Final Environmental Impact Statement

Viveash Fire Salvage Project

Lead Agency:

USDA Forest Service
Pecos/Las Vegas Ranger District
Santa Fe National Forest

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1.1 ABSTRACT

This Final Environmental Impact Statement documents the analysis of four alternatives to harvest a portion of the fire-killed trees on the 29,000-acre burn area of the Viveash Fire. The Viveash Fire began on May 29, 2000, and burned approximately 29,000 acres in the Pecos/Las Vegas Ranger District on the Santa Fe National Forest. The primary purpose of this project is to recover value in the wood from a portion of the burn area by putting it to beneficial use in the local and regional communities. A secondary purpose is to increase employment opportunities in the area, particularly San Miguel County, which has high poverty and unemployment rates. Alternatives 2, 3, and 4 propose different levels of harvesting and roadside salvage. Alternative 1 is the No Action alternative. Alternative 2 is the preferred alternative and the Proposed Action. This document discloses the analysis of those alternatives and portrays the consequences of each alternative on physical, biological, and socioeconomic resources.

1.2 NOTE TO REVIEWERS

This decision is subject to appeal pursuant to the Forest Service regulations at 36 CFR. Any written appeal of this decision must be fully consistent with 36 CFR 5.14, "Content of an Appeal," and must be postmarked or received by the Appeal Deciding Officer, Regional Forester Harv Forsgren, USDA Forest Service, Southwestern Region, 333 Broadway SE, Albuquerque, NM, 87102 within 45 days after the date of publication of the legal notice of this decision appears in the Albuquerque Journal in Albuquerque, New Mexico.

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List of Acronyms

AOI	annual operating instructions
BA	Biological Assessment
BAER	Viveash Fire Burned Area Emergency Rehabilitation
BE	Biological Evaluation
BMP	best management practice
CFR	Code of Federal Regulations
cu ft/ac/yr	cubic feet per acre per year
CWA	Clean Water Act
dbh	diameter breast height
EIS	Environmental Impact Statement
EO	Executive Order
ESA	Endangered Species Act
F	Fahrenheit
FEIS	Final Environmental Impact Statement
Forest Plan	Santa Fe National Forest Plan
FR	forest road
FSM	Forest Service Manual
ft	feet
LOP	limited operating period
MA	management area
MBF	thousand board feet
mi/m^2	miles per square miles
MIS	management indicator species
ML	Maintenance Level
MMBF	million board feet
NAAQS	National Ambient Air Quality Standards
NEPA	National Environment Policy Act of 1969
NFMA	National Forest Management Act of 1976
NMFS	National Marine Fisheries Services
NOI	Notice of Intent
NWI	National Wetland Inventory
OHV	off-highway vehicle

ORV	off-road vehicle
PAC	protected activity center
PCPI	per capita personal income
PFA	Post-fledgling area
PNV	Present Net Value
RARE	Roadless Area Review and Evaluation
RMRIS	Rocky Mountain Resource Information System
RN	roaded natural
ROS	Recreation Opportunity Spectrum
ROW	right-of-way
SDI	stand-density index
SMS	Scenery Management System
SMZ	streamside management zones
SR	state road
SWANCC Decision	Solid Waste Agency of Northern Cook County (U.S. Supreme Court) Decision
TES	Terrestrial Ecosystem Survey
TSPIRS	The Timber-Sale Program Information Reporting System
USC	United States Code
USDA	U.S. States Department of Agriculture
USFS	USDA Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VMS	Visual Management System
WEPP	Water Erosion Prediction Project

Executive Summary

DESCRIPTION OF PROJECT AREA

The Viveash Fire Salvage Environmental Impact Statement (EIS) Project Area is located in north-central New Mexico (Figure ES-1), between the southern ends of the Sangre de Cristo and Santa Fe mountains. The Project Area encompasses 35,875 acres of public and private lands. Approximately 30,470 acres are National Forest System lands administered by the Pecos/Las Vegas Ranger District of the Santa Fe National Forest.

A large portion of the Project Area falls within the Cow Creek Watershed, which is a major tributary of the Pecos River (Figure 1-2). Elevations within the Project Area range from approximately 7,717 feet (ft) at the southern extent of Cow Creek to 11,661 ft at the summit of Elk Mountain. The Pecos Wilderness borders the Project Area to the north.

BACKGROUND

The Viveash Fire began in the Sangre de Cristo Mountains on May 29, 2000, and burned approximately 29,000 acres in the Pecos/Las Vegas Ranger District of the Santa Fe National Forest between the towns of Pecos and Las Vegas, New Mexico. The fire burned 2,000 acres of forest the first day and more than 26,000 acres the following day.

Both private and national forest lands were burned. Approximately 40 privately owned structures were threatened by the fire, and a portion of the Gallinas River Watershed, the source of municipal water for the city of Las Vegas, was burned. The fire, suspected to be human-caused (USDA Forest Service 2000a), was fully contained on June 9, 2000.

PURPOSE AND NEED

There is a need and demand for wood and various wood products used throughout New Mexico. The local communities of Pecos, Santa Fe, and Las Vegas rely on the national forest harvest for wood products, including firewood, vigas, poles, and latillas. The primary purpose of the proposed harvesting is to recover value in the wood from a portion of the burn area by putting it to beneficial use in the local and regional communities. A secondary purpose is to increase employment opportunities in the area, particularly in San Miguel County, which has high poverty and unemployment rates and a low average income.

Areas proposed for harvest include high- and moderate-burn severity areas within ¼ mile of existing roads that are less than 35 percent slope. These areas were selected in order to minimize damage to green trees, eliminate the need for new roads, and minimize erosion from harvesting.

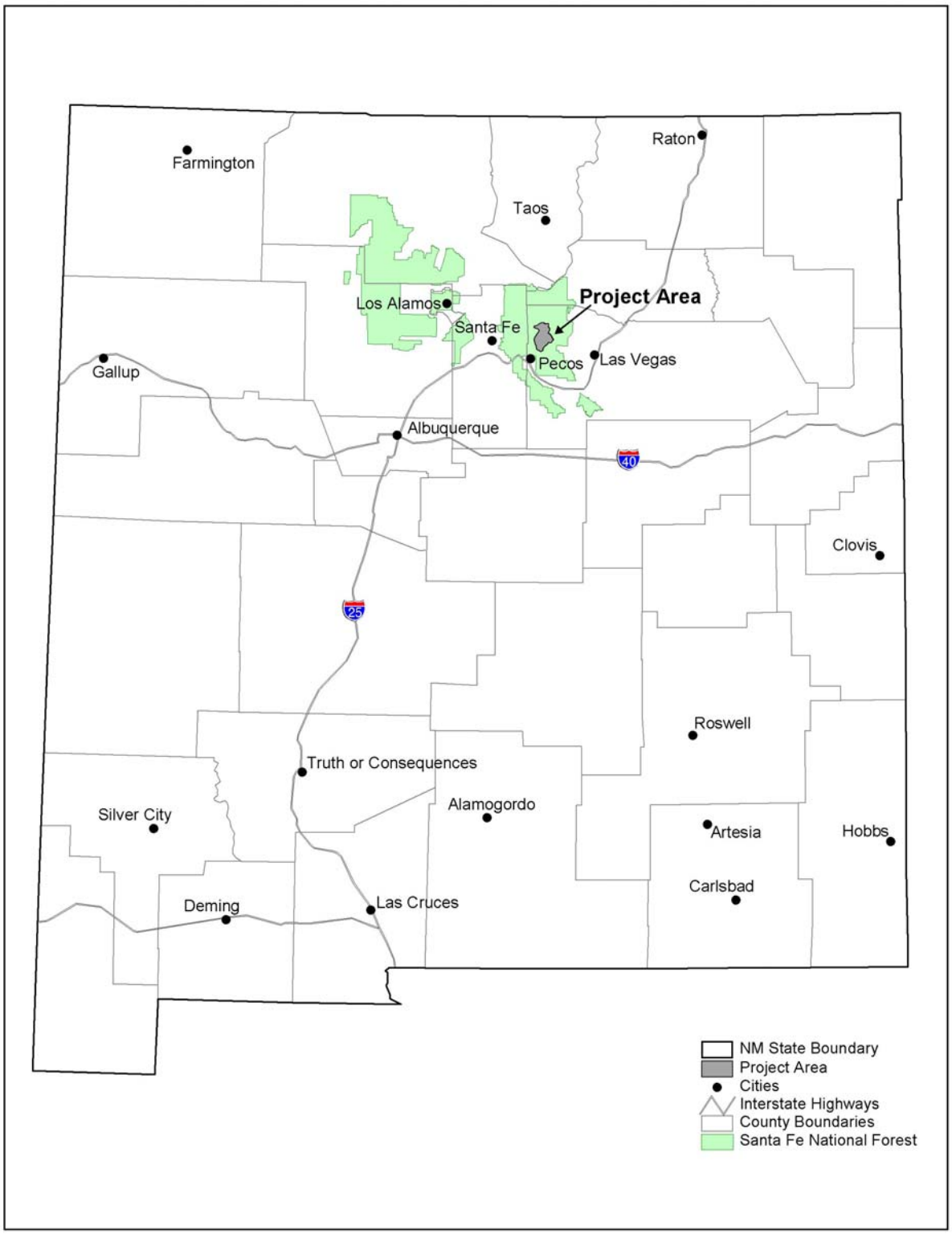

Figure ES-1. Viveash Fire EIS Site Location Map

PROPOSED ACTION

The U.S. Department of Agriculture (USDA) Forest Service (USFS) proposes to harvest a portion of the fire-killed trees on approximately 6,700 acres of the 29,000-acre area burned in the wildfire. Fire-killed trees are defined as those having no green needles present on the tree. The proposed harvesting activities are described below.

- Harvest 40 to 80 percent of standing fire-killed trees on approximately 5,600 acres from within the high- to moderate-burn severity areas on lands with slopes generally less than 35 percent and within ¼ mile from existing roads in the Project Area. The slash would be mostly left onsite to aid in erosion control. This large area, or block area, salvage would be accomplished with ground-based equipment, including skidders and feller-bunchers. This type of salvage is primarily outside roadside areas, where logging equipment is needed to remove material. These areas would be treated primarily through timber sales contracts of all sizes.

- Along selected roadside areas outside the block salvage harvest areas described above, fire-killed and hazard trees would be harvested for sawtimber, firewood, and other specialty products. This would occur on approximately 1,100 acres throughout the Project Area, and is in addition to the 5,600-acre harvest area. A total of 6,700 acres would be salvaged.

- Approximately 43 miles of currently closed roads would be opened to facilitate salvage operations for the Proposed Action. These roads would be closed or decommissioned after salvage activities have taken place. Closure of roads would involve using barricades to prevent access, and decommissioning would include removing culverts, providing for natural stream course function in intermittent and ephemeral draws, installing waterbars and dips, and barricading the road.

A comprehensive analysis of the transportation system and watershed conditions was performed to identify forest roads that are unnecessary, unstable, or poorly located so that they can be improved, decommissioned, or obliterated. This Roads Analysis identified the following road projects (Foster Wheeler Environmental 2001a). These road projects are not connected to the salvage proposal. They are considered similar actions, that, when viewed with the salvage actions, have similarities that provide a basis for evaluating their environmental consequences together. The proposed road projects and salvage harvest will be analyzed in this EIS in order to adequately assess the combined impacts of these similar actions.

Road Realignments

These activities would involve closing or decommissioning a portion of a road and constructing a new road or segment in a different location.

- Murphy's private land access would remove approximately 5 miles of existing roadway in the Willow Creek Watershed and replace it with approximately 1.5 to 2 miles of new road located upslope. The existing road along Willow Creek would be closed and parts of it would be decommissioned. The new road would be constructed to reduce current erosion and sedimentation in Willow Creek and to improve access to private land.

- A portion of Forest Road (FR) 86 would be realigned. The realignment covers approximately 1.5 miles beginning at the junction of FR 86/92 and ending at the Manzanares Creek crossing. The realigned segment of road would have a Maintenance Level (ML) of 3, which allows for sedan passage with some rider comfort. The purpose of the realignment of this portion of FR 86 is to move the road to a better location for resource protection and public safety. The existing road is located in the bottom of Tijeras Canyon, which leads to water runoff and stream sedimentation even during moderate runoff events. This makes the road unusable and creates a safety hazard for people who may attempt to drive on it during a runoff event.

- FR 86 from the Manzanares Creek crossing to the Bull Creek crossing would also be realigned for 2.3 miles, resulting in a stable and maintainable surface that would protect streams and water quality without requiring ML 3 maintenance standard.

- Approximately 1 mile of FR 92 within the Rito de la Osha Creek would be realigned away from the stream channel and the old section closed or decommissioned. Culverts would be installed at all stream crossings of tributaries in this realigned section. Portions of FR 92 in the Project Area would also be upgraded, with 13 miles of road becoming ML 2 (allowing passage of high-clearance vehicles) and 7 miles becoming ML 3 for use by passenger vehicles.

Bridge or Culvert Replacement/Construction

- Bull Creek private land access (Tapia property) would require construction of a bridge or culvert where FR 86 crosses Bull Creek. The crossing is near the end of FR 86 and is presently a low water crossing of Bull Creek. This proposal would serve to provide access to private land in the Bull Creek area and protect the stream channel and water quality of Bull Creek.

- The FR 86 culvert at Cow Creek would be replaced with a larger arch culvert. The current culvert is undersized for the high volume of water and debris that pass through it during runoff events. Replacing the culvert with a larger one would reduce the risk of failure and consequent damage to the stream and the road.

- Three concrete bridges over Cow Creek on FR 92 would be replaced. This would serve to straighten the road alignment and increase vehicle safety at the crossings. These bridges were built in the 1960s and while structurally sound, have been affected by the flooding. Replacing these bridges will improve debris passage and enhance public safety.

- A temporary crossing of FR 92V at Elk Creek would be constructed for harvest activities and would be removed following all the proposed management actions.

Decommissioning Activities

Decommissioning of a road is a process that involves more than preventing access with a gate. In the Proposed Action, decommissioning a road would include removal of culverts, restoration of drainages, and natural revegetation.

- The FR 92V system, which includes 12.5 miles of road and seven stream crossings, would be decommissioned following management actions. Decommissioning of this system would include removing culverts, installing waterbars and dips, and barricading the road to reduce road density in this area to meet the Santa Fe National Forest Plan (Forest Plan) standards designed to improve watershed and wildlife habitat conditions. The FR 92V system is not necessary for public or private land access.

Timing of Proposed Action

Salvage harvesting would occur over a 3- to 5-year period. This salvage harvest project must be implemented quickly, before the commercial value of the wood is significantly reduced due to damage from insects, weathering, and decomposition. The road projects would occur within the first 1 to 2 years, except for the decommissioning of the FR 92V system, which would occur after all salvage and rehabilitation activities are completed.

Proposed Mitigation

Harvest activities would not occur on wet or saturated soils, within occupied spotted owl or goshawk territories or within areas that may impact heritage resources. Salvage would not occur in designated stream management zones (SMZs) and logging equipment would not be allowed within riparian areas.

PUBLIC INVOLVEMENT

The public scoping process was initiated with the publication of the Notice of Intent (NOI) to prepare an EIS on March 16, 2001, in the Federal Register. Public scoping continued with the distribution of a Scoping Notice to local newspapers and individuals, organizations, and government agencies on the project mailing list. A public meeting was also held on March 29, 2001, to inform the public about the EIS and to solicit public input.

ISSUE IDENTIFICATION

The scoping process identified several issues with the Proposed Action. These issues were analyzed by the USFS and the technical team completing the EIS to identify issues key to alternative development. Three significant issues that were key to alternative development were identified. These issues were then used to develop alternatives to the Proposed Action that would respond to the Purpose and Need and address the issues. The effects of the alternatives on these issues were analyzed and are presented in Chapter 4 of this EIS.

Significant Issues

The significant issues that encompass soil, water quality, and quality of fish habitat were key to alternative development. Salvage harvesting would entail the use of heavy machines that are designed to cut trees and/or remove logs. These heavy machines, operating on moderately to severely burned sites, could increase soil compaction, which could lead to increased surface runoff. Operation of heavy equipment could increase soil disturbance and erosion rates that are already above normal due to the burned soil conditions. Skid trails, created by dragging the logs to the road, could create channels for surface runoff that could increase erosion. If eroded soil reaches a stream, it may be deposited and increase sedimentation and turbidity, which may adversely impact water quality and fish habitat. This could delay recovery of fisheries in Cow Creek and its tributaries.

Construction of new roads (FR 86 realignment and Murphy's private land access) includes the cutting and removing of trees and stumps and the use of bulldozers to create the road surface. This soil disturbance could lead to increases in soil erosion, and if the eroded soil reaches a stream, it could cause increased sedimentation with effects similar to those described above for the harvesting activities.

Important Issues

The first important issue is the economic effects of the salvage sale. There are two aspects to the economic issue—jobs and the availability of wood products to the local community. Many new jobs could be created in Pecos and surrounding communities from the salvage activities. San Miguel County has higher poverty rates, lower average incomes, and higher unemployment rates than state averages. The county would benefit from the creation of jobs associated with the salvage activities. The local community values the wood products from the forest for use as firewood, house logs, vigas, and latillas, and sawlogs.

Other important issues include transportation, terrestrial wildlife, forest vegetation, and visual resources. These concerns were not identified as significant issues and therefore did not lead to the development of additional alternatives. The Project Record for this EIS contains additional detail on the analysis and mitigations for these concerns.

Other Concerns

Concerns that are easily addressed through mitigation are analyzed in less detail in Chapter 4 of the EIS, including range resources, recreation, heritage resources, air quality, fire and fuels, noxious weeds, wetlands, sensitive plants, and roadless areas in the Project Area, in accordance with 40 CFR Part 1500.4. The Project Record for this EIS contains additional detail on the analysis for these concerns.

ALTERNATIVE DEVELOPMENT

An alternative is a set of management actions that meet both the Purpose and Need of the Proposed Action while addressing one or more significant issues. An alternative is considered reasonable if it is feasible and would achieve the Purpose and Need. Alternatives considered but eliminated from further analysis included those that were beyond the scope of this action, failed to meet the Purpose and Need, were poorly defined, or were unlikely to be implemented.

Alternatives Considered but Eliminated from Detailed Study

There were two alternatives that were considered but eliminated from further analysis in the FEIS. The first one considers the entire area within the Cow Creek Watershed burned by the Viveash Fire for salvage timber harvesting. This would involve salvage logging of fire-damaged trees on approximately 27,500 acres of high-, moderate-, and low-burn severity (approximately 100 to 200 million board ft [MMBF]). The salvage logging would require extensive new road construction for access, temporary opening and maintenance of existing forest roads, cable/helicopter yarding systems on steeper terrain, and access across adjacent private lands.

This alternative was not considered in further detail because it is not economically feasible (due to amount of cable/helicopter logging costs) and would require salvaging on steep slopes close to streams that would result in unacceptable impacts to water quality.

The second alternative considered but dismissed from further analysis involves logging approximately 14,042 acres of high-burn severity and 3,207 acres of moderate-burn severity areas within the Viveash Fire perimeter. These burned areas are located in the Cow Creek and Upper Bull watersheds. The potential harvest area would provide approximately 50 to 60 MMBF of timber.

Logging of the burned areas would entail new road construction, modification of the existing transportation system, use of cable/helicopter yarding systems, and access across adjacent private lands. This alternative was not considered in further detail because it is not economically feasible for the same reasons identified for Alternative A.

ALTERNATIVES CONSIDERED IN DETAIL

There are four alternatives developed and analyzed in the EIS, including a No Action alternative, and three action alternatives, including the Forest Service Preferred Alternative.

Alternative 1—No Action

Under Alternative 1, none of the proposed actions of salvage harvesting or road management would be implemented in the Project Area.

Alternative 2—Proposed Action

This is the Forest Service Proposed Action and Preferred Alternative. This alternative is described in detail under the Proposed Action section above.

Alternative 3

This alternative was developed in response to the key issues of soil erosion, water quality, and fish habitat.

Harvest Activities

Salvage activities are the same as those identified for Alternative 2 with the following changes:

- Standing fire-killed trees on approximately 2,900 acres from areas of high- and moderate-burn severity in the Cow Creek Watershed would be removed. Over a 3- to 5-year period, the estimated output of wood products expected to be removed from the Project Area would be approximately 10,000 cords of firewood and 12 to 15 MMBF of sawtimber.

- Roadside salvage areas for this alternative would include 2,000 acres.

Road Management Activities

The road management activities for this alternative would be the same as those described in Alternative 2, the Proposed Action. Approximately 43 miles of currently closed roads would be opened to facilitate salvage operations for this alternative. These roads would be closed or decommissioned after salvage activities have taken place. Closure of roads would involve using

barricades to prevent access and decommissioning would include removing culverts, providing for natural stream course function in intermittent and ephemeral draws, installing waterbars and dips, and barricading the road.

Alternative 4

Alternative 4 was developed in response to the key issues of soil erosion, water quality, and fish habitat. Under this alternative, 2,600 acres would be designated for roadside salvage. The proposed treatment area would not exceed 150 ft on either side of the roads. This alternative was designed to minimize the potential for adverse soil erosion, water quality degradation, and impacts to fish habitat by allowing salvage only within 150 ft on either side of existing roads. The trees would be removed as firewood through the issuance of firewood cutting permits, and other specialty products and sawtimber through small commercial sales. Under this alternative, an estimated 10,000 cords of firewood, including specialty wood products, would be the potential output of wood products over a 3- to 5-year period.

Road Management Activities

The road management activities for this alternative would be the same as in Alternative 2. Refer to Alternative 2 for a discussion of transportation activities for this alternative.

Approximately 37 miles of currently closed roads would be opened to facilitate salvage operations for this alternative. The 2,600 acres of roadside salvage are adjacent to these roads, which would be closed or decommissioned after salvage activities have taken place. Closure of roads would involve using barricades to prevent access and decommissioning would include removing culverts, providing for natural stream course function in intermittent and ephemeral draws, installing waterbars and dips, and barricading the road.

ALTERNATIVE COMPARISON

Some selected features that differ by alternative are displayed in Table ES-1.

Table ES-1. Comparison of Proposed Salvage and Streamside Buffers by Alternative

Proposed Activities	Alternative			
	1	2 Proposed Action	3	4
Harvesting				
Fire Salvage Area (acres)	0	5,600	2,900	0
Roadside Salvage (acres)[2]	0	1,100	2,000	2,600
Salvage Volume	0	10,000 cords and 20–25 MMBF	10,000 cords and 12–15 MMBF	10,000 cords
Streamside Buffers (ft)[1]				
Category 1 and 2 Subwatersheds	NA	100	200	100
Category 3 and 4 Subwatersheds	NA	200	NA	100

[1] Category 1, 2, 3, and 4 subwatersheds are defined in Foster Wheeler Environmental (2001b).
[2] Roadside salvage areas are outside of the block area salvage.
NA = Not applicable

Table ES-2 provides a summary of the effects of the alternatives with respect to the Purpose and Need and significant issues. Differences in effects provide a basis for choice among the alternatives. A brief discussion is provided below on the effects of the alternatives on the key issues. Detailed analyses and discussion of the effects for all resources are presented in Chapter 4 of the EIS with additional details contained in the Project Record.

Table ES-2. Comparison of the Effects of Alternatives

Purpose/Need and Issues	Alternative			
	1	2 Proposed Action	3	4
Significant Issue: Soils				
Soil Loss Change	0%	< 11%	< 7%	<2%
Significant Issue: Water Quality				
Road density (mi/sq mi)	2.6	2.3	2.3	2.3
Sediment delivery Change	0%	<11%	<7%	<2%
Delay in Sediment Yield Recovery (years)	0	<1	<1	<1
Significant Issue: Fish Habitat				
Reduction in physical fish habitat	No Effect	Low probability	Low probability	Low probability
Important Issue: Economics				
Wood recovery (MMBF)	0	20–25	12–15	0
Specialty products (cords)	0	10,000	10,000	10,000
Full-time jobs created	0	248–302	146–178	52–57
Total regional income creation (millions)	$0	$6.4–7.8	$3.7–4.6	$1.4–1.6
Important Issue: Transportation				
Delay Log truck trips	0	5,556	3,334	0
Small vehicle (e.g., pickups) trips	0	6,667	6,667	6,667
Important Issue: Terrestrial Wildlife				
Threatened, endangered, and sensitive Species	No effect	May affect, not likely to adversely affect	May affect, not likely to adversely affect	May affect, not likely to adversely affect
Management indicator species	No effect	No effect	No effect	No effect
Migratory bird species	No effect	No adverse effects	No adverse effects	No adverse effects
Important Issue: Forest Vegetation				
Change in forest structure	None	Minor	Minor	Minor
Change in live forest vegetation	None	No effect	No effect	No effect
Important Issue: Visual Resources				
Visual effects	None	Short-term	Short-term	Short-term

mi/sq mi = miles per square mile

Significant Issues

Soils

The primary concern relating to soil resources is that logging may increase soil erosion from burned areas, which would reduce site productivity and revegetation potential. Substantial amounts of soil productivity have already been lost because of the Viveash Fire, and soil productivity may decrease with the creation and use of roads, landings, and skid trails.

Alternative 2 would result in 15.5 fewer miles of road for the entire Project Area, once roads are decommissioned after implementation of salvage activities. In order to relocate roads away from streams, there would be some soil productivity loss caused by creating new road segments.

However, there would be an overall gain in vegetative recovery and long-term soil productivity by the extensive amount of proposed road decommissioning. The effects of decreasing road density would be a reduction in soil erosion and improvement of soil productivity. Therefore, the effect would be positive for soil productivity in the long term.

Ground cover would also improve with the scattering of treetops, limbs, and unmerchantable wood from the salvage activities. Leaving this material on site would reduce overall soil erosion. The WEPP model predicts the effects of harvesting would be increased soil erosion of up to a maximum of 11 percent above the existing soil erosion rates (Table ES-2). However, with the expected application and effectiveness of BMPs and other mitigation measures, the actual increase in soil erosion should be well below the 11 percent increase predicted by the model.

Water Quality

The primary water quality issue is that salvage logging could cause erosion that would adversely affect water quality in Cow Creek, its tributaries, and ultimately the Pecos River. Water quality is particularly important because Cow Creek is a high-quality cold-water fishery. Most of the streams in the Project Area were impacted by increased sediment deposition as a result of the Viveash Fire and storms that followed, and do not currently support beneficial uses. Most of the Project Area streams, including Cow Creek, currently do not support fish populations.

Alternative 2 would result in reduced road density, from 2.6 mi/mi^2 to 2.3 mi/mi^2 for the entire Project Area and improve several stream crossings. Sediment delivery resulting from existing roads would be lowered through the reduction in road density. The application of appropriate BMPs would reduce most of the potential impacts to water quality caused by road relocation and replacement of culverts and bridges. The projected effects of decreasing road density would be to reduce soil erosion and sediment delivery to streams and, therefore, maintain or enhance water quality.

The reduced road densities, low predicted increases in sediment delivery, no delay in recovery of sediment delivery, and specific mitigation measures designed to reduce sediment delivery to streams result in a low probability of generating noticeable or measurable effects from this alternative. Implementation of the mitigation measures and BMPs, and the effectiveness monitoring would ensure compliance with the CWA and Forest Plan. Therefore, the direct and indirect effects of Alternative 2 on water quality in the Project Area would have a low probability of generating noticeable or measurable changes.

Fish Habitat

The primary concern for fish habitat and riparian ecosystems in the Project Area is the movement of sediment through the stream systems that results in a reduction in quality of fish and stream habitat. Fine sediment inputs from surface erosion and road failures are known to have deleterious effects on fish species, including the Forest Service Region 3 sensitive species, Rio Grande cutthroat trout. In fact, large amounts of fine ash sediment in addition to increased streamflows have eliminated all fish species from the majority of the Cow Creek drainage. The potential for direct and indirect effects to fish and aquatic resources from the Proposed Action is measured in relation to potential for sediment input from the miles of road to be decommissioned, acres and types of timber

harvested, and location of timber harvest on sensitive land types that would be more prone to erosion and sediment input.

The primary effect of ground-based logging activities on fish habitat and riparian ecosystems would be in the form of additional sediment delivery to stream channels, which could potentially affect fish habitat and spawning areas. The water quality analysis concluded that the Proposed Action would have a low probability of generating noticeable or measurable sediment increases in stream channels (Table ES-2). Therefore, there would be a corresponding low probability of adverse effects to fish habitat due to sediment impacts for the Proposed Action.

The cumulative effects of the Proposed Action are analyzed in combination with future foreseeable actions in and around the Project Area. These future foreseeable actions may include private land harvest activities, restoration activities, and construction and restocking of privately owned fish ponds. Post-fire restoration activities on private land and rehabilitation activities on national forest land are predicted to continue to contribute to an improvement in water quality and fish habitat. The direct and indirect effects of this alternative are predicted to have a low probability of generating noticeable or measurable changes. Road improvements and decommissioning would likely contribute to the existing positive trend for fish habitat. Although harvesting may detract slightly from that trend, the overall cumulative effect would be maintaining the trend of fish habitat recovery in the Project Area. Therefore, the cumulative effects of the Proposed Action would be that the Rio Grande cutthroat trout would likely be unaffected. This conclusion is based upon the direct and indirect effects discussed above, use of Best Management Practices (BMPs), evaluation of the magnitude and locations of the actions, and professional judgment.

Important Issues

Economics

The evaluation of the effects of the alternatives on economics was based on income and employment generated. The analysis of products harvested used volumes as the unit of measure expressed as thousand board feet (MBF) or million board feet (MMBF). Employment impacts were estimated using the combined harvest volume from sawlogs, specialty products, and firewood.

As shown in Table ES-2, total harvest level of products sold and removed under the Proposed Action would be expected to be between 20 MMBF and 25 MMBF and approximately 10,000 cords of specialty wood products would be produced. Total employment in logging and wood products industries and the indirect and induced employment generated would be between 248 and 302 full- or part-time job opportunities created or retained if all proposed harvesting were to occur in a single year. Estimated total income generated from these job opportunities would translate into a total income range of $6.4 million to $7.8 million. This also translates into an additional 2.06 job opportunities are created throughout other sectors of the regional economy for every wage and salary job in the logging and wood specialty products industries. When combined with private logging activities, the cumulative number of jobs generated would be between 312 and 366. Though not all job opportunities associated with the Proposed Action would occur in every year, it is clear from these numbers that the job opportunities associated with this sale and other logging activities in the area would contribute substantially to forest-products related employment in San Miguel, Santa Fe, and Rio Arriba counties.

Transportation

A detailed Roads Analysis has been completed for the Project Area (Foster Wheeler Environmental 2001a). In this Roads Analysis, road management objectives were set for all roads in the Project Area other than those slated for decommissioning or obliteration. The transportation system would be substantially improved through the projects described under the Proposed Action. The road realignment and upgrade of culverts would reduce the continuing deterioration to the road system and improve subsequent maintenance. By raising the maintenance level (ML) of the public road portion of system, budget increases for road maintenance and operations would be stimulated. The Proposed Action would minimize difficult driving conditions in portions of the Project Area.

The removal of the 20-25 MMBF of sawtimber, vigas, and house logs would require a maximum of 5,556 logging truck trips, assuming 4,500 board ft per logging truck. An additional 6,667 small vehicle trips would be required to harvest the 5,000 to 10,000 cords located in the 1,100 acres of roadside salvage. The overall effects of the Proposed Action on traffic are not significant because the logging trucks would be required to operate during the hours of 7 a.m. to 7 p.m., while at the same time avoiding peak traffic hours. The estimated number of daily trips by all logging vehicles is 16. The main intersection in the village of Pecos involves Highways 50 and 63, and it currently has a high traffic volume. Therefore, 16 logging trucks passing through each day would have a negligible effect.

Noise mitigations within the village of Pecos include the prohibition of log truck hauling during weekends and holidays and between the hours of 7:00 p.m. to 7:00 a.m. weekdays. Noise would be mitigated further by prohibiting the use of jakebrake type brakes. The large number of personal vehicles utilized for roadside salvage efforts would result in a slight increase in noise effects when traveling through the village of Pecos.

Noise emanating from logging vehicles on national forest lands would be noticeable to those using the area for recreation. This noise effect is not long-term, and would only affect the Project Area until the logging efforts are complete.

Terrestrial Wildlife

Current management direction on desired conditions for selected wildlife on the national forest land are included in the National Forest Management Act of 1976 (NFMA), Endangered Species Act (ESA), Migratory Bird Treaty Act (MTBA), Forest Service Manual, Forest Plan for Santa Fe National Forest (Forest Plan), species-specific recovery plans, species management plans or conservation strategies, and the Regional Forester's policy and management directions.

Threatened, Endangered, and Sensitive Species

A preliminary screening of terrestrial species was conducted to identify species to be included in the effects analysis. One federally listed species, the threatened Mexican spotted owl; four Forest Service Region 3 Sensitive Species including American peregrine falcon, northern goshawk, New Mexican (meadow) jumping mouse, and Rio Grande cutthroat trout; twenty migratory bird species (Table 3-14); and five terrestrial Management Indicator Species (MIS) including Merriam's turkey, mourning dove, Mexican spotted owl (covered under ESA), hairy woodpecker, and Rocky Mountain elk were found to potentially occur in the Viveash Project Area. Other species that were determined to have low probability of occurrence in the Project Area were not further considered in the EIS. The

Mexican spotted owl, a management indicator species and federally threatened species is covered in detail in the Biological Assessment (BA) found in the Project Record. The northern goshawk, and other Forest Service Sensitive Species, is covered in detail in the Biological Evaluation (BE) found in the Project Record.

Direct and indirect effects on these species include the potential impacts on individuals of a species or the loss of suitable habitats.

The salvage areas in the Proposed Action overlap designated Mexican spotted owl Protected Activity Centers (PACs). However, in general, salvage logging would be modifying already unsuitable or marginal Mexican spotted owl habitat created by the catastrophic wildfire. The Viveash Fire left a mosaic of moderate-/high-burn severity and low-burn severity/unburned areas in the Project Area. The loss of closed canopy, tree dominated habitats on national forest land and adjacent private land has had an impact on the distribution of nesting/roosting habitats preferred by the Mexican spotted owl. The management actions in the Proposed Action include the removal of fire-killed trees. Reforestation in the burned areas would contribute positively to Mexican spotted owl habitat by developing desired forest conditions in the future. Streamside areas may provide some level of habitat connectivity at the landscape-level by retaining what is left of the tree-dominated riparian areas that were not burned by the Viveash Fire.

Mexican spotted owl surveys conducted in 2001 and 2002 indicated the presence of owls in the Cow Creek/Lower Cow and Creek/Upper Cow Mexican spotted owl PACs. There would be no logging activities within these occupied PACs. Activities within a ¼ mile PAC buffer would be conducted outside of breeding season. Further, no salvage logging would take place on any slopes greater than 35 percent. All PACs, with the exception of the fire-destroyed Rosilla/Elk/Middle Cow PAC would be surveyed during the 2002 breeding season prior to project implementation. In the event spotted owls are located, all applicable mitigation measures would be implemented. This procedure is in compliance with the Mexican spotted owl Recovery Plan (U.S. Fish and Wildlife Service 1995) protocol, in that no more than one breeding season will have elapsed since the last survey and the action. Therefore, the activities associated the Proposed Action may affect, but not likely adversely affect, the Mexican spotted owl. The U.S. Fish and Wildlife concurred with this decision in a letter dated May 9, 2002 (located in Project Record).

Based on historic occurrences, four designated northern goshawk Post-Fledgling Areas (PFAs) are located within the Project Area. Similar to the Mexican spotted owl, the northern goshawk is closely associated with closed-canopy late successional forests. As a result of the catastrophic wildfire, open-grassland/early seral forests dominate the landscape and the existing forest condition provides mostly unsuitable habitat for the northern goshawk. A survey conducted in 2001, indicated that that there is only one active PFA, Manzanares, in the Project Area. This PFA was only partially damaged by the wildfire.

The determination of effects in the BE concluded that the Proposed Action would not likely adversely affect the northern goshawk. No salvage activity is planned in the currently active northern goshawk PFA. The Proposed Action activities would not take place in the Manzanares PFA during the breeding season months of March through September

Management activities on National Forest System lands within the Project Area and elsewhere, and on adjacent private lands, could cause incremental loss of suitable nesting habitat for the goshawk, such as closed-canopy forest with large trees. However, the Proposed Action would remove fire-killed trees with altered canopy structure. Reforestation (natural regeneration and/or tree planting) in the burned areas would contribute positively to northern goshawk habitat by developing the desired stand structure and canopy cover.

The cumulative effects analysis of the Proposed Action on the northern goshawk includes evaluating activities on private land combined with the salvage and road projects. Activities on private land may have occurred within designated PFAs; however the salvage and road projects proposed in Alternative 2 would not contribute cumulative effects. The cumulative effects of the Proposed Action may affect, but not likely adversely affect, the northern goshawk.

Management Indicator Species

As described above, there are five MIS that have potential habitat and/or occurrence within the Project Area. The Mexican spotted owl is discussed above and will not be repeated here. Effects to Merriam's turkey, mourning dove, hairy woodpecker, and Rocky Mountain elk are the same for all action alternatives, including the Proposed Action.

These species (and associated wildlife species) would be subject to disturbance and/or displacement for the short duration of the activities under the Proposed Action. The effects of disturbance would not likely be measurable above normal population fluctuations that occur from year to year. Over the long term, the reduced road density would decrease the disturbance associated with road use.

Harvesting dead trees would not significantly alter habitat for the turkey, dove, or elk since these species do not depend on an abundance of dead trees. Therefore, the Proposed Action would not be likely to influence the overall population status, viability, or trend of these species. No adverse impacts to these species are anticipated. Further, given the minimal short-duration nature of direct or indirect effects expected, even when adding normal levels of disturbance from other management activities, rehabilitation efforts, recreational activities, and private land uses in the area, cumulative effects expected to be minimal.

The hairy woodpecker would be similarly affected by the short-duration noise disturbance and may be temporarily displaced as a result. However, no adverse or long-term impacts would be expected from harvesting a portion of the dead trees in the area and implementing the road improvement activities. The number of snags that would remain in the area after salvage harvest is completed would be higher than pre-fire levels. Thus, the direct, indirect, and cumulative effects on the hairy woodpecker would not differ overall from the effects described for other species above.

Migratory Bird Species

The effects on migratory birds were analyzed by evaluating the New Mexico Partners in Flight Species of Highest Priority for each habitat type found in the Project Area. There are twenty species identified The nationwide list of Important Bird Areas was evaluated, and the Viveash Project Area is not on the list. It was also assessed for its potential as an important overwintering area. Due to its relatively high elevation and lack of large water bodies, it is not an important overwintering area.. For short periods, salvage and road management activities could disturb migratory birds during

operations. However, the noise and visual disturbance would not be expected to have long-term effects on these bird species. They would avoid the areas of disturbance temporarily, then return to these areas or move to other areas.

Forest Vegetation

The forest-wide and management area directions, goals, standards, and guidelines in the Forest Plan were reviewed and would be met for all action alternatives, including the Proposed Action.

Under the Proposed Action, salvage timber harvest would only remove standing fire-killed trees from areas of high-and moderate-burn severity. Thus, there would be no effect on live forest vegetation. The salvage harvest would alter the forest structure by reducing the number of snags. However, the forest canopy cover has been modified by the catastrophic wildfire, with opened forest structure and a future potential for downed logs characterizing the post-fire conditions. Snags would be left at a density of 4 to 6 stems per acre and downed wood would be retained under the Proposed Action. This meets Forest Service Plan standards.

Road relocation and roadside salvage activities would not have direct, indirect, or cumulative effects associated with forest composition and structure because of their small area. Salvaging on private land has reduced the number of snags, and the salvage activities on national forest lands under the Proposed Action would not significantly alter the landscape structure that currently exists within the Project Area. The natural-caused landscape pattern would undergo the pathways of forest development starting with even-aged forest structure. Snag and downed dead wood standards in the Forest Plan would be met even after many snags have fallen down 15 years after the Viveash Fire. Therefore, the direct, indirect, and cumulative effects of the Proposed Action on forest structure are expected to be minor.

