grindelia aphanactis</i>	Grap	Gumweed
<i>Habenaria sparsiflora</i>	Hasp	Bog orchid
<i>Hymenopappus filifolius</i>	Hyfi	White ragweed
<i>Hymenoxys richardsonii</i>	Hyri	Bitterweed
<i>Ipomopsis aggregata</i>	Ipag	Desert trumpet
<i>Jamesia americana</i>	Jaam	Cliff bush
<i>Juncus interior</i>	Juin	Inland rush
<i>Juniperus monosperma</i>	Jumo	One-seeded juniper

<i>Juniperus scopulorum</i>	Jusc	Rocky Mountain juniper
<i>Koeleria cristata</i>	Kocr	Junegrass
<i>Lithospermum multiflorum</i>	Limu	Many-flowered stoneseed
<i>Linum neomexicana</i>	Line	New Mexico yellow flax
<i>Lotus wrightii</i>	Lowr	Deervetch
<i>Lupinus caudatus</i>	Luca	Tall lupine
<i>Melilotus albus</i>	Meal	White sweet clover
<i>Melilotus officinalis</i>	Meof	Yellow sweet clover
<i>Medicago sativa</i>	Mesa	Alfalfa
<i>Monarda menthaefolia</i>	Mome	Beebalm, Horsemint
<i>Muhlenbergia montana</i>	Mumo	Mountain muhly
<i>Muhlenbergia wrightii</i>	Muwr	Spike muhly
<i>Oenothera caespitosa</i>	Oeco	White stemless evening-primrose
<i>Oenothera hookeri</i>	Oeho	Hooker's primrose
<i>Orthocarpus luteus</i>	Orlu	Yellow owl-clover
<i>Parthenocissus inserta</i>	Pain	Virginia creeper
<i>Penstemon barbatus</i> var. <i>torreyi</i>	Peba	Scarlet bugler
<i>Pericome caudata</i>	Peca	Taperleaf
<i>Penstemon virgatus</i>	Pevi	Variegated penstemon
<i>Pinus ponderosa</i>	Pipo	Ponderosa pine
<i>Plantago rishii</i>	Plpu	Woolly indianwheat
<i>Poa</i> sp.	Poax	Bluegrass
<i>Polygonum convolvulus</i>	Poco	Black bindweed
<i>Poa interior</i>	Poin	Inland bluegrass
<i>Populus tremuloides</i>	Potr	Aspen
<i>Potentilla</i> sp.	Potx	Cinquefoil
<i>Prunus virginiana</i>	Prvi	Chokecherry
<i>Pseudotsuga menziesii</i>	Psme	Douglas fir
<i>Pseudocymopterus montanus</i>	Psmo	Mountain parsley
<i>Pterospora andromedea</i>	Ptan	Pinedrop
<i>Pulsatilla ludoviciana</i>	Pulu	Pasque flower
<i>Quercus</i> sp.	Quex	Oak
<i>Quercus gambelii</i>	Quga	Gambel oak
<i>Ratibida</i> sp.	Ratx	Coneflower
<i>Ribes cerceum</i>	Rice	Wax current
<i>Ribes inerme</i>	Riin	Gooseberry
<i>Rorippa nasturtium-aquaticum</i>	Rona	Watercress
<i>Robinia neomexicana</i>	Rone	New Mexico locust
<i>Rosa woodsii</i> var. <i>fendleri</i>	Rowo	Fendler's rose
<i>Rumex</i> sp.	Rumx	Dock
<i>Rubus strigosus</i>	Rust	Wild raspberry
<i>Senecio bigelovii</i>	Sebi	Bigelow groundsel
<i>Sitanion hystrix</i>	Sihy	Bottlebrush squirreltail
<i>Solidago</i> sp.	Solx	Goldenrod
<i>Thalictrum fendleri</i>	Thfe	Fendler meadowrue
<i>Thermopsis pinetorum</i>	Thpi	Pine goldenpea
<i>Townsendia incana</i>	Toin	Townsend's aster
<i>Tragopogon dubius</i>	Trdu	Salsify, Goatsbeard
<i>Typha angustifolia</i>	Tyan	Narrow-leaved cattail
<i>Valeriana acutiloba</i>	Vaac	Tobacco root

