APPENDIX: A FLOODPLAINS AND WETLANDS ASSESSMENT OF THE PROPOSED FUTURE DISPOSITION OF CERTAIN CERRO GRANDE FIRE FLOOD AND SEDIMENT RETENTION STRUCTURES AT LOS ALAMOS NATIONAL LABORATORY

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Title

A Floodplains and Wetlands Assessment of the Proposed Future Disposition of Certain Cerro Grande Fire Flood and Sediment Retention Structures at Los Alamos National Laboratory

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Assessment Decision

No adverse effect: proposal effects on floodplains and wetlands would be short-term and temporary in nature.

Executive Summary

The Department of Energy proposes future disposition of certain structures installed to mitigate potential flooding after the Cerro Grande fire, including the Flood Retention Structure, the Los Alamos Canyon weir and detention basin, road reinforcements, and a steel diversion wall. This assessment documents potential impacts of the floodplains and wetlands associated with the areas. General best management practices are included to ensure that impacts do not occur to floodplains and wetlands that may exist in the area of the proposed projects. No potential loss of life or property has been identified with respect to the floodplains and wetlands for the proposed project. Concerns about siltation, erosion, and excessive storm water runoff will be addressed with specific mitigation implemented as part of careful project planning. Although there may be some effect to floodplains and wetlands, the potential impacts from these projects are expected to be minor.

1.0 Introduction

In May 2000, a prescription burn, started on Federally administered land to the northwest of Los Alamos National Laboratory (LANL), blew out of control and was designated as a wildfire. This wildfire, which became known as the Cerro Grande Fire (CGF), burned over 17,200 ha (43,000 ac) of forest along the eastern flank of the Pajarito Plateau before it was extinguished. Approximately 7,650 ac (3,061 ha) within the boundaries of LANL were burned; nearly 10 percent (over 200 residential units occupied by over 400 families) of the Los Alamos townsite nearby was also burned. During the fire a number of emergency actions were undertaken by the National Nuclear Security Administration (NNSA) to suppress and extinguish the fire within LANL; immediately thereafter, NNSA undertook additional emergency actions to address the post-fire conditions.

The CGF resulted in the creation of areas of hydrophobic soils, which are non-permeable soil areas created as a result of very high temperatures often associated with wildfires. These hydrophobic soils, combined with the loss of vegetation from steep canyon sides as a result of high- and moderate-severity fires, greatly affected the hydrologic functions of the watersheds in the LANL area. Surface runoff and soil erosion on the hillsides above LANL were greatly increased over pre-fire levels. The danger to LANL facilities and structures and homes located down-canyon from the burned area was magnified. Decisions to install storm water and flood control and erosion damage reduction features were made during the summer following the CGF based on the perceived increased risk of damages to LANL and offsite facilities, structures, and homes. Computer modeling was used to estimate the risks using data collected on the amount of rain that fell and subsequent runoff generated in June, July, and August 2000. Storm water and flood damage control actions undertaken included the placement of sand bags, rocks, logs, straw bales and wattles, silt fences, and concrete barriers at numerous locations throughout LANL and the installation of trash racks at several locations. In addition, the U.S. Army Corps of Engineers (USACE) or LANL contractors constructed certain flood and sediment retention structures. These certain constructed flood and sediment retention structures and their watershed canyon locations are as follows:

1. A flood retention structure (FRS) constructed of roller compacted concrete (RCC) located in Pajarito Canyon.
2. A low-head weir, constructed of rectangular rock-filled wire cages (gabions), and associated detention basin in Los Alamos Canyon.
3. Reinforcements of several road crossings;
   a. a land bridge along Anchor Ranch Road in Two-Mile Canyon,
   b. State Road (SR) 501 embankment reinforcements in Two-Mile Canyon,
   c. SR 501 reinforcements in Pajarito Canyon, and
   d. SR 501 reinforcements in Water Canyon.
4. A steel diversion wall upstream of Technical Area (TA) 18 in Pajarito Canyon.
5. A downstream access road to the Los Alamos Reservoir and reinforcement of the reservoir embankment[1].

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[1] The disposition of reinforcements to the Los Alamos Reservoir and the access road will not be considered in this document because they are no longer under the administrative control of DOE, NNSA.

These structures are identified by number in Figure 1.

The construction of these structures and other activities taken by NNSA in the wake of the CGF, and their impacts, were analyzed in the *Special Environmental Analysis for the Department of Energy, National Nuclear Security Administration, Actions Taken in Response to the Cerro Grande Fire at Los Alamos National Laboratory, Los Alamos, New Mexico* (DOE/SEA-03) (DOE 2000a) issued by NNSA in September 2000.

Subsequent modeling performed in 2001 based on additional site information shows little recovery (Springer 2002). However, many of the areas that were reseeded as part of the recovery efforts have new vegetative cover because of favorable growing conditions experienced over the past year. This vegetation coverage as it grows, matures, and spreads and is augmented by the germination and growth of native species, will begin to moderate the flood threat substantially over the next two to five years, depending on the severity and onset of drought, which may prolong recovery. A return to pre-fire conditions, or at least stabilization of the regional ecosystem, is expected to occur over the next three to eight years (2005 to 2010). The need for protection afforded by the placement of the flood and sediment retention structures will diminish accordingly.

While the impacts of constructing the identified flood and sediment retention structures were included in the analysis provided in DOE/SEA-03, the future disposition of these structures, some of which were designed to last for decades, was not considered. Mitigation measures listed in DOE/SEA-03 include the following commitment: "Removal of the constructed flood control and erosion damage reduction features and the FRS when storm water flows have returned to pre-fire levels as denoted by vegetation recovery and annual modeling estimates will be considered. Additional NEPA [National Environmental Protection Act] and other regulatory compliance would be necessary when these actions become ripe for consideration. If structures are removed, re-contouring and reseeding of these areas with appropriate site-specific seed mixtures would be conducted until these construction sites have been completely revegetated." DOE is preparing an environmental assessment (DOE 2002) to evaluate the effects of the disposition of the FRS, the low-head weir and detention basin, road reinforcements, and the steel diversion wall.

2.0 Proposed Action

The Proposed Action is to remove part of the above ground portion of the FRS and the entire above ground portions of the steel diversion wall; the other subject structures would remain in place with continued performance of routine maintenance activities. However, until NNSA determines that site conditions have returned to pre-fire status or the local ecosystem has recovered enough to approximate pre-fire conditions, the various subject structures will be maintained as described in the Flood Retention Structure Environmental Assessment (FRS EA) (DOE 2002); this may be the case for the next several years. The exact duration for the continuance of the status quo cannot be established at this time because of the unpredictability of weather patterns, revegetation rates, changes in soil structure, and the possibility of other events that would affect revegetation and flows, such as other fires in the watersheds above where the subject structures are located. In addition, there may be changes in NNSA missions, land