Scenic Resources

Management direction regarding scenic resources is derived from the Forest Plan and *Landscape Aesthetics: A Handbook for Scenery Management* (USDA Forest Service, 1995b). The evaluation criteria used to analyze the effects of the Proposed Action on scenic resources includes immediate scenic effects of project activities and whether scenic integrity objectives are being met throughout the Project Area as assessed through long-term monitoring of scenic resources.

Under the Proposed Action, the potential exists for adverse direct effects on scenic resources. Slash and unmerchantable trees could create scenic impacts on roads, trails, scenic corridors, or residential areas. However, all roads, trails, and access areas would be kept free of slash and unmerchantable trees. In addition, within 100 ft of roads and trails, unpiled slash and unmerchantable tree accumulations would be less than 1.5 ft in height.

Logging trucks, skid trails, and landings could also create scenic impacts. In general, such impacts would be short-term impacts viewed from the foreground that would occur during harvest activities. These impacts would also be minimized through mitigation measure described earlier.

Cumulative effects on scenic resources from the Proposed Action would be short-term in duration (1-2 years) and the positive effects of erosion control measures would lead to very positive long-term cumulative scenic effects from the regeneration of vegetation.

This final Environmental Impact Statement (FEIS) is organized to comply with Council on Environmental Quality (CEQ) regulations and Forest Service Guidelines for implementing National Environmental Policy Act (NEPA) and CEQ regulations. Chapter 1 describes the Purposed and Need for this FEIS. Chapter 2 details the range of alternatives that were developed in response to issues raised during the scoping process and describes those alternatives that were eliminated from further analyses. Chapter 3 describes the environment that may be affected by the decision of this FEIS. Chapter 4 describes, evaluates, and compares the potential impacts of the range of alternatives selected for analysis on physical, biological, and socioeconomic resources. Chapter 5 contains the works cited, list of preparers, Forest Service personnel consulted, list of agencies, organizations and individuals to whom the FEIS and/or Record of Decision are sent, glossary, and an index.

2.0 PURPOSE AND NEED FOR ACTION

2.1 DESCRIPTION OF PROJECT AREA

The Viveash Fire Salvage Environmental Impact Statement (EIS) Project Area is located in north-central New Mexico (Figure 1-1), between the southern ends of the Sangre de Cristo and Santa Fe mountains. The Project Area encompasses 35,875 acres of public and private lands. Approximately 30,470 acres are National Forest System lands administered by the Pecos/Las Vegas Ranger District of the Santa Fe National Forest.

A large portion of the Project Area falls within the Cow Creek Watershed, which is a major tributary of the Pecos River (Figure 1-2). Elevations within the Project Area range from approximately 7,717 feet (ft) at the southern extent of Cow Creek to 11,661 ft at the summit of Elk Mountain. The Pecos Wilderness borders the Project Area to the north.

2.2 BACKGROUND

The Viveash Fire began in the Sangre de Cristo Mountains on May 29, 2000, and burned approximately 29,000 acres in the Pecos/Las Vegas Ranger District of the Santa Fe National Forest between the towns of Pecos and Las Vegas, New Mexico (see Figure 1-2). The fire burned 2,000 acres of forest the first day and more than 26,000 acres the following day. A typical view of the high-burn severity area is displayed in Photograph 1-1.

Photograph 1-1. Typical Burned Area from the Viveash Fire

Both private and national forest lands were burned. Approximately 40 privately owned structures were threatened by the fire, and a portion of the Gallinas River Watershed, the source of municipal water for the city of Las Vegas, was burned. The fire, which is suspected to be human-caused (USDA Forest Service 2000a), was fully contained on June 9, 2000.

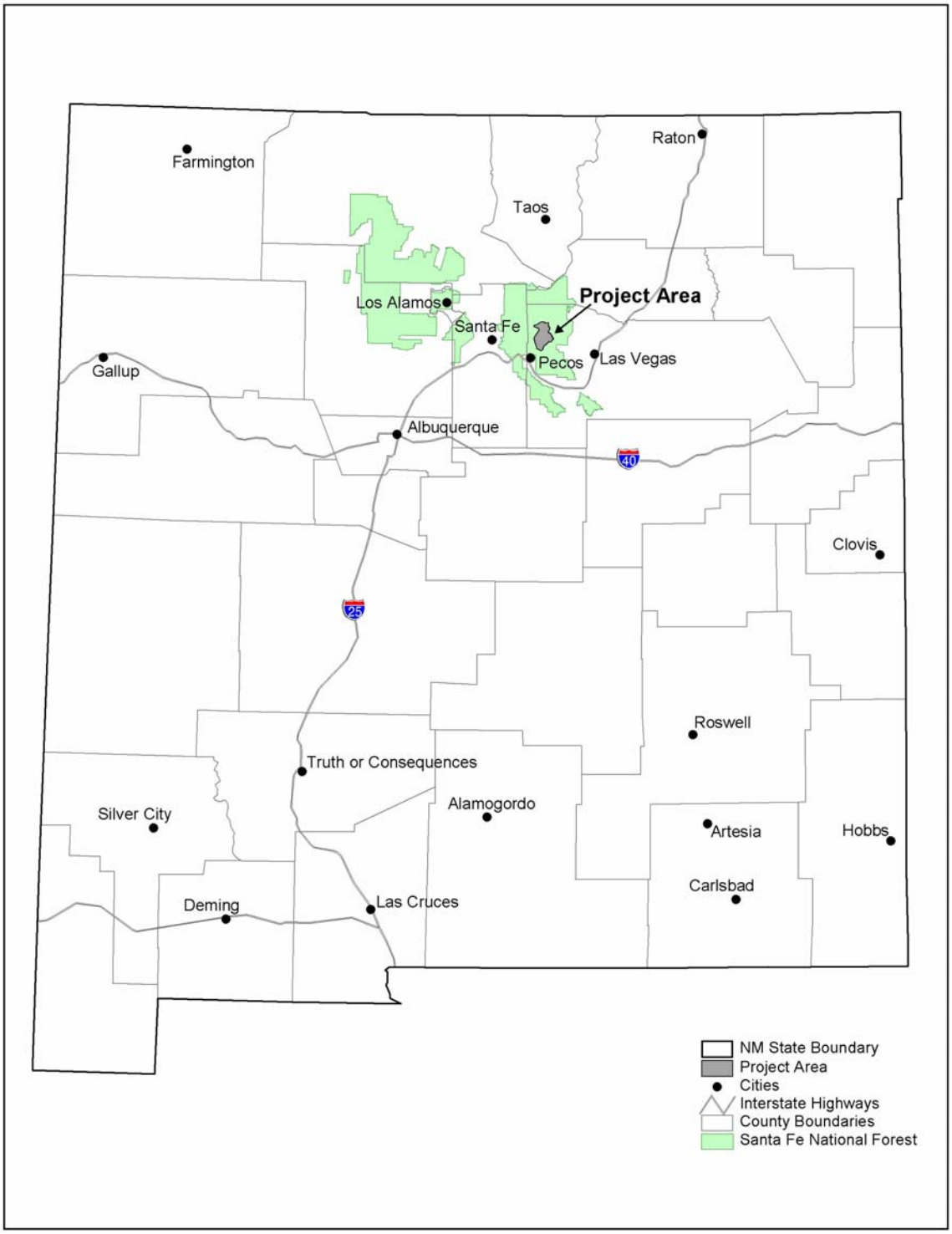

Figure 1-1. Viveash Fire EIS Site Location Map

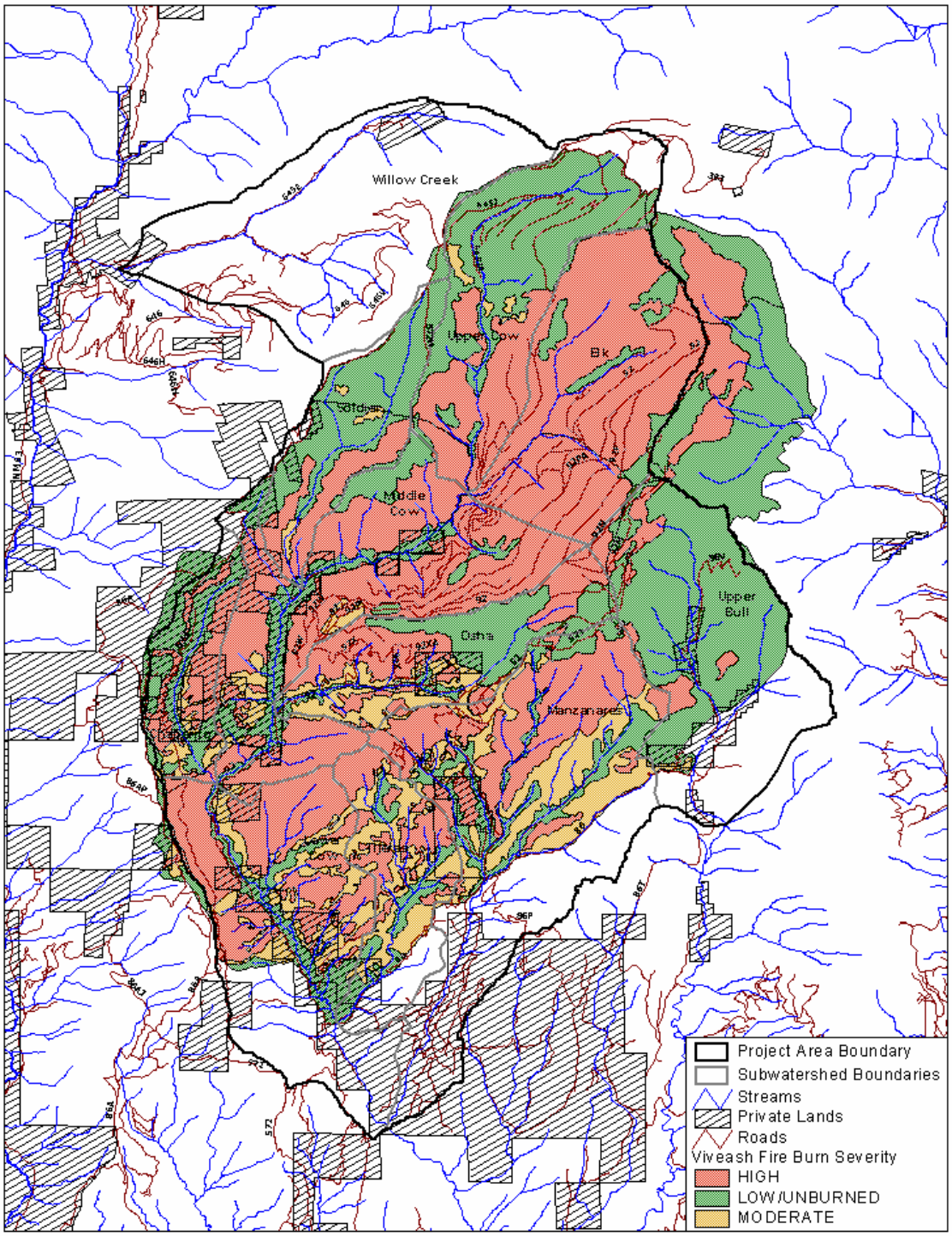

Figure 1-2. Viveash Fire EIS Project Area

2.3 PURPOSE AND NEED

There is a need and demand for wood and various wood products used throughout New Mexico. The local communities of Pecos, Santa Fe, and Las Vegas rely on the national forest harvest for wood products, including firewood, vigas, poles, and latillas. The primary purpose of the proposed harvesting is to recover value in the wood from a portion of the burn area by putting it to beneficial use in the local and regional communities. A secondary purpose is to increase employment opportunities in the area, particularly in San Miguel County, which has high poverty and unemployment rates and a low average income.

Areas proposed for harvest include high- and moderate-burn severity areas within ¼ mile of existing roads and having less than 35 percent slope. These areas were selected in order to minimize damage to green trees, eliminate the need for new roads, and minimize erosion from harvesting.

2.4 PROPOSED ACTION

The U.S. Department of Agriculture (USDA) Forest Service (USFS) proposes to harvest a portion of the fire-killed trees on approximately 6,700 acres of the 29,000-acre area burned in the wildfire. Fire-killed trees are defined as those having no green needles present on the tree. The proposed harvesting activities are described below.

- Harvest 40 to 80 percent of standing fire-killed trees on approximately 5,600 acres from within the high- to moderate-burn severity areas on lands with slopes generally less than 35 percent and within ¼ mile from existing roads in the Project Area. The slash would be mostly left onsite to aid in erosion control. This large area or block area salvage would be accomplished with ground-based equipment, including skidders and feller-bunchers. This type of salvage is primarily outside roadside areas, where logging equipment is generally needed to remove material. These areas would be treated primarily through timber sales contracts of all sizes. Photograph 1-2 shows a typical view of a salvage area following harvest activities.

- Along selected roadside areas outside the block salvage harvest areas described above, fire-killed and hazard trees would be harvested for sawtimber, firewood, and other specialty products. This would occur on approximately 1,100 acres throughout the Project Area, and is in addition to the 5,600-acre harvest area. A total of 6,700 acres would be salvaged and treated primarily through smaller permit sales.

- Approximately 43 miles of currently closed roads would be opened to facilitate salvage operations for the Proposed Action. These roads would be closed or decommissioned after salvage activities have taken place. Closure of roads would involve using barricades to prevent access, and decommissioning would include removing culverts, providing for natural stream course function in intermittent and ephemeral draws, installing waterbars and dips, and barricading the road.

A comprehensive analysis of the transportation system and watershed conditions was performed to identify forest roads that are unnecessary, unstable, or poorly located so that they can be improved, decommissioned, or obliterated. This Roads Analysis identified the following road projects (Foster Wheeler Environmental 2001a). Table 2-1 summarizes the proposed road projects. These road

projects are not connected to the salvage proposal. They are considered similar actions, that when viewed with the salvage actions, have similarities that provide a basis for evaluating their environmental consequences together. The proposed road projects and salvage harvest will be analyzed in this EIS in order to adequately assess the combined impacts of these similar actions.

Photograph 1-2. Typical Salvage Area Following Harvest

Road Realignments

These activities would involve closing or decommissioning a portion of a road and constructing a new road or segment in a different location.

- Murphy's private land access would remove approximately 5 miles of existing roadway in the Willow Creek Watershed and replace it with approximately 1.5 to 2 miles of new road located upslope. The existing road along Willow Creek would be closed and parts of it would be decommissioned. The new road would be constructed to reduce current erosion and sedimentation in Willow Creek and to improve access to private land.

- A portion of Forest Road (FR) 86 would be realigned. The realignment covers approximately 1.5 miles beginning at the junction of FR 86/92 and ending at the Manzanares Creek crossing. The realigned segment of road would have a Maintenance Level (ML) of 3, which allows for sedan passage with some rider comfort. The purpose of the realignment of this portion of FR 86 is to move the road to a better location for resource

protection and public safety. The existing road is located in the bottom of Tijeras Canyon, which leads to water runoff and stream sedimentation even during moderate runoff events. This makes the road unusable and creates a safety hazard for people who may attempt to drive on it during a runoff event.

- FR 86 from the Manzanares Creek crossing to the Bull Creek crossing would also be realigned for 2.3 miles, resulting in a stable and maintainable surface that would protect streams and water quality without requiring ML 3 maintenance standard.

- Approximately 1 mile of FR 92 within the Rito de la Osha Creek would be realigned away from the stream channel and the old section closed or decommissioned. Culverts would be installed at all stream crossings of tributaries in this realigned section. Portions of FR 92 in the Project Area would also be upgraded, with 13 miles of road becoming ML 2 (allowing passage of high-clearance vehicles) and 7 miles becoming ML 3 for use by passenger vehicles.

Bridge or Culvert Replacement/Construction

- Bull Creek private land access (Tapia property) would require construction of a bridge or culvert where FR 86 crosses Bull Creek. The crossing is near the end of FR 86 and is presently a low water crossing of Bull Creek. This proposal would serve to provide access to private land in the Bull Creek area and protect the stream channel and water quality of Bull Creek.

- The FR 86 culvert at Cow Creek would be replaced with a larger arch culvert. The current culvert is undersized for the high volume of water and debris that passes through it during runoff events. Replacing the culvert with a larger one would reduce the risk of failure and consequent damage to the stream and the road.

- Three concrete bridges over Cow Creek on FR 92 would be replaced. This would serve to straighten the road alignment and increase vehicle safety at the crossings. These bridges were built in the 1960s and while structurally sound, have been affected by the flooding. Replacing these bridges will improve debris passage and enhance public safety.

- A temporary crossing of FR 92V at Elk Creek would be constructed for harvest activities and would be removed following all the proposed management actions.

Decommissioning Activities

Decommissioning of a road is a process that involves more than preventing access with a gate. In the Proposed Action, decommissioning a road would include removal of culverts, restoration of drainages, and natural revegetation.

- The FR 92V system, which includes 12.5 miles of road and seven stream crossings, would be decommissioned following management actions. The decommissioning of this system would include removing culverts, installing waterbars and dips, and barricading the road to reduce road density in this area to meet the Santa Fe National Forest Plan (Forest Plan) standards

that are designed to improve watershed and wildlife habitat conditions. The FR 92V system is not necessary for public or private land access.

Timing of Proposed Action

Salvage harvesting would occur over a 3- to 5-year period. This salvage harvest project must be implemented quickly, before the commercial value of the wood is significantly reduced due to damage from insects, weathering, and decomposition. The road projects would occur within the first 1 to 2 years, except for the decommissioning of the FR 92V system, which would occur after all salvage and rehabilitation activities are completed.

Proposed Mitigation

Harvest activities would not occur on wet or saturated soils, within occupied spotted owl or goshawk territories, or within areas containing heritage resource sites. Salvage would not occur in riparian areas or sensitive plant habitat. A complete list of mitigation measures for the Proposed Action is presented in Section 2.5.

2.5 SCOPE OF THE DECISION (DECISION TO BE MADE)

The Pecos/Las Vegas District Ranger is the responsible official who will decide which, if any, of the salvage harvest and road management actions for this site-specific project may be implemented. Management actions involve decisions regarding the extent, location, and type of salvage harvesting activities that may be undertaken in the Project Area, as well as making a decision about decommissioning certain roads, and building segments of new roads to replace poorly located existing roads. The decision includes all the mitigation measures and monitoring actions that will be required in association with the selected alternative.

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3.0 ALTERNATIVES

This chapter describes the action alternatives that wholly or partially meet the Purpose and Need for Action. The No Action alternative is also discussed. Each action alternative was developed in response to identified issues, resulting in different approaches to achieving the Purpose and Need. This chapter also describes the public involvement process, scoping and issues identification, and development of alternatives.

3.1 MANAGEMENT DIRECTION

The *Santa Fe National Forest Plan, Southwestern Region* (USDA Forest Service 1987) as amended, sets forth broad, programmatic management direction for the Santa Fe National Forest. For clarity, that document is hereafter referred to as the "Forest Plan." This EIS is a project-level analysis, designed in conformance with the applicable Forest Plan management direction (goals and standards/ guidelines). Where appropriate, this EIS tiers to the Forest Plan, as encouraged by 40 Code of Federal Regulations (CFR) 1520.20. Through its goals, standards and guidelines, and management area (MA) direction, the Forest Plan provides the overall guidance for management of the land within its borders. In this chapter, the general guidance of each MA direction is presented.

The forest-wide standards/guidelines in the Forest Plan that apply to this project are primarily those regarding protection of heritage resources (pages 58–61), wildlife habitat (pages 61–66), and water and soil resources (pages 75–80), and are hereby incorporated by reference. This project was also designed in conformance with the area-specific Forest Plan direction that applies to specific MAs.

3.1.1 Management Areas

The Forest Plan divides the Santa Fe National Forest into individual MAs. The Forest Plan designates specific direction, goals, standards, and guidelines to be used in the management of these areas to more completely meet the MA emphasis. These are referred to as "management area prescriptions." There are four MAs in the Project Area (Figure 2-1 and Figure 2-2). About 72 percent of the Project Area is designated MA A (Timber/Wildlife) or B (Wildlife/Timber).

3.1.1.1 Management Area A

Management Emphasis—Timber production and enhancement of wildlife habitat

This MA consists primarily of those national forest lands suitable for and capable of growing commercial timber. These areas also provide primary wildlife habitat for deer, elk, turkey, and other species and contain cold-water fisheries. Roaded dispersed recreational experiences are emphasized. Firewood is provided as a byproduct of timber harvest activities. Under the Proposed Action, approximately 1,644 acres within Management Area A would be harvested and 457 acres would be used for roadside salvage activities. The relevant standards/guidelines for Management Area A are found in the Forest Plan on pages 98–101.

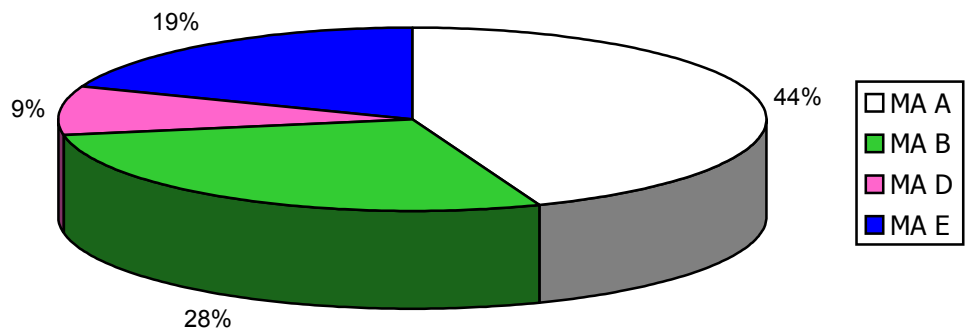

Figure 2-1. Percentage of Management Areas on Federal Land Within the Project Area

3.1.1.2 Management Area B

Management Emphasis—Wildlife habitat improvement and key species habitat protection

This MA consists of those national forest lands that provide key deer and elk winter range, some of the essential habitat for threatened and endangered species, or other areas important to game and non-game wildlife. Grazing and timber-harvesting activities occur, when compatible, with the primary emphasis of this area. Recreation is mostly of a dispersed, roaded nature. Slash from timber activity will be used for firewood or left for wildlife habitat. Under the Proposed Action, approximately 3,604 acres would be harvested in Management Area B and 397 acres will be used for roadside salvage. The relevant standards/guidelines for Management Area B are found in the Forest Plan on pages 102–105.

3.1.1.3 Management Area D

Management Emphasis—Visual quality and developed recreational opportunity

This MA consists primarily of transportation corridors that are normally associated with state highways and high-volume roads. They provide outstanding opportunities for developed recreation and visual quality because they were constructed in a variety of ecosystems. Much of the fishing recreation use and many of the potential and existing developed sites occur in this area. Grazing and timber activities occur where consistent with the primary emphasis of this area. Under the Proposed Action, no acreage would be harvested in Management Area D, but 38 acres would be used for roadside salvage. The relevant standards/guidelines for Management Area D are found in the Forest Plan on pages 112–116.

3.1.1.4 Management Area E

Management Emphasis—Dispersed recreation, visual quality, timber and firewood production

This MA consists of those national forest lands that provide a broad range of recreational opportunities and visual quality. These areas provide scenic backdrops from highways or communities and provide important dispersed recreation areas or minor developed recreation sites. They also provide a wide array of game, non-game, and fisheries recreational opportunities. Under the Proposed Action, approximately 481 acres would be harvested in Management Area E and 194 acres would be used for roadside salvage. The relevant standards/guidelines for Management Area E are found in the Forest Plan on pages 117–120.

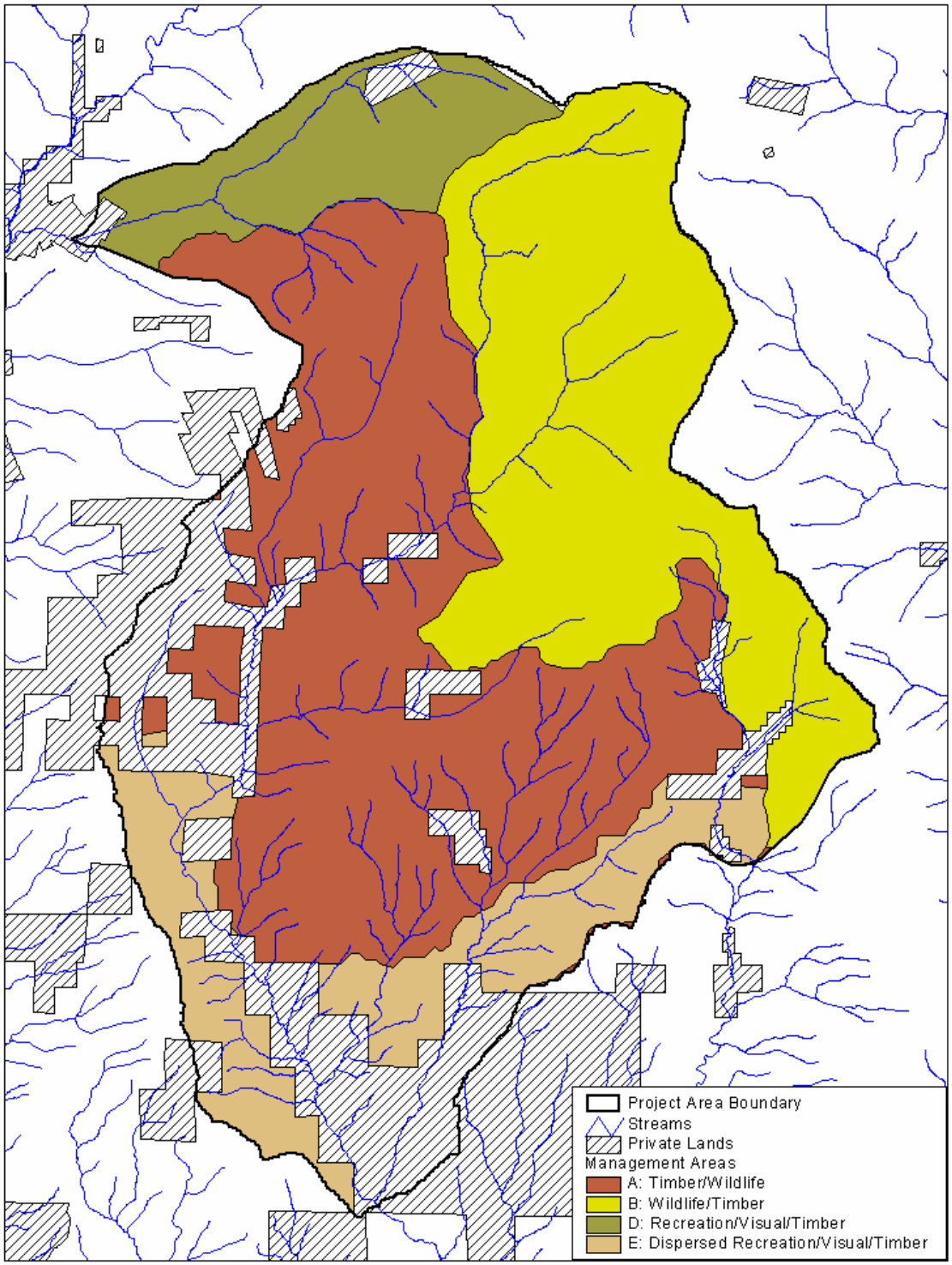

Figure 2-2. Management Areas in the Viveash Project Area

3.2 PUBLIC INVOLVEMENT, SCOPING, AND ISSUE IDENTIFICATION

Public involvement is a process that continues throughout the development and refinement of an EIS. However, there are two specific time periods when public and agency comments are solicited—before the environmental analyses are conducted to define the scope of the studies (scoping) and following publication of the Draft EIS.

Scoping, which initiates the EIS process, is an open process that involves identification of issues regarding the proposed activities. During scoping, input is solicited from the public; federal, state and local government agencies; and affected Indian tribes to identify and define the issues. The issues can then be used to develop a range of alternatives to the Proposed Action that meet the Purpose and Need.

3.2.1 Public Involvement

3.2.1.1 Scoping Notice

The public scoping process was initiated with the publication of the Notice of Intent (NOI) to prepare an EIS on March 16, 2001, in the Federal Register. Public scoping continued with the distribution of a Scoping Notice to local newspapers and individuals, organizations, and government agencies on the project mailing list. The Scoping Notice and NOI described the project, presented the Purpose and Need for the proposal, provided information on how to participate in the scoping process, and set the date and place for the public meeting. Interested parties were invited to comment on the proposal.

3.2.1.2 Public Meeting

A public meeting was held on March 29, 2001, to inform the public about the EIS and to solicit public input. Approximately 50 people attended the meeting. The meeting was held in an open-house format that allowed residents and other interested parties to review displays and maps and have one-on-one discussions with project team members. Those attending the meeting were asked to complete feedback sheets that asked for input—questions, concerns, suggestions—as to what individuals thought about the project.

Most comments and questions covered issues already generated internally by the project staff and presented at the meeting. Concern was expressed about sensitivity of soils and sedimentation in streams, how it affects fish habitat, current and projected harvest volumes, and commercial logging in general—how the USFS manages it—and how many trees will be left onsite for wildlife and resource protection. Additional concerns included the logging trucks hauling through the town of Pecos as well as safety, noise, traffic, road damage, and air quality.

Eight written responses from individuals were received during the scoping period. The letters were reviewed and discussed by the project leaders.

3.2.2 Issue Identification

The scoping process identified several issues with the Proposed Action. These issues, briefly discussed in Section 2.2.1.2, were analyzed by the USFS and the technical team completing the EIS to identify issues key to alternative development. The issues were categorized into three groups,

based upon significance, whether an issue can be mitigated, or whether there is an effect. The three groups are:

- Significant issues that are key to alternative development
- Important issues are areas that have effects and/or may be addressed by mitigation measures or project design, but are used in the decision
- Other concerns that are easily addressed by mitigation measures or have no effects from the Proposed Action

Three significant issues that were key to alternative development were identified. These issues were then used to develop alternatives to the Proposed Action that would respond to the Purpose and Need and address the issues. The effects of the alternatives on these issues were analyzed and are presented in Chapter 4 of this EIS.

3.2.2.1 Significant Issues

The significant issues that encompass soil, water quality, and quality of fish habitat were key to alternative development. Salvage harvesting would entail the use of heavy machines that are designed to cut trees and/or remove logs. These heavy machines, operating on moderately to severely burned sites, could increase soil compaction, which could lead to increased surface runoff. Operation of heavy equipment could increase soil disturbance and erosion rates that are already above normal due to the burned soil conditions. Skid trails, created by dragging the logs to the road, could create channels for surface runoff that may increase erosion. If eroded soil reaches a stream, it may be deposited and increase sedimentation and turbidity, which could adversely impact water quality and fish habitat. This could delay recovery of fisheries in Cow Creek and its tributaries.

Construction of new roads (FR 86 realignment and Murphy's private land access) includes the cutting and removing of trees and stumps and the use of bulldozers to create the road surface. This soil disturbance could lead to increases in soil erosion, and if the eroded soil reaches a stream, it could cause increased sedimentation with effects similar to those described above for the harvesting activities. Reconstruction and reopening closed roads for the salvage operation could also lead to similar impacts as new road construction.

3.2.2.2 Important Issues

The first important issue is the economic effects of the salvage sale. There are two aspects to the economic issue—jobs and the availability of wood products to the local community. Many new jobs could be created in Pecos and surrounding communities from the salvage activities. San Miguel County has higher poverty rates, lower average incomes, and higher unemployment rates than state averages. The county would benefit from the creation of jobs associated with the salvage activities. The local community values the wood products from the forest for use as firewood, house logs, vigas, and latillas.

Other important issues include transportation, terrestrial wildlife, forest vegetation, and visual resources. These concerns were not identified as significant issues and therefore did not lead to the

development of additional alternatives. The Project Record for this EIS contains additional detail on the analysis and mitigations for these concerns.

3.2.2.3 Other Concerns

Concerns that are easily addressed through mitigation are analyzed in less detail in Chapter 4, including range resources, recreation, heritage resources, air quality, fire and fuels, noxious weeds, wetlands, sensitive plants, and roadless areas in the Project Area, in accordance with 40 CFR Part 1500.4. The Project Record for this EIS contains additional detail on the analysis for these concerns.

3.3 ALTERNATIVE DEVELOPMENT

An alternative is a set of management actions that meet the Purpose and Need of the Proposed Action while addressing one or more significant issues. An alternative is considered reasonable if it is feasible and would achieve the Purpose and Need. Alternatives considered but eliminated from further analysis included those that were beyond the scope of this action, failed to meet the Purpose and Need, were poorly defined, or were unlikely to be implemented.

3.3.1 Alternatives Considered but Eliminated from Detailed Study

This section describes the alternatives that were considered but were eliminated from further analysis in the EIS.

3.3.1.1 Alternative A

This alternative considers the entire area within the Cow Creek Watershed burned by the Viveash Fire for salvage timber harvesting. This would involve salvage logging of fire-damaged trees on approximately 27,500 acres of high-, moderate-, and low-burn severity (approximately 100 to 200 million board ft [MMBF]). The salvage logging would require extensive new road construction for access, temporary opening and maintenance of existing forest roads, cable/helicopter yarding systems on steeper terrain, and access across adjacent private lands.

This alternative was not considered in further detail because it is not economically feasible (due to amount of cable/helicopter logging costs) and would require salvaging on steep slopes close to streams, which would result in unacceptable impacts to water quality.

3.3.1.2 Alternative B

This alternative involves logging approximately 14,042 acres of high-burn severity and 3,207 acres of moderate-burn severity areas within the Viveash Fire perimeter. These burned areas are located in the Cow Creek and Upper Bull watersheds. The potential harvest area would provide approximately 50 to 60 MMBF of timber.

Logging of the burned areas would entail new road construction, modification of the existing transportation system, use of cable/helicopter yarding systems, and access across adjacent private lands. This alternative was not considered in further detail because it is not economically feasible for the same reasons identified for Alternative A.

3.4 ALTERNATIVES CONSIDERED IN DETAIL

This section describes the features of the Proposed Action and alternatives to the Proposed Action that were considered in detail.

3.4.1 Alternative 1—No Action

Alternative 1 is the No Action alternative. Under Alternative 1, none of the proposed actions of salvage harvesting or road management would be implemented in the Project Area.

3.4.2 Alternative 2—Proposed Action and Preferred Alternative

Alternative 2 is the USFS's Proposed Action and preferred action (Figure 2-3). This alternative includes both salvage harvesting and road management actions, which are described below.

3.4.2.1 Harvest Activities

Salvage activities for a portion of the Viveash Fire area include the following:

- Harvest 40 to 80 percent of standing fire-killed trees on approximately 5,600 acres from within the high- to moderate-burn severity areas on lands with slopes generally less than 35 percent and within ¼ mile from existing roads in the Project Area. Slash would be mostly left onsite to aid in erosion control. Salvaging would be accomplished with ground-based equipment (skidders and feller-bunchers). Photograph 1-2 shows a typical view of a salvage area following harvest activities.

- Along selected roadside areas outside the block salvage harvest areas, fire-killed and hazard trees would also be harvested for sawtimber, fuelwood, and other specialty products. This would occur on approximately 1,100 acres throughout the Project Area. This is in addition to the 5,600-acre harvest area for a total of 6,700 acres to be salvaged.

- Approximately 43 miles of currently closed roads would be opened to facilitate salvage operations for this alternative. These roads would be closed or decommissioned after salvage activities have taken place. Closure of roads would involve using barricades to prevent access, and decommissioning would include removing culverts, provide for natural stream course function in intermittent and ephemeral draws, install waterbars and dips, and barricading the road.

- A temporary crossing of FR 92V at Elk Creek would be constructed for harvest activities. This crossing was washed out following the Viveash Fire. The crossing would be removed following all the proposed management actions.

- Over a 3- to 5-year period, the estimated output of wood products expected to be removed under this alternative would be about 10,000 cords of firewood, and 20 to 25 MMBF of sawtimber, vigas, and house logs.

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Figure 2-3. Map of Alternative 2 (Proposed Action)

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3.4.2.2 Road Management Activities

A comprehensive analysis of the transportation system and watershed conditions was performed to identify forest roads that are unnecessary, unstable, or poorly located so that they can be improved, decommissioned, or obliterated. The Roads Analysis (Foster Wheeler Environmental 2001a) identified the following road projects (see also Table 2-1). These road projects are not connected to the salvage proposal. They are evaluated in this EIS because they are considered similar in geography and timing.

Table 2-1. Summary of Proposed Road Activities

Proposed Road Activities	Relocation/ New roads	Decommissioned or closed roads	Reconstruction /Realignment	Improvement	Drainage activities
FR 86 Cow Creek crossing replacement	—	—	—	—	Replace culvert
FR 92 Cow Creek bridges replacement	—	—	—	—	Replace three bridges
FR 86 relocation (from Junction FR 92 to Manzanares Creek)	Relocate 2.3 miles	Decommission 1.5 miles	—	—	New road standards
FR 86 Improvement (from Manzanares Creek to Bull Creek)	—	—	—	2.3 miles	New road standards
FR 92 realignment	—	—	1.0 mile	—	New road standards
FR 92 improvement	—	—	7.0 miles	13.0 miles	New road standards
Decommission 92V system, including Elk Creek crossing removal	—	Decommission 12.5 miles	—	—	—
FR 92V temporary Elk Creek crossing	—	—	—	—	Install temporary crossing
Murphy's private land access (new road)	2.0 miles	Decommission5.0 miles	—	—	New road standards
Bull Creek private land access	—	—	—	—	Install culvert
Totals	**4.3 miles**	**19.0 miles**	**8.0 miles**	**15.3 miles**	**-**

FR = Forest Road

Road Relocations/New Roads

To improve resource protection and public safety, road relocation and realignment activities would involve closing or decommissioning a road or segment of a road and constructing a new portion in a different location.

- Murphy's private land access would remove approximately 5 miles of existing roadway in the Willow Creek Watershed and replace it with approximately 1.5 to 2 miles of new road located upslope. The existing road along Willow Creek would be closed and parts of it would be decommissioned. The new road would be constructed to reduce current erosion and sedimentation in Willow Creek and to improve access to private land.

- A portion of FR 86 would be realigned. The realignment covers approximately 1.5 miles beginning at the junction of FR 86/92 and ending at the Manzanares Creek crossing. The realigned segment of road would have a ML of 3, which allows for sedan passage and rider

comfort. The purpose of realigning this portion of FR 86 is to move the road to a better location for resource protection and public safety. The existing road is located in the bottom of Tijeras Canyon, which leads to water runoff and stream sedimentation even during moderate runoff events. This makes the road unusable and creates a safety hazard for people who may attempt to drive on it during a runoff event, which can result in motorists becoming trapped in the stream.

- FR 86 from Manzanares Creek crossing to the Bull Creek crossing would also be realigned for 2.3 miles resulting in a stable and maintainable surface. This would protect streams and water quality without requiring a Level 3 maintenance standard.

- Approximately 1 mile of FR 92 within the Rito de la Osha Creek would be realigned away from the stream channel and the old road section would be closed or decommissioned. Culverts would be installed at all stream crossings of tributaries in this realigned section. Portions of FR 92 in the Project Area would also be upgraded, with 13 miles of road becoming ML 2 allowing passage of high-clearance vehicles and 7 miles becoming ML 3 for passenger vehicle use.

Bridge or Culvert Replacement/Construction

- Bull Creek private land access (Tapia property) would require construction of a bridge or culvert where FR 86 crosses Bull Creek. The crossing is near the end of FR 86 and is presently a low water crossing of Bull Creek. This proposal would serve to provide access to private land in the Bull Creek area and to protect the stream channel and water quality of Bull Creek.

- The FR 86 culvert at Cow Creek would be replaced with a larger arch culvert. The current culvert is undersized for the high volume of water and debris that passes through it during runoff events. Replacing the culvert with a larger one would reduce the risk of failure and consequent damage to the stream and the road.

- Three concrete bridges over Cow Creek on FR 92 would be replaced. This would serve to straighten the road alignment to increase vehicle safety at the crossings. These bridges were built in the 1960s and while structurally sound, have been affected by the flooding. Replacing these bridges now will improve debris passage and enhance public safety.

Decommissioning Activities

Decommissioning a road is a process that involves more than preventing access with a gate. In the Proposed Action, decommissioning a road would include removal of culverts, restoring of drainages, and natural revegetation.