<i>Verbesina encelioides</i>	Veen	Crownbeard
<i>Verbascum thapsus</i>	Veth	Mullein
<i>Vicia americana</i>	Viam	American vetch

Operable Unit 1082: TA-16, Cañon de Valle, Behind building 340,
Canyon

Bottom, Ponderosa Pine, 8/26/92, Overstory

File = TA161C.XLS

Trees	No. Trees	Trees Per Acre	Rel. Density	AVG DBH	%Cover	Rel. Cover	%Freq.	Rel. Freq.	Importance Index
JUMO	1.00	2.20	1.79	0.10	5.00	14.61	0.14	7.69	8.03
JUSC	1.00	2.20	1.79	2.50	0.10	0.29	0.14	7.69	3.26
PIPO	47.00	103.30	83.93	7.98	19.01	55.57	1.00	53.85	64.45
PSME	6.00	13.19	10.71	13.15	10.00	29.23	0.29	15.38	18.44
SNAG	1.00	2.20	1.79	0.29	0.10	0.29	0.29	15.38	5.82
Total =	56.00	123.08	100.00	24.02	34.21	100.00	1.86	100.00	100.00

Shrubs	#Stems	#Stems Per Acre	Rel. Density	AVG DBH	%Cover	Rel. Cover	%Freq.	Rel. Freq.	Importance Index
QUGA	267.00	586.81	41.46	1.30	16.86	48.52	0.86	25.00	38.33
RIIN	45.00	98.90	6.99	0.10	1.33	3.81	0.29	8.33	6.38
ROWO	8.00	17.58	1.24	0.10	0.10	0.29	0.29	8.33	3.29
RONE	74.00	162.64	11.49	0.10	2.55	7.34	1.00	29.17	16.00
PRVI	13.00	28.57	2.02	0.10	5.00	14.39	0.29	8.33	8.25
BEFE	32.00	70.33	4.97	0.10	5.00	14.39	0.14	4.17	7.84
JAAM	202.00	443.96	31.37	0.10	3.81	10.97	0.43	12.50	18.28
RUST	3.00	6.59	0.47	0.10	0.10	0.29	0.14	4.17	1.64
Total =	644.00	1415.38	100.00	2.00	34.75	100.00	3.43	100.00	100.00

Operable Unit 1082: TA-16, Cañon de Valle, Behind building 340, Canyon
Bottom, Ponderosa Pine, 8/26/92, Understory

File = TA161U.XLS

Species	Cover	Plant Cover	Rel. Plant Cover	Freq.	Rel. Freq.	Importance Index
BARE SOIL	8.41					
ROCK	6.71					
LITTER	49.84					
MOSS/LICHEN	5.07					
TYAN		1.21	4.05	0.13	6.47	5.26
EPIX		0.16	0.52	0.04	2.16	1.34
AGAL		0.57	1.91	0.06	2.88	2.39
ROWO		0.57	1.91	0.09	4.32	3.11
POAX		7.86	26.23	0.40	20.14	23.19
BROX		0.89	2.96	0.17	8.63	5.79
TRDU		0.21	0.72	0.01	0.72	0.72
UNK GRASSES		8.93	29.80	0.36	17.99	23.90
AGOX		0.14	0.48	0.03	1.44	0.96
HASP		0.09	0.29	0.03	1.44	0.86
VETH		0.43	1.43	0.03	1.44	1.43
SIHY		0.07	0.24	0.01	0.72	0.48
JUIN		3.14	10.49	0.13	6.47	8.48
QUGA		0.57	1.91	0.06	2.88	2.39
RONE		2.57	8.58	0.14	7.19	7.89
BEFE		0.50	1.67	0.03	1.44	1.55
ANGE		0.36	1.19	0.01	0.72	0.96
RUST		0.21	0.72	0.04	2.16	1.44
RICE		0.37	1.24	0.03	1.44	1.34
CIRX		0.37	1.24	0.03	1.44	1.34
THFE		0.21	0.72	0.04	2.16	1.44
RONA		0.14	0.48	0.03	1.44	0.96
VAAC		0.14	0.48	0.03	1.44	0.96
FRAM		0.14	0.48	0.03	1.44	0.96
CLPS		0.07	0.24	0.01	0.72	0.48
PTAN		0.01	0.05	0.01	0.72	0.38
Total =	70.04	29.96	100.00	1.99	100.00	100.00