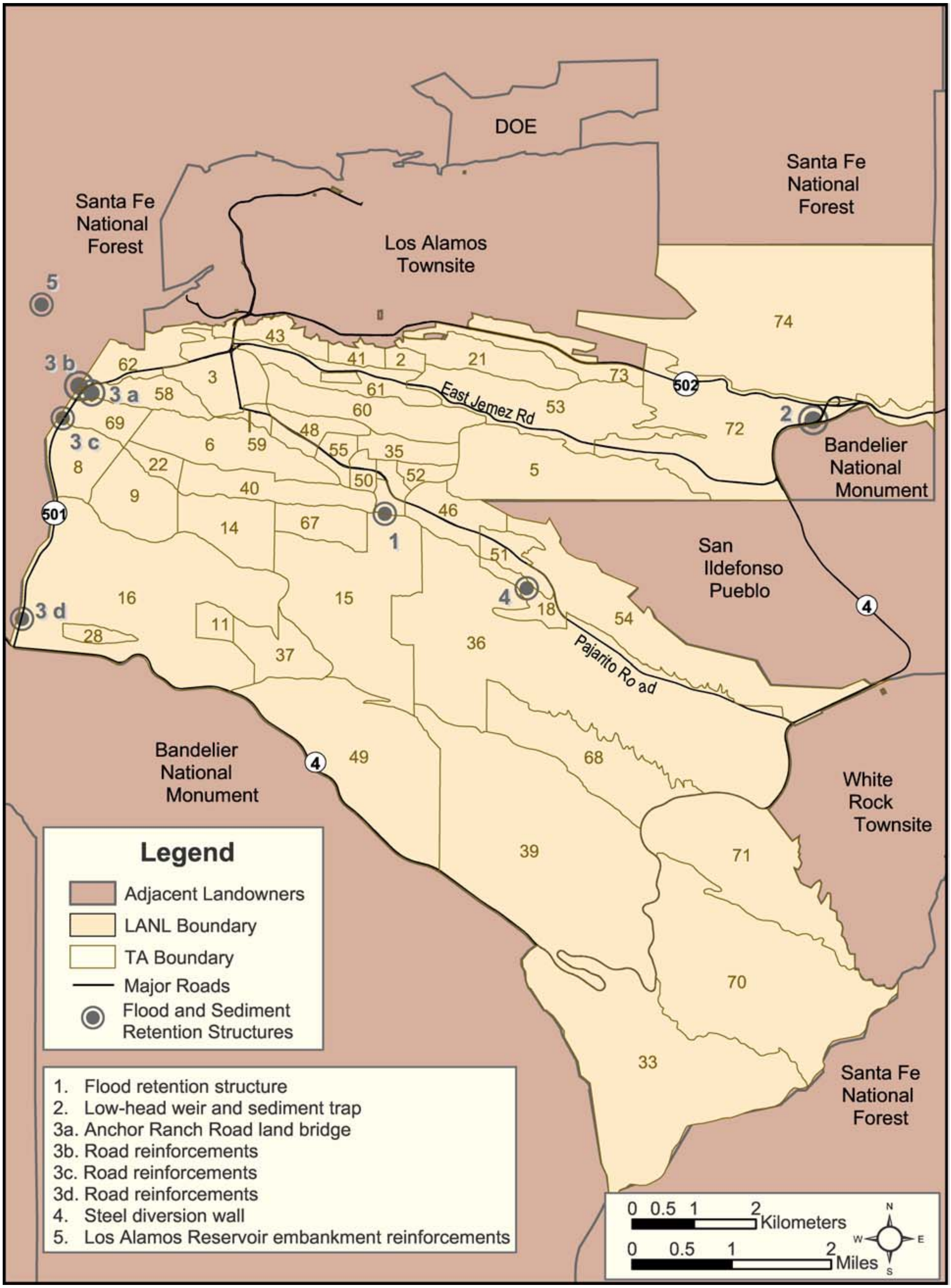

Figure 1. Locations of certain flood and sediment retention structures.

management policies, and environmental stewardship policies that might affect when disposition of the subject structures should occur. The Proposed Action and alternatives described in this document are based on the continuance of LANL mission support activities and capabilities for the foreseeable future, as described in LANL's Site-Wide Environmental Impact Statement (SWEIS) (DOE 1999) and other DOE NEPA documents and planning documents. If changes in mission support activities or policies occur such that these alternatives are no longer suitable, further NEPA analysis might be required. Additionally, the Proposed Action and alternatives are based on the projection of adequate recovery of the ecosystem at LANL within the next eight years (by 2010) (DOE 2000b). Proposed activities under each alternative would occur by the end of 2010. For full details see DOE 2002.

2.1 Flood Retention Structure

Implementing the Proposed Action would result in the removal of part of the FRS above ground level and in the removal of sediments sufficient to allow resumption of the natural flow in the streambed without future floodwater retention. Currently, the volume of sediment that has accumulated behind the FRS is estimated to be about 4,330 m^3 (5,700 yd^3) of material at a depth of 3 ft (0.9 m) at the base of the FRS. This volume of sediment represents two years accumulation. With continuing revegetation in the watershed above the FRS, sediment is likely to be deposited and accumulate at a diminishing rate. As part of the DOE/SEA-03 MAP, the sediment is tested annually for chemical, radiological, and heavy metal constituents. Removal of sediment volumes under the Proposed Action would be based on the sediment composition as well as on the amount of accumulation over the next several years. A bounding volume of 21,660 m^3 (28,500 yd^3) of sediment material would need to be removed from the FRS site; this is the amount estimated to accumulate over 10 years based on the accumulation in the two years following the Cerro Grande Fire.

2.2 Low-head Weir and Detention Basin

The low-head weir and detention basin would be left in place as part of the Proposed Action; routine maintenance activities would be performed. As described in the corresponding environmental assessment (DOE 2002), a wetland could be forming in the detention basin. If present, the wetland would remain in place. Current maintenance activities would be carried out, including the replacement of wire mesh containers as they rust or fail. Sampling of sediments would be performed to evaluate potential chemical radiological and heavy metal constituent concentrations in the detention basin, and sediments would be removed as required and disposed of appropriately through the LANL waste management program.

2.3 Road Reinforcements

Road reinforcements would be left in place as part of the Proposed Action. Routine inspection and maintenance activities would continue to be conducted when required.

2.4 Steel Diversion Wall

Under either option for the TA-18 facilities, the steel diversion wall above TA-18's CASA I would be removed. The pilings would be removed down to ground level with a cutting torch or similar tool. The 19 m^3 (25 yd^3) of panels and beams generated by the demolition would be removed and shipped off site for recycling. A crew of eight would be required to work for approximately six weeks to accomplish removal of this structure.

3.0 Environmental Baseline

3.1 Regional Description

3.1.1 Location within the State

LANL and the associated residential areas of Los Alamos and White Rock are located in Los Alamos County, north-central New Mexico, approximately 100 km (60 mi) north-northeast of Albuquerque and 40 km (25 mi) northwest of Santa Fe (Figure 2). The 11,596-ha (28,654-ac) LANL site is situated on the Pajarito Plateau. This plateau is a series of fingerlike mesas separated by deep east-to-west-oriented canyons cut by intermittent streams. Mesa tops range in elevation from approximately 2,400 m (7,800 ft) on the flanks of the Jemez Mountains to about 1,900 m (6,200 ft) at their eastern termination above the Rio Grande.

Most LANL and community developments are confined to mesa tops. The surrounding land is largely undeveloped. Large tracts of land north, west, and south of the LANL site are held by the Santa Fe National Forest, Bureau of Land Management, Bandelier National Monument, General Services Administration, and Los Alamos County. The Pueblo of San Ildefonso borders LANL to the east.

3.1.2 Geologic Setting

Most of the fingerlike mesas in the Los Alamos area are composed of Bandelier Tuff, which consists of ash fall, ash fall pumice, and rhyolite tuff. The tuff, ranging from nonwelded to welded, is more than 300 m (1,000 ft) thick in the western part of the plateau and thins to about 80 m (260 ft) eastward above the Rio Grande (Broxton et al., 1995). Tuff was deposited after major eruptions in the Jemez Mountains Volcanic Field about 1.2 to 1.6 million years ago (Self and Sykes 1996).

On the western part of the Pajarito Plateau, the Bandelier Tuff overlaps onto the Tschicoma Formation, which consists of older volcanics that form the Jemez Mountains (Self and Sykes 1996). The conglomerate of the Puye Formation underlies the tuff in the central plateau and near the Rio Grande. Chino Mesa basalts interfinger with the conglomerate along the river. These formations overlay the sediments of the Santa Fe Group, which extend across the Rio Grande Valley and are more than 1,000 m (3,300 ft) thick. LANL is bordered on the east by the Rio Grande, within the Rio Grande rift. Because of the faulting associated with the rift, the area experiences frequent minor seismic disturbances.

Surface water in the Los Alamos area occurs primarily as short-lived or intermittent reaches of streams. Perennial springs on the flanks of the Jemez Mountains supply base flow into the upper reaches of some canyons, but the volume is insufficient to maintain surface flows across the LANL site before they are depleted by evaporation, transpiration, and infiltration (DOE 1999). Runoff from heavy thunderstorms or heavy snowmelt reaches the Rio Grande several times a year in some drainages. Effluents from sanitary sewage, industrial waste treatment plants, and