The FR 92V system would be decommissioned following management actions. The system includes 12.5 miles of road and seven stream crossings. Decommissioning of this system would include removing culverts, installing waterbars and dips, and barricading the road to reduce the road density in this area. This would meet the Forest Plan standards that were designed to improve watershed and wildlife habitat conditions. The FR 92V system is not necessary for public or private land access.

3.4.3 Alternative 3

Alternative 3 was developed in response to the key issues of soil erosion, water quality, and fish habitat. The Viveash Fire created water-repellent soils (or hydrophobic soils) that have resulted in increased runoff and accelerated sediment delivery to streams, thus impacting water quality and fish habitat. Of the approximately 29,017 acres of burned areas within the Viveash Fire perimeter, it is estimated that 15,646 acres became hydrophobic (Figure 2-4). Areas proposed for harvest in Alternative 3 were selected based upon the Watershed Analysis (Foster Wheeler Environmental 2001b) conducted for the Project Area. In the Watershed Analysis, subwatersheds were ranked by their relative susceptibility to disturbances. The major factors that defined susceptible subwatersheds in the Watershed Analysis include soil erosion, water quality degradation, and impacts to fish habitat. The most susceptible subwatersheds to these types of disturbances were eliminated from consideration of salvage activities. Salvage would occur in the less sensitive subwatersheds, which are generally in the northern portion of the Project Area (Figure 2-4).

3.4.3.1 Harvest Activities

Salvage activities are the same as those identified for Alternative 2 with the following changes:

- Standing fire-killed trees on approximately 2,900 acres from areas of high- and moderate-burn severity in the Cow Creek Watershed would be removed. Over a 3- to 5-year period, the estimated output of wood products expected to be removed from the Project Area would be approximately 10,000 cords of firewood and 12 to 15 MMBF of sawtimber.

- Roadside salvage areas for this alternative would include 2,000 acres.

3.4.3.2 Road Management Activities

The road management activities for this alternative would be the same as those described in Alternative 2. Refer to Alternative 2 for a discussion of road management activities for this alternative.

Approximately 43 miles of currently closed roads would be opened to facilitate salvage operations for this alternative. These roads would be closed or decommissioned after salvage activities have taken place. Closure of roads would involve using barricades to prevent access and decommissioning would include removing culverts, providing for natural stream course function in intermittent and ephemeral draws, install waterbars and dips, and barricading the road.

3.4.4 Alternative 4

Alternative 4 was developed in response to the key issues of soil erosion, water quality, and fish habitat. Under this alternative, 2,600 acres would be designated for roadside salvage (Figure 2-5). The proposed treatment area would not exceed 150 ft on either side of the roads. This alternative was designed to minimize the potential for adverse soil erosion, water quality degradation, and impacts to fish habitat by allowing salvage only within 150 ft on either side of existing roads. The trees would be removed as firewood through the issuance of firewood cutting permits, and other

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Figure 2-4. Map of Alternative 3

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Figure 2-5. Map of Alternative 4

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specialty products and sawtimber through small commercial sales. Under this alternative, an estimated 10,000 cords of firewood, including specialty wood products, would be the potential output of wood products over a 3- to 5-year period.

3.4.4.1 Road Management Activities

Road management activities for this alternative would be the same as in Alternative 2. Refer to Alternative 2 for a discussion of transportation activities.

- To facilitate salvage operations for this alternative, approximately 37 miles of currently closed roads would be opened. The 2,600 acres of roadside salvage are adjacent to these roads, which would be closed or decommissioned after salvage activities have taken place. Closure of roads would involve using barricades to prevent access and decommissioning would include removing culverts, providing for natural stream course function in intermittent and ephemeral draws, installing waterbars and dips, and barricading the road.

3.5 MITIGATION MEASURES

This section describes mitigation measures that would be associated with the implementation of any of the action alternatives. The term "mitigation" is described in 40 CFR 1508.20:

- Avoiding the impact altogether by not taking a certain action or parts of an action
- Minimizing impacts by limiting the degree or magnitude of the action and its implementation
- Rectifying the impact by repairing, rehabilitating, or restoring the affected environment
- Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action
- Compensating for the impact by replacing or providing substitute resources or environments

3.5.1 Mitigation Measures Common to all Action Alternatives

Soil/Water

- Logging operations would be limited to less than 35 percent slopes. Harvest would occur within ¼ mile of existing forest roads located in high- and moderate-burn severity areas. No new roads would be constructed for harvest activities.
- Best management practices (BMPs) for water quality protection would be applied to all ground-disturbing activities. Erosion and sediment control measures would include, but not be limited to, equipment limitation zones during timber harvesting, contour felling/log erosion barriers, mulching, seeding, culvert removal/resizing, and drainage control for roads and trails (see Appendix A for descriptions of BMPs and Section 4.2.1 for implementation of BMPs). These BMPs are contained in or are derived from Forest Service Handbook 2509.2 *Soil and Water Conservation Practices Handbook*. Erosion and sediment control measures would vary based on the Watershed Analysis and field designation by the District Hydrologist. Subwatersheds in the Project Area with a higher relative susceptibility ranking would have higher levels of erosion and sediment control measures (see Section 4.3.2.2).

Adaptive management would be used to evaluate the effectiveness of BMPs. Adaptive management is a systematic, interdisciplinary process for continually improving management policies and practices by learning from the outcomes of operational programs through monitoring.

- Severely compacted skid trails and landings would be ripped and seeded following harvest.
- Harvest activities are restricted to dry or frozen soils.
- Streamside management zones (SMZ) of approximately 100 to 200 ft wide would be applied on both sides of all perennial streams for riparian area protection. On intermittent streams, SMZs of approximately 25 to 50 ft would be mapped and flagged on a site-specific basis. The SMZs would retain shading to streams from surrounding trees and would filter potential sediment yield from upslope disturbances. Harvest equipment would be excluded within these zones. Meadows and springs would have equipment exclusion zones. See Section 2.6 for differences in buffer zones by alternative.

Terrestrial Wildlife

- Within harvest areas, snags (standing dead trees) would be retained at an average of six dead trees per acre in the spruce/fir areas and four dead trees per acre in ponderosa pine/mixed-conifer areas (Forest Plan, page 72). The snags may be distributed unevenly across the landscape, so snag density would be evaluated on a 40-acre basis (excluding the riparian areas). The 40-acre evaluation areas may include areas that are not harvested.
- Downed wood material would be retained at five logs per acre (Forest Plan, page 62).
- There would be no logging in the currently occupied Cow Creek/Lower Cow Creek and Creek/Upper Cow Mexican spotted owl's protected activity centers (PACs), and the Manzanares northern goshawk's post-fledging areas (PFAs).
- Limited operating periods (LOPs) would be implemented, with no salvage activities taking place within ¼ mile of all PACs, with the exception of the Rosilla/Elk/Middle Cow PAC (which no longer contains Mexican spotted owl habitat), from March 1 through August 31. Use of FR 92 will not be subject to seasonal restrictions. This road is heavily used by the public and government agencies and closure is not feasible.
- All PACs, with the exception of the Rosilla/Elk/Middle Cow PAC, will be surveyed during the 2002 breeding season, prior to project implementation. In the event that Mexican spotted owls are located, all applicable mitigation measures will be implemented. This procedure is in compliance with the Mexican Spotted Owl Recovery Plan (U.S. Fish and Wildlife Service 1995) protocol, in that no more than one breeding season will have elapsed since the last survey and the implementation of the Proposed Action.
- LOPs would be implemented within ¼ mile of the occupied Mazanares PFA, with no salvage activities taking place during the breeding season from March through September to reduce potential impacts to goshawks.
- Disturbance to sensitive areas for big game, such as elk calving and wintering grounds, would be avoided or minimized by implementing LOPs during the critical calving period of May 1 to June 30.

Sensitive Plants

- Salvaging hazard trees felled along the edge of known Pecos fleabane populations or potential habitat sites would be directed away from habitat.

Noxious Weeds

- All skidding and road maintenance equipment entering the Project Area would be thoroughly cleaned and free of weed seeds. Only certified weed-free seed mixtures will be utilized in revegetation operations.

Heritage Resources

- Activity areas would be inventoried for heritage resources, and all heritage resource sites would be flagged and no harvest activities will take place in these areas.
- Ground-disturbing activities would be limited near heritage resource sites and skid trails would be located to avoid channel runoff towards those identified sites.
- All heritage resource sites would be monitored for disturbance and vandalism.

Recreation and Scenery

- A 150-ft no-cut buffer zone will be used in units adjacent to the Skyline Trail to protect foreground views.
- All roads, trails, and access areas would be kept free of slash or unmerchantable trees. Additionally, within 100 ft of the open roads and trails, unpiled slash or unmerchantable tree accumulations would be less than 1.5 ft in height.
- No log hauling would be permitted during weekends and holidays without prior approval.
- Landings visible from FR 92 would be restored to original or characteristic contours and revegetated with native vegetation within 1 year of project completion.

Traffic and Noise

- Logging truck travel through the town of Pecos and within Cow Creek will be restricted to the hours of 7:00 am to 7:00 pm to reduce noise.
- Truck braking is restricted to engine downshifting, as well as using normal brakes, to avoid the nuisance of loud Jake-braking through the town of Pecos.
- Low speed requirements would be maintained for all vehicles traveling along high recreation-use areas and the residential property in the Project Area.
- Signs would be posted when logging efforts are taking place to warn recreational visitors or roadside salvage persons.
- The use of water or dust palliatives would be evaluated and used on the roads as necessary during periods of increased log hauling.

3.6 ALTERNATIVE COMPARISON

Some selected features that differ by alternative are displayed in Table 2-2. Section 2.5 details the mitigation and monitoring requirements and resource protection activities by alternative.

Table 2-2. Comparison of Proposed Salvage and Streamside Buffers

Proposed Activities	Alternative			
	1	2	3	4
Harvesting				
Fire Salvage Area (acres)	0	5,600	2,900	0
Roadside Salvage (acres)[2]	0	1,100	2,000	2,600
Salvage Volume	0	10,000 cords and 20–25 MMBF	10,000 cords and 12–15 MMBF	10,000 cords
Streamside Buffers (ft)[1]				
Category 1 and 2 Subwatersheds	NA	100	200	100
Category 3 and 4 Subwatersheds	NA	200	NA	100

[1] Category 1, 2, 3, and 4 subwatersheds are defined in Foster Wheeler Environmental (2001b).
[2] Roadside salvage areas are outside of the block area salvage.
NA = Not applicable

Table 2-3 provides a summary of the effects of the alternatives with respect to the Purpose and Need and significant issues described in Section 2.2.2. Differences in effects provide a basis for choice among the alternatives. Detailed analyses and discussion of the effects for all resources are presented in Chapter 4 with additional details contained in the Project Record.

Table 2-3. Comparison of the Effects of Alternatives

Purpose/Need and Issues	Alternative			
	1	2	3	4
Significant Issue: Soils				
Soil loss change	0%	<11%	<7%	<2%
Significant Issue: Water Quality				
Road density (mi/sq mi)	2.6	2.3	2.3	2.3
Sediment delivery change	0%	<11%	<7%	<2%
Delay in Sediment Yield Recovery (years)	0	<1	<1	<1
Significant Issue: Fish Habitat				
Reduction in physical fish habitat	No Effect	Low probability	Low probability	Low probability
Important Issue: Economics				
Wood recovery (MMBF)	0	20–25	12–15	0
Specialty products (cords)	0	10,000	10,000	10,000
Full-time jobs created	0	248–302	146–178	52–57
Total regional income creation (millions)	$0	$6.4–7.8	$3.7–4.6	$1.4–1.6
Important Issue: Transportation				
Log truck trips	0	5,556	3,334	0
Small vehicle (e.g., pickups) trips	0	6,667	6,667	6,667
Important Issue: Terrestrial Wildlife				
Threatened, endangered, and sensitive species	No effect	May affect, not likely to adversely affect	May affect, not likely to adversely affect	May affect, not likely to adversely affect
Management indicator species	No effect	No effect	No effect	No effect
Migratory bird species	No effect	No adverse effects	No adverse effects	No adverse effects
Important Issue: Forest Vegetation				
Change in forest structure	None	Minor	Minor	Minor
Change in live forest vegetation	None	No effect	No effect	No effect
Important Issue: Scenic Resources				
Visual effects	None	Short-term	Short-term	Short-term

mi/sq mi = miles per square mile

4.0 AFFECTED ENVIRONMENT

This chapter describes the existing conditions and affected environment for the environmental and social resources that are potentially affected by the Proposed Action or alternatives. The existing condition for all resources is defined as those that existed after the Viveash Fire; though for context, some discussion of the effects of the fire are included in most of the resource discussions. The existing condition discussions are arranged into physical, biological, and social resources.

This chapter summarizes some of the more detailed information from the individual technical reports to reduce the length of this EIS and improve readability. The individual analysis reports are in the Project Record and available for public review.

4.1 Physical Resources

4.1.1 Watershed Characterization

4.1.1.1 Introduction

The Viveash Fire burned watersheds within the Santa Fe National Forest boundary located between the southern ends of the Sangre de Cristo and Santa Fe mountains in New Mexico. The landscape varies from alluvial valley bottoms to hills and mountains surrounded by narrow valleys. The area is relatively rugged, with slopes of 65 percent or more along cliffs and canyons.

The southern part of the Project Area contains several highly dissected drainages, and several less-dissected drainages occur in the northern portion of the area. These watersheds fall within the larger Pecos Headwaters Watershed (U. S. Geological Survey [USGS] Hydrologic Unit 13060001), which includes all of the headwater tributaries of the Pecos River. The watersheds in the Project Area are the Cow Creek and Willow Creek (and are illustrated in Table 3-1 and Figure 3-1). The watersheds are generally oriented in a north/south to southeast direction. Within these watershed drainages are several subwatersheds ranging in elevation from 7,717 ft at the southern extent of Cow Creek to 11,661 ft at the summit of Elk Mountain.

Table 3-1. Project Area Watersheds Within the Perimeter of the Viveash Fire

Watershed	Subwatershed	Total Area (acres)	Area Burned (%)
Cow Creek	Lower Cow	3,965	67
	Middle Cow	4,257	99
	Upper Cow	3,327	100
	Tijeras	1,825	81
	Manzanares	5,482	65
	Osha	2,148	100
	Chaparito	1,172	97
	Soldier	1,805	65
	Elk	3,486	100
	Upper Bull	3,817	67
	Total Cow Creek	31,284	83
Willow Creek	Willow Creek	4,521	0
	Total	**35,805**	72*

* The total percent area burned determined from the weighted average of the percent area burned in each subwatershed.

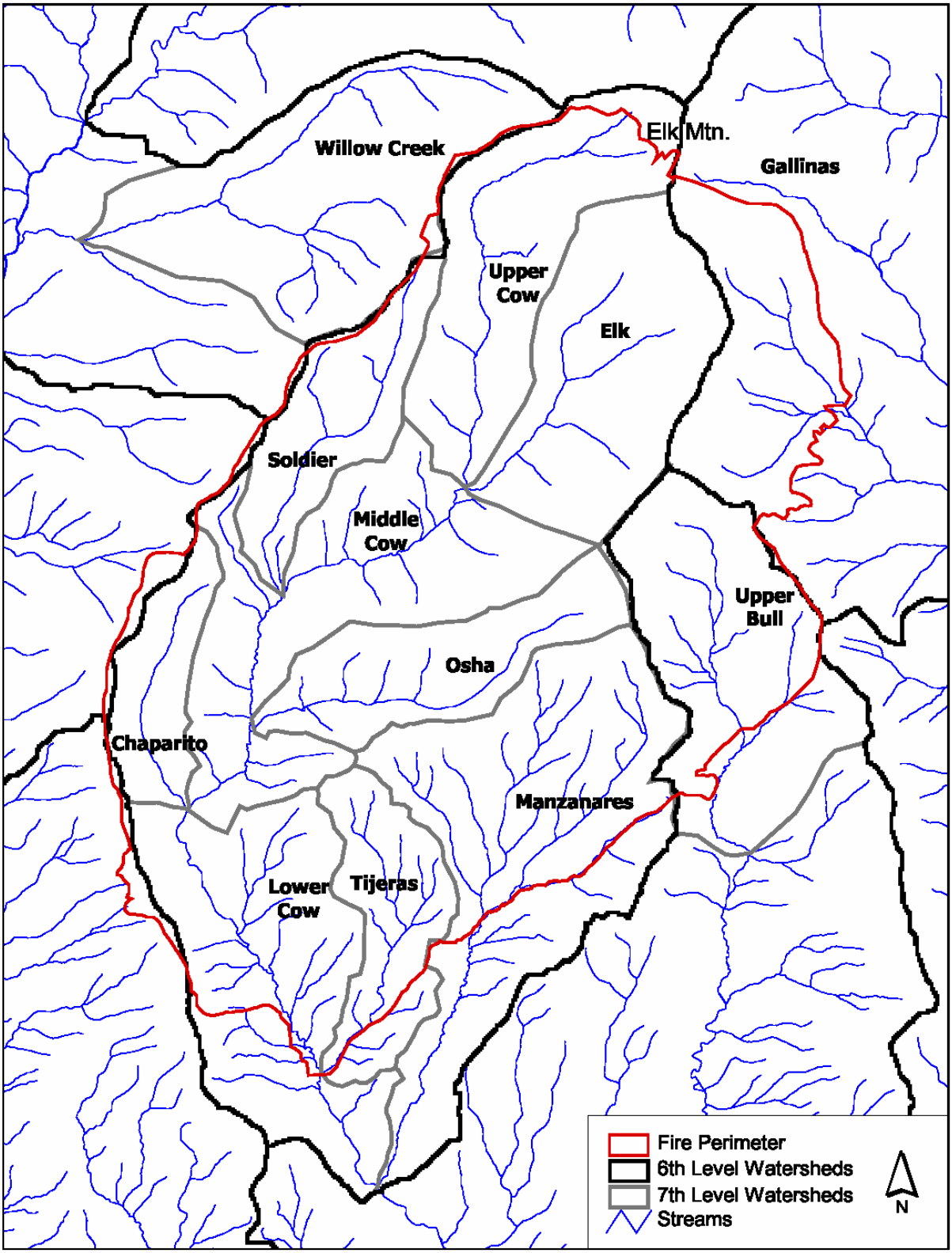


Figure 3-1. Viveash EIS Project Area Watersheds

Cow Creek is 31,284 acres in size and is a major tributary to the Pecos River. Elk and Soldier creeks form the headwaters of Cow Creek, while Bull and Rito Manzanares are major tributaries to Cow Creek. Cow Creek and its tributaries flow in a southerly direction through the Project Area. The confluence of Cow Creek and the Pecos River is near the community of San Jose, New Mexico, which is approximately 15 miles south of the Project Area.

The Gallinas River Watershed, another tributary to the Pecos River, was also partially burned during the Viveash Fire. The headwaters of the Gallinas River Watershed provide the municipal water supply for the city of Las Vegas, New Mexico. Because this area provides drinking water to Las Vegas, the USFS plans no harvesting in the Gallinas River Watershed. Therefore, this area was excluded from further analysis.

Willow Creek flows to the west and joins the Pecos River. The Willow Creek Watershed covers 4,521 acres and is located north of the upper portion of the Cow Creek Watershed. This area was not impacted by fire; however, the watershed contains USFS roads that are near streams and small tributaries. FRs 645 and 646 are the predominant roads in the Willow Creek Watershed. Portions of these roads are proposed for realignment and decommissioning under Murphy's land access.

4.1.1.2 Climate

The area experiences low relative humidity, and mean annual precipitation ranges from 20 to 35 inches. Summer rains fall almost entirely during brief but often intense thunderstorms. The general upslope circulation from the Gulf of Mexico carries moisture for these storms across the Great Plains. July and August are typically the wettest months of the year, with nearly 40 percent of the average annual precipitation falling during that time. Winter precipitation is caused mostly by frontal storms from the Pacific Ocean that generally move from west to east. Lowest precipitation intensities occur from November to March. Most of the winter precipitation falls as snow in the mountains, but may also occur as rain at lower elevations. The mean annual snowfall is about 70 to 80 inches, and the freeze-free period is 50 to 70 days. Within the Project Area, average annual temperatures range from 32 degrees to 50 degrees Fahrenheit (ºF). The average maximum temperature during July reaches approximately 82°F, and average minimum temperatures range from 0° to 16°F.

4.1.1.3 Stream Channels

Cow Creek and its tributaries flow to the south and make up the main stream system in the Project Area. Segments of Willow Creek are also included in the Project Area. Tributaries of Cow Creek tend to be relatively small with segments of intermittent flow. Willow Creek also includes both perennial and intermittent stream segments. Elk Creek, one of the most severely burned tributaries, has a steep gradient with a minimal floodplain. The metamorphic rock in this subwatershed prevents streams from developing a dense stream network as observed in lower subwatersheds that cut through granite.

Soldier Creek, which flows at slightly lower elevations, is less steep and has created a floodplain near the channel. This channel also follows a linear pattern, in part due to the presence of north-south faults along the western boundary of the Project Area. Rito de la Osha and Rito Manzanares occur at mid-elevations, but the underlying metamorphic rocks give Rito de la Osha a slightly higher overall slope. At lower elevations, Tijeras Creek is an intermittent stream system that dissects the

underlying granite in a dense drainage pattern. Rito Chaparito is on the western edge of the burned area and consists of a moderate-gradient intermittent stream. Cow Creek and its floodplains grow wider and channel gradients decrease downstream through the Upper, Middle, and Lower Cow subwatersheds. On the eastern edge of the burned area, the Upper Bull Creek subwatershed forms part of a separate stream system that connects with Cow Creek downstream of the Project Area. Bull Creek is also a relatively low-gradient stream.

4.1.1.4 Roads

The Cow Creek and Willow Creek watersheds include 154.6 miles of unpaved roads (Table 3-2). Historically, the road system was established as a result of timber harvesting and private land access. These roads currently provide access for National Forest visitors and management activities. The density of roads ranges from 1.4 miles per square mile (mi/mi^2) in the Soldier subwatershed to 3.6 mi/mi^2 in the Osha subwatershed (Table 3-2). The overall road density in the Project Area is 2.8 mi/mi^2. These roads generally follow valley bottoms and ridgelines. Many roads pass directly through stream channels for a total of 145 stream crossings in the Project Area. The Manzanares subwatershed has the greatest number of roads that pass within 300 horizontal feet of a stream (12.6 miles), while only 475 ft of road are that close to streams in the Chaparito subwatershed.

Table 3-2. Watershed Road Characteristics

Watershed	Subwatershed	Roads (miles)	Roads within 100 ft of Stream (miles)	Roads within 300 ft of Stream (miles)	Road Density (mi/mi^2)	Number of Road Stream Crossings
Cow Creek	Lower Cow	13.8	2.0	5.1	2.2	11
	Middle Cow	20.3	1.1	3.6	3.1	13
	Upper Cow	18.3	1.3	2.7	3.5	13
	Tijeras	4.3	0.8	1.6	1.5	10
	Manzanares	30.3	5.6	12.6	3.5	38
	Osha	12.1	2.3	4.0	3.6	13
	Chaparito	3.5	0.0	0.1	1.9	0
	Soldier	4.0	0.1	0.6	1.4	0
	Elk	18.2	0.4	1.9	3.4	6
	Upper Bull	10.6	1.4	3.1	1.8	9
	Total Cow Creek	135.4	14.9	35.2	2.8	113
Willow Creek	Willow Creek	19.2	3.6	6.6	2.7	32
	Totals	**154.6**	**18.5**	**41.8**	**2.8**	**145**

ft = feet
mi/mi^2 = miles per square mile

4.1.2 Soil Types and Geology

Precambrian granites, Precambrian metamorphic rocks, and Paleozoic sedimentary rocks dominate the geology of the Project Area (Figure 3-2). This local geology and the general north-south trending fault system along the western boundary of the Project Area control two distinct drainage density

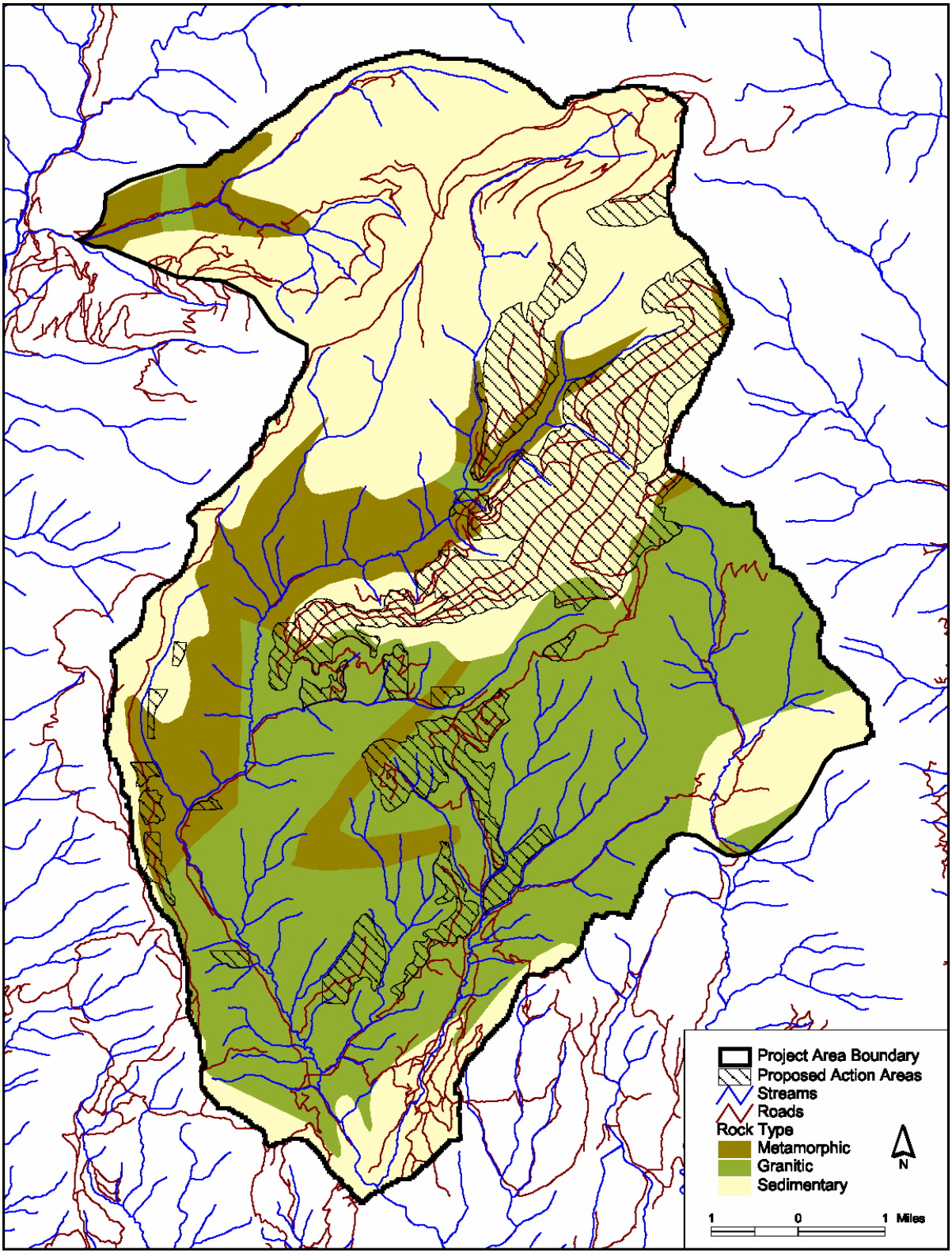


Figure 3-2. Geology in Viveash EIS Project Area

patterns in the watershed (Table 3-3). In the upper watershed, low drainage density is due to the resistant metamorphic bedrock and general linear faulting, whereas the lower watershed has higher drainage density due to the more erodible granitic bedrock. Sandstone and shale outcrops occur mostly at higher elevations. Alluvium (waterlain sediment) occurs in valley bottoms. Isolated inactive deposits of colluvium (gravity-driven materials) appear in higher elevations of Cow Creek.

Table 3-3. Watershed Drainage Density

Watershed	Subwatershed	Drainage Density (mi/mi^2)
Cow Creek	Lower Cow	60.25
	Middle Cow	43.61
	Upper Cow	116.28
	Tijeras	118.15
	Manzanares	91.46
	Osha	76.64
	Chaparito	87.21
	Soldier	129.77
	Elk	69.31
	Upper Bull	60.32
	Total Cow Creek	101.97
Willow Creek	Willow Creek	68.37
	Total	**97.73**

mi/mi^2 = miles per square mile

The granite, metamorphic, and sedimentary geology of the Project Area produces several distinct soils that are mapped in the Santa Fe National Forest Terrestrial Ecosystem Survey (TES) (USDA Forest Service 1993). Individual soil types mapped in the TES reflect areas with similar physical and biological characteristics, such as slope, vegetation, climate, and soil properties. The TES shows small areas of the following soils:

- Inceptisols (soils in the early stages of breaking down the underlying bedrock)
- Entisols (soils lacking any horizons because they are so young)
- Alfisols (well-developed forest soils common to this region)

Alfisols are more developed soils than either inceptisols or entisols, which generally makes them more fertile.

Soils with relatively high levels of organic matter, called mollisols, also occur in valley bottoms and swales where water collects (USDA Forest Service 2000a). Scattered gravel and cobbles occur over and within many soil profiles in the burned area. In general, slopes facing southeastward experience more cycles of freezing and thawing during snowy months than the slopes that lie in the shadier north- and northwest-facing slopes. As a result, soils on southeastern slopes tend to be deeper and are composed of coarser materials.

Before the Viveash Fire, soils in the Project Area generally included thick duff layers, which is an organic surface soil layer below the surface groundcover where the original form of plant and animal matter cannot be identified with the unaided eye. These layers occurred under well-established forest canopies and protected the soil from erosion and contributed to nutrient cycling (USDA Forest Service 2000a). After the fire soil conditions changed. The fire totally consumed ground litter in areas mapped as high-severity burns. In some locations, the fire produced a water-repellent, hydrophobic layer that prevents water from soaking into the soil, resulting in increased runoff.

The Watershed Analysis was completed to estimate watershed sensitivity (Foster Wheeler Environmental 2001b). Among other factors, the analysis included soil erosion potential. Figure 3-3 shows the results of the sensitivity ranking throughout the Cow Creek and Willow Creek watersheds. Category 1 watersheds are least sensitive and Category 4 watersheds are most sensitive.

Post-fire field inspection revealed that soils have already begun to recover from the Viveash Fire. Soils in the higher elevation subwatersheds, including Elk, Upper Cow, and parts of Middle Cow, developed on metamorphic rock. These upper subwatersheds generally experienced less erosion per acre of high-severity burn than soils that were developed in granite would have experienced under those same conditions. Grasses already cover much of the hillsides in these stable subwatersheds. In contrast, granite weathers into small, mobile gruss (coarse crystalline sand that tends to be spherically shaped), so that soils developing in the lower watershed eroded more easily. The most dramatic post-fire erosion has occurred in these more erodible soils, particularly in the Manzanares, Tijeras, and Lower Cow subwatersheds, as well as parts of Middle Cow. Aspen and oak tree regeneration has begun to stabilize some of the more erodible hillslopes.

Figure 3-4 shows pre- and post-fire soil loss for each watershed in the Project Area. Much of this eroded soil was delivered to streams, leading to water quality degradation. Streams in areas with higher drainage densities received more sediment than streams in areas with lower drainage densities. The existing network of unpaved roads also moved sediment into channels. The post-fire rates reflect conditions immediately following the Viveash Fire. Soil loss rates in 2002 have decreased from these extreme levels as the watersheds have begun to recover.

The impacts of fire on soil properties may last weeks or decades, depending on the fire severity and intensity, any remedial measures, and the rate of vegetative recovery (Baker 1990). Although catastrophic fires infrequently occur in spruce-fir forests (USDA Forest Service 2000a), a large portion of the Viveash Fire was outside the range of natural behavior for this forest. Despite the extreme nature of this fire, soil conditions have already improved through both natural recovery processes and active management. For more information on the effects of the fire on soil erosion, refer to the Watershed Analysis (Foster Wheeler Environmental 2001b).

4.1.3 Water Quality

Increases in sedimentation, turbidity, and mass erosion are regarded as the most serious threats to water resources following wildfire. These changes in water quality often alter stream functions so that original designated uses, including municipal water supply, wildlife habitat, and fish culture, are no longer supported. Adverse impacts to water quality after the Viveash Fire were largely attributed to ash and sediment. Streams impacted by the Viveash Fire experienced high levels of turbidity that

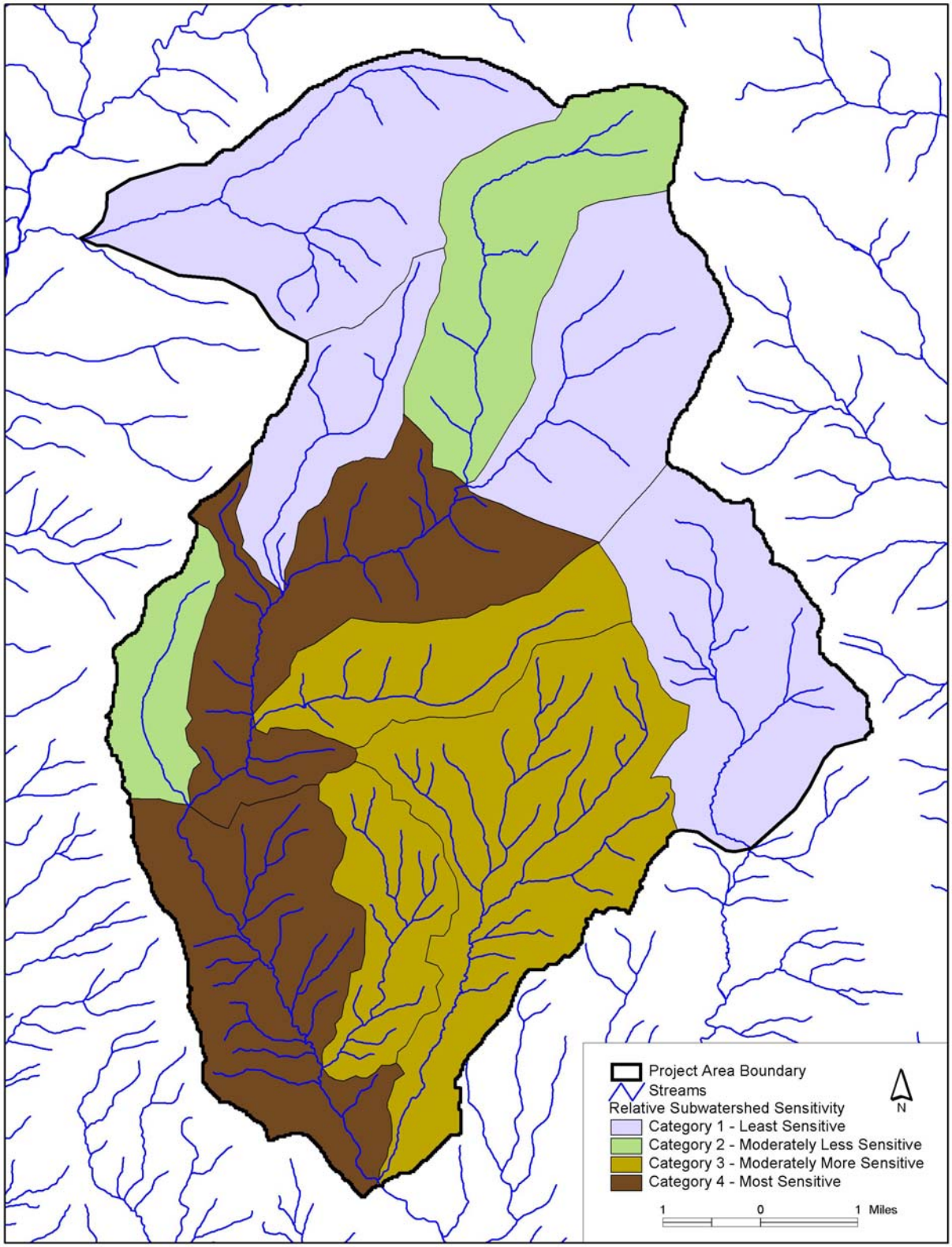
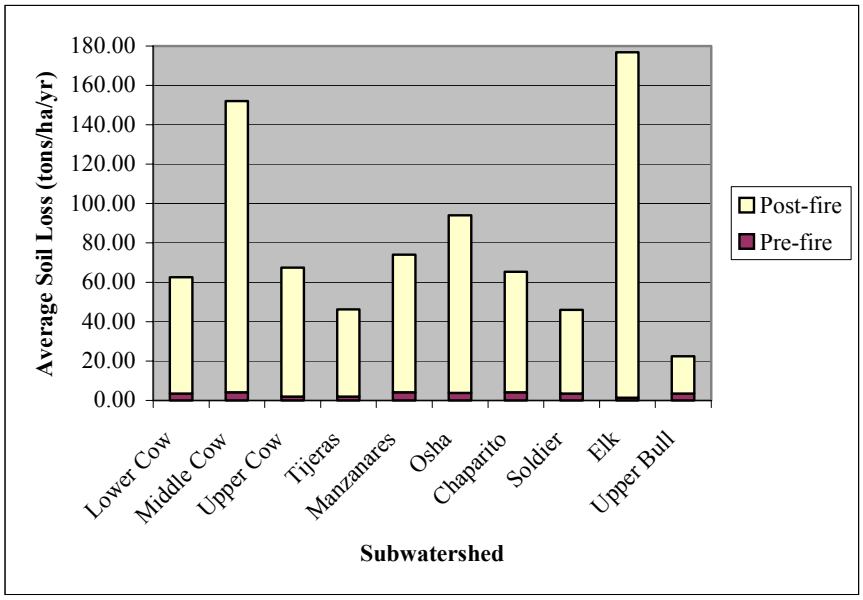


Figure 3-3. Subwatershed Sensitivity Ranking in Viveash EIS Project Area



tons/ha/yr = tons per hectare per year

Figure 3-4. Pre- and Post-Fire Estimated Soil Loss Rates

was caused by suspended sediment. Short-term increases of nutrients, dissolved solids, and pH may also occur while water yields remain elevated.

4.1.3.1 Designated Uses

Cow Creek and Willow Creek are headwater tributaries of the Pecos River. As such, the state of New Mexico has classified several designated uses for the Cow Creek and Willow Creek watersheds (Table 3-5). These designated uses include domestic water supply, fish culture, high-quality cold water fisheries, irrigation, livestock watering, wildlife habitat, and secondary contact (human contact with water) (New Mexico Environment Department 2000).

Table 3-5. Designated Uses of Project Area Streams

Project Area Stream	Designated Uses	Stream Impairment
Cow Creek (from the mouth at the Pecos River to the headwaters)	Domestic Water Supply	Stream Bottom Deposits, Conductivity, Turbidity
	Fish Culture	Stream Bottom Deposits, Conductivity, Turbidity
	High-Quality Cold Water Fishery	Stream Bottom Deposits, Conductivity, Turbidity
	Irrigation	Stream Bottom Deposits, Conductivity, Turbidity
	Livestock Watering	Stream Bottom Deposits, Conductivity, Turbidity
	Wildlife Habitat	Stream Bottom Deposits, Conductivity, Turbidity
	Secondary Contact	Stream Bottom Deposits, Conductivity, Turbidity
Willow Creek (near the confluence at the Pecos River to the headwaters)	Domestic Water Supply	None—Use Fully Supported
	Fish Culture	None—Use Fully Supported
	High-Quality Cold Water Fishery	Stream Bottom Deposits
	Irrigation	None—Use Fully Supported
	Livestock Watering	None—Use Fully Supported
	Wildlife Habitat	None—Use Fully Supported
	Secondary Contact	None—Use Fully Supported

Before the Viveash Fire, Cow Creek had water quality impacts because of stream deposits from grazing, agriculture, road maintenance and runoff, removal of riparian vegetation, and streambank modification and destabilization. Because of these impacts, Cow Creek was listed as partially attaining its designated uses. These problems resulted in insufficient support for high-quality cold water fisheries. Elk, Soldier, Bull, and Rito Manzanares all met the designated water quality standards despite minor impacts caused by livestock in Elk and Soldier creeks (USDA Forest Service 2000a). Other designated uses will likely not be fully supported in the current deteriorated post-fire conditions. Prior to the fire, all the designated uses in Willow Creek were not fully supported because of excessive stream bottom deposits, conductivity, and turbidity. Metals (copper, zinc, cadmium, and mercury) derived from the abandoned Pecos Mine (also known as Terrero Mine) caused streams in Willow Creek to be transferred from the 303(d) list (Total Maximum Daily Load) to the 305(b) list (National Water Quality Inventory Report to Congress 1998) in 1998.