Operable Unit 1082: TA-16, Cañon de Valle, Behind building 340, North facing Slope, Ponderosa Pine, 8/25/92, Overstory

File = TA162C.XLS

Species	No. Trees	Trees Per Acre	Rel. Density	AVG. DBH	%Cover	Rel. %Cover	Freq	Rel. Freq	Importance Index
JUMO	3.00	9.33	2.42	1.60	0.00	0.00	0.21	17.65	6.69
PIPO	129.00	376.48	97.58	5.18	49.49	100.00	1.00	82.35	93.31
Total =	132.00	385.82	100.00	6.78	49.49	100.00	1.21	100.00	100.00

Species	No. Stems	Stems/ Acre	Rel. Density	Rel. Cover	Rel. Cover	Freq	Rel. Freq	Importance Index
QUGA	190.00	591.17	95.48	13.69	100.00	0.50	63.64	86.37
FAPA	6.00	18.67	3.02	0.00	0.00	0.07	9.09	4.04
RONE	3.00	9.33	1.51	0.00	0.00	0.21	27.27	9.59
Total =	199.00	619.17	100.00	13.69	100.00	0.79	100.00	100.00

Operable Unit 1082: TA-16, Cañon de Valle, Behind building 340, North-facing Slope, Ponderosa Pine, 8/26/92, Understory

File = TA162U.XLS

Species	Cover	Plant Cover	Rel. Plant Cover	Freq.	Rel. Freq.	Importance Index
BARE SOIL	15.10					
ROCK	0.00					
LITTER	73.17					
SOIL CRUST	3.36					
MOSS/LICHEN	0.79					
SIHY		0.17	2.24	0.06	4.04	3.14
ANSC		0.14	1.87	0.01	1.01	1.44
MUMO		2.21	28.91	0.34	24.24	26.58
BLTR		0.86	11.19	0.13	9.09	10.14
POAX		0.43	5.60	0.07	5.05	5.32
ANPA		0.59	7.65	0.07	5.05	6.35
BADI		0.01	0.19	0.01	1.01	0.60
ALCE		0.09	1.12	0.03	2.02	1.57
FAPA		0.00	0.00	0.00	0.00	0.00
KOCR		0.07	0.93	0.01	1.01	0.97
ANGE		0.07	0.93	0.01	1.01	0.97
ROWO		0.07	0.93	0.01	1.01	0.97
ACLA		1.11	14.55	0.19	13.13	13.84
ERDI		0.10	1.31	0.04	3.03	2.17
LOWR		0.01	0.19	0.01	1.01	0.60
PEBA		0.00	0.00	0.00	0.00	0.00
ORLU		0.00	0.02	0.01	1.01	0.51
SEBI		0.07	0.93	0.01	1.01	0.97
BRAN		0.30	3.92	0.06	4.04	3.98
GECA		0.21	2.80	0.04	3.03	2.91
RONE		0.21	2.80	0.04	3.03	2.91
ERFL		0.07	0.93	0.01	1.01	0.97
FRAM		0.14	1.87	0.03	2.02	1.94
ARLU		0.16	2.05	0.04	3.03	2.54
THPI		0.21	2.80	0.04	3.03	2.91
CARX		0.14	1.87	0.03	2.02	1.94
PULU		0.10	1.31	0.04	3.03	2.17
PSMO		0.07	0.93	0.01	1.01	0.97
VAAC		0.01	0.19	0.01	1.01	0.60
Total =	92.41	7.66	100.00	1.41	100.00	100.00

Operable Unit 1082: TA-16, Cañon de Valle, Behind building 340, North-facing Slope, Ponderosa Pine, 8/26/92, Overstory

File = TA162U.XLS

Cont.