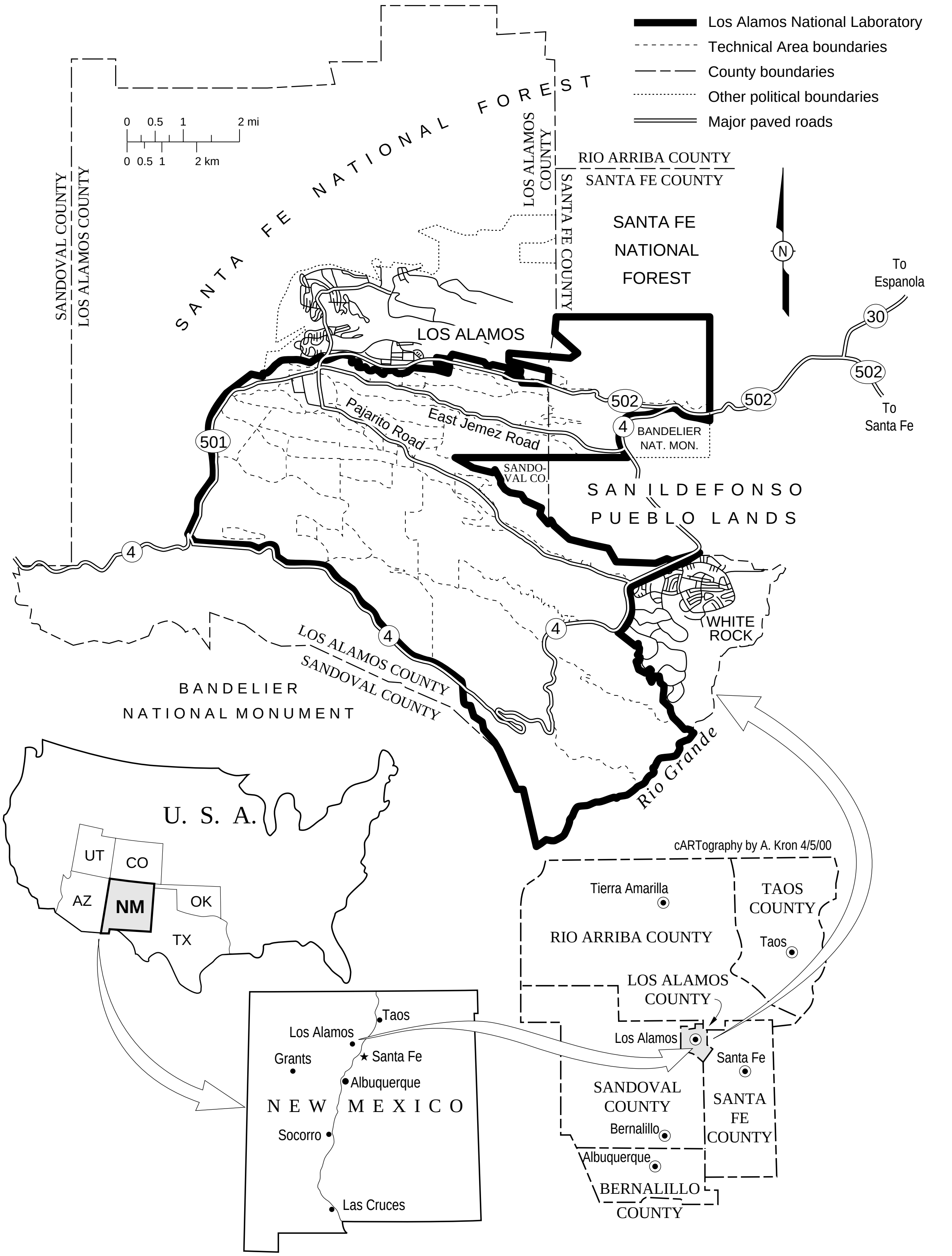

Figure 2. Location of Los Alamos National Laboratory.

cooling-tower blowdown enter some canyons at rates sufficient to maintain surface flows for varying distances.

Groundwater in the Los Alamos area occurs in three forms: (1) water in shallow alluvium in canyons, (2) perched water (a body of groundwater above a less permeable layer that is separated from the underlying main body of groundwater by an unsaturated zone), and (3) the main aquifer of the Los Alamos area. Ephemeral and intermittent streams have filled some parts of canyon bottoms with alluvium that ranges from less than 1 m (3 ft) to as much as 30 m (100 ft) in thickness. Runoff in canyon streams percolates through the alluvium until its downward movement is impeded by layers of weathered tuff and volcanic sediment that are less permeable than the alluvium. This process creates shallow bodies of perched groundwater that move downgradient within the alluvium. As water in the alluvium moves down the canyon, it is depleted by evapotranspiration and movement into underlying volcanics (Purtymun et al., 1977). The chemical quality of the perched alluvial groundwaters shows the effects of discharges from LANL.

In portions of Pueblo, Los Alamos, and Sandia canyons, perched groundwater occurs beneath the alluvium at intermediate depths within the lower part of the Bandelier Tuff and within the underlying conglomerates and basalts. Perched groundwater has been found at depths of about 37 m (120 ft) in the midreach of Pueblo Canyon to about 137 m (450 ft) in Sandia Canyon near the eastern boundary of LANL (Purtymun 1995a). This intermediate-depth perched water discharges at several springs in the area of Basalt Spring in Los Alamos Canyon. These intermediate-depth groundwaters are formed in part by recharge from the overlying perched alluvial groundwaters and show evidence of radioactive and inorganic contamination from LANL operations (Purtymun 1995a).

Perched water may also occur within the Bandelier Tuff in the western portion of LANL, just east of the Jemez Mountains. The source of this perched water might be infiltration from streams discharging from the mouths of canyons along the mountain front and underflow of recharge from the Jemez Mountains. Industrial discharges from LANL operations may also contribute to perched groundwater in the western portion of LANL. Perched groundwater in the Tschicoma Formation is the source of water supply for the ski area located just west of the LANL boundary in the Jemez Mountains.

The main aquifer of the Los Alamos area is the only aquifer in the area capable of serving as a municipal water supply (Griggs 1964). The surface of the aquifer rises westward from the Rio Grande within the Tesuque Formation (part of the Santa Fe Group) into the lower part of the Puye Formation beneath the central and western part of the plateau. Depth to the main aquifer is about 300 m (1,000 ft) beneath the mesa tops in the central part of the plateau. The main aquifer is separated from alluvial and perched waters by about 110 to 190 m (350 to 620 ft) of tuff and volcanic sediments with low (less than 10 percent) moisture content (Griggs 1964).

Water in the main aquifer is under artesian conditions under the eastern part of the Pajarito Plateau near the Rio Grande (Purtymun and Johnson 1974). The source of recharge to the aquifer is presently uncertain. Early research studies concluded that major recharge to the main aquifer is probably from the Jemez Mountains to the west because the piezometric surface slopes downward to the east, suggesting easterly groundwater flow beneath the Pajarito Plateau

(Purtymun 1995b). However, the small amount of recharge available from the Jemez Mountains relative to water supply pumping quantities, along with differences in isotopic and trace element composition, appear to rule this out. Further, isotopic and chemical composition of some waters from wells near the Rio Grande suggest that the source of water underlying the eastern part of the Pajarito Plateau may be the Sangre de Cristo Mountains (Blake et al. 1995).

Groundwater flow along the Rio Grande rift from the north is another possible recharge source. The main aquifer discharges into the Rio Grande through springs in White Rock Canyon. The 18.5-km (11.5-mi) reach of the river in White Rock Canyon between Otowi Bridge and the mouth of Rito de los Frijoles receives an estimated 5.3 to 6.8×10^6 m^3 (4,300 to 5,500 acre-ft) annually from the aquifer (Griggs 1964).

3.1.3 Topographic Setting

LANL and its surrounding environments encompass a wide range of environmental conditions. This is due in part to the prominent elevational gradient in the east-west direction. This is also attributable to the complex, local topography that is found throughout much of the region.

The spectacular scenery that is a trademark of the Los Alamos area is largely a result of this regional gradient. The difference between its lowest elevation in the eastern extremities and its highest elevation on the western boundaries represents a change of approximately 1,568 m (5,146 vertical feet). At the lowest point along the Rio Grande, the elevation is approximately 1,631 m (5,350 ft) above mean sea level. At the opposite elevational extreme, the Sierra de los Valles, which is part of the more extensive Jemez Mountains, forms a continuous backdrop to the landscapes of the region being studied. The tallest mountain peaks in the Sierra include Pajarito Mountain at 3,182 m (10,441 ft), Cerro Rubio at 3,185 m (10,449 ft), and Caballo Mountain at 3,199 m (10,496 ft).

In addition to the prominent elevational gradient, the Los Alamos region is also topographically complex. Within Los Alamos County, there are three main physiographic systems (Nyhan et al., 1978). From east to west, these systems are the White Rock Canyon, the Pajarito Plateau, and the Sierra de los Valles. White Rock Canyon is 1,890 m (6,200 ft) above mean sea level. This rugged canyon is approximately 1.6 km (1 mi) wide and extends to a depth of nearly 275 m (900 ft). White Rock Canyon occupies about 5 percent of Los Alamos County. The Pajarito Plateau is the largest of the three physiographic systems, occupying nearly 65 percent of Los Alamos County. The Pajarito Plateau is a broad piedmont that slopes gently to the east and southeast. At a more localized scale, the Pajarito Plateau is also topographically complex. The surface of the plateau is dissected into narrow mesas by a series of east-west-trending canyons. Above 2,377 m (7,800 ft), the Sierra de los Valles rises to the western extremity of the study region. These mountains occupy approximately 30 percent of Los Alamos County. The Sierra is also dissected into regularly spaced erosional features, although these canyons in the mountains are not so prominent as the canyons on the Pajarito Plateau.

3.1.4 Weather and Climate

Los Alamos has a temperate, semiarid mountain climate. However, its climate is strongly influenced by elevation, and large temperature and precipitation differences are observed in the area because of the topography.

Los Alamos has four distinct seasons. Winters are generally mild, but occasionally winter storms produce large amounts of snow and below-freezing temperatures. Spring is the windiest season of the year. Summer is the rainy season in Los Alamos, when afternoon thunderstorms and associated hail and lightning are common. Fall marks the end of the rainy season and a return to drier, cooler, and calmer weather. The climate statistics discussed below summarize analyses given in Bowen (1990 and 1992).