4.1.3.2 Stream Conditions

Before the fire, average turbidity increased slightly from the upper to lower reaches within the Santa Fe National Forest and doubled on private land largely because riparian vegetation had deteriorated (USDA Forest Service 2000a). Current post-fire conditions include increased turbidity during short durations of high flows as sediment is delivered to downstream valleys. Runoff that transports ash and charred organics into stream systems adversely affects fish populations.

Stream temperatures after the Viveash Fire should remain within the standard acceptable range for cold water fisheries. During the summer, however, water temperatures will be elevated a few degrees during low flows. The detrimental affect on aquatic life may be countered by an increase in the magnitude of base flows that result from the loss of upslope and riparian vegetation.

Fire impacts on the riparian zone varied by the amount of conifer vegetation. The fire burned hottest in riparian areas dominated by dense conifers. As a result, these areas have lost vegetative cover. In contrast, more open riparian areas with willow, aspen, and sedges remained largely intact after the fire, because fire stimulates growth of aspen and willow. Aspen regeneration has begun in many of these less affected areas. Without a major storm event, habitats will likely remain unchanged with respect to large woody debris or debris flows. Similarly, landslides and other mass failures are unlikely.

Pre-fire water quality in the Gallinas River, a comparable river system to the east, tended to be cool, clear, highly oxygenated, slightly alkaline, and low in nutrients, heavy metals, and dissolved chemicals. After the fire, water quality parameters such as nutrients, dissolved solids, and pH may experience spikes immediately following storms and large flow events. These temporarily elevated concentrations will most likely not preclude any designated use as they will tend to be limited and very short in duration.

The proximity and density of stream channels also play an important role in water quality following high-intensity fires. Developed drainages provide systems for downstream sediment transport. The drainage density in Elk Creek, the most impacted subwatershed, is 69.3 mi/mi^2—lower than any other in Cow Creek (Table 3-3). Other subwatersheds with relatively low drainage densities include Chaparito, Osha, and Upper Bull. Channels in the lower, severely burned, granitic areas are particularly sensitive to high-intensity rainfall events.

4.1.4 Hydrology and Floodplains

The Viveash Fire dramatically changed the overall hydrology of the burned watersheds within the Project Area. In general, where the fire burned much of the vegetation, interception and evapotranspiration decreased dramatically. Even more importantly, the fire consumed the organic layers of the forest floor and exposed mineral soils. Removing this duff layer greatly decreased the infiltration of water into the soil. The loss of the duff layer also eliminated most of the available water storage capacity in the burned soil units. Both the decrease in infiltration and the loss in water storage capacity have produced flooding from even moderate rainfall events. Anderson and others (1976) documented the same effects following wildfires in similar watersheds. The Viveash Fire also left a relatively impermeable, hydrophobic layer in the soils. This water-repellent layer has changed the hydrologic regime of the Project Area from little or no surface runoff before the fire to large amounts of overland flow after the fire. This process is described in other forests by Rochibaud and Waldrop (1994).

Post-fire testimony by the USFS and local landowners reveals that flooding has increased dramatically in the Project Area following the Viveash Fire. Increases in annual water yields generally decline to pre-fire conditions within 20 to 40 years as the forest grows and regenerates. In other words, flooding will likely continue to occur for several years, regardless of any management activity. Flooding severity will likely decrease slowly over time. Until then, the removal of the vegetative cover and the duff layer by the fire, as well as the formation of less permeable soils, has led to increased peak flows and higher levels of surface runoff and overland flow (McNabb and Swanson 1990). Increased snowmelt base flows caused by the loss of interception and by increased direct solar radiation have also occurred as a result of the Viveash Fire. These conditions also prompt earlier spring snowmelt peak flow. All of these forms of post-fire flooding have caused the detachment and transport of sediment. The result is an increase in sheetwash and mass transport including debris torrents and flows.

4.1.5 Wetlands

The U. S. Fish and Wildlife Service (USFWS) National Wetland Inventory (NWI) mapped the Viveash Fire Project Area in 1982. The potential wetland habitats that USFWS identified were subsequently printed in 1984 on the Santa Fe Wetland Inventory Map. The Viveash Fire area lies in rugged mountainous terrain dissected by a number of large canyons. These canyons collect runoff from the surrounding slopes, creating ephemeral to perennial streams that form portions of the headwaters of the Pecos River. Within all of the 10 subwatersheds defined within the Project Area, USFWS has identified 15 waterways supporting potential wetland habitats (Table 3-6) (U.S. Fish and Wildlife Service 1984).

Potential wetland habitats consisted of both palustrine and riverine systems scattered along the lengths of the waterways. In all, the NWI identified 13 different types of potential wetland habitats in the palustrine and riverine systems within the Project Area, which includes 11 palustrine and 2 riverine system types.

Table 3-6. Subwatersheds and Waterways in the Project Area

Subwatershed	Waterway Identified as Potential Wetland
Chaparito	Rito Chaparito
Elk	Elk Creek and Sheep Creek
Lower Cow	Lower Cow Creek
Manzanares	Rito Manzanares, Rito Atascoso, Rito Quemazon, Rito Torito, and Unnamed Drainage
Middle Cow	Middle Cow Creek
Osha	Rito de la Osha
Soldier	Soldier Creek
Tijeras	Canon de Tijeras
Upper Bull	Upper Bull Creek
Upper Cow	Upper Cow Creek

4.1.5.1 Wetland Systems

Within the Project Area, the riverine system includes all wetland and deepwater habitats contained within a channel that are not dominated by trees, shrubs, and persistent emergents (Cowardin et al. 1979). Vegetation within the riverine system includes aquatic bed and non-persistent emergent species. Upland or palustrine environments are generally adjacent to these wetlands. Although there are only two subsystems of riverine habitats within the Project Area, these subsystems are spread along the length of all of the major drainages in the Project Area.

The palustrine system in the Project Area includes all wetlands dominated by trees, shrubs, and persistent emergents. Uplands, riverine systems, or a mixture of both bound the palustrine system wetland habitats within the Project Area. All but one of the palustrine habitats identified by NWI within the Project Area occur along the 15 identified waterways that are scattered throughout the 10 subwatersheds. A solitary, isolated potential palustrine wetland occurs within the Chaparito subwatershed.

Riverine System

Perennial and intermittent riverine subsystems were identified within the Project Area. The Perennial system includes waterways in which the gradient is high, water velocity is fast, and some water flows throughout the year. The bottoms of these streams generally consist of rock, cobble, or gravel with scattered patches of sand. This wetland system is found along the major drainages in the Project Area such as Cow Creek, Rito Chaparito, Bull Creek, Rito de la Osha, and Rito Manzanares. The Intermittent system consists of channels that have flowing water for only part of the year. When the water is not flowing, it may be retained in small, isolated pools, or it may be wholly absent. This system is found principally in the smaller drainages or in the extreme upper portions of larger drainages such as Soldier Creek, upper reaches of Elk Creek, numerous Unnamed Drainages, and the upper reaches of Rito de la Osha. The NWI map for the Project Area noted that many of the areas designated as Intermittent might not qualify as wetlands.

Palustrine System

Eleven types of palustrine subsystems were identified within the Project Area. These included four types of Palustrine Open Water Systems, four types of Palustrine Emergent Persistent Subsystems, one Palustrine Forested, one Palustrine Scrub-Shrub, and one Palustrine Unconsolidated Shore Subsystem. These subsystems are principally confined to the edges of the 15 waterways identified in the Project Area. One exception is a small Palustrine Emergent Persistent Semi-Annually Flooded potential wetland located in the upper portion of the Chaparito subwatershed near the western boundary of the Project Area. Based on the recent U. S. Supreme Court Decision (Solid Waste Agency of Northern Cook County [SWANCC] Decision), this and other isolated wetlands may not qualify as jurisdictional wetlands if they are not adjacent to jurisdictional surface water connections.

The Viveash Fire dramatically affected the wetland habitats in the Project Area. Some of the riparian areas within the Viveash Fire were burned (USDA Forest Service 2000a), but were showing signs of recovery in June 2000. In particular, scrub-shrub communities such as coyote willow stands can fully recover in 3 years after a fire event (Marron and Associates 2001). Although the riparian zones may not suffer long-term effects from direct fire damage, they are vulnerable to both sedimentation and channel cutting from runoff.

4.1.6 Transportation

As was the general practice in the southwestern United States, roads were built along streams. The development of the eastern portion of the Santa Fe National Forest was no exception. Ranches, cattle allotments, and recreational use (game hunting, fishing, and camping) are dependent upon water. Ease of access and construction created roads that follow streams.

As the USFS increased road construction in the 1970s, the long-standing plan to connect Pecos and Las Vegas with a Forest Service highway was begun with the construction of State Road (SR) 233 and the current two-lane asphalt highway to the junction of FR 83. It was to continue along the current FR 86 (San Miguel County Road to the junction with FR 92), across Cow Creek, and then along its present alignment beyond Bull Creek. The segment from Bull Creek across the divide to the Tecolote drainage was never completed. The road miles, road densities, roads located near streams, and stream crossings that are currently in the Project Area are presented in Table 3-2.

Timber sales (principally the Osha Timber Sale in the late 1970s) spurred the construction of the extensive "92" system that serves Cow, Rito de la Osha, Elk, and Sheep creek drainages. The Creek timber sale proposed a connection between Elk Creek and the Davis and Willow drainages to the north but this was never completed. FR 92 from the junction of FR 86 follows Cow Creek closely, and then follows Rito de la Osha. This old road, primarily serving ranches and cattle allotments, was "under-designed" and impinged on the creeks many times. The three concrete bridges over Cow Creek were constructed during the 1970s and served the road well until the unprecedented sediment and debris loads that followed the Viveash Fire in 2000. The roads above 9,000 ft in elevation were built to the high standard for timber access of the 1970–1980s period. They are stable, single-lane roads with rolling grades and dips and are outsloped for drainage.

The entire Viveash Project Area road system is a single lane and has no turnouts. Access to the lower portion of the 92 system is year round, having been declared a "public road" by the courts in 1997 (the judgment was silent on right-of-way [ROW] width). Therefore, traffic continues during

wet and freeze-thaw periods. Much of FR 86, beyond the junction with FR 92, is parallel to or runs through many creeks flowing south in this area. Portions of the ROW that were sufficient to relocate much of this road were acquired in the 1980s. Some of these easements have reverted back to private ownership. The USFS is actively pursuing easements for the segment from FR 86/92 to the forest land east of Tijeras Canyon. At this time there are at least 3 principal landowners involved with this ROW. The area near the FR 86/92 junction is undergoing "gentrification," and several large cabins and second homes are being constructed. How this will affect the demand for higher (or lower) road standards is uncertain.

Access to and within the Project Area occurs at the traveler's discretion—rough roads, periodic flood washouts, and poor directional signage. All roads in the Project Area are non-paved and offer dispersed road recreation. In the Project Area there is only one campground, Cow Creek Campground. The fire destroyed much of this campground, and there are plans to relocate it to the Manzanares area. The Project Area is also used for fishing, family gatherings, hunting, off-highway vehicle use, and scenic driving. These uses primarily occurred before the fire, but still continue in the Project Area. The 55 System connects FRs 86 and 92 beginning at Rito del Torito and serves cattle operations. Passage along this system is through many cattle fences. The roads are low-standard, single lanes with rolling grades and rolling dips, and are considered to be administratively closed.

Forest Service Road 572 is a 9.4-mile ridge route along the western boundary of the fire. The first portion beyond the access off of FR 86 has been impacted by early spring logging operations. The road system is a single-lane, rolling-grade road and has been used as a haul route for fire salvage and private land logging.

The northwest corner of the Project Area is accessed by the FR 645/646 road system. Until the late 1990s, the traditional access for the Willow Creek road system had been via FR 645 along Willow Creek. The lower 2 miles of this road was closed for the Torrero Mine restoration project and has reduced some of the water quality impacts to Willow Creek.

4.1.7 Air Quality

The Project Area lies within and affects four airsheds: the Pecos River, Pecos, Upper Rio Grande, and Arkansas/White River. All airsheds in New Mexico are defined by watershed boundaries developed by the New Mexico Water Quality Control Commission. Although the airsheds lie within multiple counties, the Project Area is located within San Miguel County.

The Clean Air Act Amendment of 1977 established National Ambient Air Quality Standards (NAAQS) for airsheds throughout the United States. These standards set limits to provide a level of protection for public health, animal, vegetation, crops, buildings, and decreased visibility. The Pecos River Airshed has a NAAQS classification of Class II. The remaining three airsheds are associated with the Pecos Wilderness and have both Class I and II designations, depending upon location. Within Class I areas, the ambient air quality must essentially remain unchanged. Class II areas are allowed to experience increases in air pollution above baseline levels. However, no baseline levels have been established for this area (Barkmann 2001).

The Project Area has excellent air quality and meets the Clean Air Act attainment standards. The community of Pecos lies to the southeast of the Project Area. There are numerous dirt roads in the

Project Area. Occasional degradation may occur from wood burning stoves, smokestack emissions, industrial development, motor vehicle emissions, and dust resulting from dirt roads. Generally these types of emissions are transitory in nature.

4.2 BIOLOGICAL RESOURCES

4.2.1 Fisheries and Aquatic Resources

4.2.1.1 Fish and Aquatic Species

Fish Assemblages

The primary fish species in the Project Area are the native Rio Grande cutthroat trout (*Oncorhynchus clarki virginalis*), introduced brown trout (*Salmo trutta*), rainbow trout (*O. mykiss*), and brook trout (*Salvelinus fontinalis*). The Rio Grande cutthroat is a listed sensitive species and is the only aquatic management indicator species (MIS) in the Santa Fe National Forest. Historically, Cow Creek was stocked with rainbow and brown trout. Bull Creek contains brown, brook, and rainbow trout. Elk Creek contained brown, brook, and rainbow trout prior to the fire. Post-fire surveys during July 2000 indicated that few fish survived. The fish populations in Cow, Sheep, Elk, Osha, and Soldier Creeks were nearly eliminated as a direct result of the Viveash Fire. This was likely due to the large amount of ash and debris that entered these systems during the summer rains. Surveys conducted in summer 2001 discovered a surviving population of non-native eastern brook trout. This population will be removed by the New Mexico Department of Game and Fish as part of the effort to reintroduce the native Rio Grande cutthroat trout.

Aquatic species were affected by the fire because of increasing upslope and channel-area runoff and sediment production. Initial post-fire field observations included many live fish populations. Some dead fish were reported in Cow Creek following a rainstorm event that resulted in an ash-sediment plume in the stream channel. There could be impacts to aquatic species for a number of years as increased sediment continues to be delivered to the streams. Sediment can fill in gravel substrates that provide trout spawning gravel and macroinvertebrate habitat. These impacts are expected to continue until upland areas stabilize and sediment delivery to streams is reduced.

Increases in sedimentation, turbidity, and mass movement are generally regarded as the most serious threat to water quality and fish following wildfire. Loss of protective streambank vegetation cover can adversely affect both channel erosion and stream temperature, which poses a threat to fish. Evaluation criteria for water quality that relate to fish habitat have been identified from the state of New Mexico's Standards for Interstate and Intrastate Surface Waters Antidegradation Policy and Implementation Plan (New Mexico Water Quality Control Commission 2000). These standards identify general parameters for water quality, such as bottom deposits, temperature, and turbidity for the state of New Mexico (Table 3-7). These general standards apply to all perennial streams in the Viveash Project Area.

Bull Creek was not as severely affected by the fire and still has stocked populations of non-native brown, brook, and rainbow trout, which have a competitive relationship with Rio Grande cutthroat trout. Therefore, Rio Grande cutthroat trout introduction will not take place in Bull Creek. The catastrophic fire heavily impacted Sheep Creek and there are no fish present in this stream. Rito Manzanares has limited historical fisheries information, but is unlikely to have fish. Rito de al Osha may be fish bearing, but it is currently believed to not contain fish.

In a survey conducted directly after the Viveash Fire, benthic invertebrates were absent from Lower Cow Creek. However, they are expected to recolonize the area within a year (McWilliams 2001).

Table 3-7. General Water Quality Standards for the State of New Mexico

Parameter	Criteria
Bottom Deposits	Surface waters shall be free of water contaminants that occur from anything other than natural causes. These contaminants should not settle and damage or impair the normal growth, function, or reproduction of aquatic life or significantly alter the physical or chemical properties of the bottom.
Temperature	The introduction of heat by other than natural causes shall not increase the temperature, as measured from above the point of introduction, by more than 2.7°C (5°F) in a stream or more than 1.7°C (3°F) in a lake or reservoir. In no case will the introduction of heat be permitted when the maximum temperature specified for the reach (generally 20°C [68°F] for cold water fisheries and 32.2°C [90°F] for warm water fisheries) would be exceeded. These temperature standards shall not apply to impoundments constructed offstream for the purpose of heat disposal. High water temperatures caused by unusually high ambient air temperatures are not violations of these standards.
Turbidity	Turbidity attributable to other than natural causes shall not reduce light transmission to the point that the normal growth, function, or reproduction of aquatic life is impaired or that will cause substantial visible contrast with the natural appearance of the water.

°C = degrees Celsius
°F = degrees Fahrenheit

Selected Emphasis Species

Rio Grande cutthroat trout (*Oncorhynchus clarki virginalis*), a USFS MIS, is the only aquatic MIS species within the Project Area. Rio Grande cutthroat trout is the southernmost subspecies of cutthroat trout, so called because of the reddish-orange slashes in folds on either side of the jaw, and is the official state fish of New Mexico. This cutthroat trout has a yellowish-green to gray-brown body, peppered with black spots, including the fins. It is more densely spotted toward the tail. Its abdomen is creamy white and, during breeding season, the underside of the male turns a flaming reddish-orange (NMDGF 2001b).

At one time, the Rio Grande cutthroat was the only trout in northern New Mexico waters. However, over-harvesting led to the stocking of non-native and aggressive rainbow, brook, and brown trout during the 1890s. Due to competition for food and habitat, predation, and hybridization, the original population of Rio Grande cutthroat became decimated. The remaining populations are found further upstream in high-mountain headwaters where stocking of non-native fish has not taken place. This fragmented the Rio Grande cutthroat's range and separated their gene pool into tiny pockets—a potentially detrimental situation for the future of a species. In the Carson and Santa Fe National Forests in New Mexico today, Rio Grande cutthroat occupy only about 5 to 7 percent of stream miles available.

An additional concern for Rio Grande cutthroat trout is hybridization with the non-native rainbow trout. Where the two species occupy the same habitats, the potential for hybridization is high as both species spawn in the spring. Continued interbreeding results in a loss of the cutthroat traits. Rio Grande cutthroat spawn in well-oxygenated gravel between March and July and females lay between 200 and 4,500 eggs.

Cutthroats are opportunistic feeders and prey mostly on aquatic and terrestrial insect larvae and adults. They will also feed on zooplankton and crustaceans that are found predominantly in pool areas.

Small remnants of native Rio Grande cutthroat trout populations still live in isolated headwaters of four major drainages. Of these, the Rio Grande drainage has the highest populations: 23 in the Sangre de Cristo Range, 13 in the Jemez Range, 4 in the San Juan Mountains, and 1 in the Black Range.

Following the fire, a small population of Rio Grande cutthroat trout was found in the headwaters of Cow Creek. On June 22, 2000, 94 trout were removed from Elk and Cow Creek and transferred to the Mora National Fish Hatchery. These trout were removed from the creek before summer monsoon rains could wash ash and debris into the stream, which would result in fish kill. Genetic tests are being performed to determine the purity of these species. The trout were found above a 15-ft waterfall/natural barrier (Brown 2000). Hatchery personnel took tissue samples from the trout that are being processed to confirm species identification (Britton 2001). Cow, Elk, and Bull creeks have potential habitat for Rio Grande cutthroat trout. Elk Creek contained brown, brook, and rainbow trout prior to the fire. Considerable effort on the part of the Pecos/Las Vegas Ranger District has been expended to conserve existing habitat, improve potential habitat, and enhance the existing populations of this species. Extensive stream habitat monitoring will be conducted through 2002. Areas with the potential for habitat restoration or enhancement to benefit the species will be identified and prioritized. The Ranger District will work jointly with the New Mexico Department of Game and Fish to begin a re-population effort in areas with a suitable habitat.

4.2.1.2 Aquatic and Riparian Habitats

The Cow Creek Watershed is 31,284 acres in size and generally flows in a southerly direction. About 26,000 acres of the watershed were burned in the Viveash Fire. The elevation of the watershed ranges from 7,717 to 11,661 ft. Vegetation consists of Ponderosa pine in the lower elevations and mixed conifer and spruce-fir in the higher elevations. Riparian vegetation, including willow, alder, and sedges, exists along the stream banks in some areas of the watershed. Changes in riparian vegetation can affect water quality parameters that are mandated by the state of New Mexico's water quality standards (Table 3-7).

Local geology controls two distinct drainage density patterns in the watershed. In the upper portion of Cow Creek and all of Willow Creek watersheds, low drainage density is caused by the metamorphic bedrock that is more resistant to erosion (see Figure 3-2). The lower portion of the Cow Creek Watershed has a higher drainage density because the granitic bedrock is less resistant to erosion. Generally, the watershed is geologically stable. Evidence of mass failures exists, but events are infrequent and appear to have occurred long ago in geologic time.

High percentages of severely burned areas in a watershed can significantly increase the potential for decreases in water quality that may result in fish mortality and impacts to fish habitat. Increases in flow levels from runoff on hydrophobic soils in severely burned areas contributed to large inflows of debris and ash through the system. With 90 percent of the subwatershed severely burned, Sheep Creek (a tributary to Elk Creek) was found devoid of fish following large flows of ash and debris.

Soldier Creek experienced a 26 percent burn area, and substantial headcutting and erosion are evident, as are debris and ash flows. Major flooding of Soldier Creek has also occurred.

Areas with willow, aspen, and sedges in the riparian corridor remained unburned in areas along Elk and Cow creeks, and burned areas with these species have experienced significant regrowth since the catastrophic wildfire. This mix of vegetation withstood a number of the high-flow events that have occurred since the fire (at least 14); however, in many areas where intact riparian corridors exist, the contribution of sediment has had an impact. The upper slopes and many riparian areas dominated by conifers burned very hot and may not regenerate trees naturally for 20 to 40 years. Several intermittent streams with intensely burned riparian corridors are contributing significant sediment to downstream areas.

Ninety percent of the Elk Creek Watershed, including most of the riparian vegetation, burned at high severity. Elk Creek has a steep gradient with a minimal floodplain and conifer trees dominating the stream banks. Soldier Creek, in which 26 percent of the area was severely burned, is in low-elevation terrain and willow, alder, and sedge species dominated this low-gradient stream with a sizable riparian area. Osha Creek is a high-gradient stream at mid-elevation and is dominated by coniferous riparian vegetation. Rito Manzanares is also at mid-elevation, but has a lower gradient and is dominated by alder, willow, and sedge. Bull Creek is a low-gradient stream with willow, alder, and sedge communities in the riparian area.

Many burned areas with riparian vegetation are already showing regrowth of herbaceous species. Many of the riparian woody species were not totally consumed and portions of them are green and growing. Fire stimulates willow and alder to resprout. Most impacts of the catastrophic wildfire on the stream systems were from the deposition of soil that has eroded from uplands. Some riparian areas experienced severe erosion or sediment deposition following intense rainstorm events that occurred after the fire. The most severe impacts occurred in areas where the vegetation completely burned or in areas adjacent to severely burned uplands, such as Middle Cow and Elk creeks. Downstream effects were cumulative as downstream reaches received input from all upstream events. High runoff to these streams caused flooding, bank destabilization, stream downcutting, and loss of riparian vegetation. These changes to the stream habitat translated into negative impacts to fish habitat.

4.2.2 Forest Vegetation

Terrestrial ecosystems involve interaction between climate, soils, and vegetation. Section 3.1.1.2 describes the climate in the Project Area and Section 3.1.2 describes its soils. Based on descriptions of the Ecoregions of the United States, the Project Area is located in the Southern Rocky Mountain Steppe-Open Woodland-Coniferous Forest-Alpine Meadow Province of the Temperate Steppe Division (USDA Forest Service 1995a). Predominant coniferous forest types include ponderosa pine, Douglas-fir, aspen, Engelmann spruce, and corkbark fir.

The Rocky Mountain Resource Information System (RMRIS) for the Santa Fe National Forest was used for forest stand-related database queries. Approximately 13,900 acres, or 48 percent, of the Viveash Fire area had Stage II stand exams before the fire. These data provide a general overview of the forest conditions in the Project Area before the wildfire.

4.2.2.1 Vegetation Composition

Forest types across the Project Area are dominated by spruce-fir at higher elevations, mixed-conifer type in the mid-slope positions, and ponderosa pine at lower elevations.

Spruce-fir (or *sub-alpine conifer*) forest generally occurs from about 8,000 ft to 12,000 ft or higher in elevation. In the spruce-fir forest, Engelmann spruce (*Picea engelmanni*) is the predominant species, corkbark fir (*Abies lasiocarpa var. arizonica*) is a co-dominant species, and aspen (*Populus tremuloides*) and white fir (*Abies concolor*) are typical tree associates.

Mixed-conifer forest dominated by Douglas-fir (*Pseudotsuga menziesii*) and white fir generally occurs from 8,000 ft to 9,500 ft in elevation. Ponderosa pine (*Pinus ponderosa*), limber pine (*Pinus flexilis*), and aspen are also common tree species in the mixed-conifer forest.

Ponderosa pine forest is generally found from 6,500 ft to 8,000 ft in elevation. Gambel oak (*Quercus gambelii*) is a common tree associate with ponderosa pine at lower elevations. At higher elevations, the ponderosa pine forest transitions into the mixed-conifer zone.

Vegetation cover types present within the Project Area include ponderosa pine, Douglas-fir, white fir, aspen, Engelmann spruce, oak woodland, bristlecone pine (*Pinus aristata*), and grassland (including Therber's and Arizona fescue, timber oatgrass, and other species) (Table 3-8). Engelmann spruce, Douglas-fir, and Ponderosa pine are the dominant vegetation types with less representation by the other cover types in the Project Area. Other cover types not described here are hardwood (e.g., mountain mahogany) and riparian vegetation.

Table 3-8. Vegetation Cover Types within the Viveash Fire Perimeter and inside the Project Area

Vegetation Cover Type	Total Acres	Percent of Total Area
Engelmann spruce	12,101	41.7
Douglas-fir	7,884	27.2
Ponderosa pine	4,748	16.4
Aspen	2,167	7.5
White fir	858	3.0
Grassland	824	2.8
Oak woodland	315	1.1
Bristlecone pine and alpine	120	<1.0

Source: RMRIS Forest Stand Database, USDA Forest Service 2000a.
< = less than

Engelmann spruce is dominant in the spruce-fir forest type and occurs in deep canyons and north-facing slopes at higher elevations of the Project Area. In Douglas-fir or white fir dominant mixed-conifer forests, ponderosa pine exists as scattered remnants in the overstory, and common understory include white fir, aspen, gambel oak, grasses, and shrubs. The understory vegetation for ponderosa pine type includes native grasses, forbs and shrubs, gambel oak, and mountain mahogany. Quaking aspen exists in association with white fir and Engelmann spruce, usually on steeper north- or east-facing slopes in draws. The broad-leaf component (e.g., aspen) of mixed-conifer forests is

important to many terrestrial wildlife species. Hardwood areas in the Project Area are dominated by gambel oak and mountain mahogany and generally occur on exposed ridges and south- and west-facing slopes. Overall, for New Mexico forests, there has been an increase in the extent of mixed-conifer forests and a decline of aspen stands when compared to historic forest species composition (Dahms and Geils 1997).

4.2.2.2 Stand Structure

Stand density is a quantitative measure describing the degree of tree crowding within an area. The number of trees and basal area per unit (either per acre or hectare) are absolute measures of stand density. Stand-density index (SDI) is a relative measure of stand density in even- and uneven-aged stands. It is based on the number of trees per unit area and the diameter of the tree of average basal area. The SDI can be used to evaluate forest vegetation and wildlife habitat objectives.

Table 3-9 illustrates the mean quadratic stand diameter, and absolute and relative stand density by forest cover types in the Project Area prior to the Viveash Fire. The averages for mean quadratic diameter, stand density, and SDI range from 9.2 to 11.0 inches diameter at breast height (dbh), 204 to 370 trees per acre, and 231 to 352, respectively, depending on forest cover type. Table 3-10 shows the snag component in various forest types. Snags and downed logs are components of decadence and are diversity requirements for many terrestrial wildlife assemblages. In the Project Area, spruce-fir and Engelmann spruce had higher levels of hard and soft snags prior to the Viveash Fire.

Table 3-9. Average Pre-fire Mean Quadratic Stand Diameter, Absolute and Relative Stand Densities by Forest Cover Type

Forest Cover Type	Mean Quadratic Diameter (Trees ≥ 5-inch) (inches)	Stand Density (Trees per acre ≥ 5-inch) dbh	Stand-Density Index
Ponderosa pine	10.1	204	231
Douglas-fir	10.5	301	352
White fir	9.9	262	270
Engelmann spruce	10.0	314	330
Spruce-fir	11.0	279	334
Aspen	9.2	370	339

Source: RMRIS Forest Stand Database, USDA Forest Service 2000a.
dbh = diameter at breast height

Table 3-10. Pre-Fire Standing Dead Trees Snags by Forest Cover Type

Forest Cover Type	Hard Snags per acre (≥ 5-inch) dbh	Soft Snags per acre (≥ 5-inch) dbh
Ponderosa pine	—	3.4
Douglas-fir	2.2	10.8
White fir	2.4	12.4
Engelmann spruce	4.8	27.1
Spruce-fir	5.4	25.7
Aspen	0.3	11.9

Source: RMRIS Forest Stand Database, USDA Forest Service 2000a.
dbh = diameter at breast height

4.2.2.3 Site Productivity

The stand basal area, which is the cross-sectional area in square ft at dbh of all stems expressed on a per-acre basis, is highly correlated with the volume and growth of forest stands. The pre-burn stand basal area per acre averages within the Viveash Fire perimeter range from 110 to 175 square ft per acre depending on forest cover type (Table 3-11). Gross standing volume (in board ft or cubic ft) is the volume per acre of growing stock trees larger than merchantable diameter. The pre-fire gross standing volume averages varied by forest cover type from 1,897 to 3,708 cubic ft per acre and 4,029 to 13,420 board ft per acre (Table 3-11). Overall, the stocking levels and standing volume varied in relation to forest cover type, past timber harvest and stand-density management, and fire history. Current stocking levels in ponderosa pine and mixed-conifer types are relatively higher than historical conditions, with a significant increase in the number of smaller-diameter-class conifer trees (USDA Forest Service 2001b).

Table 3-11. Pre-Fire Average Stand Density and Timber Productivity by Forest Cover Type

Forest Cover Type	Basal area per acre (≥ 5-inch) (sq ft/ac)	Volume Per acre (Cubic ft)	Volume per acre (Board ft)	Site Index	Site Productivity (cu ft/ac/yr)
Ponderosa pine	110	1,897	6,987	64	38
Douglas-fir	175	3,280	11,445	61	46
White fir	139	2,387	8,018	61	36
Engelmann spruce	163	3,292	10,686	73	58
Spruce-fir	171	3,708	13,420	72	55
Aspen	158	2,762	4,029	70	40

Source: RMRIS Forest Stand Database, USDA Forest Service 2000a.
sq ft/ac= square feet per acre
cu ft/ac/yr = cubic feet per acre per year

The site index is a measure of site quality that is based entirely on tree height at some index age (in this case, 100 years). The averages for site index in the burned area range from 61 to 73 (61 to 73 ft at 100 years of age), depending on forest cover type (Table 3-11). Site index and dominant height-growth curves are used to identify potential height-growth patterns in an area. Site index varies in relation to forest type, soil type and depth, and elevation. Productivity, an inherent characteristic of a site, is an expression of the gross productivity of a site expressed as cubic ft per acre per year (cu ft/ac/yr). The pre-fire site productivity varied by forest cover type from 36 to 58 cu ft/ac/yr (Table 3-11).

4.2.2.4 Forest Conditions and Fire Disturbance

The forest conditions described above represent the landscape setting for the Project Area that is within the Viveash Fire perimeter. Initial field reconnaissance of the burned area identified three levels of burn severity. These three levels were described as high-, moderate-, and low-burn severity or unburned. Forest vegetation burned at high- and moderate-burn severities was generally severely damaged—entire forest stands of trees were killed directly as a result of fire-related injuries. The low-burn severity was characterized by a mosaic burn pattern with spot mortality where clumps of trees were killed as a direct result of fire-related injuries.

Table 3-12 displays the extent of the burn severity in various vegetation cover types within the Viveash Fire perimeter in the Project Area. Overall, the spruce-fir and mixed-conifer forest types have a larger area classified as high- and moderate-burn severity within the Viveash Fire perimeter. Existing riparian areas and grassland meadows in the Project Area were less damaged by the catastrophic wildfire. Burned riparian areas with willow and alder tree species and burned upslope areas with aspen showed rapid vegetation regrowth after the fire.

Table 3-12. Viveash Fire Area Burn Severities by Vegetation Cover Types

Forest Vegetation Type	High-Burn Severity (in acres)	Moderate-Burn Severity (in acres)	Low-Burn Severity and Unburned (in acres)
Spruce-fir	6,775	120	6,848
Mixed conifer	6,584	2,375	2,042
Ponderosa pine	387	697	445
Grassland	133	5	961
Bristlecone pine	75	—	631
Oak woodland	73	—	175
Riparian	14	3	185
Others	1	7	482
Total Area	**14,042**	**3,207**	**11,769**

Source: Viveash Fire BAER report, USDA Forest Service 2000a.

Prior to European settlement, the higher elevation forest types in the southwestern United States, such as spruce-fir, had area-wide fire frequencies of more than 150 years. Mid-slope forest types, such as mixed-conifer, had fire frequencies of 5 to 25 years. Lower elevation forest types, such as ponderosa pine, had fire frequencies of 2 to 10 years (Dahms and Geils 1997). Fire suppression and land-use management practices have altered the historical fire regimes of high-frequency and low-burn severity fires, especially in the lower elevation forest communities, to favor less frequent and high-burn severity stand-replacement fires. The low-burn severity fire regimes that are essential for reduction of fuel accumulations have experienced significant changes with fire exclusion practices.

Post-fire tree mortality is influenced by factors such as the season the fire occurred, pre-fire tree vigor, site quality, extent of crown and cambium damage, post-fire stand density and competition, post-fire climatic conditions, and insect/disease damage (Wagner 1961 in USDA Forest Service 2000a). Conifers are most susceptible to fire damage early in the growing season. Fires that occur after bud set have much less impact on tree survival (Wagner 1961 in USDA Forest Service 2000a). The Viveash Fire occurred just as buds were beginning to elongate. Thus, moderate levels of crown scorch can be expected to have serious effects on tree vigor and mortality. Additional tree mortality is expected in the low-burn severity and unburned areas because of the stress resulting from the catastrophic wildfire.

Fire-injured standing trees within the Viveash Fire perimeter are vulnerable to forest insects and pathogens. Fire-damaged trees may encounter deterioration of sapwood and heartwood from insects (e.g., bark beetle, woodborers, and ambrosia beetles), along with fungal deterioration.

4.2.3 Terrestrial Wildlife

This section provides an overview of species that may occur in the Project Area based on species/habitat associations and available suitable habitats. Selected emphasis is on federal proposed, threatened, or endangered species; USFS sensitive species; state threatened and endangered species; and USFS management indicator species (MIS).

Wildland fire in terrestrial ecosystems has varying effects on animal populations and communities, wildlife foods, and fauna/landscape interactions (USDA Forest Service 2000a). Direct effects of fire on animals include injury, mortality, emigration, and immigration. Stand-replacement fire reduces habitat quality for wildlife species that require dense cover, but improves it for species that prefer open areas. Fires often cause a short-term increase in productivity, availability, or nutrient content of forage and browse (USDA Forest Service 2000b). Wildlife assemblages associated with snags or downed wood generally increase after mixed-severity and stand-replacement fires.

Pre-fire vegetation composition and structure are described in Section 3.2.2. The catastrophic wildfire has altered the forest conditions (especially vegetation composition and structure), potentially affecting fauna/habitat relationships. This stand-replacement fire created a substantial amount of fire-killed snags and dead wood on the forested landscape in the Project Area. The Viveash Fire has changed species/habitat composition in the Project Area from a closed-canopy forest to an open grassland/open-canopy forest with a corresponding change in vegetation types to early successional species.

4.2.3.1 Wildlife Species

Table 3-13 displays the wildlife species listed as federally proposed, threatened, or endangered that may occur in the Santa Fe National Forest and potentially occur in the Project Area. These species are protected pursuant to the Endangered Species Act (ESA) of 1973 as amended. Table 3-14 lists migratory birds identified by New Mexico Partners in Flight as Highest Priority Species of Concern that are protected under the Migratory Bird Treaty Act, as amended [16 United States Code (USC) §703-713] and Executive Order 13186, that may occur in the Project Area.

Table 3-13. Federally Proposed, Threatened, or Endangered Wildlife Species Potentially Occurring in San Miguel County, New Mexico

Common Name ***(Scientific Name)***	**Potential for Occurrence in Project Area**
Bald eagle *(Haliaeetus leucocephalus)*	Unlikely
Mexican spotted owl *(Strix occidentalis lucida)*	Known to Occur
Mountain plover *(Charadrius montanus)*	Unlikely
Southwestern willow flycatcher *(Empidonax traillii extimus)*	Unlikely
Whooping crane *(Grus americana)*	Unlikely
Black-footed ferret *(Mustela nigripes)*	Unlikely (close association to prairie dogs)

Source: SW Region USFS Sensitive Species List, 21 July 1999, as corrected 23 February 2000.