Plants found in area but not recorded in the transect:

TOIN
ERPH
POTX
IPAG
HYFI
CHVI
ARCA
CEFE
ARDR
LINE
QUGA
GENX

Operable Unit 1082: TA-16, Cañon de Valle, South-facing Slope,
Ponderosa Pine, 8/26/92, Overstory

File = TA163C.XLS

Species	No. Trees	Trees/ Acre	Rel Density	AVG. DBH	%Cover	Rel %Cover	Freq	Rel Freq	Importance Index
JUMO	6.00	15.56	16.67	0.10	0.00	0.00	0.36	25.00	13.89
PIPO	24.00	71.56	76.67	8.83	21.31	49.80	0.64	45.00	57.16
QUGA	1.00	3.11	3.33	13.50	21.49	50.20	0.36	25.00	26.18
SNAG	1.00	3.11	3.33	20.10	0.00	0.00	0.07	5.00	2.78
Total =	32.00	93.34	100.00	42.53	42.80	100.00	1.43	100.00	100.00

Species	No. Stems	Stems/ Acre	Rel Density	Rel Cover	Rel Cover	Rel Freq	Importance Index
QUGA	163.00	507.16	56.21	21.49	97.16	0.86	67.79
QUEX	90.00	280.03	31.03	0.63	2.84	0.36	18.24
RONE	4.00	12.45	1.38	0.00	0.00	0.21	4.63
CEMO	12.00	37.34	4.14	0.00	0.00	0.14	4.16
JAAM	21.00	65.34	7.24	0.00	0.00	0.14	5.19
Total =	290.00	902.32	100.00	22.11	100.00	1.71	100.00

Operable Unit 1082: TA-16, Cañon de Valle, South-facing Slope,
Ponderosa Pine, 8/26/92, Understory

File = TA163U.XLS

Species	Cover	Plant Cover	Rel. Plant Cover	Freq.	Rel. Freq.	Importance Index
BARE SOIL	13.20					
ROCK	13.21					
LITTER	67.94					
MUMO		1.36	24.05	0.23	27.12	25.58
ANSC		2.30	40.76	0.24	28.81	34.79
ANGE		0.50	8.86	0.04	5.08	6.97
ARLU		0.47	8.35	0.13	15.25	11.80
SIHY		0.09	1.52	0.03	3.39	2.45
RONE		0.14	2.53	0.03	3.39	2.96
ARIX		0.07	1.27	0.01	1.69	1.48
BRAN		0.21	3.80	0.03	3.39	3.59
POAX		0.36	6.33	0.07	8.47	7.40
CARX		0.07	1.27	0.01	1.69	1.48
BLTR		0.07	1.27	0.01	1.69	1.48
Total =	94.36	5.64	100.00	0.84	100.00	100.00

Plants found in area but not recorded in the transect:

LOWR
CHVI
POIN
CIRX

Operable Unit 1082: TA-16, Mesatop, Behind building 460, Old Field,
8/27/92, Overstory

File = TA164C.XLS

Species	No. Trees/	Rel	AVG.	Rel	Rel	Importance			
	Trees	Acre	Density	DBH	%Cover	%Cover	Freq	Freq	Index
PIPO	5.00	15.56	100.00	4.62	0.14	100.00	0.21	100.00	100.00
Total =	5.00	15.56	100.00	4.62	0.14	100.00	0.21	100.00	100.00