Several factors influence the temperature in Los Alamos. An elevation of 2,256 m (7,400 ft) helps to counter its southerly location, making for milder summers than nearby locations with lower elevations. The sloping nature of the Pajarito Plateau causes cold-air drainage, making the coolest air settle into the valley. The Sangre de Cristo Mountains to the east act as a barrier to arctic air masses affecting the central and eastern United States. The temperature does occasionally drop well below freezing, however. Another factor affecting the temperature in Los Alamos is the lack of moisture in the atmosphere. With less moisture, there is less cloud cover, which allows a significant amount of solar heating during the daytime and radiative cooling during the nighttime. This heating and cooling often causes a wide range of daily temperature.

Winter temperatures range from 30°F to 50°F (-1°C to 10°C) during the daytime to 15°F to 25°F (-9°C to -4°C) during the nighttime. The record low temperature recorded in Los Alamos (as of 1992) is -18°F (-28°C). Winter is usually not particularly windy, so extreme wind chills are uncommon at Los Alamos. Summer temperatures range from 70°F to 88°F (21°C to 31°C) during the daytime to 50°F to 59°F (10°C to 15°C) during the nighttime. Temperatures occasionally will break 90°F (32°C). The highest temperature ever recorded (as of 1992) in Los Alamos is 95°F (35°C).

The average annual precipitation in Los Alamos is 47.57 cm (18.73 in.). The average snowfall for a year is 149.6 cm (58.9 in.). Freezing rain and sleet are rare at Los Alamos. Winter precipitation in Los Alamos is often caused by storms entering the United States from the Pacific Ocean, or by cyclones forming or intensifying in the lee of the Rocky Mountains. When these storms cause upslope flow over Los Alamos, large snowfalls can occur. The snow is usually a dry, fluffy powder, with an average equivalent water-to-snowfall ratio of 1:20.

The summer rainy season accounts for 48 percent of the annual precipitation. During the July–September period, orographic thunderstorms form when moist air from the Gulf of Mexico and the Pacific Ocean moves up the sides of the Jemez Mountains. These thunderstorms can bring large downpours, but sometimes they only cause strong winds and lightning. Hail frequently occurs from these rainy-season thunderstorms.

Winds in Los Alamos are also affected by the complex topography, particularly in the absence of a large-scale disturbance. There is often a distinct daily cycle of the winds around Los Alamos. During the daytime, upslope flow can produce a southeasterly wind on the plateau. In the evening, as the mountain slopes and plateau cool, the flow moves downslope, causing light westerly and northwesterly flow. Cyclones moving through the area disturb and override the cycle. Flow within the canyons of the Pajarito Plateau can be quite varied and complex.

3.1.5 Plant Communities

The Pajarito Plateau, including the Los Alamos area, is biologically diverse. This diversity of ecosystems is due partly to the dramatic 1,500-m (5,000-ft) elevation gradient from the Rio Grande on the east to the Jemez Mountains 20 km (12 mi) to the west, and partly to the many steep canyons that dissect the area. Five major vegetative cover types are found in Los Alamos County: juniper (*Juniperus monosperma*)-savanna, piñon (*Pinus edulis*)-juniper, ponderosa pine (*Pinus ponderosa*), mixed conifer, and spruce-fir. All of the communities and their distribution are described in Balice (1998). The juniper-savanna community is found along the Rio Grande on the eastern border of the plateau and extends upward on the south-facing sides of canyons at elevations between 1,700 to 1,900 m (5,600 to 6,200 ft). The piñon-juniper cover type, generally in the 1,900- to 2,100-m (6,200- to 6,900-ft) elevation range, covers large portions of the mesa tops and north-facing slopes at the lower elevations. Ponderosa pines are found in the western portion of the plateau in the 2,100- to 2,300-m (6,900- to 7,500-ft) elevation range. These three cover types predominate, each occupying roughly one-third of the LANL site. The mixed conifer cover type, at an elevation of 2,300 to 2,900 m (7,500 to 9,500 ft), overlaps the ponderosa pine community in the deeper canyons and on north-facing slopes and extends from the higher mesas onto the slopes of the Jemez Mountains. Spruce-fir is at higher elevations of 2,900 to 3,200 m (9,500 to 10,500 ft). Twenty-seven wetlands and several riparian areas enrich the diversity of plants and animals found on LANL lands.

3.1.6 Post-Fire Plant Communities

In May 2000, the CGF burned over 17,200 ha (43,000 ac) of forest on and around LANL. Most of the habitat damage occurred on Forest Service property to the west and north of LANL. An assessment of fire-induced vegetation mortality was made by the Burned Area Emergency Rehabilitation Team (BAER 2000). As a result of the fire, approximately 3,110 ha (7,684 ac) or 28 percent of the vegetation at LANL was burned in some fashion. However, few areas on LANL were burned severely. Additionally, some vegetation was burned in floodplains, but very little in wetlands.

3.1.7 Pre- and Post-Fire Hydrology

McLin (1992) modeled all major 100-year floodplains for LANL using USACE Hydrologic Engineering Center HEC-1 and HEC-2 computer-based models. These data represent pre-fire flow rates for all of the floodplains on LANL. Post-fire analyses have been completed (McLin et al., 2001, 2002). These new models show increases in peak flow of one to two orders of magnitude per unit drainage basin area.

4.0 Description and Effects on Floodplains and Wetlands

Pursuant to Executive Order 11988, Floodplain Management, each Federal agency is required, when conducting activities in a floodplain, to take actions to reduce the risk of flood damage; minimize the impact of floods on human safety, health, and welfare; and restore and preserve the natural and beneficial values served by floodplains. DOE's 10 CFR Part 1022.4 defines a flood or flooding as ". . . a temporary condition of partial or complete inundation of normally dry land areas from . . . the unusual and rapid accumulation of runoff of surface waters . . . ." DOE's 10 CFR Part 1022.4 identifies floodplains that must be considered in a floodplain assessment as the base floodplain and the critical-action floodplain. The base floodplain is the area inundated by a flood having a 1.0 percent chance of occurrence in any given year (referred to as the 100-year floodplain). The critical-action floodplain is the area inundated by a flood having a 0.2 percent chance of occurrence in any given year (referred to as the 500-year floodplain). Critical action is defined as any activity for which even a slight chance of flooding would be too great. Such actions could include the storage of highly volatile, toxic, or water-reactive materials.

Pursuant to Executive Order 11990, Protection of Wetlands, each Federal agency is to avoid, to the extent practicable, the destruction or modification of wetlands, and to avoid direct or indirect support of new construction in wetlands if a practicable alternative exists. DOE regulations define wetlands as "those areas that are inundated by surface or groundwater with a frequency sufficient to support and under normal circumstances does or would 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" (10 CFR Section 1022.4[v]).

According to 10 CFR 1022.12(a)(2), a floodplain/wetland assessment is required to discuss the positive and negative, direct and indirect, and long- and short-term effects of the Proposed Action on the floodplain and/or wetlands. In addition, the effects on lives and property and on natural and beneficial values of floodplains must be evaluated. For actions taken in wetlands, the assessment should evaluate the effects of the Proposed Action on the survival, quality, and natural and beneficial values of the wetlands. If DOE finds no practicable alternative to locating activities in floodplains or wetlands, DOE will design or modify its actions to minimize potential harm to or in the floodplains and wetlands. The floodplains and wetlands that are assessed herein are those areas in canyons or drainages that are seasonally inundated with perennial or intermittent streams from runoff during 100-year floods.

4.1 General

Wetland functions are naturally occurring characteristics of wetlands such as food web production; general nesting, resting, or spawning habitat; sediment retention; erosion prevention; flood and runoff storage; retention and future release; groundwater discharge or recharge; and land-nutrient retention and removal. Wetland values are ascribed by society based on the perception of significance and include water-quality improvement, aesthetic or scenic value, experiential value, and educational or training value. These values often reflect concerns regarding economic values; strategic locations; and, in arid regions, the location relative to other landscape features. Thus, two wetlands with similar size and shape could serve the same function but have different values to society. For example, a wetland that retains or changes flood-flow timing of a flood high in the mountains might not be considered as valuable as one of similar size that retains or changes flood-flow timing of a flood near a developed community. Wetlands were addressed in the LANL SWEIS as follows (DOE 1999):

"Wetlands in the general LANL region provide habitat for reptiles, amphibians, and invertebrates and potentially contribute to the overall habitat requirements of the peregrine falcon, Mexican spotted owl, southwestern willow flycatcher, and spotted bat. Wetlands also provide habitat, food, and water for many common species such as deer, elk, small mammals, and many migratory birds and bats. The majority of the wetlands in the LANL region are associated with canyon stream channels or are present on mountains or mesas as isolated meadows containing ponds or marshes, often in association with springs."

Wetlands within LANL have been broadly mapped by the U.S. Fish and Wildlife Service. This information is available in the National Wetlands Inventory in a Geographic Information System-based format. This hierarchical system follows Cowardin et al. (1979) and is based entirely on aerial photography. Small wetlands, or those in steep canyons, may not be detected using this method. Additional onsite surveys and internal University of California databases were also used to gather information regarding these resources.