Table 3-14. Migratory Birds Identified by New Mexico Partners In Flight as Highest Priority Species of Concern Potentially Occurring in the Viveash Project Area

Common Name ***(Scientific Name)***	**Species-Habitat Associations**
Northern Goshawk *(Accitper gentilis)*	See Biological Evaluation.
Mexican spotted owl *(Strix occidentalis lucida)*	See Biological Assessment.
Boreal Owl *(Aegolius funereus)*	Sub-alpine forests with spruce-fir; most nesting at > 10,000 ft in elevation; obligate cavity nester in dense canopy cover forests at high elevations.
Flammulated Owl *(Otus flammeolus)*	Open-canopy Ponderosa pine and oak forests; secondary cavity nester; highly insectivorous and highly migratory in United States.
Olive-sided Flycatcher *(Contopus borealis)*	Summer migrant; riparian areas, spruce-fir, ponderosa pine, aspen; uses forest openings and edges. Known to use recently burned forests.
Dusky Flycatcher *(Empidonax oberholseri)*	Summer migrant; uses low to medium density forests with shrubby understory; shrubs critical habitat component; uses early successional habitat following disturbance.
Hammond's Flycatcher *(Empidonax hammondii)*	Wet mountain forests, riparian woodlands, douglas-fir, ponderosa pine, aspen; aerial forager stays in middle canopy and nests in large conifers from 12–50 ft.
Williamson's Sapsucker *(Sphyrapicus thyroideus)*	Coniferous forests, especially ponderosa pine; aspen is important nesting substrate; live conifers preferred over snags.
Red-naped Sapsucker *(Sphyrapicus nuchalis)*	Prefers mature deciduous forests, especially aspen; prefers old stands with openings; if snags and hardwoods maintained, may use logged areas.
Blue Grouse *(Dendragapus obscurus)*	Open woodlands, mountain slopes, bushy lowlands; prefers forest with ponderosa pine and Douglas fir; nests on ground.
Virginia's Warbler *(Vermivora virginiae)*	Summer migrant; riparian woodlands, ponderosa pine, oak, pinyon-juniper; dense understory is critical habitat component; scrubby hillsides a special requirement; nests in understory species, especially gambel oak. Dry woodlands, chaparral, scrub oak brushlands, canyons and ravines; dense understory is critical habitat component.
Grace's Warbler *(Dendroica graciae)*	Summer migrant; mature ponderosa pine obligate in New Mexico; montane pine-oak forests above 6,000 ft; feeds in upper portions of robust pines; nests 20–60ft above ground; removal of trees 40–70 ft detrimental.
MacGillivray's Warbler *(Oporornis tolmiei)*	Riparian habitat wet thicket with dense undergrowth and moderate cover, and dense understory of mountain forests; may nest in deciduous or coniferous forests with 60-75% total cover. Associated with logged areas.
Black swift *(Cypseloides niger)*	Riparian woodlands, Douglas fir and aspen; near cliffs in mountainous regions; uses high walls underneath or near waterfalls for nest sites; high aerial forager.
Lewis' Woodpecker *(Melanerpes lewis)*	Large, open-canopy cottonwood riparian or ponderosa pine; nests in large, dead, or decaying trees. Associated with water as it supports vegetation for foraging; feeds on insects.
Red-headed Woodpecker *(Melanerpes erythrocephalus)*	Riparian forests and agricultural areas; nest sites surrounded by open areas that contain dead or live trees; prefers limbs without bark for nests; may be out-competed by Lewis' woodpecker and European starlings.
American Dipper *(Cinclus mexicanus)*	Fast-moving, clear, unpolluted, rocky mountain streams with numerous small rapids, riffles and waterfalls, high elevation lakes; nests near fast or deep water, requires terrestrial structure for nest concealment; feeds on aquatic invertebrates; found in coniferous forests, elevation constraints—5000 ft to timberline.
Yellow-billed Cuckoo *(Coccyzus americanus)*	Riparian obligate; prefers late successional cottonwood/willow. Found in woodlands and riparian areas, sensitive to disturbance of these areas.
Summer Tanager *(Piranga rubra)*	Wooded lowland areas, riparian woodlands dominated by cottonwood/willow and sycamore; will use pine-oak woods.
Painted Bunting *(Passerina ciris)*	Open areas with large trees or shrubs, sometimes near water, especially streamside; brush, thickets, rangeland. Susceptible to cowbird parasitisim.

Source: New Mexico Partners in Flight 2000.

Threatened and Endangered Species

Considering the existing post-fire habitat conditions, potentially suitable habitat in the Project Area, and consultation with the Pecos/Las Vegas District biologist, the Mexican spotted owl is the only federally listed species that may occur in the Project Area (Lujan 2001). Prior to the Viveash Fire, there were four delineated spotted owl PACs within the Project Area (Figure 3-5). Criteria for spotted owl PAC delineation include nesting sites, foraging areas, and roosting sites in mixed-conifer habitat with slopes of at least 40 percent (Federal Register 1993).

Three of the spotted owl PACs located in the Lower Cow, Upper Cow, and Elk subwatersheds were severely damaged by the catastrophic wildfire, while the PAC located in Upper Bull subwatershed was only partially damaged in the fire. In addition, there is severe loss of suitable habitat caused by the wildland fire in the Project Area. A focused field survey during the breeding season of 2001 identified the presence of a pair of Mexican spotted owls in the Cow Creek/Lower Cow PAC (the results of the 2001 field survey for the Mexican spotted owl are found in the Project Record). Additionally, a USFS survey documented a call response in the Creek/Upper Cow PAC (Napp 2002). However, no roost sites or nests were located. No other individuals of this species were observed in the Project Area during these surveys. Habitat characteristics desired by Mexican spotted owls include high-canopy closure, high-stand density, a multi-layered canopy, uneven-aged stands, numerous snags, and downed woody matter. These habitat characteristics are found in old-growth, mixed-conifer forests, and in younger forest stands that are unmanaged or minimally managed and contain large remnant hold-over trees (Federal Register 1993).

Region 3 Sensitive Species

The USFS Southwestern Region identifies and lists certain species as sensitive species for management purposes and legal requirements associated with them. The sensitive species list may include species that require special management considerations because of low or unknown population levels and/or the potential for their suitable habitat to be degraded. Table 3-15 lists sensitive species that are known to occur in the Santa Fe National Forest. Nine sensitive species with potential occurrence in the Project Area were initially considered. Post-fire forest conditions and wildlife species distribution preclude the potential occurrence of most of these sensitive species in the Project Area. The American peregrine falcon and New Mexican meadow jumping mouse have low probability of occurrence in the Project Area (Lujan 2001). Despite the occurrence of northern goshawk PFAs in the Project Area, the probability of occurrence in the Project Area is low to moderate due to the burned habitat.

Potential suitable habitat for American peregrine falcons, such as vertical cliffs or rocks with holes or ledges, exists in the Project Area. However, there are no known active nesting sites or observations of peregrine falcons in the Project Area. Prior to the Viveash Fire, there were four delineated northern goshawk PFAs located within the Project Area boundary (Figure 3-5) (Lujan 2001).

Two of the northern goshawk PFAs located in Tijeras and Manzanares subwatersheds suffered severe fire-related damage, while the two northern goshawk PFAs in Upper Bull subwatershed were only partially damaged by the fire. A focused field survey during the breeding season of 2001 (complete results are in the Project Record) resulted in an unconfirmed detection of northern

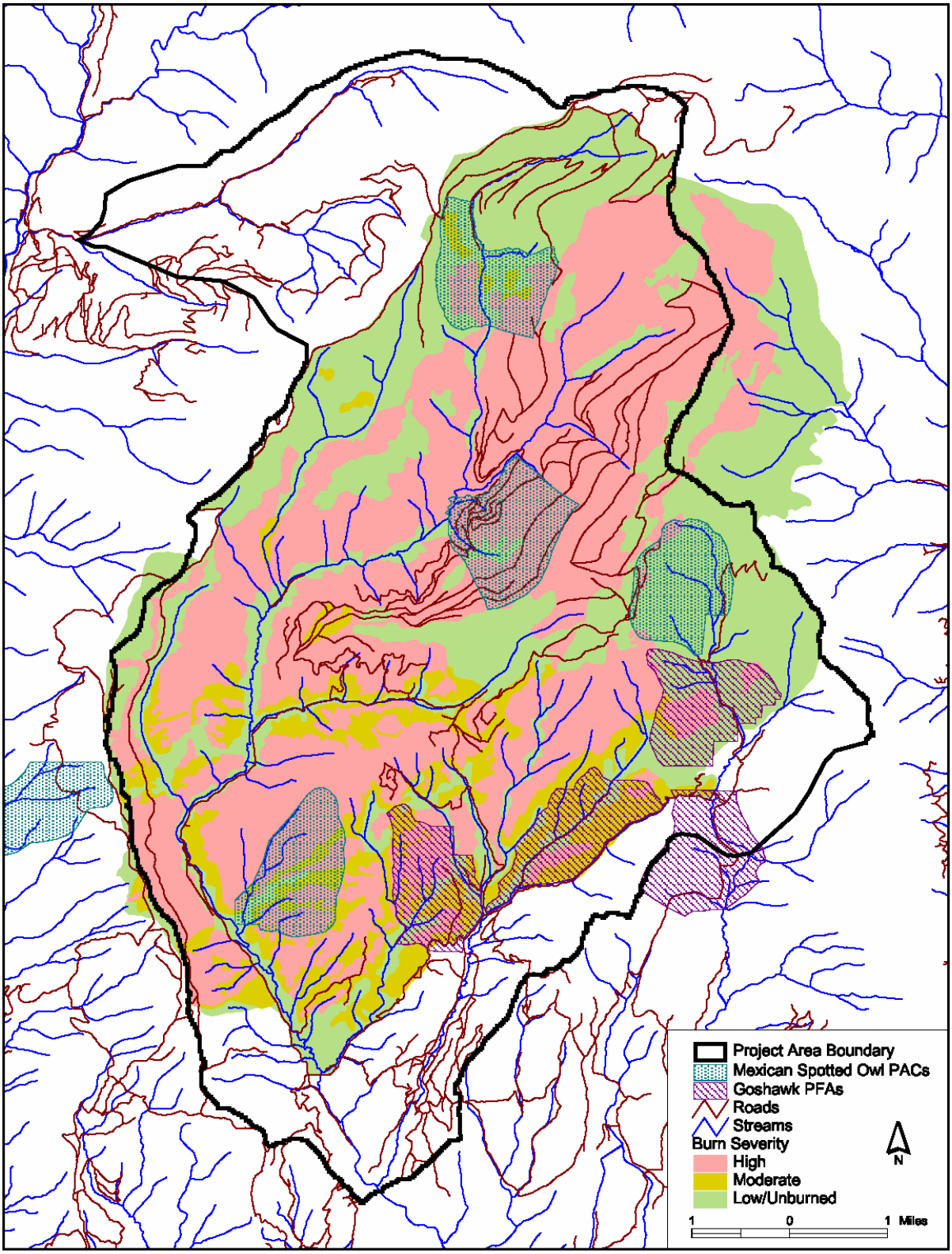


Figure 3-5. Mexican Spotted Owl PACs and Northern Goshawk PFAs in the Project Area

Table 3-15. USFS (Southwestern Region) Sensitive Wildlife Species Potentially Occurring in Santa Fe National Forest

Common Name (*Scientific Name*)	Potential for Occurrence in Project Area
American peregrine falcon (*Falco peregrinus anatum*)	Potential (low probability)
Northern goshawk (*Accipter gentilis*)	Potential (low to moderate probability)
Black-tailed prairie dog (*Cynomys ludovicianus*)	Unlikely
Swift fox (*Vulpes velox*)	Unlikely
Goat peak pika (*Ochotona princeps nigrescens*)	Unlikely (endemic to Jemez Mountains)
New Mexican (meadow) jumping mouse (*Zapus hudsonicus luteus*)	Potential (low probability)
Jemez Mountains salamander (*Plethedon neomexicanus*)	Unlikely (endemic to Jemez Mountains)
Rio Grande cutthroat trout (*Oncorhynchus clarki virginalis*)	See Section 3.2.1.1
Nokomis fritillary (Blue-black silverspot butterfly) (*Speyeria nokomis nokomis*)	Unlikely (No documented occurrences in Project Area)

Source: Southwestern Region USFS Sensitive Species List, 21 July 1999, as corrected 23 February 2000.

goshawks in the Manzanares PFA in the Upper Bull subwatershed. None of the PFAs in the Upper Bull subwatershed were severely damaged by the fire and one of these PFAs only partially overlaps the Project Area boundary. The principal forest types occupied by the northern goshawk in the USFS Southwestern Region are ponderosa pine, mixed-species, and spruce-fir (Reynolds et al. 1992). The breeding habitat includes pine-oak woodlands (Hubbard 1992).

The New Mexican (meadow) jumping mouse, which is associated with grasslands near permanent water, has a low probability of occurrence in the Project Area. There are no historical or recently known occurrences of the jumping mouse in the Project Area. The New Mexican meadow jumping mouse is generally found from 4,000 to 10,000 ft in elevation, and characteristically occurs in mesic habitats dominated by herbaceous vegetation (NMDGF 2001a).

Detailed descriptions of species' distribution, habitat associations, discussions on species considered, and potential impacts of the project-related actions can be found in the Biological Assessment (BA) and the Biological Evaluation (BE) located in the Project Record.

State Threatened and Endangered Species

Threatened and endangered species that potentially occur in the Project Area are identified as either federally listed threatened and endangered species or USFS Region 3 sensitive species lists. Therefore, they have been discussed above. Detailed information on each species can be found in the BA and the BE.

Management Indicator Species

In the USFS-based MIS approach, certain assemblages of wildlife have been identified and selected as management indicators. These wildlife assemblages were chosen primarily because they represent the vegetation types, seral stages, and special habitat elements necessary to provide for all forest wildlife species in the national forests, and the projected changes to habitat and thus populations is believed to indicate or represent the effects of management activities on other wildlife populations.

Table 3-16 lists the USFS MIS for the Santa Fe National Forest. It also lists the species-habitat relationships and whether or not the species or habitat is present within the Project Area. The Mexican spotted owl (federally listed threatened species) and Rio Grande cutthroat trout (USFS sensitive species) are discussed in the Threatened and Endangered Species section and the Fish and Aquatic Species section, respectively. Of the remaining MIS, Merriam's turkey, hairy woodpecker, mourning dove, and elk may occur or have potentially suitable habitat in the Project Area.

Table 3-16. Santa Fe National Forest Management Indicator Species Occurring in the Project Area

Common Name (*Scientific Name*)	**Species-Habitat Associations**	**Occurrence in Project Area**
Merriam's turkey (*Meleagris gallopavo merriami*)	Ponderosa pine, mixed-conifer, aspen, pinon, and riparian areas in mountainous habitats	Habitat and species present (high probability)
Mourning dove (*Zenaida macroura*)	Open forest habitats and edges, and avoids dense forests	Habitat and species present (high probability in low elevations)
Mexican spotted owl (*Strix occidentalis lucida*)	Mixed-conifer forest	See Threatened and Endangered Species, Section 3.2.3.1
Hairy woodpecker (*Picoides villosus*)	Low elevation riparian habitat in desert grasslands up into spruce-fir forest	Habitat and species present (High probability)
Pinyon jay (*Gymnorhinus cyanocephalus*)	Pinon-juniper, sagebrush, and low elevation Ponderosa pine forest	Unlikely (No pinyon-juniper habitat present in the Project Area
Rocky Mountain bighorn sheep (*Ovis canadensis canadensis*)	Rugged cliffs and crags, or rocky areas near grass and browse plant feeding sites	Unlikely Outside of established range
Rocky Mountain Elk (*Cervus elaphus nelsoni*)	Mountain meadow and coniferous forests	Habitat and species present (high probability)
Rio Grande cutthroat trout (*Oncorhynchus clarki virginalis*)	Clear, cold water streams and lakes	See Section 3.2.1.1

Source: Forest-wide MIS Assessment Report 2002.

Populations of MIS are estimated at the forest level based on the following ranking system. The ranking system is based on the predicted number of breeding pairs or adult females, depending on which is most appropriate for the species addressed.

The ranking system for the forest-wide evaluation is presented in Table 3-17:

Table 3-17. Ranking System for Forest-Wide Evaluation

Category	Breeding Pair/Adult Female
Not Present	0
Extremely Rare	1–10
Rare	10–100
Uncommon	100–1,000
Common	1,000–10,000
Abundant	10,000–100,000
Very Abundant	>100,000

Merriam's Turkey

The turkey population in the Santa Fe National Forest is ranked as common among breeding females. Wild turkeys are listed as secure, common, widespread, and abundant. Their populations are generally trending upward throughout the western United States. In the Santa Fe National Forest, the trend is rated as stable to upward. Prior to the Viveash Fire, turkeys had approximately 1,314,000 acres of suitable habitat in the forest. The Viveash Project Area contained approximately 25,268 of those acres. The fire created new turkey habitat by converting some of the vegetation types that are not a primary habitat type for turkeys into vegetation cover types that are preferred by turkeys. The Viveash Project Area now contains approximately 30,672 acres of turkey habitat. The Viveash Fire improved habitat for wild turkeys and the area should contribute positively to the turkey production in the forest.

Mourning Dove

Mourning dove nesting populations are stable or decreasing based on Breeding Bird Surveys in New Mexico. This species occupies New Mexico as a breeding resident and can be found year round in the southern counties. No threats to the mourning dove are known except for human encroachment or overhunting. The mourning dove population in the Santa Fe National Forest is ranked as common among breeding females. Across the Forest, there were approximately 989,993 acres of suitable Mourning dove habitat prior to the Viveash Fire. The Viveash Fire converted some forested habitat types to grassland types preferred by the mourning dove. While the Viveash Project Area provides suitable habitat for the mourning dove, most of this habitat is at a high elevation, which is not generally preferred by the mourning dove. The amount of mourning dove suitable habitat is estimated to be approximately 9,025 acres in the Viveash Project Area prior to the fire, and 11,234 acres following the fire. Post-fire mourning dove populations should remain stable or respond positively to the increased habitat created by the Viveash Fire.

Mexican Spotted Owl

Mexican spotted owls are ranked as rare in the Santa Fe National Forest. The trend for Mexican spotted owl populations is believed to be increasing in the Santa Fe National Forest. The

Threatened and Endangered Species analysis in Section 3.2.3.1 presents a detailed discussion of the Mexican spotted owl and its habitat.

Hairy Woodpecker

The hairy woodpecker population is ranked as abundant in the Santa Fe National Forest. The Santa Fe National Forest contains over 900,000 acres of hairy woodpecker habitat. The Viveash Project Area provides 34,328 acres of habitat for the hairy woodpecker. The recent fire dramatically changed the vegetation within the area. Much of the fire was a stand-replacement type fire where most of the existing mature forest vegetation was killed. Hairy woodpecker populations should respond positively to the increase in habitat that was created by the Viveash Fire.

Rocky Mountain Elk

Elk populations in the Santa Fe National Forest are stable to increasing. The elk population in the forest is ranked as common among breeding females. The elk population from the New Mexico Department of Game and Fish data for all of Hunt Units 44 and 45, which includes the Viveash Project Area, is estimated at about 1,200 animals. The entire Viveash Project Area provides habitat for elk. The Viveash Fire improved habitat for elk throughout the area by stimulating the growth of herbaceous ground vegetation. This improved habitat should contribute positively to the elk production in the forest.

Rio Grande Cutthroat Trout

There are no longer any known populations of Rio Grande cutthroat trout within the Cow Creek Watershed. See Section 3.2.1.1 for a discussion of Rio Grande cutthroat trout and habitat.

4.2.3.2 Wildlife Habitats

Forest Composition and Structure

Wildlife species distribution and occurrence are functions of available habitat stages and landscape patterns. Forest cover types in the Project Area change with elevations, including ponderosa pine forest in lower elevations, mid-slope positions with mixed-conifer forest, and spruce-fir forest in higher elevations. Aspen forests (a sub-alpine, broad-leaf forest type dominated by quaking aspen) are often long-term successional communities to mesic to wet mixed-conifer and spruce-fir forests. The Viveash Fire affected a large portion of the proposed Project Area. Detailed forest composition descriptions are included in Section 3.2.2.

Spruce-fir and mixed-conifer forest types within the Viveash Fire perimeter encountered extensive fire-related damage. The stand-replacement fire in spruce-fir and mixed-conifer forests with an aspen component would have higher regeneration potential for fire successional species such as quaking aspen. Thus, fire disturbance will likely alter habitat structure and change vegetation composition in certain forest types. The aspen forest has undergone a tremendous reduction from historical extent in the southwestern United States because of fire suppression and land-use management practices. Aspen is a relatively short-lived, broad-leaf species that regenerates by sprouting following opening of the canopy. Longer fire-return intervals have created forest conditions with minimal aspen regeneration and an overall reduction of aspen forest in the southwestern United States. However, after the Viveash Fire, aspen has shown rapid sprouting.

4.2.3.3 Wildlife Habitat Components

Snags and Dead Wood

Prior to the Viveash Fire, the spruce-fir and Engelmann spruce forest cover types had relatively high hard and soft snag densities (see Table 3-10 in Section 3.2.2.2). Snags, and dead and down wood are important stand decadence components. Wildlife assemblages associated with these habitat elements include raptors, woodpeckers, insect-eating birds, primary and secondary cavity nesters, ground-dwelling small mammals, and herptiles. In the Santa Fe Municipal Watershed Project (a project with similar habitat types, elevation soils, and geology), a combined total of 56 wildlife species were associated with snag habitat in ponderosa pine, mixed-conifer, aspen, and spruce-fir forests (USDA Forest Service 2001b). This project also identified a combined total of 33 wildlife species using coarse woody debris in ponderosa pine, mixed-conifer, aspen, and spruce-fir forests (USDA Forest Service 2001a). The stand-replacement fire in the Project Area has created a substantial amount of fire-killed snags and dead and down wood. Current snag densities range from 449/acre in Ponderosa pine to 717/acre in Douglas-fir (USDA Forest Service 2000a).

Riparian and Wetland Habitats

Within riparian areas, there is a wide diversity of plant and wildlife species. Wildlife assemblages associated with riparian areas are dependent on this habitat type and adjacent vegetation that forms ecotones or edge habitat. Riparian forests provide dispersal corridors, connective habitat, and migration routes on the forested landscape. The Santa Fe Municipal Watershed Project identified 163 vertebrate species (7 reptile, 124 bird, and 32 mammal species) that were associated with montane riparian habitat. A combined total of 48 bird species within the montane riparian habitat nest in cavities in live or dead trees or nest in large trees (USDA Forest Service 2001a). Beaver is a keystone species in the riparian ecosystem.

The Viveash Fire caused some damage to riparian areas and grassland meadows. The riparian areas are composed of grass-dominated meadows, deciduous trees and shrub communities, and coniferous forests. A detailed description of riparian and wetland habitats can be found in Sections 3.2.1.2 and 3.1.5.1, respectively.

Forest Landscape Pattern

The Viveash Fire has created a forest landscape condition with a preponderance of open grassland/open-canopy forest habitat (see Section 3.2.2.4). Prior to the catastrophic wildfire, the forested landscape was dominated by a closed-canopy forest habitat with high tree densities. The wildland fire has created a landscape pattern with a short-term increase in grass/forb, shrub, and early successional habitats and forest openings, intermixed with ecotone/mosaic habitats in low-burn severity or unburned areas. The post-fire landscape structure within the Viveash Fire perimeter is a mosaic of grassland/open forest, aspen regeneration, and remnant patches of forest. The forest landscape in the Project Area that was affected by the Viveash Fire encompasses a relatively large area. The fire altered forest habitat distribution and converted a large amount of previously forested habitat to burned habitat. Post-fire forest habitat conditions would prevent the recolonization of late succession dependent wildlife species until desired forest habitats are restored in the Project Area. Conversely, edge species, habitat generalists, and early successional species will likely increase above pre-fire levels.

4.2.4 Range

There are primarily five range allotments within the Project Area. Most of the burned area was not considered to be suitable range. All stocked allotments are seasonal, and the grazing season begins in early to mid-June and ends about the end of September. This post-fire assessment is based on field observations and reviews of the burn severity map.

Bull Creek: The Bull Creek allotment covers 13,804 acres; 48 cows are authorized to graze for 5 months. The burned area is primarily within the north pasture, which is about one-third of the allotment. The Bull Creek allotment is on a deferred rotation grazing system.

Cow Creek: Eleven head of livestock are authorized to graze for 5 months on this 6,301-acre allotment. Most of the Cow Creek allotment was burned with a moderate to severe intensity. This allotment has a season-long permit.

Soldier Creek: This allotment consists of intermingled public and private lands. A small portion to the eastern side of the allotment burned severely. Currently this allotment is not stocked.

Valle Osha: Much of the Valle Osha allotment was within the severely burned area. Seventy-seven head of livestock are authorized to graze for 4 months on this 4,567-acre allotment. This allotment has a season-long permit.

Rosilla: The Rosilla allotment covers about 16,831 acres, the southeastern quarter of the allotment was severely burned. There are 194 cows and 12 bulls permitted to graze for 3½ months. Rosilla is under a deferred rotation grazing system.

4.2.5 Fire and Fuels

The Viveash Fire, which is suspected of being human-caused, burned terrain that varies from nearly level to moderately sloping valleys and plains to moderately steep to very steep mountainside slopes. The elevations range from 7,717 ft to 11,661 ft; the highest point is the summit of Elk Mountain. A volatile situation existed, created by very low moisture and extreme fire hazard conditions. There were no inventoried fuels data collected for the area prior to the fire. Based upon best professional judgment by local fire management personnel, it is estimated the fuel loads varied between 17 and 25 tons per acre (Archuleta 2001).

The post-fire area consists of about 11,769 acres burned at low/unburned severity, 3,207 acres at moderate severity, and 14,042 acres at high severity (USDA Forest Service 2000a) (see Figure 1-2). Extreme fire behavior conditions existed for 3 days before thunderstorms and associated higher relative humidity moderated fire behavior. For those areas at low/unburned severity, forest vegetation still remains; the understory was the primary loss. In moderate- to high-burn severity areas, the understory vegetation was destroyed and severe damage was done to the tree structure. In the high-burn severity areas, only skeletal portions of trees remain. The residual fuel loading that exists for all burned areas varies and is estimated to range from ½ to 3 tons per acre (Archuleta 2001).

The forest is currently dominated by snags created by the Viveash Fire. Current snag densities range from 449/acre in Ponderosa pine to 717/acre in Douglas-fir (USDA Forest Service 2000a).

Approximately 10–15 percent of the standing snags would be on the ground by post-fire year 5 and approximately 90–95 percent of the snags would be on the ground by post-fire year 15 (Keen 1929 and Greenlee 2000). The increased fuel loading in 2005 would be a build-up of approximately 9 tons/acre in the pine type; approximately 10 tons/acre in the mixed-conifer type; approximately 10 tons/acre in the spruce-fir type. The increased fuel loading in 2015 would be a build-up of approximately 55 tons/acre in the pine type, approximately 61 tons/acre in the mixed-conifer type, and approximately 65 tons/acre in the spruce-fir type.

4.2.6 Noxious Weeds

The Viveash Fire converted thousands of acres of climax forest into habitat potentially suitable to the establishment of noxious weeds. The fire provided ready-made habitat for any weed species that may have already been established in the area. In addition, the fire-fighting operations and subsequent reseeding may have also provided source material for weed infestations. As many as 14 different species of noxious weeds could find potential habitat in the Project Area and may already be established (see Project Record for a list of species of concern).

Prior to the catastrophic wildfire, a very limited portion of the Project Area would have been suitable habitat for the spread of noxious weeds. Existing information from USFS documented only small, scattered populations of noxious weeds in the Viveash Fire burn area. These weed populations were confined to existing roadways (Lujan 2001). Weedy species generally rely on surface disturbance to become established and spread. The Viveash Fire created large areas of open, and often disturbed habitat that may be suitable for the establishment of some noxious weed species. During the emergency, construction equipment from many sources was conveyed into the Project Area. This equipment may have not been cleaned prior to entry into the Project Area. Vehicles moving from one site to another can be prime vectors for transmittal of weed seeds. Another source of potential noxious weed contamination in the Project Area was the reseeding operation implemented after the completion of the wildfire. While the reseeding was done with certified weed-free seed, it is possible that some weed seeds were inadvertently included in the seed mixtures that were used to revegetate the area to prevent erosion.

4.2.7 Sensitive Plants

The sensitive plants in the Project Area are under the jurisdiction of USFWS for endangered, threatened, candidate, or proposed for threatened or endangered species of concern and of USFS Region for sensitive species. In addition to these federal agencies, the state of New Mexico also maintains a list of state threatened and endangered species. The species on the USFWS and the state endangered lists were reviewed and found to be in the following three general categories:

- Plants known to occur in the general area but not expected to occur on or near the Project Area because of the range of the species or the lack of habitat in the Project Area.
- Plants that could potentially occur in the Project Area, but were not found or were not documented by prior reported surveys.
- Plants that were recently reported in the Project Area by prior studies.

Plant species were either dropped from further consideration or considered in further detail based on existing data.

Seven target species of plants under the jurisdiction of the USFWS, USFS, and the New Mexico State Forestry Division were originally considered as potentially occurring within the Project Area. After initial review, the Holy Ghost ipomopsis (*Ipomopsis sancti spiritus*), Arizona willow (*Salix arizonica*), and spiny aster (*Eurybia horrida*) were determined not to occur within the Project Area due to lack of suitable habitat. In addition to the seven target plant species considered in this analysis, there are a few state species of concern that potentially occur in the Project Area. Although the state species of concern have no formal legal status, and the species have no protection, they are worthy of consideration for long-term management practices in the Project Area.

Based on the results of the initial review, three plant species of special status are anticipated to have potential habitat occurrence within the Project Area (Table 3-18). These include species under the jurisdiction of USFWS, USFS, and the New Mexico State Forestry Division. One of these species, the Pecos fleabane (*Erigeron subglaber*), is known to occur within the Project Area. The remaining two plant species were found to have a reasonable likelihood of potentially occurring in the Project Area.

Table 3-18. Special Status Plant Species Potentially Occurring in the Project Area

Common Name (*Scientific Name)*	**Status**
Golden lady's slipper (*Cypripedium pubescens*)	State Endangered
Pecos fleabane *(Erigeron subglaber*)	Forest Service Sensitive
Chiricahua dock (*Rumex orthoneurus)*	Forest Service Sensitive

Golden Lady's Slipper (Cypripedium pubescens)

The Golden lady's slipper is a perennial herbaceous species found in bogs, meadows, and damp woods in mid- to upper-montane coniferous forests from 8,000 to 11,000 ft in elevation. It has been documented to be locally common in the Upper Pecos Watershed on the western side of the Viveash Fire area and the Gallinas River Watershed along the eastern side of the Viveash Fire area. Although there are no documented records of this species in the Viveash Fire burned area, it could have occurred in moist, shaded habitats in canyons and cool, shaded slopes throughout the Project Area prior to the catastrophic wildfire. The wildfire would have removed most of its potential habitat in the Project Area. But it may still occur in pockets of habitat that survived the fire.

Pecos Fleabane (Erigeron subglaber)

The Pecos fleabane is a small perennial herb found in rocky, open meadows in sub-alpine coniferous forest from 10,000 to 11,500 ft in elevation. This narrow endemic occurs sporadically on high ridges and peaks along the Sangre de Cristo Mountains (New Mexico Rare Plant Technical Council 1999). Pecos fleabane has been documented on top of Elk Mountain near the radio towers at the northern end of the Viveash Fire area. It is also found on the ridge that extends north of the radio towers. The Elk Mountain population represents the currently identified southern end of the species range. A

portion of the Viveash Fire stopped short of damaging the existing population. Aside from the known populations around Elk Mountain, this species is most likely to occur in the higher portions of the Project Area, possibly in the meadow habitats around Valle de la Piedra and Valle de la Osha. It is likely that the fire may ultimately result in more meadow habitat for this species in the Project Area.

Chiricahua Dock (Rumex orthoneurus)

The Chiricahua dock occurs in moist, loamy soils within riparian and wetland habitats in cienegas, springs, and streams between 6,500 and 11,000 ft in elevation. It is most frequently found in shaded conditions surrounded by mixed-conifer forest, but can also occur in open meadows or along streams with open canopies. In 1999, USFWS withdrew the proposal to list this species as threatened based on its widespread range and lack of sufficient threats to warrant listing (Federal Register 1999). This species has also been removed from consideration for protection status by the state of New Mexico. Based on the current understanding of this species, it is known to occur in the Santa Fe, Lincoln, Gila, and Carson national forests in New Mexico. It has been identified in the Pecos Wilderness of the Santa Fe National Forest, and very likely occurred in the wetland and riparian areas of the Viveash Fire.

4.3 SOCIAL RESOURCES

4.3.1 Socioeconomics

4.3.1.1 Background

The Santa Fe National Forest is located in north-central New Mexico, and its headquarters are located in the state capital, Santa Fe. The Santa Fe National Forest contains 1,567,181 acres of national forest land. Small communities within the forest area directly affected by resource decisions of the Santa Fe National Forest Service are the Española Valley, Santa Fe, Los Alamos, Las Vegas, and Albuquerque. For purposes of the Viveash Fire EIS, the Project Area analysis consists primarily of the village of Pecos and surrounding countryside—represented by San Miguel County and, to a lesser degree, Santa Fe and Rio Arriba counties, which are located immediately to the west of the Project Area. Table 3-19 captures the local socioeconomic information from the New Mexico Employment Department for San Miguel County, Santa Fe County, and New Mexico.

Table 3-19. Local Socioeconomic Information

Statistic	San Miguel County	Santa Fe County	Rio Arriba County	New Mexico State
2000 population	30,126	129,292	41,190	1,819,046
Per capita personal income	$16,110	$29,346	$15,272	$21,836
Average wage and salary	$19,378	$26,152	$20,184	$26,272
1999 Labor force	11,685	63,014	19,180	809,094
Unemployment	7.1%	5.6%	7.4%	2.9%
Poverty rate	28. 7%	12.4%	23.7%	20.2%

4.3.1.2 San Miguel County

San Miguel is one of the smaller counties in New Mexico. The total population of the county is 30,126. The largest communities in this county, the village of Pecos and city of Las Vegas, have

populations of 1,441 and 14,565, respectively. Seventy-eight percent of the population are of Hispanic heritage. The statewide average is 42 percent.

Per Capita Personal Income

In 1999, San Miguel County had a per capita personal income (PCPI) of $16,110. This PCPI ranked 26th in the state and was 74 percent of the state average of $21,836, and 56 percent of the national average of $28,767. The average annual growth rate of PCPI over the past 4 years was 4.2 percent. The average wage and salary in the county is $19,378, which is 77 percent of the state average of $26,272.

Labor Force and Employment

In 1999, the total labor force in San Miguel County was 11,685, and 826 individuals were unemployed. Current unemployment figures in Santa Fe County and the state were 7.1 percent and 2.9 percent, respectively. Services and government jobs are important sectors in the overall industry of the county. In 1999, the services and government sectors provided more than 60 percent of the county's jobs. Agricultural employment makes up 7.2 percent of total county jobs.

Poverty Rate

It is estimated that 28.7 percent of the county population lives in poverty. This rate is higher than the state-wide average of 20.2 percent and resulted in San Miguel County being ranked in 1995 as one of New Mexico's poorest counties—27th out of 33.

4.3.1.3 Santa Fe County

Santa Fe County contains the Santa Fe metropolitan area, and the year 2000 population of 129,292 ranked third in the state. As the state capital, Santa Fe is the only incorporated city in the county, and it has a population of 62,203. The population's ethnic make-up reflects the state characteristics, with 49 percent of its population having Hispanic origins, compared to the state average of 42.1 percent.

Per Capita Personal Income

In 1999, Santa Fe County had a PCPI of $29,346. This PCPI ranked second in the state, and was 134 percent of the state average of $21,836, and 103 percent of the national average of $28,500. The average annual growth rate of PCPI over the past 4 years was 3.7 percent.

Labor Force and Employment

In 1999, the total labor force in Santa Fe County was 63,014. There were 1,809 unemployed individuals or 2.9 percent of the total labor force. Current comparative unemployment figures in San Miguel County and the state were 7.1 percent and 2.9 percent, respectively. Similar to San Miguel County in 1999, the services and government sectors provided more than 55 percent of the county's jobs. Agriculture employment makes up only 0.6 percent of total county jobs. Average wage and salary in the county is $26,152, which is almost the same as it was for the state-wide average of $26,272.

Poverty Rates

Santa Fe County has the second lowest poverty rate in the state. Only Los Alamos County has a lower rate. In 1995, this figure was 12.4 percent compared to the state-wide average of 20.2 percent.

4.3.1.4 Rio Arriba County

Rio Arriba County is located outside of a metropolitan area. In 2000, its population was 41,190. The two incorporated cities in the county, Chama and Espanola, have populations of 1,199 and 9,688, respectively. Espanola is located at the northern part of Santa Fe County. Officially, it is in Rio Arriba County but some of its communities are located within Santa Fe County. Rio Arriba's ethnic population make-up is similar to San Miguel County, with 72.9 percent of its population having Hispanic origins compared to the state average of 42.1 percent.

Per Capita Personal Income

In 1999, Rio Arriba County had a PCPI of $15,272. This PCPI places it within the state's lowest five counties at 54 percent of the state average PCPI. The average annual growth rate of PCPI over the past 4 years was 4.3 percent.

Labor Force and Employment

In 1999, the total labor force in Rio Arriba County was 19,180, with 1,413 individuals or 7.4 percent of the total labor force unemployed.

Similar to San Miguel and Santa Fe counties in 1999, the services and government sectors together provided more than 54 percent of the county's jobs. Agriculture employment makes up 7.1 percent of total county jobs. Average wage and salary in the county is $20,184, which is slightly higher than those in San Miguel County.

Poverty Rates

Rio Arriba County, similar to San Miguel County, has a high poverty rate. In 1995, this figure was 23.7 percent compared to the state-wide average of 20.2 percent.

4.3.2 Scenic Resources

4.3.2.1 Scenic Management System Overview and Scenery Management Areas

Scenery management is necessary because people are concerned about the quality of their environment, including aesthetic values of landscapes—particularly scenery and spiritual values (USDA Forest Service 1995b). High-quality scenery, especially scenery with naturally appearing landscapes, enhances people's lives and benefits society. People need natural appearing landscapes to serve as psychological and physiological "safety valves" for a variety of reasons—the world's urban population pressures are increasing, people's lives are becoming more complex, urban pressures are demanding more land for development, and once plentiful naturally appearing landscapes are becoming more scarce (USDA Forest Service 1995b).

USFS developed the Scenery Management System (SMS) as a flexible system for managing scenery and determining the relative value and importance of scenery in a national forest. Ecosystems provide the environmental context for the SMS. This system is used in the context of ecosystem management to inventory and analyze scenery in a national forest, assist in establishment of overall resource goals and objectives, monitor the scenic resources, and ensure high-quality scenery for future generations. SMS integrates aesthetics with other biological, physical, and social/cultural resources in the planning process.

Scenery management direction for the Santa Fe National Forest is included in the Forest Plan (USDA Forest Service 1987). At the time the plan was published, the Visual Management System (VMS) was used for scenery management (or visual quality management, per VMS terminology).

4.3.2.2 Overview of Pre-Fire Scenic Resources

The pre-fire landscape of the Project Area was a relatively uniform forest of mixed-conifer vegetation (white fir, Douglas-fir, limber pine, and ponderosa pine) with patches of mature aspen and oak woodland vegetation (gambel oak and mountain mahogany). Rocky bluffs and outcrops were, and still are, prominent throughout the area. This dominant landscape pattern graded into a piñon-juniper forest at lower elevations to the east and south. Spruce-fir stands (Engelmann spruce, corkbark fir, white fir, and aspen) and alpine grasslands (native grasses and forbs) along the ridges and peaks defined the higher elevations of the Elk Mountain and Gallinas Canyon watersheds.

The area of the Santa Fe National Forest where the Viveash Fire occurred has not been formally characterized and mapped with regard to landscape value prior to or since the fire. Although there are very limited viewpoints from outside the Project Area (based on information from BAER report (USDA Forest Service 2000a), aerial photographs, and personal communication with USFS personnel) prior to the fire the northern half of the Project Area was considered to have moderate to high scenic integrity. The southern half of the Project Area, south of the Osha Watershed, was considered to have primarily moderate scenic integrity.

4.3.2.3 Existing Scenic Resources

The impacts of the fire are evident from all roads leading into and out of Cow Creek, Bull Creek, Rito de la Osha, and Elk Creek Basin. The scale and intensity of the burned area dominate the viewshed. The existing landscape is a mosaic of black, gray, and green. Black burned tree trunks and thick black/gray ash contrast with lighter colored exposed mineral soils, green grass, and aspen. Scattered patches of unburned vegetation occur throughout the area, offering contrast from the burned areas.

A variety of emergency measures implemented in the burn area following the fire also have contributed to a less natural landscape in those affected areas. As detailed in the BAER report, these measures were implemented to reduce erosion and minimize impacts from flooding and fire suppression efforts and include contour felling; hand raking; construction of rock or log erosion barriers; erosion control wattles; and recontouring, waterbarring, and seeding dozer lines, hand lines, safety zones, and helipads. These activities are currently evident, but grasses and forbs are beginning to establish in these areas.

4.3.3 Recreational Resources

The *ROS: Primer and Field Guide* (USDA Forest Service 1990) describes national forests as places that not only provide settings for diverse recreational activities such as hiking, backpacking, fishing, and hunting, but also allow for varying user experiences. For example, camping in a large undeveloped setting with difficult access and few facilities offers some people a sense of solitude, challenge, and self reliance. In contrast, camping in a setting that has easy access and highly developed facilities offers other people more comfort, security, and social opportunities. Because people have different

recreational needs and experiential desires, USFS manages a variety of settings in which people can seek their own desired opportunities (USDA Forest Service 1990).

USFS has developed six classes or settings for the Recreation Opportunity Spectrum (ROS) as a framework and flexible recreation planning tool for understanding these relationships and interactions (Table 3-20). The ROS aims to maintain a broad spectrum of these classes to provide people with diverse recreational choices (USDA Forest Service 1990). Based on ROS characterizations, the Project Area (prior to and since the Viveash Fire) is considered semi-primitive motorized (SPM) with a roaded natural (RN) corridor along FR 92.