Operable Unit 1082: TA-16, Mesatop, Behind building 460, Old Field,
8/27/92, Understory

File = TA164U.XLS

Species	Cover	Plant Cover	Rel. Plant Cover	Freq.	Rel. Freq.	Importance Index
BARE SOIL	14.86					
ROCK	0.00					
LITTER	30.09					
POAX		23.07	41.87	0.81	27.40	34.64
SIHY		0.21	0.39	0.04	1.44	0.92
AGOX		0.21	0.39	0.04	1.44	0.92
BOGR		0.71	1.30	0.09	2.88	2.09
MUMO		0.14	0.26	0.01	0.48	0.37
AGSM		6.00	10.89	0.24	8.17	9.53
GECA		0.23	0.41	0.06	1.92	1.17
ARDR		5.29	9.59	0.43	14.42	12.01
FRAC		1.44	2.62	0.17	5.77	4.19
BADI		0.01	0.03	0.01	0.48	0.25
VETH		0.01	0.03	0.01	0.48	0.25
LUCA		7.79	14.13	0.31	10.58	12.35
POTX		1.86	3.37	0.11	3.85	3.61
ME		0.43	0.78	0.03	0.96	0.87
ERFL		3.86	7.00	0.20	6.73	6.87
ARCA		0.57	1.04	0.10	3.37	2.20
AGDE		0.14	0.26	0.03	0.96	0.61
MUWR		0.36	0.65	0.01	0.48	0.56
ANPA		0.57	1.04	0.03	0.96	1.00
LINE		0.00	0.01	0.03	0.96	0.48
HYRI		0.07	0.13	0.01	0.48	0.31
COCA		0.16	0.29	0.03	0.96	0.62
RATX		1.71	3.11	0.09	2.88	3.00
VEEN		0.07	0.13	0.01	0.48	0.31
OECO		0.01	0.03	0.01	0.48	0.25
ERDI		0.16	0.29	0.03	0.96	0.62
Total =	44.94	55.10	100.00	2.97	100.00	100.00

Operable Unit 1082: TA-16, Mesatop, Behind building 460, Old Field,
8/27/92, Understory

File = TA164U.XLS
Cont.

Plants found in area but not recorded in the transect:

PHPA
AGAL
JUN
VIAM
TRDU
ALCE
PEVI
PLPU
GRAP
OEHO

Operable Unit 1082: TA-16, Mesatop, Behind building 460, Ponderosa
Pine, 8/27/92, Overstory

File = TA165C.XLS

Species	No. Trees/ Trees	Rel Acre	AVG. Density	Rel DBH	Rel %Cover	Rel %Cover	Rel Freq	Rel Freq	Importance Index
PIPO	64.00	213.44	100.00	4.06	36.98	100.00	1.00	100.00	100.00
Total =	64.00	213.44	100.00	4.06	36.98	100.00	1.00	100.00	100.00

Species	No. Stems/ Stems	Rel Acre	Rel Density	Rel Cover	Rel Cover	Rel Freq	Rel Freq	Importance Index
QUGA	1.00	4.36	100.00	0.00	0.00	0.10	100.00	66.67
Total =	1.00	4.36	100.00	0.00	0.00	0.10	100.00	66.67

Operable Unit 1082: TA-16, Mesatop, Behind building 460, Ponderosa
Pine, 8/27/92, Understory