4.2 Canyon Area Issues and Concerns

The canyon areas on LANL land are comprised primarily of mixed conifer and ponderosa pine. Areas outside of Habitat Management Plan (LANL 1998) areas for threatened and endangered species will be treated according to the mitigation detailed within this document and DOE/SEA-03. In all cases, erosion, sediment transfer, and movement of contaminants are a concern, from work on mesa tops as well as within floodplains, particularly during rain events and the rainy season. Cumulative erosion of ash and soils from severely burned headlands above project sites is also a potential concern. The potential for downstream floodplain and wetland values to be impacted by the proposed project exists for the canyons.

4.3 Potential Effects of the Proposed Projects

The proposed actions of partial removal of the FRS and full removal of the above-ground section of the steel diversion wall are subject to various impacts described below. After ten years of growth, the vegetation in all of the structure sites will likely be mature. This includes potential establishment of a wetland in the Los Alamos weir detention basin area.

In all cases where the projects take place within a canyon, personnel are subject to maintaining the integrity of all natural and beneficial floodplain values. In those floodplains that also have wetlands, survival, quality, natural and beneficial wetland values also must be maintained. In carrying out activities described above for these projects, as per Executive Order 11988 and Executive Order 11990 all impacts to public health, safety, and welfare including water supply, quality, recharge and discharge, pollution, flood and storm hazards, sediment, and erosion will be evaluated. Additionally, the corresponding environmental assessment for this document includes extensive discussion of suggested BMPs (DOE 2002).

Possible direct effects of the proposed projects are a reduction in vegetation cover and exposure of mineral soils. If heavy equipment is used directly within the floodplain, soil compaction and increased surface impermeability may occur. General indirect effects of these efforts are the potential for the increase of erosion and storm water runoff.

Primary indirect effects (within identified canyons) to floodplains and wetlands resulting from the removal effort may include movement or ponding of water or sediment within the project area. For instance, if work conducted in Pajarito Canyon contributed to increased sediment movement, there may be some retention of those sediments by the wetlands downstream. There will likely be a great deal of soil and sediment disturbance, including the removal of any growth that may have established in the 10 or more years prior. For all proposed structures facing removal or partial removal, all materials would have to be removed from the floodplain (parts of the structure, debris, soils, and vegetation) such that normal flows could continue after removal.

Secondary indirect effects (outside of the project area) resulting from the removal effort would result in possible impacts to floodplains and wetlands not associated with the project area (e.g., downstream to the Rio Grande). Downstream floodplain/wetland values potentially affected by the project could include a slight alteration of flood-flow retention times, a slight alteration of nesting, foraging, or resting habitat, and a slight redistribution of sediments and sediment-retention time changes. These secondary indirect impacts are anticipated to come from both changes in timing of storm water runoff (speed) and increases in storm water runoff (volume) from increased impermeable surfaces within the tract from the use of heavy equipment compacting the soil.

5.0 Specific Assessments for the Proposed Projects

5.1 Flood Retention Structure

The FRS, located 240 m (800 ft) downstream of the confluence of Two-Mile and Pajarito Canyons, rises 21.6 m (72 ft) above the natural ground surface and stretches 117 m (390 ft) across Pajarito Canyon (Figure 3). The slopes of the canyon are showing signs of revegetation with upland species.

5.1.1 Floodplains

The floodplain covers the entire extent of the canyon from the headlands to White Rock. The 100-year floodplain near the FRS is shown in Figure 3.

5.1.2 Wetlands

Wetlands exist in Pajarito Canyon below TA-18. They range in size from 0.09 ha (0.23 ac) to 5.3 ha (13.2 ac) on either side of the road beginning at Potrillo Drive (the entrance to TA-18). These wetlands are hydrologically maintained by storm water and natural springs. The headlands of the Pajarito Canyon watershed were severely burned in the CGF. Ash deposits from storm water runoff were measured between 46 and 61 cm (18 to 24 in.) in the upper most wetland (Marsh 2001). Non-wetland species washed down from the hydromulch were also noted post-CGF.

5.1.3 Potential Effects of the Proposed Action and Alternatives

Implementing the Proposed Action would result in the removal of part of the FRS above ground level and in the removal of sediments sufficient to allow resumption of the natural flow in the streambed without future floodwater retention. There are two different options for removal of sediment, concrete and gabion rock resulting from the demolition of the FRS, depending on the decisions made about the future disposition of the TA-18 capabilities and facilities that are currently located downstream from the FRS (see Related Actions discussion in section 2.6 of the FRS EA). Option A describes the Proposed Action under the condition that the TA-18 capabilities and facilities remain located in facilities downstream from the FRS and that national security concerns would not allow use of the maintenance road below the FRS. Option B describes the Proposed Action under the condition that the TA-18 mission has been relocated and

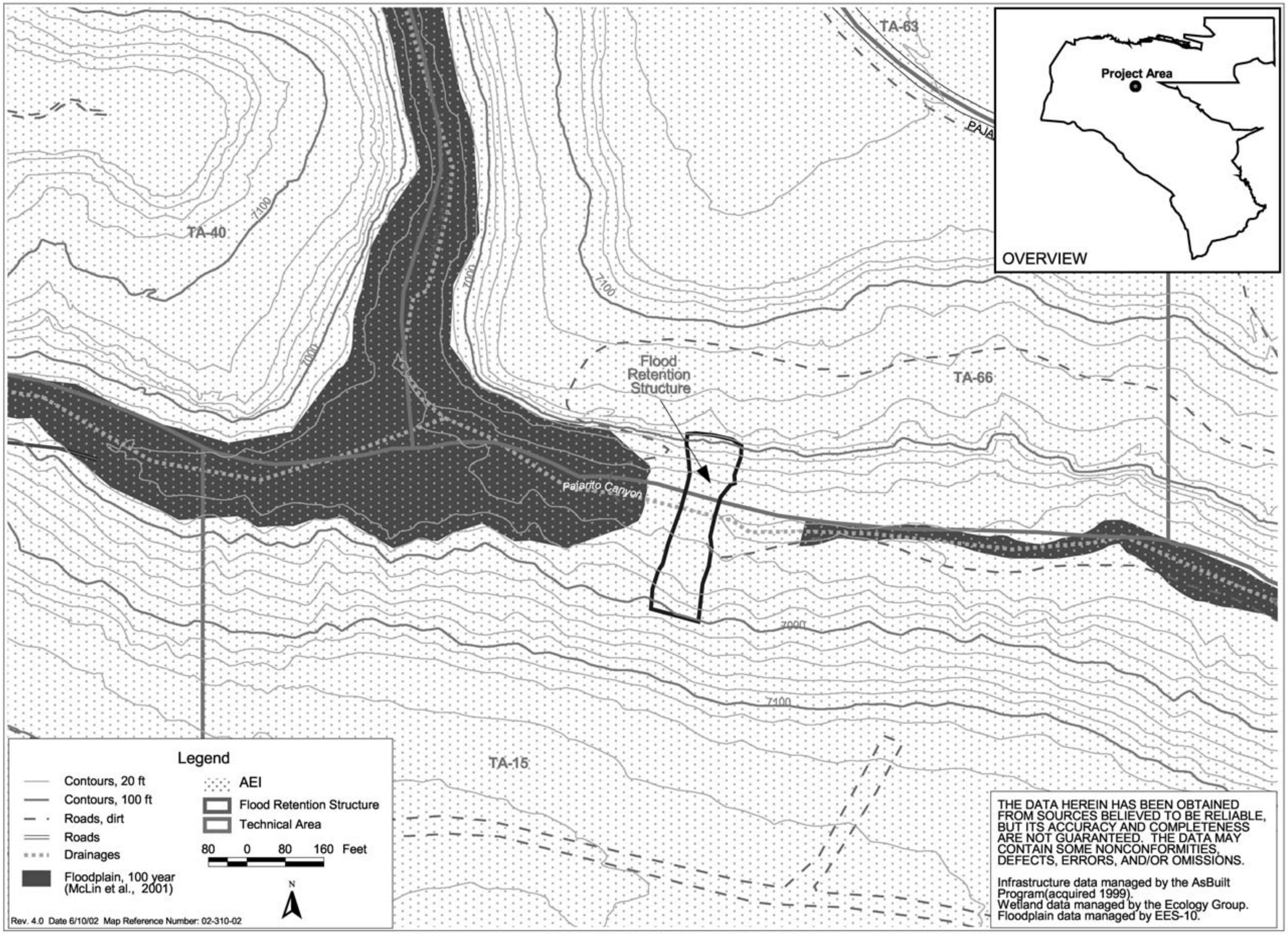

Figure 3. Location of FRS in Pajarito Canyon.

that the existing facilities are not subject to heightened national security measures, allowing construction equipment access through that site.