Table 3-20. ROS Settings

ROS Setting	Designation
Primitive	P
Semi-Primitive Non-Motorized	SPNM
Semi-Primitive Motorized	SPM
Roaded Natural	RN
Rural	R
Urban	U

All roads within the Project Area are non-paved and offer dispersed, roaded recreation. From the town of Pecos, FR 86 drops down to Cow Creek and becomes FR 92, following Cow Creek before continuing northeast along Rito de la Osha, eventually meeting up with Trail 251 to Elk Mountain. FR 92 is the longest developed roadway within the Project Area and provides access to the Cow Creek Campground, the only designated campground within the Project Area. Use of motorized vehicles off USFS-developed roads and trails is permitted throughout the Project Area. Much of the northern half of the Project Area has a seasonal restriction to prohibit off-road vehicle (ORV) use during the period from April 15 through June 30, as prescribed in the Forest Plan.

Prior to the Viveash Fire, the Cow Creek Watershed had been a recreation area for the local community for many years. The local community used the Cow Creek Watershed for recreation opportunities as the Pecos Canyon became increasingly popular to the non-local community. The local community used the Cow Creek Watershed for dispersed camping and family gatherings on weekends from May through October. Open roads throughout the Project Area attracted those interested in scenic driving and off-highway vehicle (OHV) use. The Cow Creek Watershed was also a trout fishery for the local community. During the fall hunting season, deer and elk hunters could be found from Elk Mountain down to the Rito de la Osha and Bull Creek. Other limited recreation uses included mountain biking, horseback riding, hiking, and backpacking (USDA Forest Service 2000a; Buehler 2001).

The Viveash Fire burned through the Cow Creek Campground and one of the two outhouses was destroyed. This five-site campground is located adjacent to Cow Creek in the southeastern part of the Project Area. Prior to the fire, local fishermen and their families primarily used the Cow Creek Campground. Access to the campground is from the town of Pecos via FR 86 and FR 92. Recreational opportunities at the campground are currently limited by the loss of fish in Cow Creek, flooding, and by the Viveash Fire itself. The campground will be reconstructed in the Manzanares

area. The design and relocation of the campground will be evaluated in a future National Environmental Policy Act of 1969 (NEPA) document.

Trails were damaged to varying degrees by the Viveash Fire. An assessment of the trails within the Las Vegas/Pecos Ranger District was conducted immediately after the fire. The data can be found in the BAER report. The fire directly impacted about 18 miles of trail within the Las Vegas/Pecos Ranger District, approximately 7 miles within the burn area, and about 4 miles within the Project Area (Table 3-21).

Table 3-21. Effects of Viveash Fire on Trails Within the Project Area

Santa Fe National Forest—Pecos/ Las Vegas Ranger District Trail	Trail Length (miles)				Trail Length in Burn Severity Areas (miles)		
	Total Length	Outside Burn Area	Within Burn Area	Within Project Area	Low	Medium	High
Skyline Trail 251	63. 0	56. 0	7.0	4.0	4.0	–	3. 0
Harvey's Trail 218	5. 0	5. 0	–	0.0	*5.0	–	–
Total	68.0	61.0	7.0	4.0	9.0	–	3. 0

* Trail was bulldozed to create indirect fire suppression line.
– = not applicable

The amount of damage to recreational opportunities varies depending on the specific activity, burn severity, and individual user perception. The overall loss of fish habitat throughout the Project Area has resulted in a reduction of trout fishing, the main recreational loss from the Viveash Fire. Camping and hiking activities may have decreased following the fire. However, some members of the local community have indicated that they continue to use the area for camping and hiking activities regardless of the aftereffects of the fire. There are also people who now visit the area specifically to see the aftereffects (Buehler 2001).

4.3.4 Heritage Resources

The information provided by USFS heritage resource surveys in advance of timber sales, road and trail construction, and other forest improvement projects suggests that prehistoric use of the Upper Pecos River Valley was sporadic. Archaeological evidence of that utilization consists primarily of isolated artifacts and small artifact scatters representing short-term camps and resource extraction activities.

A Paleoindian projectile point base was found at a Archaic site in the Pecos Wilderness, but it may be a curated item (Abel 1989). Elsewhere, isolated late Paleoindian projectile points have been reported from surveys at intermediate elevations. At least one Clovis point has been found at an elevation above 10,000 ft (Cordell 1979). These data evidence infrequent forays by Paleoindian hunters into the northern New Mexico mountains between 11,500 and 8,000 years ago.

Thirty heritage resources sites are within the Project Area. These sites consist of log cabins with associated historical trash scatters, prospector's pits, wooden structures associated with logging, corrals, an acequia, a telephone line, and a burial/shrine. Prehistoric sites are limited to lithic and/or sherd scatters. The prehistoric sites are all small artifact scatters reflecting short-term resource

procurement activities during the Archaic and Formative periods or are of unknown time period and/or cultural affiliation. Given the heavy vegetation cover present when the previous surveys were conducted, it is likely that these low-visibility sites are under-represented in the sample of known sites. There are no known sacred sites, traditional cultural properties, or traditional use areas within the Project Area and, as of April 25, 2002, no Native American tribes have expressed concerns about the Proposed Action.

Only six of the known heritage resources sites are within the Proposed Action areas. These sites consist of log cabins with associated historical trash scatters, prospector's pits, a wooden logging structure, and a lithic scatter.

4.3.5 Roadless Areas

There are no roadless areas within the Project Area. The Pecos Wilderness Area borders the Project Area to the north, and a roadless area borders the Project Area to the east. The adjacent roadless area was the Roadless Area Review and Evaluation (RARE) II that was designated as nonwilderness in the FEIS (USDA Forest Service 1979). There are no activities proposes in the Project Area within an inventoried roadless area as defined by the Forest Service Roadless Area Conservation FEIS (USDA Forest Service 2000c).

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5.0 ENVIRONMENTAL CONSEQUENCES

5.1 INTRODUCTION

This chapter discusses the environmental consequences of implementing the alternatives described in Chapter 2. The analysis discloses the impacts to resources that have been identified as significant issues or concerns. The discussion focuses on the resource issues identified in previous chapters. This chapter provides the scientific and analytical basis for the comparison of alternatives.

Impacts to the environment are discussed in terms of their direct, indirect, and cumulative effects. Definitions for these effects are as follows (40 CFR 1508.7 and 1508.8):

5.1.1 Direct Effects

Direct effects are defined as effects caused by the action and occurring at the same time and place.

5.1.2 Indirect Effects

Indirect effects are defined as effects caused by the action but occurring later in time or further removed in distance.

5.1.3 Cumulative Effects

Cumulative effects are effects that result from the incremental impact of the action when added to other past, present, and reasonably foreseeable actions that are not included in the Proposed Action. The activities included in each cumulative effects analysis may vary. The ongoing and future activities that are planned or known in the Project Area are listed in Section 4.2.

5.2 ONGOING OR FORESEEABLE FUTURE ACTIONS

The following projects are ongoing or foreseeable future actions within or near the Project Area. The need to include these actions in the individual resource analysis is dependent on the cumulative effects area and duration of effects for each resource. Future projects described in this section are not part of the decision to be made from this EIS, and most will require separate environmental analysis documents and public involvement.

5.2.1 USFS Fire Restoration Activities

5.2.1.1 Planting

In the Viveash Fire BAER (USDA Forest Service 2000a) report, the Santa Fe National Forest requested funding for the reforestation of a portion of the burned area. It is anticipated that approximately 5,000 acres of national forest land within severely burned areas of the Viveash Fire will be planted.

Reforestation surveys within the fire boundaries that will be conducted during 2002/2003 will help refine the acreage that requires planting. Not all severely burned acres will be planted. In fact, the majority of the burn area will not be replanted. Planting will be concentrated primarily in two areas—severely burned areas with unstable soils that are not planned for salvage and are not quickly

revegetating naturally, and burned areas planned for salvage that do not have aspen in the understory.

5.2.1.2 Rio Grande Cutthroat Repopulation

An aquatic habitat inventory was conducted in summer 2001 in Elk Creek, Sheep Creek, Cow Creek, and Bull Creek. Preliminary results show an opportunity to re-introduce Rio Grande cutthroat trout in Cow Creek and its tributaries above a waterfall located near the mouth of Rito Manzaneres on the Bar-X-Bar Ranch. This includes nearly all perennial waters within the Project Area. Many populations of introduced fish (rainbow trout, brown trout, and brook trout) no longer inhabit the areas of Cow Creek that were impacted by the Viveash Fire. These fish have a competitive interaction with Rio Grande cutthroat trout for food and habitat resources. Rainbow trout are known to hybridize with the native fish. Some privately created fish ponds adjacent to Cow Creek are currently recovering from the burn and could serve as suitable habitat for the re-introduction of Rio Grande cutthroat trout. The USFS will be working in cooperation with the New Mexico Department of Game and Fish to re-establish successful populations of this native species.

5.2.1.3 Range and Noxious Weeds

Range-related restoration and rehabilitation projects within the Viveash Fire area include range-readiness monitoring, noxious weed treatment, range fence replacement, and the cleaning and protection of springs. Some projects have been accomplished and others are scheduled to take place in 2002. Portions of the Soldier Creek, Cow Creek, Valle Osha, Bull Creek, and Rosilla range allotments fall within the area burned by the wildfire.

Noxious weeds will be inventoried within the burn area over the next 2 to 3 years. The next step would be to treat any existing populations of noxious weeds. Since noxious weed populations can increase after fires, it is very important to map and treat any populations to prevent establishment. Treatment could continue over the next few years.

5.2.1.4 Trails and Recreation

Trails

Trail conditions within the fire perimeter will be inventoried. Other projects include stabilizing and repairing trails and monitoring trail conditions. Both the inventory and the development of monitoring standards are nearing completion. Development of the reconstruction design and survey is also planned for 2002, and the trail stabilization work is planned for completion in 2002/2003.

Recreation

The Cow Creek Campground was burned in the fire, and as a result, some of the facilities were damaged or destroyed. One outhouse was destroyed and vegetation around the sites was damaged. Based on these factors and water quality concerns, a decision was made to decommission the present Cow Creek Campground and rebuild it in an area better suited for a developed recreation site. The Manzanares Administration Site is being considered for potential relocation of Cow Creek Campground. The new campground will be constructed in 2003.

5.2.1.5 Heritage Resources

Berke and Abel (2001) and Reycraft (2001, 2002) report that approximately 20 of the 30 known heritage resource sites in the Viveash Fire area were impacted by either the fire itself or by fire suppression activities. During summer 2002, these sites would be treated by various methods (e.g., contour felling, and/or placement of straw wattles, straw bales, or excelsior matting, monitoring, etc.) to inhibit further damage from surface runoff and slope erosion. Interpretation and public education projects would be completed. Planned projects include public presentations and production of a brochure and/or portable interpretive display explaining the effects of fire on heritage resources.

5.2.1.6 Watershed and Riparian

Watershed monitoring, channel stabilization, riparian restoration, and seeding within the Viveash Fire area began in 2001 and will continue into 2002. Watershed and stream health monitoring will be conducted as well as channel stabilization, riparian restoration, and seeding.

In 2001, channel stabilization began along Cow Creek, especially in areas where resource damage is occurring on USFS lands and where there are impacts on private property and water quality. Additional channel stabilization will be accomplished in 2002. Seeding was accomplished in the Viveash Fire Area in 2001 to facilitate regeneration of ground cover and reduce erosion. Willow and cottonwood plantings are planned to help stabilize the riparian habitat.

5.2.2 Activities on Private Land

5.2.2.1 Timber Harvesting

Many of the private landowners in the Project Area have already logged most of the dead trees on their land. The following sections are based on personal communications with Mr. Charlie Wickland (New Mexico Office of the State Forester) and Mr. Charlie Butler (Las Vegas District Office of the New Mexico Forestry Division) on April 27, 2001; Mr. Leroy Jons (District Conservationist, Las Vegas Field Office of the Natural Resource Conservation Service) and Mr. Steve Reichert (Agricultural Conservation Facilitator, Tierra y Montes Soil and Water Conservation District) on April 30, 2001; and Mr. Ken Leiting (State Resource Conservationist, Natural Resource Conservation Service) on May 2, 2001. The Office of the New Mexico State Forester speculates that other landowners will likely continue to harvest trees for commercial purposes and the reduction of available fuel for future wildfires. One landowner owns and operates a timber mill, which he used to process his own wood. The exact number of acres logged on private land is difficult to quantify but is estimated as 1,000 to 1,500 acres.

5.2.2.2 Conservation Practices

Private landowners within the affected area have implemented several conservation practices in response to the wildfire. Many of these resource conservation approaches will continue, including native grass reseeding, tree seedling planting, and the breaking apart of hydrophobic soils using heavy equipment. The Tierra y Montes Soil and Water Conservation District has also made approximately 300 straw wattles available for use as erosion barriers. The use of similar brush and slash barriers will likely continue into the future. The Las Vegas Field Office of the Natural Resource Conservation Service has also provided local landowners with sandbags to reduce the effects of floodwaters that are a result of increased post-fire channel flows. Despite relatively large

labor requirements, some private landowners will likely use these sandbags. Future funding may also become available through the Natural Resource Conservation Service and the Tierra y Montes Soil and Water Conservation District for tree replanting.

5.2.2.3 Structural Repairs and Maintenance

Post-fire rangeland restoration on private land will continue into the future. A local organization has contributed funding to private landowners for fence replacement in the Project Area. Many local landowners have also sought assistance to clean out sediment that has accumulated in livestock and fish ponds. Some ponds filled completely with eroded soil and ash, and others were destroyed because the excessive water and sediment breached the associated dam. Private landowners within the Viveash Fire perimeter have also implemented road restoration efforts, including road maintenance and culvert additions and repairs. Road maintenance will continue since future storms may damage the existing road network.

5.2.2.4 Development

Houses and vacation homes are being constructed, usually on large lots, within the Project Area. The sites are generally located in the lower portion of the Project Area, where the majority of private land exists.

5.3 PHYSICAL RESOURCES

5.3.1 Soil Resources

5.3.1.1 Evaluation Criteria

Direct, Indirect, and Cumulative Effects

The primary concern relating to soil resources is that logging may increase soil erosion from burned areas, which would reduce site productivity and revegetation potential. Substantial amounts of soil productivity have already been lost because of the Viveash Fire, and soil productivity may decrease with the creation and use of roads, landings, and skid trails. Compaction is generally not a concern for the soil types and climate in the Project Area, except where heavy equipment is used to drag or pile logs (skid trails and landings), or where loaded pick-up trucks repeatedly drive over the same path.

Soil erosion is defined as soil particles that are detached and moved. These soil particles may be re-deposited downslope or reach a stream and become lost from the site. Some soil particles may only travel a few inches, others may reach the stream and leave the Project Area. Once soil erosion reaches a stream it becomes part of the sediment in the stream system. Sediment delivery is the amount of soil/sediment that is contributed from the hillslopes to the stream. Soil productivity would only be adversely affected if soil erosion reached a stream (sediment delivery) and became lost from the site. For this EIS, the soil erosion that reaches a stream and is lost from the site will be called soil loss. Soil loss is interchangeable with sediment delivery described in Section 4.3.2.2. The primary evaluation criterion for the effects of the alternatives on soil productivity is change in soil loss.

The Water Erosion Prediction Project (WEPP) (Elliot et al. 2000) computer model was used to predict the amount of soil erosion that would be produced by salvage and skidding on individual, isolated hillslopes. Soil that leaves each of these isolated hillslopes may be either re-deposited further downhill or carried away in a stream. The WEPP predictions of soil erosion are based upon post-fire conditions in 2000 with no recovery of ground cover or the effects of the fire on the soils, such as

hydrophobic conditions. Soil types and characteristics were derived from the Terrestrial Ecosystem Survey of the Santa Fe National Forest (USDA FS, 1993).

Recovery of effective ground cover, including vegetation, woody debris, pine needles, or rock cover would lessen the impact of rain splash, allow infiltration of rainwater, and reduce soil erosion. Effective ground cover would prevent soil from moving down the hillslope, provide shade, slow runoff, reduce flood peaks, retain site productivity, and reduce downstream sedimentation. Assumptions regarding recovery rates are based on studies and past experience with post-fire and post-salvage sale recovery rates. For example, one previous study has found that 60 percent ground cover reduced soil movement to negligible amounts, and 30 percent ground cover reduced erosion by half compared to bare ground (Robichaud et al. 2000). Since it is more than two years after the Viveash Fire burned, effective ground cover has recovered in some cases to greater than before the fire. The low and moderate intensity burn areas generally have greater than 60 percent ground cover, while the high intensity burn areas generally have greater than 30 percent effective ground cover (Napp 2002).

5.3.1.2 Alternative Comparison

Analysis of the effects of alternatives relies in part on the results generated by the WEPP computer model. In the following discussion, increases in soil erosion refer to increases over the existing post-fire condition unless otherwise specified, as predicted by the WEPP model.

The BMPs discussed in the Section 4.3.2.2 that would be implemented in all action alternatives would also help to maintain soil productivity. These BMPs would further reduce soil loss from what is calculated by the WEPP model. For a discussion of mitigation measures that would be implemented under this alternative, see Section 2.5, Mitigation Measures. Monitoring the effectiveness of the BMPs would implement the feedback loop discussed in the Section 4.3.2.2 and in Appendix A.

Alternative 1—No Action

Direct, Indirect, and Cumulative Effects

No road relocation or timber harvesting activity would occur on National Forest land under Alternative 1. This alternative, therefore, would have no direct or indirect effects on soil productivity. However, soil erosion and soil loss would continue to be high for some time. Some soil productivity would continue to be temporarily reduced on private land due to soil erosion that is associated with timber harvesting on private land. Positive cumulative effects to soil productivity would continue to occur from on-going USFS activities including seeding, soil stabilization, and riparian restoration. Additionally, some beneficial rehabilitation efforts are occurring on private land that would promote recovery of soil productivity. Soil conditions would likely improve over the next several years as the water-repellent (hydrophobic) layer breaks down (Robichaud and Brown 1999; McNabb et al. 1989; Morris and Moses 1987; DeBano and Rice 1973). Increases in sunlight reaching the forest floor would continue to promote growth of grasses, shrubs, and aspen trees. The burned area has already begun to recover ground vegetation and soil productivity.

Table 4-1. Soil Productivity Effects for Alternative 2

Subwatershed	Soil Erosion (tons)		Sediment Delivery Ratio (%)	Soil Loss/Sediment Delivery (tons/yr)		Change in Soil Loss/ Sediment Delivery	
	Existing Condition	Alternative 2		Existing Condition	Alternative 2	Tons/year	(%)
Chaparito	5,202	5,463	2	90	94	4	5
Elk	23,783	29,326	3	689	850	161	23
Lower Cow	20,334	21,127	5	1,101	1,144	43	4
Manzanares	23,321	25,650	4	1,041	1,145	104	10
Middle Cow	31,287	34,607	5	1,559	1,724	165	11
Osha	12,648	14,324	5	689	780	91	13
Soldier	5,773	5,807	1	81	81	0	1
Tijeras	8,187	8,696	4	313	333	19	6
Upper Bull	3,168	3,668	1	30	35	5	16
Upper Cow	11,243	12,599	1	125	140	15	12
Willow Creek	180	194	0	0	0	0	7
Total	**145,126**	**161,461**	**3**	**4,375**	**4,868**	**492**	**11**

Alternative 2—Forest Service Preferred Alternative

Direct and Indirect Effects

This alternative would result in 15.5 fewer miles of road for the entire Project Area, once roads are decommissioned after implementation of salvage activities. In order to relocate roads away from streams, there would be some soil productivity loss caused by creating new road segments. However, there would be an overall gain in vegetative recovery and long-term soil productivity by the extensive amount of proposed road decommissioning. The effects of decreasing road density would be a reduction in soil erosion and improvement of soil productivity. Therefore, the effect would be positive for soil productivity in the long term.

In the areas where block area salvage would occur, soil productivity would be temporarily reduced where large machinery creates skid trails and landings for log removal. However, existing landings would be used as much as possible. Skid trails would only have soil compaction great enough to reduce soil productivity on a small portion of their area, which would be temporary. Skid trails and landings would be expected to recover soil productivity within five to seven years, depending on whether they are ripped and seeded or left to recover naturally. Also, there would be a positive effect as the machines break up the water-repellent (hydrophobic) soil layers. The breaking apart of these layers would result in increased soil productivity and revegetation potential because of greater water infiltration into the soil (see Chapter 3). This effect has been documented in other National Forest lands (Maloney and Thornton 1995).

Ground cover would also improve with the scattering of treetops, limbs, and unmerchantable wood from the salvage activities. Leaving this material on site would reduce overall soil erosion (Shakesby et al. 1996). Furthermore, the harvest activities would occur primarily on alfisols, which are more developed and fertile than inceptisols or entisols, making them generally able to support successful regeneration of vegetation. The WEPP model predicts the effects of harvesting would be increased soil erosion of up to a maximum of 11 percent above the existing soil erosion rates (Table 4-1). However, with the expected application and effectiveness of BMPs and other mitigation measures,

the actual increase in soil erosion should be well below the 11 percent increase predicted by the model. These mitigations include:

- Limiting harvest activities to times when the soil is dry or frozen, and to slopes less than 35 percent, and areas within a relatively short distance of existing roads
- Leaving slash on the soil as a barrier to erosion and runoff, the potential for any lasting harmful effects to soil productivity would be unlikely.

The effect of the salvage activities on soil productivity can be estimated by calculating inches of soil lost. The amount of soil lost from the Project Area was calculated to be 492 tons. If that amount of soil loss were to occur evenly across the salvage areas it would amount to less than 0.0002 inches of soil. Soil erosion is likely to be more heterogeneous; however, the estimate of 0.0002 inches indicates that soil productivity would not experience noticeable or measurable changes as a result of the salvage activities. Implementation of the mitigation measures and BMPs and the effectiveness monitoring would also ensure consistency with the Forest Plan.

Cumulative Effects

Cumulative effects of Alternative 2 would include changes in soil productivity from salvage activities on both public and private lands. For this alternative, the most noticeable change in soil productivity would occur as a result of the on-going restoration activities that are clearly enhancing the rate of recovery of vegetative productivity. Erosion control structures appear to have reduced soil erosion and runoff on the steeper slopes. Proposed road decommissioning combined with the salvage activities would cumulatively result in soil productivity increases. The direct and indirect effects of this alternative are predicted to have a low probability of generating noticeable or measurable changes to soil properties, site productivity, or revegetation potential. The limited magnitude, duration, and intensity of direct and indirect soil effects, together with the mitigating effects of the BMPs, would result in insignificant cumulative effects to soil properties.

Alternative 3

Alternative 3 was developed to minimize the potentially negative impacts of timber harvesting on soil erosion and water quality in the Viveash Fire area, by spatially concentrating the harvesting in areas with lower soil erodibility and sediment delivery potential.

Direct and Indirect Effects

This alternative would result in 15.5 fewer miles of road for the entire Project Area, once roads are decommissioned after implementation of salvage activities. The direct and indirect results of these actions are discussed under Alternative 2. Harvesting is predicted to increase soil loss to 7 percent above the existing condition (Table 4-2). However, mitigation measures and BMPs as previously discussed would keep the actual increase below the 7 percent increase calculated.

The effect of the salvage activities on soil productivity can be estimated by calculating inches of soil lost. The amount of soil lost from the Project Area was calculated to be 292 tons. If that amount of

Table 4-2. Soil Productivity Effects for Alternative 3

Subwatershed	Soil Erosion (tons)		Sediment Delivery Ratio (%)	Sediment Soil Loss Delivery (tons/yr)		Change in Sediment Soil Loss Delivery	
	Existing Condition	Alternative 3		Existing Condition	Alternative 3	Tons/year	(%)
Chaparito	5,202	5,463	2	90	94	4	5
Elk	23,783	29,340	3	689	850	161	23
Lower Cow	20,334	20,550	5	1,101	1,112	12	1
Manzanares	23,321	23,696	4	1,041	1,058	17	2
Middle Cow	31,287	32,157	5	1,559	1,602	43	3
Osha	12,648	13,087	5	689	713	24	3
Soldier	5,773	5,810	1	81	81	0	1
Tijeras	8,187	8,242	4	313	315	2	1
Upper Bull	3,168	3,667	1	30	35	5	16
Upper Cow	11,243	12,599	1	125	140	15	12
Willow Creek	180	194	0	0	0	0	8
Total	**145,126**	**154,807**	**3**	**4,375**	**4,667**	**292**	**7**

soil loss were to occur evenly across salvage areas, it would amount to less than 0.0002 inches of soil. Soil erosion is likely to be more heterogeneous; however, the estimate of 0.0002 inches indicates that soil productivity would not experience noticeable or measurable changes as a result of the salvage activities. Implementation of the mitigation measures and BMPs and the effectiveness monitoringwould also ensure consistency with the Forest Plan.

Cumulative Effects

Cumulative effects of Alternative 3 would include changes in soil productivity from salvage activities on both public and private lands. The Viveash Fire has had a dramatic effect on soil productivity. For this alternative, the most noticeable change in soil productivity would occur as a result of the on-going restoration activities that clearly enhance the rate of recovery of vegetative productivity. Erosion control structures appear to have reduced soil erosion and runoff on the steeper slopes. Proposed road decommissioning combined with the salvage activities would cumulatively result in soil productivity increases. The direct and indirect effects of this alternative are predicted to have a low probability of generating noticeable or measurable changes to soil properties, site productivity, or revegetation potential. The limited magnitude, duration, and intensity of direct and indirect soil effects, together with the mitigating effects of the BMPs, would result in insignificant cumulative effects to soil properties.

Alternative 4

Under Alternative 4, only roadside trees would be designated and removed. The proposed treatment area would not exceed 150 ft on either side of roads and trails. Approximately 2,600 acres of these trees would be removed under this alternative.

Direct and Indirect Effects

This alternative would result in 15.5 fewer miles of road for the entire Project Area, once roads are decommissioned after implementation of salvage activities. The direct and indirect results of these

Table 4-3. Soil Productivity Effects for Alternative 4

Subwatershed	Soil Erosion (tons)		Sediment Delivery Ratio (%)	Soil Loss/Sediment Delivery (tons/yr)		Change in Soil Loss/ Sediment Delivery	
	Existing Condition	Alternative 4		Existing Condition	Alternative 4	Tons/year	(%)
Chaparito	5,202	5,223	2	90	90	0	0
Elk	23,783	24,624	3	689	714	24	4
Lower Cow	20,334	20,550	5	1,101	1,112	12	1
Manzanares	23,321	23,696	4	1,041	1,058	17	2
Middle Cow	31,287	32,157	5	1,559	1,602	43	3
Osha	12,648	13,087	5	689	713	24	3
Soldier	5,773	5,810	1	81	81	0	1
Tijeras	8,187	8,242	4	313	315	2	1
Upper Bull	3,168	3,280	1	30	31	1	4
Upper Cow	11,243	11,522	1	125	128	3	2
Willow Creek	180	194	0	0	0	0	8
Total	**145,126**	**148,387**	**3**	**4,375**	**4,474**	**98**	**2**

actions are discussed under Alternative 2. Harvesting is predicted to increase soil loss to 2 percent above the existing conditions (Table 4-3). However, mitigation measures and BMPs would keep the actual increase below the calculated 2 percent.

The effect of the salvage activities on soil productivity can be estimated by calculating inches of soil lost. The amount of soil lost from the Project Area was calculated to be 98 tons. If that amount of soil loss were to occur evenly across the salvage areas it would amount to less than 0.0001 inches of soil. Soil erosion is likely to be more heterogeneous; however, the estimate of 0.0001 inches indicates that soil productivity would not experience noticeable or measurable changes as a result of the salvage activities. The implementation of the mitigation measures and BMPs and the effectiveness monitoring would also ensure consistency with the Forest Plan.

Cumulative Effects

Cumulative effects of Alternative 4 would include changes in soil productivity from salvage activities on both public and private lands. The Viveash Fire has had a dramatic effect on soil productivity. For this alternative, the most noticeable change in soil productivity would occur as a result of the on-going restoration activities that are clearly enhancing the rate of recovery of vegetative productivity. Erosion control structures appear to have reduced soil erosion and runoff on the steeper slopes. Proposed road decommissioning, combined with salvage activities, would cumulatively result in soil productivity increases. The direct and indirect effects of this alternative are predicted to have a low probability of generating noticeable or measurable changes to soil properties, site productivity, or revegetation potential. The limited magnitude, duration, and intensity of direct and indirect soil effects, together with the mitigating effects of the BMPs, would result in insignificant cumulative effects to soil properties.

5.3.2 Water Resources

5.3.2.1 Water Quantity

Changes in water yield and peak flows can reduce channel stability and negatively impact in-stream biota. Water quantity and subsequent flooding may increase if live trees are harvested from a watershed. Elimination of the duff layer and existing vegetation caused by the Viveash Fire has already dramatically increased peak flows and total water yields. Harvesting green trees is not proposed as part of any of the alternatives. Roads have been linked to increases in peak flows where they increase the drainage network (Megahan 1980). The amount of roads would actually decrease by 15.5 miles for each action alternative. Therefore, the effect of any of the action alternatives would be no increase and potentially a decrease in water quantity or flooding.

5.3.2.2 Water Quality

Increased stream water temperatures pose a concern because they can affect in-stream biota. The Viveash Fire has removed most of the riparian vegetation that provided shade and cover near streams. Some public comments expressed a concern about the effect of harvest on increasing stream temperatures. However, none of the alternatives significantly reduce forest shade along streams because of buffers; therefore, there would be no measurable effect on stream temperature.

Timber harvesting and its associated activities can impact water quality (Beschta 1995). Water quality may be affected by increased sediment delivery to streams and subsequent transport and deposition in the stream channel. Salvage may accelerate soil erosion, leading to increased sediment yields (Helvey et al. 1985). Changes in sediment transport may affect the stability of the stream channel. The Viveash Fire and subsequent flood events have dramatically increased sediment delivery. Roads can be a major source of increased sediment yield in a managed watershed (Swank et al. 1989).

Evaluation Criteria

Direct, Indirect, and Cumulative Effects

The primary water quality issue is that salvage logging could cause erosion that would adversely affect water quality in Cow Creek, its tributaries, and ultimately the Pecos River. Water quality is particularly important because Cow Creek is a high-quality cold water fishery. Most of the streams in the Project Area were impacted by increased sediment deposition as a result of the Viveash Fire and storms that followed, and do not currently support beneficial uses. Most of the Project Area streams, including Cow Creek, currently do not support fish populations.

Roads are the primary contributors of sediments to streams in managed watersheds (Swanson et al. 1981; Amaranthus et al. 1985; Rice and Lewis 1986; Bilby et al. 1989; Donald et al. 1996; Megahan and Kidd 1972; Reid and Dunne 1984; Rothacher 1971; Sullivan and Duncan 1981; Kochenderfer et al. 1997; Swift 1985, 1988). Therefore, road density (and the connection to sediment production, transport, and yield) is one of the important criteria used to evaluate impacts of the alternatives.

Sediment often follows road networks, making road density an important measure of both direct and indirect effects. Road densities were calculated as the net length of roads (mile) per subwatershed area (square mile) for each proposed alternative. Road densities reflect all roads in the watershed, including roads on national forest land and private lands.

For this FEIS, sediment delivery will be defined as soil erosion that reaches a stream. Soil loss, as defined in Section 4.3.1, is interchangeable with sediment delivery. Sediment yield is the amount of sediment that moves past a point in a stream over a given time.

Sediment delivery ratios were calculated using estimates of sediment delivery ratios from the Viveash BAER report (USDA Forest Service 2000a) and the burn severity and geology for each subwatershed (Foster Wheeler Environmental 2002). These ratios were reduced where estimates of current effective ground cover showed a change from post-fire conditions (see Soil Resources). The sediment delivery ratio ranged from 0 to 5 percent. Sediment delivery was estimated by multiplying the soil erosion by the sediment delivery ratio.

Predicted increases in sediment delivery to streams do not by themselves constitute an adverse impact or a violation of the Clean Water Act (CWA) (see Foster Wheeler Environmental 2001b for discussion of all applicable regulations). However, if increases in sediment delivery are realized, there could be a change in the sediment supply and processing, possibly resulting in a loss of pool volumes and depths, and consequent impact to beneficial uses. Beneficial uses of streams in the Project Area have been significantly impacted from increased sediment delivery, which is a result of the Viveash Fire.

The total direct, indirect, and cumulative effects of each alternative are evaluated by considering the following:

- Changes in road density
- Predicted changes in sediment delivery
- Delays in sediment delivery recovery

Alternative 1—No Action

Direct, Indirect, and Cumulative Effects

No road relocation, rehabilitation, or timber harvesting activities would occur on national forest land under Alternative 1. Many streams in the Project Area have experienced dramatic sediment transport and deposition events following the Viveash Fire (Hopkins 2001). These streams would continue to recover by natural processes. Some additional erosion and deposition events may occur as the watersheds continue to recover from the fire (Hopkins 2001). Despite these transitory events, the overall trend in water quality and stream stabilization would continue to improve, especially with the rehabilitation efforts on national forest and private lands.

Natural and managed post-fire recovery in the Project Area throughout the last 2 years following the Viveash Fire has lead to greatly reduced soil erosion and loss compared to initial post-fire conditions. The recovery of sediment deliveries following wildfire depends mostly on burn severity. Erosion rates have been reported to return to pre-fire levels in as little as 3–4 years following low-severity wildfires (DeBano et al. 1996 and Robichaud and Brown 1999). Moderately to severely burned watersheds have been reported to take between 7 and 14 years to recover to normal sediment delivery (DeBano et al. 1996). For this analysis it was assumed that sediment delivery recovery will take 14 years to reach pre-fire levels. Sediment delivery was estimated for the current condition based upon effective ground cover (see Soil section). It is assumed that the recovery shows a straight-line relationship from the present (year 2002) until full recovery (Figure 4-1).

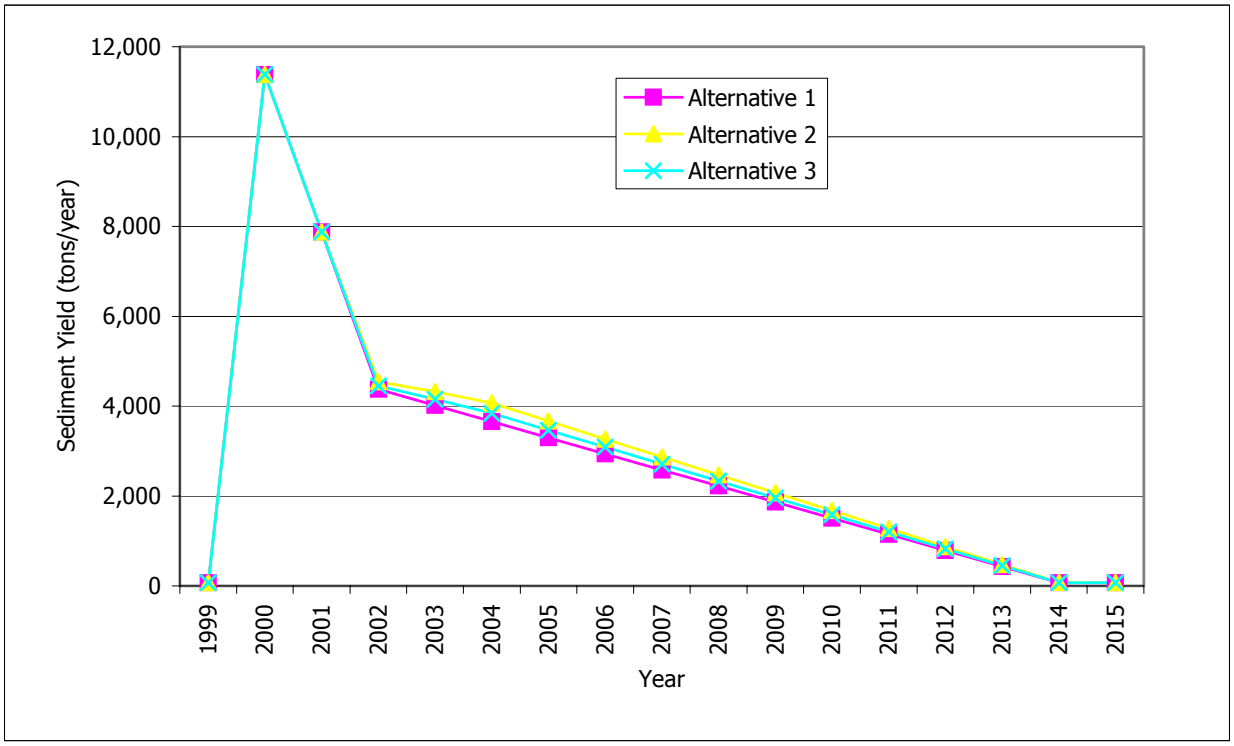

Figure 4-1. Effects of Alternatives on Sediment Yield Recovery

Alternative 2—Forest Service Preferred Alternative

Direct and Indirect Effects

This alternative would result in reduced road density, from 2.6 mi/mi^2 to 2.3 mi/mi^2 for the entire Project Area and improve several stream crossings (Table 4-4). Sediment delivery resulting from existing roads would be lowered through the reduction in road density. The application of appropriate BMPs would reduce most of the potential impacts to water quality caused by road relocation and replacement of culverts and bridges. The projected effects of decreasing road density would be to reduce soil erosion and sediment delivery to streams and therefore maintain or enhance water quality.

Table 4-4. Evaluation Criteria by Alternative

Criteria	Alternative			
	1	2	3	4
Change in Sediment Delivery of Each Alternative (%)	0.0	11.2	6.7	1.0
Delay in Sediment Yield Recovery (years)	0	<1	<1	<1
Net Change in Miles of Road	0.0	–15.5	–15.5	–15.5

Road realignment in the Tijeras and Osha subwatersheds would improve water quality by relocating the road out of the streambed and reducing sediment delivery to the stream. Where practical, buffer zones would reduce disturbance to streams. Implementation of these buffer zones and other water control structures would further decrease the impact of existing roads by preventing eroded soil from reaching streams. Replacement of culverts and bridges would reduce the risk of failure of those

structures and would provide a benefit to water quality. The decommissioning of 12.5 miles of the 92V road system would reduce road density in the Elk and Middle Cow subwatersheds, which would reduce the sediment delivery potential in those watersheds. The removal of the 92V crossing on Elk Creek would be a benefit to water quality, due to the elimination of the sediment impacts to Elk Creek caused by the failure of this crossing.

Opening closed roads has the potential to generate increased sediment delivery from the use of those roads. The closed roads are in good condition and would be properly maintained during logging. Reopening roads to vehicles would contribute to soil compaction along the roads, leading to short-term increases in sediment production. However, only minimal amounts of increased sediment delivery would be expected from reopening existing roads. The post-harvest road closing/decommissioning would have a comparatively greater reduction of sediment delivery than any increases from opening closed roads.

Expected indirect effects of block area salvage and roadside salvage harvest is projected to be an 11 percent increase in sediment delivery above existing conditions (Table 4-4). Predicted increases would occur between 2 and 5 years following the Viveash Fire. The sediment delivery would have already decreased from the highest levels and predicted increases would delay the recovery of sediment delivery to pre-fire levels by less than one year (Figure 4-1).

Increases in sediment delivery do not include decreases in sediment delivery that are a result of road decommissioning or mitigation measures. Soil erosion would also decrease all harvest units as ground cover improves with the scattering of treetops, limbs, and unmerchantable wood. Furthermore, mitigation measures, monitored BMPs (particularly on sensitive landtypes), and reduced road densities would improve water quality. Therefore, the actual increases are expected to be significantly less than 11 percent.

BMPs would be implemented for all harvest units in all action alternatives, stream improvements, and new road construction (USDA Forest Service 1990, Appendix A). Appropriate BMPs would be identified in the field before project implementation. Implementation of any action alternative would include these BMPs, which would prevent a violation of the CWA, the Antidegradation Policy, or the Forest Plan.