File = TA165U.XLS

Species	Cover	Plant Cover	Rel. Plant Cover	Freq.	Rel. Freq.	Importance Index
BARE SOIL	19.40					
ROCK	0.64					
LITTER	58.44					
MOSS/LICHEN	0.43					
SIHY		1.57	7.45	0.33	11.86	9.65
LUCA		4.86	23.00	0.34	12.37	17.69
POTX		1.94	9.16	0.31	11.34	10.25
BOGR		6.93	32.81	0.57	20.62	26.71
ARCA		0.91	4.30	0.30	10.82	7.56
CHVI		0.14	0.68	0.01	0.52	0.60
PLPU		0.00	0.01	0.01	0.52	0.26
HYRI		0.21	1.01	0.04	1.55	1.28
MUMO		0.07	0.34	0.01	0.52	0.43
ALCE		0.00	0.01	0.03	1.03	0.52
LINE		0.00	0.01	0.01	0.52	0.26
ERFL		0.72	3.39	0.10	3.61	3.50
ARLU		0.00	0.01	0.01	0.52	0.26
CARX		0.14	0.68	0.04	1.55	1.11
PSMO		0.14	0.68	0.04	1.55	1.11
AGSM		0.57	2.71	0.11	4.12	3.42
BADI		0.00	0.01	0.01	0.52	0.26
IPAG		0.00	0.01	0.01	0.52	0.26
GECA		0.14	0.68	0.04	1.55	1.11
ARDR		0.79	3.72	0.09	3.09	3.41
POCO		0.01	0.07	0.01	0.52	0.29
ANPA		0.36	1.69	0.01	0.52	1.10
MESA		0.07	0.34	0.01	0.52	0.43
POAX		1.21	5.75	0.19	6.70	6.22
CHVI		0.09	0.41	0.03	1.03	0.72
CIRX		0.07	0.34	0.01	0.52	0.43
VIAM		0.01	0.07	0.01	0.52	0.29
FRAC		0.14	0.68	0.03	1.03	0.85
Total =	78.92	21.13	100.00	2.77	100.00	100.00

Operable Unit 1082: TA-16, Mesatop, Behind building 460, Ponderosa
Pine, 8/27/92, Understory

File = TA165U.XLS
cont.

Plants found in area but not recorded in the transect:

ORLU
ANGE

Operable Unit 1082: TA-28, Mesatop, Behind Bunker 1, Burned Ponderosa
Pine, 8/27/92, Overstory

File = TA281C.XLS

Species	No. Trees	Trees/Acre	Rel Density	AVG. DBH	%Cover	Rel %Cover	Rel Freq	Importance Index
PIPO	14.00	24.89	66.67	0.76	0.00	0.00	0.57	48.89
SNAG	1.00	3.11	8.33	15.70	0.00	0.00	0.07	6.11
POTR	4.00	12.45	33.33	2.85	0.00	0.00	0.14	17.78
Total =	18.00	37.34	100.00	3.61	0.00	0.00	0.71	66.67

Species	No. Stems	Stems/Acre	Rel Density	Rel Cover	Rel Cover	Rel Freq	Importance Index
QUGA	337.00	1048.55	48.98	10.09	31.10	0.71	39.52
RONE	337.00	1048.55	48.98	22.34	68.90	1.00	57.24
BEFE	6.00	18.67	0.87	0.00	0.00	0.07	1.57
RUST	8.00	24.89	1.16	0.00	0.00	0.07	1.67
Total =	688.00	2140.66	100.00	32.43	100.00	1.86	100.00

Operable Unit 1082: TA-28, Mesatop, Behind Bunker 1, Burned Ponderosa
Pine, 8/27/92, Understory

File = TA281U.XLS

Species	Cover	Plant Cover	Rel. Plant Cover	Freq.	Rel. Freq.	Importance Index
BARE SOIL	16.84					
ROCK	29.99					
LITTER	41.09					
MOSS/LICHEN	4.00					
BLTR		2.29	28.26	0.19	17.11	22.68
MUMO		1.43	17.66	0.19	17.11	17.38
KOCR		0.09	1.06	0.03	2.63	1.85
RONE		1.71	21.19	0.24	22.37	21.78
ERDI		0.29	3.53	0.04	3.95	3.74
CHFO		0.01	0.18	0.01	1.32	0.75
ARCA		0.09	1.06	0.03	2.63	1.85
COCA		0.14	1.78	0.04	3.95	2.87
VETH		0.29	3.53	0.04	3.95	3.74
BADI		0.09	1.06	0.03	2.63	1.85
RUST		0.57	7.06	0.06	5.26	6.16
AGAL		0.07	0.88	0.01	1.32	1.10
CARX		0.17	2.14	0.07	6.58	4.36
QUGA		0.43	5.30	0.03	2.63	3.97
POAX		0.21	2.65	0.03	2.63	2.64
POTR		0.14	1.77	0.03	2.63	2.20
ARDR		0.07	0.88	0.01	1.32	1.10
Total =	91.91	8.09	100.00	1.09	100.00	100.00