If TA-18 capabilities continue at their present location, the Proposed Action project would use the existing access road that connects Pajarito Canyon to Pajarito Road. The road may have to be modified to change the current steep grade. If TA-18 capabilities continue at their present location, the Proposed Action would use the existing access road that connects Pajarito Canyon to Pajarito Road. The road may have to be modified to change the current steep grade to accommodate six-wheel-drive off-road vehicles to carry the concrete, rocks, and sediment up the road. Alternatively, DOE may decide to use a continuous generator conveyor belt, such as those that are used in the mining industry, to haul debris out of the canyon. This would minimize truck traffic in the canyon. The staging area for loading material into dump trucks to be moved to a long-term storage yard would be at the top of the canyon, near Pajarito Road and well away from the floodplain. At the end of demolition and removal of the gabions, concrete, and sediment, the streambed would be graded. The remaining sides of the FRS would be stabilized and the banks would be reseeded. The area would be monitored and maintained to prevent erosion of the slopes and damage to the floodplain and downstream wetlands. The access road would be removed and that part of the canyon wall would be recontoured and stabilized.

If the TA-18 capabilities and facilities are relocated away from TA-18, it is unlikely that NNSA would decide to use the existing site for any NNSA mission support activity that had the same level of national security requirements. Currently, access to the maintenance road below the FRS connecting to the TA-18 facilities is restricted because of enhanced security conditions. If this mission relocation occurs before the disposition of the FRS, the existing maintenance road below the FRS and the area occupied by the TA-18 facilities could be used for transportation and staging of the concrete, rock, and sediment. The road would be upgraded and erosion BMPs would be installed. Similar to Option A, the removal would require 6-wheel-drive off-road vehicles to carry the concrete, rocks, and sediment up the road. The truckloads and material quantities would be the same as for Option A. A new 3-ac (1.2-ha) staging area would be established and used in TA-18. The staging area would be located outside of the floodplain and would be sited so as to avoid any cultural resources and potential release sites (PRSs). At the staging area, the concrete would be loaded onto dump trucks for transportation to a long-term storage yard within LANL. At the end of demolition and removal of the gabions, concrete, and sediment, the streambed would be graded. The remaining sides of the FRS would be stabilized and the banks would be reseeded. The area would be monitored and maintained to prevent erosion of the slopes and damage to the floodplain and downstream wetlands. Unlike Option A, at the end of the FRS removal activities, both the maintenance road and the access road to the upstream side of the FRS would be retained as fire roads for vehicle access to the upper portion of Pajarito Canyon and the firing sites at TA-22.

The downstream wetland area east of TA-18 would not likely be adversely affected due to the BMPs that would be employed at the site and the distance to the wetlands. Work conducted in Pajarito Canyon could contribute to an increase in the potential for sediment movement. If large quantities of sediment were moved downstream, there could be some retention of those sediments by the wetlands downstream in Pajarito Canyon. All excess materials, including demolition debris, soils, and dead vegetation, would be removed from the area so that normal flows could resume after the conclusion of the project. The area would be reseeded to stabilize the site.

Implementing the Disassembly Alternative would result in the total removal of the FRS to ground level, along with sediments and gabion rocks, and restoration of the entire area of the FRS and reservoir surface to approximately preconstruction topographic conditions. As described in the Proposed Action, there would be two options for removal of the concrete, rock and sediments. Under the condition that the TA-18 capabilities and facilities remain located in facilities downstream from the FRS and that national security concerns would not allow use of the maintenance road below the FRS, the material would be removed as described in Option A under the Proposed Action. Should the TA-18 mission be relocated, material would be removed as described in Option B under the Proposed Action.

The downstream wetland area east of TA-18 would not likely be adversely affected due to BMPs that would be employed at the site and the distance to the wetlands. With total removal of the FRS, there would be a proportional increase in erosion potential of the canyon walls since the sides of the FRS structures would be completely removed. If large quantities of sediment move downstream, there could be some retention of those sediments by the wetlands downstream in Pajarito Canyon. All excess materials, including demolition debris, soils, and dead vegetation, would be removed from the area so that normal flows could resume at the conclusion of the project.

Under the No Action Alternative, the FRS would remain intact. UC staff at LANL would continue inspection and maintenance activities. However, because the ecosystem would have returned to pre-fire or to near pre-fire conditions and the danger of major flooding would be reduced, it is unlikely that water would be retained in the reservoir behind the FRS. The steep embankment would need continued maintenance for erosion control. The No Action Alternative activities for maintenance and repair of the FRS would reduce the potential for crumbling of the structure and subsequent long-term release of construction materials that could affect the floodplain and wetlands downstream in TA-18. Routine maintenance is expected to remove vegetation growth in the sediment upstream of the structure. No adverse effect or change to the wetland and floodplain functions and values within Pajarito Canyon would likely occur from the No Action Alternative.

5.2 Low-head Weir and Detention Basin

The low-head weir and detention basin are located in Los Alamos Canyon near the intersection of SR 4 and SR 501 within TA-72 (Figure 4). The weir provides sediment control and retention and decelerates storm water flow. The detention basin is located on the upland side of the weir where water may pool for several months, particularly in normal years with spring runoff and monsoon storm water events. The Los Alamos Reservoir is periodically drained during the rainy season, and the water collects at the low-head weir. The reservoir will continue to be periodically drained until flows return to “normal.”

5.2.1 Floodplains

The entire length of Los Alamos Canyon is considered a floodplain.

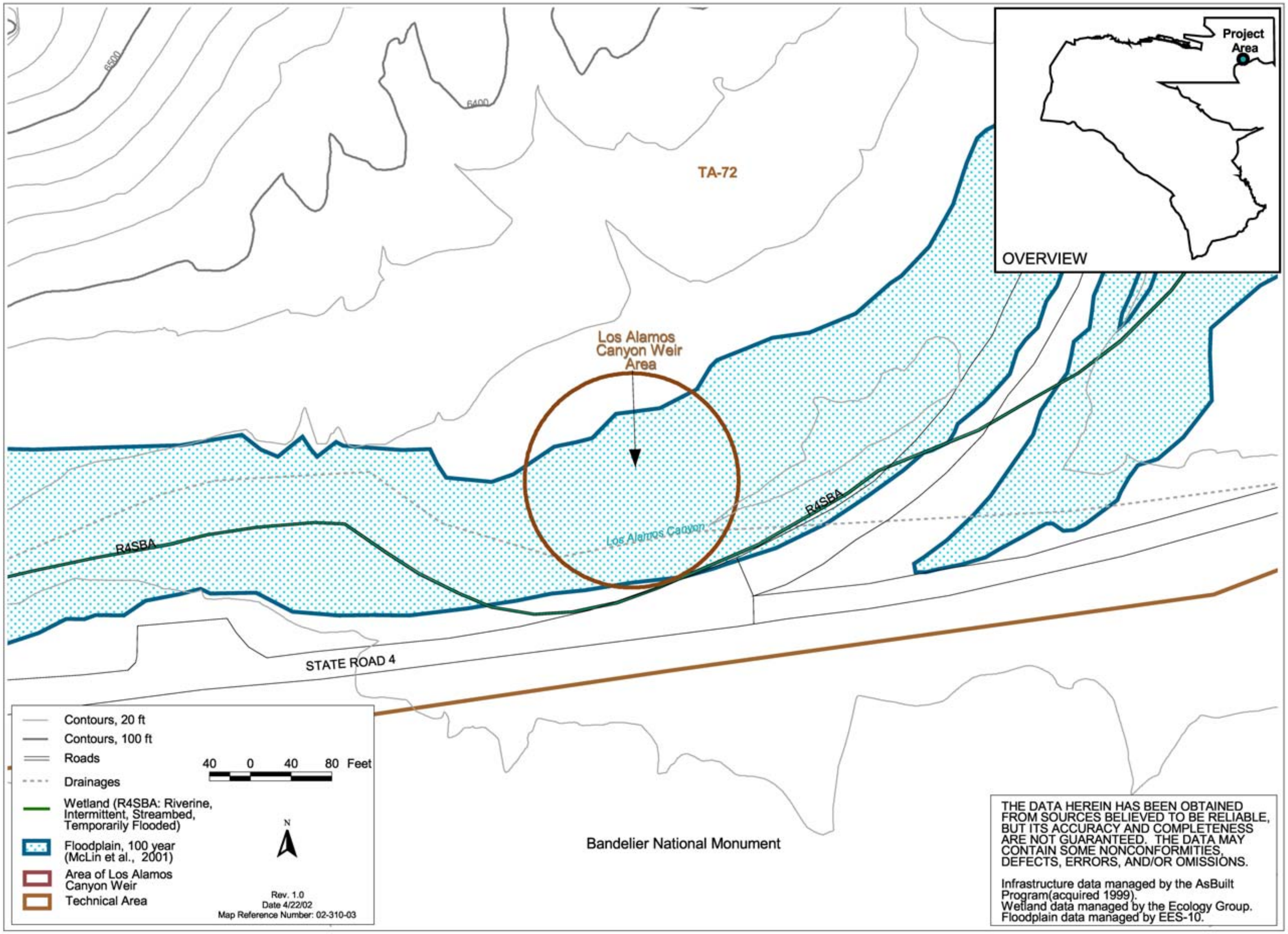

Figure 4. Location of low-head weir in Los Alamos Canyon.