BMP effectiveness would be monitored. This monitoring would consist of a feedback loop, which would begin with the design and application of appropriate BMPs. The second part of the loop would involve monitoring the effectiveness of the BMPs at protecting beneficial uses (i.e., the uses of water for any purpose from which benefits are derived such as for fisheries and domestic use). Where the beneficial uses are being affected because of ineffective BMPs or poor implementation, design modification of BMPs would be completed and monitoring continued. This modification closes the loop and the process continues with monitoring the redesigned BMPs.

The reduced road densities, low predicted increases in sediment delivery, no delay in recovery of sediment delivery, and specific mitigation measures designed to reduce sediment delivery to streams result in a low probability of generating noticeable or measurable effects from this alternative. Implementation of the mitigation measures and BMPs, and the effectiveness monitoring would ensure compliance with the CWA and Forest Plan. Therefore, the direct and indirect effects of

Alternative 2 on water quality in the Project Area would have a low probability of generating noticeable or measurable changes.

Cumulative Effects

Cumulative effects of Alternative 2 on water quality would result from the effects of salvage harvest and road projects, combined with the harvest activity on private land, and restoration activities on both private and national forest lands. Post-fire restoration activities on private land and rehabilitation activities on national forest land are predicted to continue to contribute to an improvement in water quality. The direct and indirect effects of this alternative are predicted to have a low probability of generating noticeable or measurable changes. Road improvements and decommissioning would likely contribute to the existing positive trend for water quality that is described in Alternative 1. Although harvesting may detract slightly from that trend, the overall cumulative effect would be maintaining the trend of water quality recovery in the Project Area. Therefore, the cumulative effects of this alternative would have a low probability of generating noticeable or measurable changes. The limited magnitude, duration, and intensity of direct and indirect water quality effects, together with the mitigating effects of the BMPs, would result in insignificant cumulative effects to water quality.

Alternative 3

Alternative 3 was developed to minimize the potentially negative impacts of timber harvesting on soil erosion and water quality in the Viveash Fire area, by spatially concentrating the harvesting in areas with lower soil erodibility and sediment delivery potential.

Direct and Indirect Effects

This alternative would result in reduced road density, from 2.6 mi/mi^2 to 2.3 mi/mi^2 for the entire Project Area and improve several stream crossings (Table 4-1). Sediment delivery resulting from existing roads would be lowered through reduction in road density. Road decommissioning would improve water quality from existing conditions. The direct and indirect results of these actions are discussed under Alternative 2.

Effects from harvesting would be similar to those discussed in Alternative 2, except that this alternative would not include block area salvaging on sensitive landtypes. Sediment delivery would increase to 7 percent above Alternative 1 (Table 4-1). Predicted increases would occur between 2 and 5 years following the Viveash Fire. Therefore, the sediment delivery would have already decreased from the highest levels and predicted increases would delay recovery of sediment delivery to pre-fire levels by less than 1 year (Figure 4-1).

The reduced road densities, low predicted increases in soil erosion, low sediment delivery rating in harvest areas, and specific mitigation measures designed to reduce sediment delivery to streams result in a low probability of generating noticeable or measurable effects from this alternative. The implementation of the mitigation measures and BMPs and effective monitoring would ensure compliance with the CWA. Therefore, the direct and indirect effects of Alternative 3 on water quality in the Project Area would have a low probability of generating noticeable or measurable changes.

Cumulative Effects

The cumulative effects of Alternative 3 on water quality would result from the effects of salvage harvest and road projects, combined with the harvest activity on private land, restoration activities on both private and national forest lands, and natural recovery of the ecosystem from the effects of the Viveash Fire. The post-fire restoration activities on private land and rehabilitation activities on national forest land are predicted to continue to contribute to an improvement in water quality. The direct and indirect effects of this alternative are predicted to have a low probability of generating noticeable or measurable changes. Road improvements and decommissioning would likely contribute to the existing positive trend for water quality described in Alternative 1. No block area salvaging would occur on sensitive landtypes. Although harvesting may detract slightly from that trend, the overall cumulative effect would be maintaining the trend of water quality recovery in the Project Area. Therefore, the cumulative effects of this alternative would have a low probability of generating noticeable or measurable changes. The limited magnitude, duration and intensity of direct and indirect water quality effects, together with the mitigating effects of the BMPs, would result in insignificant cumulative effects to water quality.

Alternative 4

Under Alternative 4, only roadside trees would be designated and removed. The proposed treatment area would not exceed 150 ft on either side of roads and trails. Approximately 2,600 acres of these trees would be removed under this alternative.

Direct and Indirect Effects

This alternative would result in reduced road density, from 2.6 mi/mi^2 to 2.3 mi/mi^2 for the entire Project Area, and improve several stream crossings (Table 4-4). Sediment delivery resulting from existing roads would be lowered through the reduction in road density. The direct and indirect results of these actions are discussed under Alternative 2.

This alternative includes only roadside salvage and would be expected to increase soil erosion by 2 percent above existing conditions (Table 4-4). Implementation of mitigation measures and BMPs and effectiveness of monitoring (particularly on sensitive landtypes) would offset this increase. The predicted increases would occur between 2 and 5 years following the Viveash Fire. Therefore, sediment delivery would have already decreased from the highest levels and predicted increases would delay recovery of sediment delivery to pre-fire levels by less than one year (Figure 4-1).

Reduced road densities, low predicted increases in soil erosion, low sediment delivery ratings, and specific mitigation measures designed to reduce sediment delivery to streams result in a low probability of generating noticeable or measurable effects from this alternative. The implementation of the mitigation measures and BMPs and effectiveness monitoring would ensure compliance with the CWA. Therefore, the direct and indirect effects of Alternative 4 on water quality in the Project Area would have a low probability of generating noticeable or measurable changes.

Cumulative Effects

The cumulative effects of Alternative 4 on water quality would result from the effects of salvage harvest and road projects, combined with the harvest activity on private land, restoration activities on both private and national forest lands, and natural recovery of the ecosystem from the effects of the Viveash Fire. Post-fire restoration activities on private land and rehabilitation activities on

national forest land are predicted to continue to contribute to an improvement in water quality. The direct and indirect effects of this alternative are predicted to have a low probability of generating noticeable or measurable changes. Road improvements and decommissioning would likely contribute to the existing positive trend for water quality described in Alternative 1. No block area salvaging would occur, and predicted sediment deliveries from roadside salvage harvesting are low. Although harvesting may detract slightly from that trend, the overall cumulative effect would be maintaining the trend of water quality recovery in the Project Area. Therefore, the cumulative effects of this alternative would have a low probability of generating noticeable or measurable changes. The limited magnitude, duration and intensity of direct and indirect water quality effects, together with the mitigating effects of the BMPs, would result in insignificant cumulative effects to water quality.

5.3.3 Transportation

A detailed Roads Analysis has been completed for the Project Area (Foster Wheeler Environmental 2001a). The following is a brief summary of the analysis as it relates to this EIS.

5.3.3.1 Alternative Comparison

Alternative 1—No Action

Direct, Indirect, and Cumulative Effects

Transportation System

Roads that are not necessary for ongoing management would remain closed. The poor alignment of the lower portions of FR 86 and FR 92 would not be changed, which will continue the degradation of abutting streams. The four major bridge structures would require significant yearly maintenance, including debris removal, and may have to be periodically closed to the public during flood events.

Traffic/Noise

Under this alternative, there would be no additional traffic in the Project Area that is related to harvesting activities. There would be no effects from noise, as there would be no logging trucks present. All roads in the Project Area are non-paved and offer dispersed road recreation. In the Project Area, Cow Creek is the only campground. The fire destroyed this campground, and there are plans to relocate it to the Manzanares area. Besides camping, the Project Area is used for fishing, family gatherings, hunting, and off-highway vehicle use, as well as for visual purposes (scenic driving).

Alternative 2—Forest Service Preferred Alternative

Direct, Indirect, and Cumulative Effects

Transportation System

After a comprehensive analysis of the transportation system, road management objectives were set for all roads in the Viveash Project Area other than those slated for decommissioning or obliteration. The transportation system would be substantially improved through the projects shown on Table 2-1. The road realignment and upgrade of culverts would reduce the continuing deterioration to the road system and subsequent maintenance. The continued deterioration of the road system would be slowed. Raising the standard of the public road portion of the system would stimulate increased road maintenance and operation budgets. This alternative would minimize difficult driving conditions in portions of the Project Area; however, drivers may still experience rough roads, periodic flood washouts, and poor directional signage within the Project Area.

Traffic/Noise

The removal of the 20 to 25 MMBF of sawtimber, vigas, and house logs would require a maximum of 5,556 logging truck trips, assuming 4,500 board ft per logging truck. An additional 6,667 small vehicle trips would be required to harvest the 5,000 to 10,000 cords located in the 1,100 acres of roadside salvage. The overall effects of the Proposed Action on traffic are not significant because the logging trucks would be required to operate during regular business hours, while at the same time avoiding peak traffic hours. The estimated number of daily trips by all logging vehicles is 16 trips. The effects on noise in the village of Pecos would be noticeable, and would be in compliance with the regulations of the village. Noise would not be a concern at night or on weekends or holidays because mitigation measures prohibit logtruck hauling from 7:00 p.m. to 7:00 a.m. weekdays and all hauling on weekends and holidays. Noise would further be mitigated by prohibiting the use of jakebrake type brakes.

With the implementation of mitigation measures identified in Section 2.5, noise effects would be minimized. Noise emanating from these vehicles on national forest land would be noticeable to those using the area for recreation. This noise effect is not long term, and would only affect the Viveash Project Area until the logging efforts are complete. The large number of personal vehicles utilized to take part in roadside salvage would result in a slight increase in noise effects when these vehicles travel through the village of Pecos.

The main intersection in the village of Pecos involves Highways 50 and 63. This intersection currently has a high traffic volume; therefore, the 16 logging trucks passing through each day would have a negligible effect.

Alternative 3

Direct, Indirect, and Cumulative Effects

Transportation System

The direct, indirect, and cumulative effects of this alternative would be similar to Alternative 2. This alternative would minimize difficult driving conditions in portions of the Project Area. However, drivers may still experience rough roads, periodic flood washouts, and poor directional signage within the Project Area.

Traffic/Noise

Over a 3- to 5-year period, the estimated output of wood products expected to be removed from 2,900 acres within the Project Area would be approximately 12 to 15 MMBF of sawtimber. This would require a maximum of 3,334 logging truck loads, based on 4,500 board ft per logging truck. There would be approximately 6,670 small vehicle loads to remove 10,000 cords of roadside salvage on the 2,000 acres deemed for this purpose. Alternative 3 has similar traffic effects as that of Alternative 2. There would be less of an effect from the large logging trucks; therefore, with the same amount of roadside salvage, the amount of daily vehicle trips would decrease from 16 to 13. The effects of noise from Alternative 3 would be less significant than that of Alternative 2 due to fewer logging trucks traveling through the village of Pecos. There would be noticeable noise from these trucks, yet it would be within noise standards for the village.

Alternative 4

Direct, Indirect, and Cumulative Effects

Transportation System

The direct, indirect, and cumulative effects of this alternative would be more significant than Alternative 1 and less significant than Alternatives 2 and 3. Several road improvement projects would be accomplished in Alternatives 2 and 3 (Table 2-1). This alternative would minimize difficult driving conditions in portions of the Project Area; however, drivers would still experience rough roads, periodic flood washouts, and poor directional signage within the Project Area.

Traffic/Noise

The proposed treatment area, 2,600 acres, would not exceed 150 ft on either side of roads. The trees that are felled would be left on site or removed as firewood, some through small commercial sales. Under this alternative, an estimated 10,000 cords of firewood would be the potential output of wood products over a 3- to 5-year period. The removal of wood products would require 6,667 small vehicle trips and a few large logging trucks. Under Alternative 4, there is a possibility for a significant amount of traffic due to all of the land that is available for roadside salvage. Without the use of large logging trucks, removing 10,000 cords of firewood would require 6,667 small vehicles. This noise levels for Alternative 4 would be less than that of the previous two alternatives due to small vehicles being utilized for removal rather than larger logging trucks.

5.3.4 Air Quality

Air quality concerns are defined as transitory reductions in air quality due to vehicle emissions generated from truck haul vehicles, equipment use, and dust.

5.3.4.1 Evaluation Criteria

The potential negative impact to the air quality of Class 1 airsheds with dust generated from vehicle traffic and equipment use was used as the basis from which each alternative was evaluated.

5.3.4.2 Alternative Comparison

Alternative 1—No Action

Direct, Indirect, and Cumulative Effects

There are no direct or indirect effects associated with implementing this alternative. The cumulative effects would be the lowest amount of vehicle traffic and equipment use that would generate dust. This alternative would have the lowest probability of degradation of the air quality in the Pecos Wilderness.

Alternative 2—Forest Service Preferred Alternative

Direct and Indirect Effects

The direct effects of implementing this alternative would include equipment and vehicle emissions from the onsite project work and dust particles generated from vehicular traffic over roadways. This alternative would have the highest total of vehicle traffic and equipment use. However, emissions would be of a transitory nature and only result in temporary degradation in air quality. Dust particles would be minimized through road maintenance by watering the road surfaces. Local winds would provide additional dispersal of dust and emissions. As a result, any impacts would still be well within air quality standards and would not impact the Class I airshed status of the Project Area.

Cumulative Effects

The cumulative effects of Alternative 2 would be the combination of local traffic, equipment use on private land, and dust generated from the salvage and road projects. This alternative would have the highest potential of the alternatives to degrade the air quality of the Pecos Wilderness. However, the air quality degradation that could occur would only have minor, short-term effects on the air quality of the Pecos Wilderness due to the watering of the roads and dispersal of dust by local winds and would not impact the Class I airshed status of the Project Area.

Alternative 3

Direct and Indirect Effects

This alternative would have direct and indirect effects similar to Alternative 2. However, there would be a lower probability of air quality degradation due to the smaller harvest area and subsequent fewer number of vehicles and equipment use.

Cumulative Effects

The cumulative effects would be similar to Alternative 2, but with a lower potential for minor, short-term effects on the air quality of the Pecos Wilderness.

Alternative 4

Direct and Indirect Effects

This alternative would have direct and indirect effects similar to Alternatives 2 and 3. However, there would be a lower probability of air quality degradation due to the smaller harvest area and subsequent fewer number of vehicles and equipment use.

Cumulative Effects

The cumulative effects would be similar to Alternatives 2 and 3, but with a lower potential for minor, short-term effects on the air quality of the Pecos Wilderness.

5.4 BIOLOGICAL RESOURCES

5.4.1 Fisheries and Aquatic Resources

5.4.1.1 Evaluation Criteria

Fish Habitat

There are no quantitative guidelines in the Forest Plan for in-stream fish habitat; however, the management direction identifies several goals, including the maintenance and enhancement of habitat for cold water fisheries, specifically Rio Grande cutthroat trout. In keeping with these goals, evaluation criteria for water quality that could impact fish habitat have been identified from the state of New Mexico's Standards for Interstate and Intrastate Surface Waters Antidegradation Policy and Implementation Plan (New Mexico Water Quality Control Commission 2000). These standards identify general parameters for water quality, such as bottom deposits, temperature, and turbidity for the state of New Mexico. They are presented and described in Section 3.2.1.1.

The primary concern for fish habitat and riparian ecosystems in the Project Area is the movement of sediment through the stream systems that results in impacts to fish and stream habitat. The evaluation criterion for fish habitat and aquatic life will be based on the results of the sediment yield

analysis in Section 4.3.2.2. The sediment yield analysis will be compared to the input parameters from the Viveash Fire for the perspective of additional impacts to the existing stream conditions.

Riparian Ecosystems

The Forest Plan outlines specific riparian standards on a forest-wide basis (Table 3-7). The standards were used to evaluate the potential effects of each action alternative based on available data. Cumulative effects evaluation criteria will be the area of riparian habitat affected and the nature of the effects. The analysis of effects will be qualitatively based, using available data, on how past or future actions on national forest or private lands would affect fish habitat and riparian ecosystems.

The alternative comparison will rely upon available data on road crossings and length, acres of timber harvest, riparian vegetation information, and soil loss input comparison data from the WEPP model.

5.4.1.2 Cumulative Effects Common to All Alternatives

Other management activities in the Project Area may have effects on fish populations and habitat. Some of these actions occur on private lands within the Project Area and others are foreseeable actions to be taken by the Pecos/Las Vegas Ranger District in the near future.

The construction and stocking of fish ponds on private land within the Project Area may have indirect effects on fish populations and fish habitat use. If the ponds are stocked with non-native fish, they may compete with the Rio Grande cutthroat trout if they were to escape from the ponds. This action would impact the success of the proposed re-introduction efforts planned by the Pecos/Las Vegas Ranger District in the near future.

5.4.1.3 Alternative Comparison

Alternative 1—No Action

Direct and Indirect Effects

Effects would include continued degradation of spawning habitat from runoff and sediment reaching the streams. Fine sediment inputs from surface erosion and road failures are known to have deleterious effects on fish species, including the Rio Grande cutthroat trout. Fine sediments affect egg incubation by coating egg surfaces or by clogging interstitial gravel spaces and reducing water flow (i.e., reduction in dissolved oxygen) or trapping emerging fry (Chapman 1988). Spawning gravels that contain more than 30 percent fines (less than 0.85 millimeter) are likely to have relatively low egg survival rates (< 10 percent) (Chapman 1988) and survival declines rapidly over an incremental increase of about 10 to 15 percent fines. The interstitial areas between cobbles and other substrate to small-sized substrate are important hiding places for fry during their initial rearing period. Larger-sized substrate (cobbles to boulders) are important for over-wintering juveniles. Fine sediment (especially sand-size particles) can reduce the available habitat during these periods by filling these interstitial spaces and by filling pools (Waters 1995, Bjornn and Reiser 1991).

Many macroinvertebrates are important prey for salmonids. Benthic macroinvertebrates (those that live on stream substrates) include insect larvae (mayflies, stoneflies, etc.), leeches, worms, snails, and other organisms. Fine sediment is known to negatively affect macroinvertebrate communities (May et al. 1997). Based upon the information from May et al., streams with fine sediment levels below 15 percent appear to provide suitable habitat for invertebrates, while levels above 20 percent appear to

provide poor conditions, and fine sediment levels between 15 to 20 percent appear to provide moderate conditions.

Under the No Action alternative (Alternative 1) there would be no increase in sediment delivery above existing post-fire conditions. However, there would be a continued high probability of sediment input from the lack of vegetation and topsoil that resulted from the wildfire.

Cumulative Effects

Actions taken in the fire rehabilitation effort, including channel stabilization, riparian restoration, and the Rio Grande cutthroat repopulation, would have beneficial effects on fish populations and habitat and riparian ecosystems.

Construction and stocking of fishponds on private land within the Project Area may have cumulative effects on fish populations and fish habitat use. If the ponds are stocked with non-native fish, they may compete with the Rio Grande cutthroat trout if they were to escape from the ponds. This would further delay the success of the Rio Grande cutthroat trout re-introduction and habitat improvement efforts.

Salvage harvest on private lands has likely generated some water quality degradation and potentially some fish habitat reductions. Those effects are likely localized in nature and would be difficult to distinguish from the effects of the Viveash Fire. The majority of salvage harvesting on private land has likely been completed and the effects from future activities would likely be short-term and temporary.

Alternative 2—Forest Service Preferred Alternative

Direct and Indirect Effects

The potential for direct and indirect effects to fish and aquatic habitat from Alternative 2 is measured in relation to potential for sediment input from the miles of road to be decommissioned, acres and types of timber harvested, and location of timber harvest on sensitive landtypes that would be more prone to erosion and sediment input. The type of effects from sediment on fish survival and habitat are described under Alternative 1, Direct and Indirect Effects.

The difference for comparison between alternatives also relates to the protection provided by streamside riparian buffers, acres and types of timber harvested, and potential for additional sediment above current conditions. Alternative 2 provides a 100- to 200-ft buffer on each side of perennial streams. An analysis of the potential impact of management activities with respect to water quality is presented in Section 4.2.2.2.

The primary effect of ground-based logging activities on fish habitat and riparian ecosystems would be in the form of additional sediment delivered to stream channels that could potentially affect fish habitat and spawning areas. The water quality analysis concluded that Alternative 2 would have a low probability of generating noticeable or measurable sediment increases in stream channels. Therefore, there would be a corresponding low probability of adverse effects to fish habitat due to sediment impacts for Alternative 2.

Cumulative Effects

The cumulative effects of Alternative 2 on fish habitat would result from the effects of salvage harvest and road projects, combined with the harvest activity on private land, restoration activities on both private and national forest lands, and the construction and stocking of fish ponds on private land with non-native fish. The post-fire restoration activities on private land and rehabilitation activities on national forest land are predicted to continue to contribute to an improvement in water quality and fish habitat. The direct and indirect effects of this alternative are predicted to have a low probability of generating noticeable or measurable changes. Road improvements and decommissioning would likely contribute to the existing positive trend for fish habitat described in Alternative 1. Although harvesting may detract slightly from that trend, the overall cumulative effect would be maintaining the trend of fish habitat recovery in the Project Area. Therefore, the cumulative effects of this alternative would be that Rio Grande cutthroat trout would likely be unaffected. This conclusion is based upon the direct and indirect effects discussed above, use of BMPs, evaluation of the magnitude and locations of the actions, and professional judgment.

Alternative 3

Direct and Indirect Effects

Direct and indirect effects from Alternative 3 are similar to those identified in Alternative 2. The differences in the resource protection measures between the two alternatives are in the width of the streamside buffers and the number and location of acres harvested. Alternative 3 provides a streamside buffer of 200 ft on each side for all perennial streams that are within the action area in Category 1 and 2 subwatersheds. In this alternative, there would be no block area salvage within Category 3 and 4 subwatersheds.

An analysis of the potential impact of management activities on water quality is presented in Section 4.3.2.2. The water quality analysis concluded that Alternative 3 would have a low probability of generating noticeable or measurable sediment increases in stream channels. Therefore, there would be a corresponding low probability of adverse effects on fish habitat due to sediment impacts for Alternative 3.

Cumulative Effects

The cumulative effects of Alternative 3 on fish habitat would result from the effects of salvage harvest and road projects, combined with the harvest activity on private land, restoration activities on both private and national forest lands, and construction and stocking of fishponds on private land with non-native fish. The post-fire restoration activities on private land and rehabilitation activities on national forest land are predicted to continue to contribute to an improvement in water quality and fish habitat. The direct and indirect effects of this alternative are predicted to have a low probability of generating noticeable or measurable changes. Road improvements and decommissioning would likely contribute to the existing positive trend for fish habitat described in Alternative 1. Although harvesting may detract slightly from that trend, the overall cumulative effect would be maintaining the trend of fish habitat recovery in the Project Area. Therefore, the cumulative effects of this alternative would be that Rio Grande cutthroat trout would likely be unaffected. This conclusion is based upon the direct and indirect effects discussed above, use of BMPs, evaluation of the magnitude and locations of the actions, and professional judgment. This alternative would have a lower potential for effect on fish habitat than Alternative 2.

Alternative 4

Direct and Indirect Effects

The direct and indirect effects for Alternative 4 are similar to those for Alternatives 2 and 3, except for the lack of block area salvage. As a result, the potential for adverse effects to fish populations would be lower for this alternative than the other action alternatives. An analysis of the potential impact of management activities with respect to water quality is contained in Section 4.3.2.2. The water quality analysis concluded that Alternative 4 would have a low probability of generating noticeable or measurable sediment increases in stream channels. Therefore, there would be a corresponding low probability of adverse effects to fish habitat due to sediment impacts for Alternative 4.

Cumulative Effects

The cumulative effects of Alternative 4 on fish habitat would result from the effects of salvage harvest and road projects, combined with the harvest activity on private land, restoration activities on both private and national forest lands, the construction and stocking of fishponds on private land with non-native fish, and natural recovery of the ecosystem from the effects of the Viveash Fire. The post-fire restoration activities on private land and rehabilitation activities on national forest land are predicted to continue to contribute to an improvement in water quality and fish habitat. The direct and indirect effects of this alternative are predicted to have a low probability of generating noticeable or measurable changes. Road improvements and decommissioning would likely contribute to the existing positive trend for fish habitat described in Alternative 1. Although harvesting may detract slightly from that trend, the overall cumulative effect would be maintaining the trend of fish habitat recovery in the Project Area. Therefore, the cumulative effects of this alternative would be that Rio Grande cutthroat trout would likely be unaffected. This conclusion is based upon the direct and indirect effects discussed above, use of BMPs, evaluation of the magnitude and locations of the actions, and professional judgment. This alternative would have the lowest potential for effect on fish habitat of the action alternatives.

5.4.2 Forest Vegetation

5.4.2.1 Introduction

This section describes the direct, indirect, and cumulative effects of implementing the action alternatives on forest vegetation. The forest-wide and management area directions, goals, standards, and guidelines in the Forest Plan have been reviewed and would be met for all action alternatives. The alternatives considered would conform to all current management directions for national forest land.

Fire is a natural disturbance that initiates change and affects the vegetation composition, structure, and landscape pattern. Wildland fire effects on flora include plant mortality, vegetative regeneration (i.e., aspen, and other sprouters), seedling establishment, and others. The Viveash Fire has altered the pre-fire forest structure and landscape pattern.

Timber harvesting and fire disturbances have varying potential impacts on forest vegetation composition and stand structure. With the exclusion of forest fire, species that are stimulated by fire, such as aspen, would encounter declined regeneration and decrease in their spatial extent. Even-aged silviculture would create single-storied stand structure, and uneven-aged treatments would develop

two- or multi-storied stands. In structural classification of forest vegetation, the stand structure is usually defined using tree size (diameter and/or height) and density (canopy cover, basal area, or tree per unit area) classes. Other structural components include snags and downed wood. The forest cover types define vegetation composition. Timber salvage and reforestation has potential direct and indirect effects on forest vegetation.

5.4.2.2 Evaluation Criteria

For this EIS, the evaluation criterion for forest vegetation is the potential change in forest structure. Evaluation of effects for the alternatives consists of qualitative descriptions of forest vegetation trends and resulting forest structure. Forest species composition would not be altered, although forest structure (snags, downed logs) would be altered by removal of dead trees.

5.4.2.3 Alternative Comparison

Alternative 1—No Action

Under Alternative 1 (No Action), no proposed activities would be implemented in the Project Area. Forest recovery would occur through natural processes for all areas that are affected by the Viveash Fire.

Direct, Indirect, and Cumulative Effects

Since the Project Area would be allowed to recover naturally with no new management actions started, there would be no direct effects on forest vegetation structure. Overall, the forest vegetation structure would follow pathways of forest development that resemble ecosystems impacted by wildland fires. There would be a shift in forest vegetation type as a result of increased regeneration of species such as aspen that are dependent on fire disturbance. Based upon field observations in spring 2001, aspen are regenerating vigorously in stands previously dominated by conifers. The Forest Service is directed to encourage aspen regeneration (Forest Plan), so there will be a larger area of aspen stands in the future.

The vertical forest structure is currently dominated by snags created by the Viveash Fire. Current snag densities range from 449/acre in ponderosa pine to 717/acre in Douglas-fir (USDA Forest Service 2000a). Approximately 10 to 15 percent of the standing snags would be on the ground by post-fire year 5 and approximately 90 to 95 percent of the snags would be on the ground by post-fire year 15 (Keen 1929 and Greenlee 2000). Therefore, snag densities would range from approximately 22/acre to 72/acre in 2015.

There would be no change in current trends regarding forest structure on the landscape. The ongoing management actions implemented on the national forest land would contribute towards rehabilitation and enhancement of resource conditions affected by the Viveash Fire.

Alternative 2—Forest Service Preferred Alternative

Direct, Indirect, and Cumulative Effects

Under this alternative, salvage timber harvest would only remove standing fire-killed trees from areas of high- and moderate-burn severity. The salvage harvest would alter the forest structure by reducing the number of snags. The forest canopy cover has been modified by the catastrophic wildfire, with opened forest structure and a future potential for downed logs characterizing the post-

fire conditions. Snags would be left at a density of 4 to 6 stems per acre and downed dead wood would be retained under this alternative. This meets Forest Plan standards for snags.

The vertical forest structure is currently dominated by snags created by the Viveash Fire. Current snags densities range from 449/acre in ponderosa pine to 717/acre in Douglas-fir (USDA Forest Service 2000a). Salvage of 40 to 80 percent of the fire-killed trees on 6,700 acres of the 29,000 acres that were burned in the Viveash Fire. Therefore, post-salvage snag densities would range from 90 to 430/acre in the salvaged areas. Approximately 10–15 percent of the standing snags would be on the ground by post-fire year 5 and approximately 90–95 percent of the snags would be on the ground by post-fire year 15 (Keen 1929 and Greenlee 2000). Therefore, snag densities in the salvaged areas would range from approximately 5/acre to 43/acre in 2015.

Road relocation and roadside salvage activities would not have direct, indirect, or cumulative effects associated with forest composition and structure because of their small area. Salvaging on private land has reduced the number of snags, and the salvage activities on national forest lands under this alternative would not significantly alter the landscape structure that currently exists within the Project Area. The natural-caused landscape pattern would undergo the pathways for forest development starting with even-aged forest structure. Snag and downed dead wood standards in the Forest Plan would be met even after many snags have fallen down 15 years after the Viveash Fire. Therefore, the direct, indirect, and cumulative effects of this alternative on forest structure are expected to be minor.

Alternative 3

Under Alternative 3, approximately 2,900 acres would be treated for timber salvage, fuelwood, and specialty wood products harvest. Roadside salvage would occur on approximately 2,100 acres located within 150 ft along all existing forest roads. Effects of the activities on forest structure under Alternative 3 are similar to Alternative 2, but occur over a smaller area. Therefore, the direct, indirect, and cumulative effects of this alternative on forest structure are expected to be minor.

Alternative 4

Under Alternative 4, removal of roadside trees for fuelwood, specialty wood products, and small salvage sales would occur on approximately 2,600 acres located 150 ft on each side of all existing forest roads. Effects of the activities on forest structure under Alternative 4 are similar to Alternative 2, but occur over a smaller area. Therefore, the direct, indirect, and cumulative effects of this alternative on forest structure are expected to be minor.

5.4.3 Terrestrial Wildlife

5.4.3.1 Introduction

This section describes the environmental effects of the alternatives on terrestrial wildlife. Applicable forest-wide and management area directions outlined in the Forest Plan were reviewed to determine conformance of alternatives to established goals, standards, and guidelines for management of national forest land.

5.4.3.2 Regulatory and Other Direction

Current management direction on desired conditions for selected wildlife on the national forest land are included in the National Forest Management Act of 1976 (NFMA), Endangered Species Act (ESA), Migratory Bird Treaty Act (MTBA), Forest Service Manual (FSM), Forest Plan (USDA Forest Service 1987), species-specific recovery plans, species management plans or conservation strategies, and the Regional Forester's policy and management directions.

5.4.3.3 Evaluation Criteria

The evaluation of effects uses a qualitative approach. Topics of concern identified that are based on management direction for national forest land include the protection of threatened, endangered, sensitive, and/or MIS and associated suitable habitat. Suitable habitat for these species and the way it is affected by the alternatives will be used as the qualitative evaluation criteria.

Threatened, Endangered, Sensitive, and Management Indicator Species

Direct, Indirect, and Cumulative Effects

This EIS provides an evaluation of effects on threatened, endangered, sensitive, and/or MIS for the implementation of the alternatives. Effects criteria for the selected wildlife species include the following:

- Are any threatened, endangered, or proposed species present in the action areas?
- Are the alternatives likely to cause a trend toward federal listing of the USFS's sensitive species due to a critical decline in existing populations of sensitive species?
- Do any alternatives adversely affect migratory bird species, the USFS's management indicator species, or species habitat indicators for featured game and non-game species?

Detailed analysis of federally threatened or endangered species can be found in the BA, and a detailed analysis of the USFS's sensitive species can be found in the BE. The Migratory Bird and Management Indicator Species analysis can be found in the Project Record. This EIS presents a summary of information found in these documents.

5.4.3.4 Alternative Comparison

A preliminary screening of terrestrial species was conducted in Section 3.2.3 to identify species to be included in this effects analysis. These species are presented in Chapter 3, Tables 3-13, 3-14, 3-15, and 3-16. Wildlife species that are known or likely to occur in the Project Area were considered in further detail and addressed in this effects analysis. Other species that were determined to have low probability of occurrence in the Project Area were not considered further. The only species listed as threatened or endangered that was determined to occur or potentially occur in the Project Area is the Mexican spotted owl. While the American peregrine falcon was listed in Table 3-15 as potentially occurring on the Santa Fe National Forest, this species has no known active nest sites nor has it been observed in the Project Area. It is thus dropped from further analysis here. The Mexican spotted owl, a management indicator and federally threatened species, is covered in more detail in the BA.

Threatened, Endangered, and Sensitive Species

Mexican Spotted Owl (Federally Threatened)

Alternative 1—No Action

Direct, Indirect, and Cumulative Effects

Direct and indirect effects include the potential impacts on individuals of a species or the loss of suitable habitats. Continued post-fire effects would be expected under Alternative 1 (See Section 3.2.3.1). The Viveash Fire modified the forested landscape and the post-fire condition can be characterized as open grasslands and early seral forest. The forest condition has created a large expanse of unsuitable habitat for the Mexican spotted owl, a species closely associated with closed-canopy late successional forests. Aspen regeneration is occurring in areas previously dominated by conifers, which results in larger aspen stands than pre-fire conditions. This will cause a shift in habitat that may not be as desirable for late successional species, such as the Mexican spotted owl. Prey species population for the Mexican spotted owl is anticipated to increase in the short term within the post-fire landscape.

Alternative 2—Forest Service Preferred Alternative

Direct, Indirect, and Cumulative Effects

The Recovery Plan for the Mexican spotted owl (U.S. Fish and Wildlife Service 1995) sets forth the management direction of the salvage of PACs that are affected by stand-replacement fires. In brief, this document states that in the case of stand-replacement fires within a PAC, timber salvage plans must be evaluated on a case-specific basis. Surveys following specific guidelines must be conducted to determine the presence of Mexican spotted owls within the burned PAC(s). If no owls are detected during the surveys, then ESA Section 7 consultation should be used to evaluate the proposed salvage plans. Further, the Recovery Plan states that it advocates the following philosophies for the use of salvage logging:

- No management activities should be undertaken that do not protect soil integrity.
- Actions should not be done that impede the natural recovery of disturbed systems.
- Salvage activities should maintain and enhance native species and natural recovery processes.

Further, any salvage should leave residual snags and logs at levels and size distributions that emulate those following pre-settlement, stand-replacement fires.

The salvage areas overlap designated spotted owl PACs in the Project Area. In general, salvage logging would be modifying already unsuitable or marginal habitat created by the catastrophic wildfire. The Viveash Fire left a landscape pattern with a mosaic of moderate-/high-burn severity and low-burn severity/unburned areas in the Project Area. The loss of closed-canopy, tree-dominated habitats on national forest land and adjacent private land has had an impact on the distribution of nesting/roosting habitats preferred by the Mexican spotted owls. The management actions in the Proposed Action include the removal of fire-killed trees. Reforestation in the burned areas would contribute positively to Mexican spotted owl habitat by developing desired forest conditions in the future. Streamside areas may provide some level of habitat connectivity at the landscape-level by retaining what is left of the tree-dominated riparian areas that were not burned by the Viveash Fire.

No logging activities are planned in the Cow Creek/Lower Cow and Creek/Upper Cow Mexican spotted owl PACs. Activities within the ¼-mile PAC buffer would be conducted outside the breeding season, with LOPs from March 1 through August 31. Further, no salvage logging would take place on any slopes greater than 35 percent. Mexican spotted owl habitat includes slopes greater than 40 percent in mixed-conifer forest that has not been harvested in more than 20 years. All PACs, with the exception of the Rosilla/Elk/Middle Cow PAC, would be surveyed during the 2002 breeding season prior to project implementation. As stated earlier, surveys were conducted in all four affected PACs in 2001. In the event that Mexican spotted owls are located, all applicable mitigation measures would be implemented. This procedure is in compliance with the Mexican spotted owl Recovery Plan protocol (U.S. Fish and Wildlife Service 1995), in that no more than one breeding season would have elapsed since the last survey and the action. Therefore, the activities associated with Alternative 2 including Murphy's land access, the Road 86 realignment, and the Tapia's private land access may affect, but not likely adversely affect, the Mexican spotted owl.

The cumulative effects of Alternative 2 on the Mexican spotted owl include activities on private land combined with the salvage and road projects. Activities on private land may have had an effect. The cumulative effects of Alternative 2 may affect, but not likely adversely affect, the Mexican spotted owl.

Detailed effects analysis for the Mexican spotted owl is provided in the BA and addendum to the BA.

Alternative 3

Direct, Indirect, and Cumulative Effects

The direct and indirect effects of Alternative 3 are similar to Alternative 2. This alternative is not likely to adversely affect the Mexican spotted owl. The cumulative effects associated with Alternative 3 are similar to Alternative 2.

Alternative 4

Direct, Indirect, and Cumulative Effects

The direct and indirect effects of Alternative 4 are similar to Alternative 2, although fewer acres would be treated in Alternatives 4 than Alternative 2. This alternative is not likely to adversely affect the Mexican spotted owl. The cumulative effects associated with Alternative 4 are similar to Alternative 2.

Northern Goshawk (Forest Service Sensitive Species)

Alternative 1—No Action

Direct, Indirect, and Cumulative Effects

Based on historic occurrences, four designated northern goshawk PFAs are located within the Project Area. Similar to the Mexican spotted owl, the northern goshawk is closely associated with closed-canopy late successional forests. As a result of the catastrophic wildfire, open-grassland/early seral forests dominate the landscape and the existing forest condition provides mostly unsuitable habitat for the northern goshawk. Prey species populations for the northern goshawk are anticipated to increase in the short term within the post-fire landscape. The northern goshawk is discussed in further detail in the BE.

Alternative 2—Forest Service Preferred Alternative

Direct, Indirect, and Cumulative Effects

The determination of effects in the BE concluded that Alternative 2 would not likely adversely affect the northern goshawk. No salvage activity is planned in the currently active northern goshawk PFA (Manzanaraes). The Alternative 2 activities would not take place within ¼ mile of the occupied Manzanares PFA during the breeding season months of March through September.

Management activities on national forest land within the Project Area and on adjacent private land, could cause incremental loss of suitable nesting habitat, such as closed-canopy forest with large trees. However, the Proposed Action would remove fire-killed trees with altered canopy structure. Reforestation (natural regeneration and/or tree planting) in the burned areas would contribute positively to northern goshawk habitat by developing the desired stand structure and canopy cover.

The cumulative effects analysis of Alternative 2 on the northern goshawk includes evaluating activities on private land combined with the salvage and road projects. Activities on private land may have occurred within designated PFAs; however, salvage and road projects proposed in Alternative 2 would not contribute cumulative effects. The cumulative effects of Alternative 2 may affect, but not likely adversely affect, the northern goshawk.

Alternative 3

Direct, Indirect, and Cumulative Effects

The direct and indirect effects of Alternative 3 are similar to Alternative 2. This alternative is not likely to adversely affect the Mexican spotted owl. The cumulative effects associated with Alternative 3 are similar to Alternative 2.

Alternative 4

Direct, Indirect, and Cumulative Effects

The direct and indirect effects of Alternative 4 are similar to Alternative 2, although the acres to be treated in Alternatives 4 are less than Alternative 2. This alternative is not likely to adversely affect the northern goshawk. The cumulative effects associated with Alternative 4 are similar to Alternative 2.

New Mexican (Meadow) Jumping Mouse (Forest Service Sensitive Species)

All Alternatives

Direct, Indirect, and Cumulative Effects

No direct and indirect effects would occur to the New Mexican (meadow) jumping mouse or its habitat under any of the proposed alternatives. This sensitive species is associated with moist meadows or riparian habitats. Under the proposed action alternatives and road management activities, riparian and meadow area protection would avoid or minimize potential impacts to habitats of the New Mexican (meadow) jumping mouse as activities under these alternatives would not take place in suitable habitat for this species.