Plants in area but not recorded in the transect:

ANSC
IPAG
CYES
THPI
FRAM

Operable Unit 1082: TA-28, Water Canyon, South-facing Slope, Burned
Ponderosa Pine, 8/27/92, Overstory

File = TA282C.XLS

Species	No. Trees	Trees/ Acre	Rel Density	AVG DBH	Rel %Cover	Rel %Cover	Freq	Rel Freq	Importance Index
PIPO	2.00	6.22	28.57	6.30	1.00	100.00	0.07	25.00	51.19
SNAG	5.00	15.56	71.43	11.22	0.00	0.00	0.21	75.00	48.81
Total =	7.00	21.78	100.00	17.52	1.00	100.00	0.29	100.00	100.00

Species	No. Stems	Stems/ Acre	Rel Density	Rel Cover	Rel Cover	Freq	Rel Freq	Importance Index
QUGA	223.00	693.85	77.97	7.24	65.42	0.57	53.33	65.57
CHNA	6.00	18.67	2.10	0.00	0.00	0.07	6.67	2.92
RONE	52.00	161.79	18.18	3.83	34.58	0.36	33.33	28.70
RUST	5.00	15.56	1.75	0.00	0.00	0.07	6.67	2.80
Total =	286.00	889.87	100.00	11.07	100.00	1.07	100.00	100.00

Operable Unit 1082: TA-28, Water Canyon, South-facing Slope, Burned
Ponderosa Pine, 8/27/92, Understory

File = TA282U.XLS

Species	Plant Cover	Rel. Plant Cover	Freq.	Rel. Freq.	Importanc e Index	
BARE SOIL	34.90					
ROCK	4.93					
LITTER	44.79					
MOSS/LICHEN	2.71					
BLTR		2.29	18.04	0.33	20.72	19.38
MUMO		6.71	52.99	0.71	45.05	49.02
ANSC		0.14	1.13	0.03	1.80	1.46
QUGA		0.07	0.56	0.01	0.90	0.73
RONE		0.57	4.51	0.06	3.60	4.06
ARDR		0.07	0.56	0.01	0.90	0.73
VETH		0.14	1.13	0.03	1.80	1.46
SOLX		0.21	1.69	0.04	2.70	2.20
BADI		0.09	0.68	0.03	1.80	1.24
CEFE		0.71	5.64	0.01	0.90	3.27
CARX		0.29	2.25	0.04	2.70	2.48
ANPA		0.07	0.56	0.01	0.90	0.73
ANGE		0.07	0.56	0.01	0.90	0.73
GECA		0.14	1.13	0.03	1.80	1.46
ERDI		0.01	0.11	0.01	0.90	0.51
POA		0.36	2.82	0.06	3.60	3.21
FRAC		0.29	2.25	0.06	3.60	2.93
ACLA		0.07	0.56	0.01	0.90	0.73
POTX		0.07	0.56	0.01	0.90	0.73
RUST		0.07	0.56	0.01	0.90	0.73
BRAN		0.07	0.56	0.01	0.90	0.73
FRAM		0.14	1.13	0.03	1.80	1.46
Total =	87.33	12.67	100.00	1.59	100.00	100.00

Plants in area but not recorded in transect:

IPAG
PECA
TOIN
ANMA
PLPU
CARO
MUWR

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