5.2.2 Wetlands

One small wetland is located in this canyon approximately 1.12 km (0.7 mi) northwest of the weir and out of the proposed project area. There are associated scattered areas of hydric soils in the stream channel, but not within the project area. There are also hydrophilic plants along the stream channel, which maintain the streambed integrity.

Wetland characteristics have begun to form in the sediment behind the low-head weir as of summer 2001 (Marsh 2001). Willows (*Salix* spp.) and cottonwoods (*Populus* spp.) have been planted by LANL staff to decrease soil erosion. This area is being monitored for the continued formation of a wetland. If conditions continue as they have in the last two years, further sedimentation and water pooling may occur, and this area may become a fully established wetland by the time this project takes place. Even in severe drought conditions, there is likely some seasonal rain activity that will recharge this area to some extent.

5.2.3 Potential Effects of the Proposed Action and Alternatives

The low-head weir and detention basin would be left in place as part of the Proposed Action; routine maintenance activities would be performed. As described above, a wetland could be present in the detention basin, although this is uncertain. If present, the wetland would remain in place. Current maintenance activities would be carried out, including the replacement of wire mesh containers as they rust or fail. Sampling of sediments would be performed to evaluate potential chemical radiological and heavy metal constituent concentrations in the detention basin, and sediments would be removed as required and disposed of appropriately through the LANL waste management program.

There would be no adverse effect on the floodplains. Depending on available moisture, the one-quarter acre potential wetland area could continue to develop and become established or it may fail to become established. If removal of sediments were necessary during maintenance of the structure under this alternative, as would be the case for the No Action Alternative, appropriate permitting and regulatory compliance measures would be undertaken. As the Los Alamos Canyon ecosystem recovers over time, the amount of runoff reaching the detention basin is expected to decrease. Either this decrease in available surface moisture or the disruption to the area from silt removal activities could result in the reduction or elimination of the potentially developing wetland area.

The low-head weir and detention basin would be removed as part of the Disassembly Alternative. If the sediment in the detention basin and the weir were to be removed, demolition work would be taking place within an area that might be the site of the developing wetland. Removing the sediment that allowed the wetland to develop could destroy the wetland itself if it had become established over time as discussed above.

Under the No Action Alternative, the low-head weir and detention basin would be left in place. Routine inspections and maintenance would be continued as described for the Proposed Action. The No Action Alternative would have the same effects as the Proposed Action with regard to this structure. Leaving this structure in place and providing routine maintenance could allow the wetland to continue to either develop or it could decline and disappear. The No Action Alternative could have an adverse effect on the potential wetland area if sediment were removed periodically on an "as needed" basis should the small wetland area survive. No change to the floodplain would be expected from the No Action Alternative.

5.3 Road Reinforcements

Reinforcements were made to the areas just below SR 501, below the headlands, and above Pajarito, Two-Mile, Los Alamos (above SR 501), and Water canyons (Figure 5).

5.3.1 Floodplains

All reinforcements are associated with canyons that have associated floodplains (Figure 5).

5.3.2 Wetlands

Pajarito, Water, and Los Alamos canyons have wetlands. Section 5.1.2 describes wetlands in Pajarito Canyon. Section 5.2.2 describes wetlands in Los Alamos Canyon.

5.3.3 Potential Effects of the Proposed Action and Alternatives

Road reinforcements would be left in place as part of the Proposed Action. Routine inspection and maintenance activities would continue to be conducted when required. Effects to the floodplain would be the same as for the No Action Alternative, namely, no effects would result except from maintenance activities. Maintenance activities could potentially result in a minor temporary increase in localized erosion. BMPs would be used to minimize soil erosion into the floodplains.

The articulated concrete mattresses and shotcrete would be removed from the road under the Disassembly Alternative. The road banks would be re-graded. Demolition debris would be removed from the site and disposed of appropriately. This would leave these roads without any reinforcements because the work performed as part of the Cerro Grande Fire rehabilitation replaced reinforcements that already existed. Total removal of these structures would cause a slight increase in erosion potential because the roads would be left without any reinforcements; rehabilitation work performed after the Cerro Grande Fire replaced the original reinforcements on these roads and enhanced them. BMPs would be in place to minimize or prevent any adverse short-term effects. Reseeding of the area would also help minimize or prevent long-term adverse effects.

Under the No Action Alternative, road reinforcements would be left in place. Routine inspections and maintenance would be continued as described for the Proposed Action. With maintenance, these structures would continue to provide reinforcement along the road. Maintenance would not likely have adverse effects to the floodplain or wetlands below the structures.

5.4 Steel Diversion Wall

A 228-m-long (760-ft-long) steel diversion wall was constructed upstream of TA-18 facilities within Pajarito Canyon (Figure 6). The wall was installed quickly as an interim measure to protect TA-18 capabilities until the FRS could be built. The purpose of the wall was to divert storm water and debris to the south of Critical Assembly Storage Area I (CASA I) at TA-18. Steel panels attached to large metal beams were installed to form the wall.

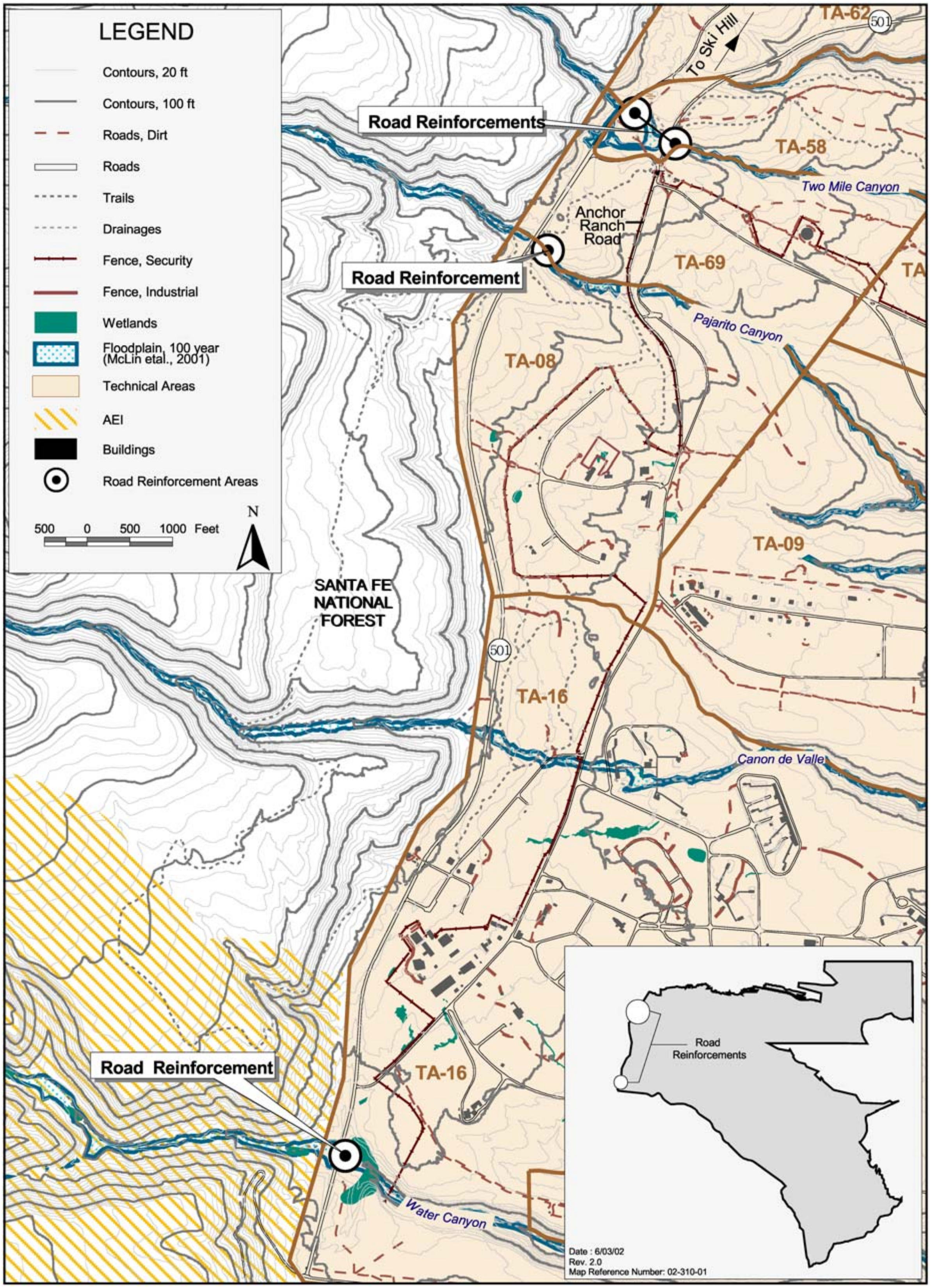

Figure 5. Location of road reinforcements in Two-Mile, Pajarito, and Water canyons.

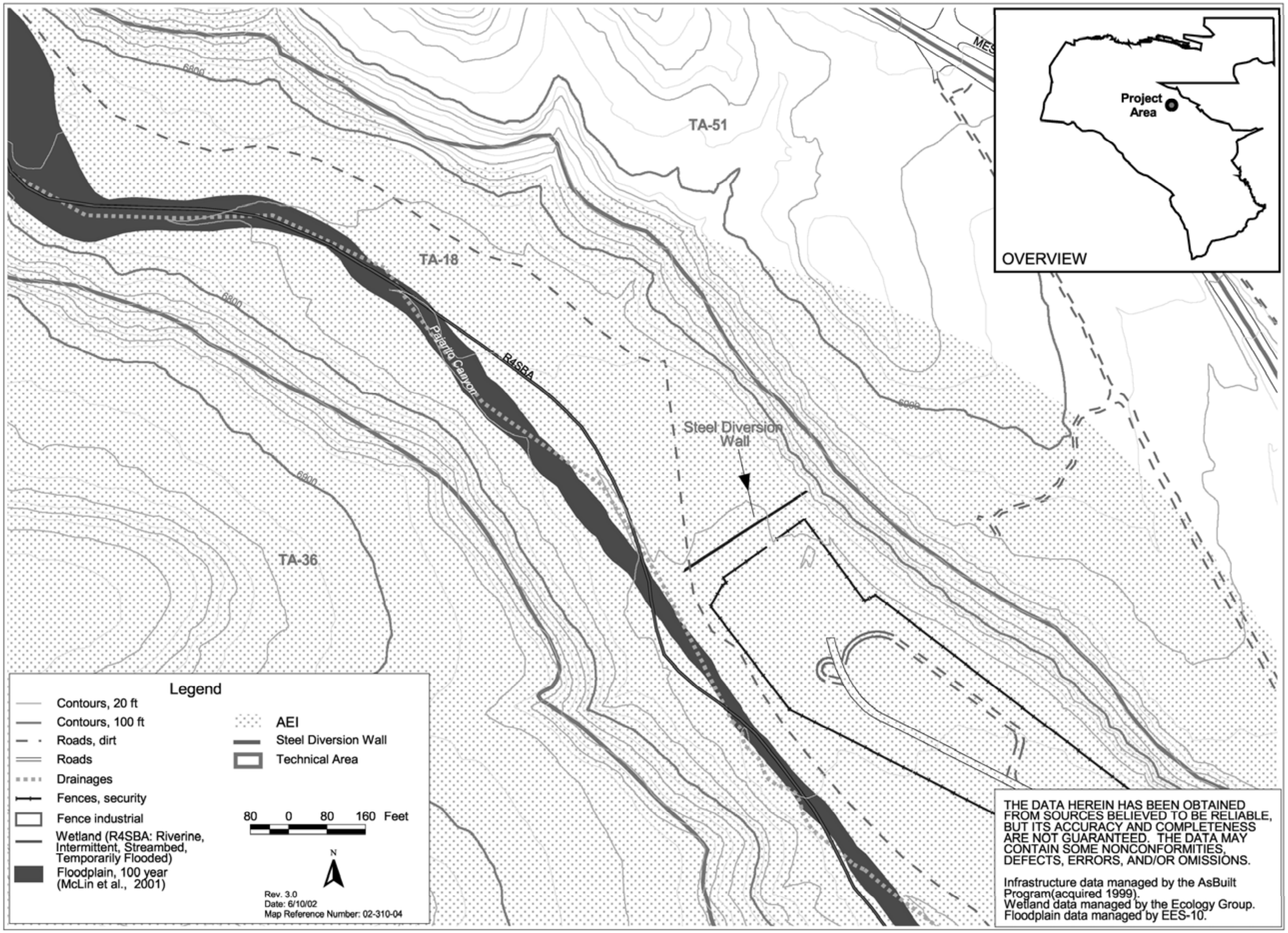

Figure 6. Location of steel diversion wall in Pajarito Canyon above TA-18.

5.4.1 Floodplains

Pajarito Canyon floodplain is described in Section 5.1.2. The steel diversion wall is located just outside the floodplain (Figure 6).

5.4.2 Wetlands

There are extensive wetlands downstream from this structure (935 m [3,068 ft] from the steel diversion wall to the wetlands at Pajarito Canyon). Pajarito Canyon wetlands are described in Section 5.1.2.

5.4.3 Potential Effects of the Proposed Action and Alternatives

Under the Proposed Action and the Disassembly Alternative, for either option for the TA-18 facilities, the steel diversion wall above TA-18's CASA I would be removed. The pilings would be removed down to ground level with a cutting torch or similar tool. The 19 m^3 (25 yd^3) of panels and beams generated by the demolition would be removed and shipped offsite for recycling. Removal of the steel diversion wall would disturb vegetation in the floodplain. BMPs would be used during demolition. Reseeding of the area would occur after site work was completed.

Under the No Action Alternative, the steel diversion wall would be left in place with continued inspections and maintenance when required. Leaving this structure in place would not affect the floodplains or wetlands. Routine maintenance would have no adverse effect on either floodplains or wetlands.

6.0 Mitigation for the Proposed Projects

Mitigation measures are set forth to protect floodplain and wetland values as stated in the Executive Orders. In addition to those values stated above, maintenance of natural systems, including conservation and long-term productivity of existing flora and fauna, species and habitat diversity, stability, hydrologic utility, wildlife, timber, food and fiber sources, and recreational, scientific and cultural issues can be mitigated with the following recommendations.

At a minimum, BMPs for runoff control, such as silt barriers and stormwater retention ponds, would be in place to mitigate runoff effects during removal of the proposed structures. These BMPs would incorporate considerations of the NPDES permit program and Environmental Protection Agency requirements for a SWPP Plan.

In all cases, BMPs would be followed according to DOE/SEA-03, the corresponding environmental assessment for this project (DOE 2002), and any and all DOE and LANL BMPs for wetlands and floodplains. All sites should be monitored and improvements installed as needed. There may be some additional useful mitigation measures that are discussed below.

All work conducted for the proposed project that involves the disturbance of soils through road building, the continuous use of roads, off-road vehicle use, and dragging of debris potentially contributes to an increase in sediment movement during a 100-year storm event (which is still possible even after things return to "normal flows"). This, in turn, can possibly increase the amount of contaminants being removed to downstream areas, particularly if soils are disturbed in canyons. Careful planning of road placement and use can minimize overall damage to the floodplain and any stream channels (Colorado State Forest Service 1998). If fill areas are established within canyons, all effort to remain off the floodplain and out of water courses should be practiced. Additionally, care should be taken to maintain trees and shrubs growing at the base of fill slopes.

Mitigation actions associated with activities in floodplains will, in part, depend upon BMPs already in place for potential release sites (PRSs), erosion control, and post-project mitigations found in the DOE/SEA-03 Mitigation Plan (DOE 2000b). In general, no debris would be left in the floodplains as defined by McLin et al. 2001. This includes all downed trees, prunings, and chipped material, as well as any cement or structural debris. If a tree is felled, care would be taken to keep it from landing in a water course. Leaving debris of any kind in a drainage, stream channel, or water course, even if it only runs seasonally, may invoke a penalty under Sections 401 and/or 404 of the Clean Water Act. Enough vegetation should remain along channel edges to stabilize the banks. BMPs suggestions from the Colorado Forest Stewardship Guidelines (Colorado State Forest Service 1998) include maintaining streamside management zones that are 15.24-m (50-ft) buffers on all sides of a perennial streambed, spring, seep, wetland, or any riparian-like area, including seasonal water channels where no disturbance would occur. This enhances stability of any potential water course.

BMPs would be employed when working in canyon bottoms as a planned part of the projects since these areas are considered potentially contaminated until proven otherwise through extensive further contaminant testing. Minimizing soil disturbance and contaminant movement is desired. Following the already prescribed method of using established roads only in canyon bottoms will help with this issue.

In addition, work conducted during rainy season within a canyon bottom may be restricted for safety issues even if pre-fire conditions return. This will be determined by Emergency Management Services for LANL. Reseeding and revegetating all disturbed surfaces should be completed once all proposed projects are completed. And finally, machine maintenance in the forest can result in water contamination. An effort should be made to prevent waste oil, gas, or antifreeze to drain onto the soil anywhere within the project area, but particularly within a floodplain (Colorado State Forest Service 1998).

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