The cumulative effects analysis for these alternatives on the New Mexican (meadow) jumping mouse includes evaluating activities on private land combined with the salvage and road projects. Activities on private land may have occurred within suitable jumping mouse habitat; however, the salvage and road projects proposed in Alternative 2 would not contribute adverse cumulative effects. Burn area

rehabilitation activities that are expected to occur within or near the Project Area would create more favorable conditions for healthy jumping mouse populations. This alternative would not affect New Mexican (meadow) jumping mouse habitat because of the streamside riparian protection areas, and equipment exclusion zones for all wet meadows and springs. Therefore, there would be minimal cumulative effects to the New Mexican (meadow) jumping mouse and likely a positive trend in the long-term as riparian areas recover from the effects of the Viveash Fire.

Migratory Bird Species

All Alternatives

Direct, Indirect, and Cumulative Effects

The effects on migratory birds were analyzed by evaluating the New Mexico Partners in Flight Species of Highest Priority for each habitat type found in the Project Area. Species that may potentially occur in the Project Area are listed in Chapter 3, Table 3-14. The nationwide list of Important Bird Areas was evaluated, and the Viveash Project Area is not on the list. It was also assessed for its potential as an important overwintering area. Due to its relatively high elevation and lack of large water bodies, it is not an important overwintering area. For short periods, the salvage and road management activities could disturb migratory birds during operations. However, the noise and visual disturbance would not be expected to have long-term effects on these bird species. They would avoid the areas of disturbance temporarily, then return to these areas or move to other areas. Thus, none of these alternatives would have adverse effects on migratory birds.

Management Indicator Species

As described in Chapter 3, there are five MIS that have potential habitat and/or occurrence within the Project Area: Mexican spotted owl, Rio Grande cutthroat trout, Merriam's turkey, mourning dove, hairy woodpecker, and Rocky Mountain elk. Effects to the Mexican spotted owl and the Rio Grande cutthroat trout have been previously described under the Fisheries and Aquatic Resources and Threatened, Endangered, and Sensitive Species sections (respectively) and will not be repeated in this section.

Alternative 1—No Action

Direct, Indirect, and Cumulative Effects

No adverse effects would occur to populations or habitat for the following MIS species: Merriam's turkey, Rocky Mountain elk, hairy woodpecker, or mourning dove. Habitat for these species would be unaltered. The amount and quality of habitat for these species would not change from current conditions. Some populations are expected to change as a result of the effects of the fire and subsequent recovery. Populations of turkey, elk, and mourning dove should respond positively to the increase in herbaceous vegetation. Woodpecker populations may respond to increased snag densities.

Alternatives 2, 3, and 4

Direct, Indirect, and Cumulative Effects.

Effects to Merriam's turkey, Rocky Mountain elk, hairy woodpecker, and mourning dove under all proposed action alternatives are analyzed together in this section.

These species (and associated wildlife species) would be subject to disturbance and/or displacement for the short duration that activities would be implemented. These species would be expected to avoid areas where logging or road work is occurring, then return to those areas following implementation. The effects of disturbance would not likely be measurable above normal population fluctuations that occur from year to year. Disturbance effects would be slightly less for Alternatives 3 and 4, as compared to Alternative 2, due to the fewer number of acres treated in those alternatives (Table 4-5). For all action alternatives, over the long term, the reduced road density would decrease the disturbance associated with road use.

Table 4-5. Percentage of Habitat Affected by Action Alternatives

Species	Percent of Forest Habitat Affected (%)*
Merriam's turkey	0.5
Mourning dove	0.2
Hairy woodpecker	0.7
Rocky Mountain elk	0.4

* Based on the maximum acreage affected by salvage harvest activities and road construction or reconstruction under the action alternatives, compared to the total acres of habitat for that species in the Santa Fe National Forest (from 2002 Forest Assessment of MIS).

Harvesting dead trees would not significantly alter the habitat for the turkey, dove, or elk, since these species do not depend on an abundance of dead trees. Therefore, none of the alternatives would be likely to influence the overall population status, viability, or trend of these species. No adverse impacts to these species would be anticipated. Further, given the minimal, short-duration nature of direct or indirect effects expected, even when adding normal levels of disturbance from other management activities, rehabilitation activities, recreational activities, and private land uses in the area, cumulative effects would be expected to be minimal. Refer to Santa Fe National Forest's Assessment of MIS (USDA Forest Service 2002) for detailed descriptions of monitoring results, habitat, population viability and trends for the turkey, dove, and elk.

The hairy woodpecker would be similarly affected by short-duration noise disturbance and may be temporarily displaced as a result. However, no adverse or long-term impacts would be expected from harvesting a portion of the dead trees in the area and implementing the road improvement activities. The number of snags that would remain in the area after the salvage harvest is completed would b significantly higher than pre-fire levels. Over 20,000 acres of the 29,000-acre burn area would not be harvested. A study of cavity dependent species was done following a wildfire in Idaho (Saab and Dudley 1998). This study analyzed the responses of nine cavity nesting birds following stand replacement fires in the ponderosa pine/Douglas-fir habitat type. It compared unlogged areas to a standard salvage treatment and wildlife salvage treatment. It assessed the number of woodpecker species including the hairy woodpecker. There was no statistical difference in the relative abundance of nests between the various treatment types. Thus, the direct, indirect, and cumulative effects on the hairy woodpecker would not differ overall from the effects described for other species above.

5.4.4 Range

There are five range allotments within the Project Area. Portions of all of the allotments were burned in the Viveash Fire. The burned areas have been converted from forest to grassland, which

should produce more quality forage for cattle. Salvage activities would only have temporary effects on grazing allotments during salvaging. The cattle would be dispersed to other portions of the allotment during salvage activities. The allotments are quite large for the number of cattle that are permitted, which restrict them to one portion of the allotment. Once the dead trees fall down they may become a barrier for grazing. The salvage activities would reduce the dead trees that would potentially be barriers for grazing and therefore may have a long-term benefit of increasing area available for grazing. The cumulative effects of the salvage harvest and road building combined with activities on private land would be a temporary minor effect. This would restrict the ability to utilize some portions of the allotment during salvage activities. Range improvement projects have and will continue to be done as part of the fire rehabilitation efforts.

5.4.5 Fire and Fuels

The concern evaluated for the fire and fuels analysis is fuel loading in the Project Area. Fuel loads over time may build to levels that would substantially increase the risk fire within the Project Area. The risk of future fires is assumed to be directly correlated to the amount of fuel available. However, the actual fire risk would include an evaluation of the fuel complex, including green fuel and vertical continuity of the fuel. The evaluation of the future fuel complex is too speculative at this time and is not included in this analysis.

5.4.5.1 Evaluation Criteria

The evaluation criteria used to evaluate the effects of each alternative include the following:

- The percentage of the Viveash Fire area that would have reduced fuel loading in the future
- Estimated fuel loading

5.4.5.2 Alternative Comparison

Alternative 1—No Action

This alternative would have no direct or indirect effects on fire and fuels. Cumulative effects include rehabilitation efforts by the Forest Service and activities on private land. Some fuel reduction has occurred or would occur on private land due to salvage harvesting. Dead trees would fall over time increasing the volume of down and dead material on the forest floor.

Total fuel loads would be expected to increase beyond pre-fire levels by approximately 58 and 68 tons per acre. Based upon best professional judgment by local fire management personnel, it is estimated the pre-fire fuel loads varied between approximately 17 and 25 tons per acre (Archaleta 2001). Therefore, the total fuel load in 2015 would be between approximately 75 and 93 tons per acre. Fuel loads have been reduced on some private land through salvage harvesting. The cumulative effects expected over time would be to increase the fuel loading over pre-fire conditions before 2015 on the majority of the 29,000 acres of the Viveash Fire.

Alternative 2—Forest Service Preferred Alternative

Direct and Indirect Effects

The direct effects of implementing this alternative would be the removal of fire-killed trees from 5,600 acres of moderate- and high-intensity burn areas and 1,100 acres of roadside salvage. These

actions would increase the accumulation of dead material on the ground in the short term but reduce it in the long term. Downed logs would be left to meet wildlife habitat requirements and soil/water course protection from surface erosion. Fuel loads would decrease to approximately 3 to 5 tons per acre in the salvage areas that make up 23 percent of the Viveash Fire area.

Because 40 to 80 percent of the fire-killed trees would be removed in block salvage areas, the predicted fuel load increases would be less than those predicted for Alternative 1. The increased fuel loading in 2005 would be a build-up of between approximately 2 and 5 tons/acre in the pine type, approximately 2 to 6 tons/acre in the mixed-conifer type, and approximately 2 and 6 tons/acre in the spruce-fir type. The increased fuel loading in 2015 would be a build-up of between approximately 11 and 33 tons/acre in the pine type, approximately 12 and 37 tons/acre in the mixed-conifer type, and approximately 13 and 39 tons/acre in the spruce-fir type.

Cumulative Effects

Total fuel loads would be expected to increase beyond post-salvage levels by approximately 33 and 39 tons per acre. Therefore, total fuel load in 2015 would be between approximately 36 and 44 tons per acre. Fuel loads have been reduced on some private land through salvage harvesting. The cumulative effects expected over time would be to decrease the fuel loading compared to Alternative 1 on 6,700 acres of the Project Area.

Alternative 3

Direct and Indirect Effects

This alternative would have direct and indirect effects similar to Alternative 2 on 4,900 acres of the Viveash Fire area.

Cumulative Effects

Total fuel loads would be expected to increase beyond post-salvage levels by between approximately 33 and 39 tons per acre. Therefore, the total fuel load in 2015 would be between approximately 36 and 44 tons per acre. Fuel loads have been reduced on some private land through salvage harvesting. The cumulative effects expected over time would be to decrease the fuel loading compared to Alternative 1 on 4,900 acres of the Project Area.

Alternative 4

Direct and Indirect Effects

This alternative would have direct and indirect effects similar to Alternative 2 on 2,600 acres of the Viveash Fire area.

Cumulative Effects

Total fuel loads would be expected to increase beyond post-salvage levels by between approximately 33 and 39 tons per acre. Therefore, the total fuel load in 2015 would be between approximately 36 and 44 tons per acre. Fuel loads have been reduced on some private land through salvage harvesting. The cumulative effects expected over time would be to decrease the fuel loading compared to Alternative 1 on 2,600 acres of the Project Area.

5.4.6 Noxious Weeds

Noxious weeds may have become established in the fire area during the fire-fighting operation and post-fire seeding. To ensure that weed populations do not become established in the near future, the Forest Service has committed to a noxious weed survey of the entire Project Area, the implementation of weed eradication programs, and long-term monitoring of the Project Area. Any treated weed infestation sites would be resurveyed to ensure that all the weeds have been eliminated and the site is no longer a potential source for the distribution of weed seeds in the Project Area. Equipment used in the salvage and road projects and seed mixtures used in seeding could convey noxious weed seeds.

5.4.6.1 Alternative Comparison

Alternative 1—No Action

Alternative 1 would have no direct or indirect effects on noxious weeds. Under this alternative, current noxious weed conditions may continue. Noxious weeds may occur on private land in the area and could be spread to national forest land. Noxious weed seeds could also be spread through private and administrative vehicle traffic through the area. The implementation of the eradication and monitoring program discussed above would minimize the spread or reduce the existing extent of noxious weeds in the Project Area. If the eradication and monitoring program is particularly effective, the noxious weed populations may trend downward.

Alternative 2—Forest Service Preferred Alternative

Equipment and vehicles used for salvage and road activities could transport noxious weed seeds into the Project Area. Seed mixtures used in seeding could also introduce noxious weed seeds. Additionally, existing areas of noxious weeds, if disturbed, could spread or serve as a seed source during salvage or road activities. Alternative 2 would salvage the largest area, 6,700 acres, of the action alternatives and therefore, would have the highest risk of noxious weed introduction and spread.

All equipment entering the Project Area would be required to be thoroughly cleaned and free of weed seeds before entering the Project Area, and only certified weed-free seed mixtures would be utilized in revegetation operations. These mitigation measures would ensure that there would be a low risk of noxious weed introduction and spread for this alternative. The cumulative effects of this alternative include the existing eradication and monitoring program and some unknown populations of noxious weeds on private land, combined with the direct and indirect effects. The cumulative effects of this alternative would result in a low risk of noxious weed introduction and spread in the Project Area. This conclusion is supported by the existing eradication and monitoring program and the proposed mitigations.

Alternative 3

The direct, indirect, and cumulative effects of Alternative 3 on the introduction and spread of noxious weeds are similar to those presented for Alternative 2. Alternative 3 would have a lower risk of introduction and spread of noxious weeds than Alternative 2 due to the smaller area of salvage, 4,900 acres. The cumulative effects of this alternative would result in a low risk of noxious weed introduction and spread in the Project Area. This conclusion is supported by the existing eradication and monitoring program and the proposed mitigations.

Alternative 4

The direct, indirect, and cumulative effects of Alternative 4 on the introduction and spread of noxious weeds are similar to those presented for Alternative 2. Alternative 4 would have a lower risk of introduction and spread of noxious weeds than Alternatives 2 and 3 due to the smaller area of salvage. The cumulative effects of this alternative would result in a low risk of noxious weed introduction and spread in the Project Area. This conclusion is supported by the existing eradication and monitoring program and the proposed mitigations.

5.4.7 Sensitive Plants

This section describes the environmental effects on sensitive plants, including federally and state listed threatened or endangered species and USFS Region 3 sensitive species. Based on Section 3.2.7, only state endangered and USFS Region 3 sensitive species are known to occur within the Project Area. The only federal endangered plant species (Holy Ghost ipomopsis), has never been documented outside of Holy Ghost Canyon, which is outside the Project Area. Therefore, it is not analyzed in this effects analysis. The state endangered and USFS Region 3 sensitive plant species will be referred to as "sensitive plant species" in this analysis.

5.4.7.1 Evaluation Criteria

The evaluation criteria for direct effects to sensitive plant species will be the disturbance or destruction of known sensitive plant species populations or potential habitat by the harvesting activities. The evaluation criteria for indirect effects to sensitive plant species will be damage to sensitive plant species populations resulting from sedimentation or microhabitat changes.

5.4.7.2 Alternative Comparison

Alternative 1—No Action

Under Alternative 1, no proposed activities would be implemented in the Project Area. Therefore, no direct or indirect effects would occur to sensitive plants. Long-term effects from Alternative 1 include the potential for an overall decline in riparian dependent species and sensitive plant habitat along Willow Creek and Rito Manzanares. Road relocation projects that move roads out of riparian areas would provide a benefit for riparian dependent species. The road relocation projects proposed in the action alternatives for Willow Creek and Rito Manzanares would reduce road-related erosion and subsequent effects. Since these projects would not be completed in Alternative 1, there may be cumulative effects on riparian dependent species such as the Chiricahua dock (a riparian plant species) from road-related erosion along Willow Creek and Rito Manzanares.

Alternative 2—Forest Service Preferred Alternative

Direct and Indirect Effects

Under this alternative, there are no direct and indirect effects to the golden lady slipper, Pecos fleabane, or Chiricahua dock. However, the proposed road realignments could potentially directly impact previously undocumented populations of golden lady slipper, Pecos fleabane, or Chiricahua dock. The alignments of these roads would be subject to a ground survey prior to construction. Any populations of golden lady slipper, Chiricahua dock, or Pecos fleabane that are discovered would be flagged and if practical, avoided by realigning the proposed road route. Indirect effects to these species could occur if the new road alignments result in changes in microhabitat conditions of populations that are adjacent to the road. Alignment shifts would take into consideration

microhabitat conditions and avoid such impacts. In addition to potential effects from road realignment, the replacement of bridges and culverts in the Project Area could also directly and indirectly affect Chiricahua dock habitat. All bridge and culvert replacement sites would be surveyed prior to construction. Any populations of Chiricahua dock found in these areas would be avoided.

Road relocation projects that move roads out of riparian areas would provide a benefit for riparian dependent species. The road relocation projects for Willow Creek and Rito Manzanares would reduce road-related erosion and subsequent effects. These road relocation projects would provide a positive long-term effect on riparian dependent species such as the Chiricahua dock by reducing road-related erosion along Willow Creek and Rito Manzanares.

The Pecos fleabane has been documented on top of Elk Mountain near the radio towers at the northern end of the Viveash Fire area. Aside from these known populations, this species is likely to occur in the higher meadow portions of the Project Area, which were not burned by the catastrophic wildfire. There are no project activities that would occur within known population sites or potential habitat for this species. A 100- to 200-ft-wide streamside protection zone for riparian areas and equipment exclusion zones for all meadows and springs would protect suitable habitat for this species. Harvesting and hazard trees felled along the edges of known Pecos fleabane populations or suitable habitat would be directed away from the specific known site. Thus, the proposed action would not effect the existing population distribution of the species in the Project Area. The Pecos fleabane would not be subject to direct or indirect effects.

With the proposed mitigation measures, Alternative 2 activities would have no direct or indirect effect upon known populations of sensitive plants species. This conclusion is supported by the survey and avoidance required before project activities would take place in known or suspected sensitive plant habitat.

Cumulative Effects

With the implementation of the mitigation measures, there are no anticipated cumulative effects on sensitive plant species from Alternative 2.

Alternative 3

Direct and Indirect Effects

With the implementation of the mitigation measures, the direct and indirect effects of Alternative 3 on sensitive plant species are the same as those discussed in Alternative 2.

Cumulative Effects

With the implementation of the mitigation measures, there are no anticipated cumulative effects on sensitive plant species from Alternative 3.

Alternative 4

Direct and Indirect Effects

With the implementation of the mitigation measures, the direct and indirect effects of Alternative 4 on sensitive plant species are the same as those discussed in Alternative 2.

Cumulative Effects

With the implementation of the mitigation measures, there are no anticipated cumulative effects on sensitive plant species from Alternative 4.

5.5 SOCIAL RESOURCES

5.5.1 Socioeconomics

5.5.1.1 Evaluation Criteria

Evaluation of the effects of various timber salvage activities was based on income and employment generated. The analysis of products harvested used volumes as the unit of measure expressed as thousand board ft (MBF) or million board ft (MMBF) harvested. The product mix included sawtimber, firewood, and specialty products. USFS Region 3 information was used to estimate impacts to employment and income. Employment impacts were estimated using the combined harvest volume from sawlogs, specialty products, and firewood. Income and employment that was generated from the harvesting activities used year 2001 wage and salary averages and number of jobs (full-time equivalent) created. It should be noted that the duration of the total number of full-time equivalent job opportunities created would take place over a 3- to 5-year period, the same time period that salvage activities would take place. The data sources in these analyses were the U.S. Department of Commerce Bureau of Economic Analysis and the IMPLAN Model ES202 based sectoral statistics.

Sale Administration Costs and Revenues and Net Present Values

Economic efficiency is measured by Present Net Value (PNV). PNV is the difference between the total value of outputs and the total value of costs that are both discounted over the life of the project. The Viveash Fire Salvage Timber Sale is expected to be completed within a 5-year period. It is expected that expenditures associated with the sale would occur up front in the first year during which all of the saw timber and approximately one-fifth of the firewood and specialty wood products are expected to be also sold. The sale of the remainder of the firewood and specialty wood products would be spread over the remaining 4 years. Alternatives 2, 3 and 4 have been included in the Economic Efficiency Analysis (Table 4-6) that uses the maximum values associated with each alternative. Sale associated costs for the Viveash Fire Timber Sale have been estimated at $840,000, which is to be used during the initial stages and estimated to be same across all of the alternatives. More details on these figures can also be found in the Socioeconomics Technical Report (Foster Wheeler Environmental 2001c).

5.5.1.2 Alternative Comparison

Alternative 1—No Action

Alternative 1 is the No Action alternative. Under Alternative 1, no proposed management activities would be implemented in the Project Area. No management measures to remove fire-killed trees from the catastrophic wildfire would be implemented at this time.

Direct and Indirect Effects

Overall, this alternative entails no change from current harvest levels, estimated as 2,600 MBF (year 2000) of various forest products sold and removed on the Pecos Ranger District of the Santa Fe National Forest. This level of harvest serves as a baseline from which to estimate changes in

employment. Alternative 1 represents no timber harvest activity; therefore, economic efficiency pertaining to timber harvest and sale activities has not been calculated.

Cumulative Effects

Forest product-related industry in the region is affected by the overall decline of the industry in New Mexico. In the last 25 years the number of large mills in the state has declined from 18 to 2. This decline has resulted, at least in part, from a lack of available low-cost timber. One of the remaining mills is located approximately 80 miles from the Project Area, just north of the Santa Fe County line, in Espanola. Based on these trends the cumulative effect of a "No Action" decision would be a lost opportunity to provide timber products and resulting economic boost to a declining industry by not allowing harvest of the timber from the Viveash Fire. The economic effects of the Proposed Action would not take place, which would not result in an increase in regional employment, increases in the local economy, or availability of forest product to local residents. The majority of salvage harvest operations on private land within the Project Area were completed during 2001. These operations generated approximately 10 loaded log truck trips a day. Assuming that the average truck load is 4 MBF, this translated into a daily harvest of approximately 40 MBF.

Alternative 2—Forest Service Preferred Alternative

Over 3 to 5 years, the estimated output of wood products expected to be removed from the Project Area would be about 10,000 cords of firewood, 25 to 30 MMBF of sawtimber.

Direct and Indirect Effects

Total harvest level of products sold and removed in Alternative 2 would be expected to be between 20 MMBF and 25 MMBF of sawtimber, vigas, and houselogs and 10,000 cords (5 MMBF) of specialty wood products (for a total of 25-30 MMBF for all products). The corresponding total sale value of products, based on year 2001 USFS sale values, is estimated to be between $275,000 and $331,250 (Table 4-7). Total employment in logging and wood products industries and the indirect and induced employment generated would be between 248 and 302 full- or part-time job opportunities created or retained if all proposed harvesting were to occur in a single year (Table 4-8). More realistic sale program implementation is expected to be 5 years, with all sawtimber sales to be conducted in the first year and firewood and specialty wood products to be sold equally spread over the 5 years. A simple calculation of average annual job opportunity creation or retention would be between 50 and 60.

Estimated total income from these job opportunities would translate into a total income range of $6.4 million to $7.8 million (Table 4-9). The total income generated is based on estimates of employment that are comprised of the direct effect of logging and wood products industry in combination with the indirect and induced multiplier that has been calculated to be 2.064 for the project region using the IMPLAN Input-Output Model. That is, for every wage and salary job opportunity in the logging and wood products industry, an additional 2.06 job opportunities are created throughout other sectors of the regional economy.

Table 4-6. Economic Efficiency Analysis Results

Alternative 2					
Year	**Project Cost(1)**	**Sale Value (2)**	**Discount (4%) (3)**	**Present Value of Costs**	**Present Value of Sales**
1	$840,000	$141,250	1.00	$840,000	$141,250
2		$47,500	0.96	$0	$45,673
3		$47,500	0.92	$0	$43,916
4		$47,500	0.89	$0	$42,227
5		$47,500	0.85	$0	$40,603
Total	$840,000	$331,250	4.63	$840,000	$313,670
Net Present Value At 4% =			*-$526,330*		
Alternative 3					
Year	**Project Cost**	**Sale Value**	**Discount (4%)**	**Present Value of Costs**	**Present Value of Sales**
1	$840,000	$83,750	1.00	$840,000	$83,750
2		$27,500	0.96	$0	$26,442
3		$27,500	0.92	$0	$25,425
4		$27,500	0.89	$0	$24,447
5		$27,500	0.85	$0	$23,507
Total	$840,000	$193,750	4.63	$840,000	$183,572
Net Present Value At 4% =			*-$656,428*		
Alternative 4					
Year	**Project Cost**	**Sale Value**	**Discount (4%)**	**Present Value of Costs**	**Present Value of Sales**
1	$840,000	$16,300	1.00	$840,000	$16,300
2		$16,300	0.96	$0	$15,673
3		$16,300	0.92	$0	$15,070
4		$16,300	0.89	$0	$14,491
5		$16,300	0.85	$0	$13,933
Total	$840,000	$81,500	4.63	$840,000	$75,467
Net Present Value At 4% =			*-$764,533*		

(1) Administration, Sale Preparation, Analysis/Documentation, and Stand Improvement.
(2) Year 1 includes 100% of all sawtimber plus 20% of total Firewood and Specialty Wood Products. Years 2-5 include 20% of the total Firewood and Specialty Wood Products.
(3) Figure set by USFS, customarily set to reflect the cost of capital or the rate of return that could be earned on the best alternative investment with similar length and similar risk.

Table 4-7. Value of Sold and Removed Products

Products	Alternatives			
	1	2	3	4
Salvage Logging [1]				
Maximum sawtimber (MMBF)	$0	$93,750	$56,250	$0
Minimum sawtimber (MMBF)	$0	$75,000	$45,000	$0
Firewood [2]				
Cord	$0	$50,000	$25,000	$50,000
Specialty Wood Products [3]				
Maximum (MMBF)	$0	$187,500	$112,500	$31,500
Minimum (MMBF	$0	$150,000	$90,000	$25,200
Total Value of Sales				
Maximum	$0	$331,250	$193,750	$81,500
Minimum	$0	$275,000	$160,000	$75,200

[1] Saw timber (high end) $/MBF =$5.00
[2] Firewood $/cord =$5.00
[3] Specialty Wood Products $/MBF=$30.00

Source: Estimated using data provided by Tom Malecek, Pecos/Las Vegas Ranger District, December 2001.

Table 4-8. Regional Employment Effects

Employment	Alternatives			
	1	2	3	4
Salvage Logging				
Maximum[1]	0	56	34	0
Minimum[1]	0	45	27	0
Wood Products				
Maximum[2]	0	90	53	28
Minimum[2]	0	75	44	25
Sub-Total				
Maximum	0	146	86	28
Minimum	0	120	71	25
Indirect and Induced Employment				
Maximum	0	156	92	29
Minimum	0	128	75	27
Total				
Maximum[3]	0	302	178	57
Minimum[3]	0	248	146	52

[1] Logging jobs per MMBF = 3 (Source: Lincoln N.F. Scott Able Fire EA, October 2000)
[2] Specialty Wood Products jobs per MMBF = 12 and Firewood jobs assumed to be same as Logging at 3 jobs/MMBF (Source: Lincoln N.F. Scott Able Fire EA, October 2000).
[3] Type II Employment Multiplier = 2.064 (Source: IMPLAN for Santa Fe, San Miguel and Rio Arriba Counties)

Table 4-9. Regional Income Effects

Income	Alternatives			
	1	2	3	4
Salvage Logging				
Maximum[1]	$0	$934,282	$560,569	$0
Minimum[1]	$0	$747,425	$448,455	$0
Wood Products				
Maximum[2]	$0	$2,466,995	$1,439,080	$756,545
Minimum[2]	$0	$2,055,829	$1,192,381	$687,469
Sub-Total				
Maximum	$0	$3,401,277	$1,999,649	$756,545
Minimum	$0	$2,803,255	$1,640,836	$687,469
Indirect and Induced Income				
Maximum[3]	$0	$4,424,591	$2,609,374	$835,000
Minimum[3]	$0	$3,630,434	$2,132,880	$758,761
Total				
Maximum	**$0**	**$7,825,868**	**$4,609,024**	**$1,591,545**
Minimum	**$0**	**$6,433,688**	**$3,773,716**	**$1,446,230**

[1] Logging jobs income ($/yr) = $16,609
[2] Wood Products jobs income ($/yr) = $27,411
[3] Regional average job income ($/yr) = $28,434

Source: IMPLAN, 1998 ES202 data adjusted to year 2001

Cumulative Effects

The forest products-related industry in San Miguel, Santa Fe, and Rio Arriba counties employed approximately 55, 88, and 175 workers, respectively. One of the two mills in the state available to bid on the proposed timber sale is located in Espanola, Rio Arriba County. The other mill is located further away, in southern New Mexico on the Mescalero Apache reservation. The total resulting job opportunities (Table 4-8), combined with the estimated job opportunities generated by the private logging activities as described in Alternative 1, would be between 312 and 366. Not all of the job opportunities associated with this alternative would occur in 1 year. Job opportunities associated with this sale and other ongoing private logging activities in the area would contribute significantly to forest products-related employment in San Miguel, Santa Fe, and Rio Arriba counties.

Projected harvest from the Project Area under this alternative is expected to range from 25 MMBF to 30 MMBF over the life of the project. This would contribute significantly to the regional wood products industry and is expected to generate between 248 and 302 full-time job opportunities. These are estimated as combined number of job opportunities in logging and wood products, as well as the indirect and induced employment that would be created as a consequence of income and earnings to be introduced into the regional economy (Table 4-8). Combined with the estimated job opportunities generated by the private logging activities described above, this would generate between 312 and 366 job opportunities. Not all of the job opportunities associated with Alternative 2 would occur in every year but it is clear from these numbers that the job opportunities associated with this sale and other logging activities in the area would contribute substantially to forest products-related employment in San Miguel, Santa Fe, and Rio Arriba counties.

Alternative 3

Over a 3- to 5-year period, the estimated output of wood products expected to be removed under this alternative would be approximately 10,000 cords of firewood and 12 to 15 MMBF of sawtimber and specialty products.

Direct and Indirect Effects

Total harvest level of products sold and removed in Alternative 3 would be expected to be between 12 MMBF and 15 MMBF. The corresponding total sale value of these products, based on year 2001 USFS sale values, are estimated to be between $160,000 and $193,750 (Table 4-7). Total employment generated would be between 146 and 178 full-time equivalent job opportunities (Table 4-8). Estimated total income from these job opportunities would translate into a total income range of $3.7 million to $4.6 million (Table 4-9). Total job opportunities created are comprised of job opportunities in the logging and wood products activities as well as the secondary job opportunities created as wages and salaries from these activities are spent in the region resulting in additional economic activity. If all of the harvesting and processing occurs in a single year, the total number of job opportunities created or retained, including the region-wide effects, would be between 146 and 178. If harvesting activities are spread evenly over the five year period, the annual job opportunities affect on the region would be somewhere between 29 and 36.

Cumulative Effects

Projected total harvest from the Project Area under this alternative would yield about 60 percent of the total harvested volumes estimated for Alternative 2. These volume estimates range from 12 MMBF to 15 MMBF over the life of the project, contributing raw materials to the regional wood products industry. The total resulting job opportunities (Table 4-8), combined with the estimated job opportunities generated by the private logging activities as described in Alternative 1, would be between 210 and 242. Not all of the job opportunities associated with this alternative would occur in 1 year. Job opportunities associated with this sale and other ongoing private logging activities in the area would contribute significantly to forest products-related employment in San Miguel, Santa Fe, and Rio Arriba counties.

Alternative 4

Over a 3- to 5-year period, the estimated output of wood products expected to be removed under this alternative would be approximately 10,000 cords of firewood and 12 to 15 MMBF of sawtimber and specialty products.

Direct and Indirect Effects

Total harvest level of specialty wood products sold and removed in Alternative 4 would be expected to be 10,000 cords. The corresponding total sale value of these products, based on year 2001 USFS sale values, is estimated to be between $75,200 and $81,500 (Table 4-7). Total employment generated would be between 10 to 11 full-time equivalent job opportunities per year (Table 4-8). Estimated total income from these job opportunities would translate into a total income range of $1.4 million and $1.6 million (Table 4-9).

Cumulative Effect

This alternative does not contain any block area salvage logging activity. Therefore, the total volume harvested is predominantly firewood with some specialty wood products. The employment impacts

of this alternative is much lower than those in Alternatives 2 and 3 because most of the job opportunity effects of potential milling activities are excluded.

The expected job opportunity creations from this alternative ranges from 52 to 57. Combined with the job opportunities generated by private logging activities as described in Alternative 1, the total job opportunities would be between 116 and 121. Almost all job opportunities associated with this alternative may occur in 1 year if all the firewood can be sold and removed. The regional employment effect of this alternative would not be as extensive as in the previous two alternatives, and would be limited mostly to San Miguel County.

5.5.1.3 Environmental Justice

Although there is a high percentage of ethnic minority populations in each of the three counties closest to the Viveash Fire location, the harvest and sale of salvage timber is not expected to disproportionately affect these groups. The selected alternatives would not disproportionately impact minority or low-income populations, based on the assessment regarding the effects of the alternatives on socioeconomics contained in the EIS (p. 4-37 through 4-42).

5.5.2 Scenic Resources

Management direction regarding scenic resources is derived from the Forest Plan and *Landscape Aesthetics: A Handbook for Scenery Management* (USDA Forest Service, 1995b).

5.5.2.1 Evaluation Criteria

Direct and Indirect Effects

The evaluation criteria for effects to scenic resources will be based upon qualitative evaluation of the following issues:

- Immediate scenic effects of project activities
- Whether scenic integrity objectives are being met throughout the Project Area as assessed through long-term monitoring of scenic resources

Cumulative Effects

In addition to the future or ongoing activities listed in the following section, the evaluation criteria for cumulative effects to scenic resources will be based upon qualitative evaluation of whether scenic integrity objectives are being met throughout the Project Area as assessed through long-term monitoring of scenic resources.

Alternative 1—No Action

Under Alternative 1, no harvest activities would occur, there would be no adverse direct effects on scenic resources. As discussed in the Forest Service BAER report (USDA Forest Service 2000a), a variety of emergency measures implemented in the burn area following the fire have contributed to a less natural landscape in those affected areas. As detailed in the BAER report, these measures included contour felling; hand raking; construction of rock or log erosion barriers; erosion control wattles; recontouring, waterbarring, and seeding dozer lines; and hand lines, safety zones, and helipads that were implemented to reduce erosion and minimize impacts from flooding and fire suppression efforts. These activities are currently evident but are expected to blend in during the

next several growing seasons. For example, tufts of grass and forbs will quickly sprout in pockets of sediment trapped behind the log barriers and straw wattles, while vegetation in areas without erosion barriers will tend to be sparse until the slope is stabilized. The visual contrast of the erosion control measures is anticipated to recede over the next several growing seasons, helping the slopes regain a more natural appearance with time—a short-term negative impact.

The scale and intensity of the burned area would dominate the viewshed for several decades. This condition may persist longer in areas that burned the hottest and where rehabilitation treatments may not be as effective. However, a substantial amount of the visibly burned area currently has green sprouts (grasses and forbs) and seedlings (including oak, mountain mahogany, and aspen).

The vegetative patterns that emerge as a result of or in spite of rehabilitation efforts would determine scenic quality for decades. The emerging post-fire vegetative pattern is expected to feature more non-conifer species such as aspen, oak, and grasses than the pre-fire pattern. Proposed plantings are anticipated for approximately 5,000 acres. The plantings would primarily occur in severely burned areas that do not appear to be regenerating naturally or do not have aspen in the understory. Even with these measures, exposed rock outcrops, grasslands with conifer patches and stringers, oak brush, and aspen patches would be much more extensive and visually dominant than in the pre-fire landscape. Anticipated trends in the naturally emerging vegetative pattern include the following:

- Broad grasslands would tend to develop, especially in areas where grass seeding is successful and where reforestation is not done or is not successful. Other than aspen and oak sprouting, reforestation would be a long-term effort. Conifers may take 15–20 years to reach heights of 4–5 feet. Without persistent reforestation efforts, grasslands would tend to be the dominant vegetation through much of the less steep or rocky areas of the burn. Meadows and grasslands can add scenic diversity to the vegetative pattern but can decrease the desirability of recreation settings and decrease scenic values if the extent and homogeneity of grasslands are too great.

- Oak brush could be the dominant vegetation over some of the rockier sites and would be a major persistent element in the vegetative pattern defining the post-fire viewshed.

- Aspen clones occur throughout the burned area and are sprouting anywhere the extensive clone root systems were not destroyed. Aspen stands would rapidly soften the visual effect of the burn.

- Pine and mixed-conifer forests would be slow to naturally re-establish dominance until the occurrence of favorable regeneration conditions. Forest Service policy is to regenerate the prevailing valued timber species within their natural range following such a fire.

Alternative 1 would not have any adverse indirect effects on scenic resources. Scenic diversity would eventually increase under this alternative that would have a beneficial impact to visitors seeking to view diverse landscapes.

Alternative 2—Forest Service Preferred Alternative

Direct and Indirect Effects

Under Alternative 2 the potential exists for adverse direct effects on scenic resources. Slash and unmerchantable trees could create scenic impacts from roads, trails, scenic corridors, or residential areas. However, all roads, trails, and access areas would be kept free of slash or unmerchantable trees. In addition, within 100 ft of roads and trails, unpiled slash or unmerchantable tree accumulations would be less than 1.5 ft in height.

Logging trucks, skid trails, and landings would create scenic impacts. In general, such impacts would be short-term impacts viewed from the foreground that would occur during harvest activities. These impacts would also be minimized through the following mitigation measures:

- Predesignated skid trails and landings would be used during logging.
- Visible landings would be restored to original or characteristic contours and revegetated with native vegetation within 1 year of project completion.

Cumulative Effects

The potential direct and indirect effects of Alternative 2, combined with the existing and anticipated effects of the fire rehabilitation and activities on private land, would create some short-term cumulative visual effects. These effects, however, would be short in duration (1–2 years) and the positive aspects of erosion control measures would lead to very positive long-term cumulative visual effects from the regeneration of vegetation.

Alternative 3

Direct, Indirect, and Cumulative Effects

The effects of Alternative 3 on visual resources would be somewhat less than, but similar to, Alternative 2. The long-term visual cumulative effect would be positive.

Alternative 4

Direct, Indirect, and Cumulative Effects

The effects of Alternative 4 on visual resources would be less than, but similar to, Alternative 3. The long-term visual cumulative effect would be positive.

5.5.3 Recreation

5.5.3.1 Evaluation Criteria

Direct and Indirect Effects

The evaluation criteria for effects to recreational resources will be based upon qualitative evaluation of the following:

- Safety hazards posed by logging truck traffic in areas where recreational activities occur
- Potentials for project activities to deter forest visitors from using the Project Area for recreational activities
- Potentials for project activities to diminish recreation opportunities

- Trail conditions (improvements vs. degradation) and effectiveness of any implemented erosion and sediment control measures as assessed through long-term monitoring
- Success of revegetation efforts and subsequent habitat quality for wildlife species including big game species

Cumulative Effects

In addition to the future or ongoing activities listed in the following section, the evaluation criteria for cumulative effects to recreational resources will be based upon qualitative evaluation of the following issues:

- Trail conditions (improvements vs. degradation) and effectiveness of any implemented erosion and sediment control measures as assessed through long-term monitoring
- Changes in recreational usage and opportunities (increases vs. decreases in usage, shifts in popularity of different activities)

5.5.3.2 Alternative Comparison

Alternative 1—No Action

Direct and Indirect Effects

Alternative 1 is the No Action alternative and there would be no direct or indirect effects.

Cumulative Effects

The overall loss of aquatic habitat from increased runoff and sediment production has resulted in a loss of trout and subsequent impacts to recreational fishing. The trout habitat would recover over time and fishing would return as a recreational activity. Wildlife habitat throughout the Project Area has been changed dramatically from a dense forest to a very open habitat. Initially, there may be some reduction in elk and deer hunting opportunities but the elk and deer habitat would improve above pre-fire conditions due to increased forage. Elk and deer hunting opportunities should improve along with the habitat. Cumulative effects of this alternative would be a positive trend in fishing, elk, and deer hunting opportunities, and associated camping and hiking activities.

Harvesting on private land appears to be mostly completed. This logging may have little or no effect on recreation in the Project Area because many recreational activities are located away from the private land, and recreational use in the area is low.

Continuation of the existing level of management intensity would include the implementation of erosion and sediment control efforts, including OHV restrictions and/or closures in sensitive areas, stream restoration efforts, and any necessary native vegetation restoration efforts such as OHV restrictions and/or closures in sensitive areas. Terrestrial and aquatic habitats, and consequently recreational activities, that are wildlife-dependent, are expected to improve with these actions.

Vegetation restoration efforts include OHV restrictions and/or closures in sensitive areas. By restoring native vegetation and reducing erosion and sedimentation into waterways, terrestrial and aquatic habitats, recreational opportunities that are wildlife-dependent, and associated activities are expected to improve. However, OHV restrictions and/or closures in sensitive areas would be a

short-term adverse recreational effect to OHV users that would eventually become a recreation opportunity after sensitive areas regenerate and erosion and sedimentation are no longer issues in those areas.

Alternative 2—Forest Service Preferred Alternative

Direct and Indirect Effects

The direct effects of Alternative 2 include increased logging truck traffic that would create safety hazards in areas where recreational driving activities occur. However, temporary closures and/or signage would be implemented to ensure safety for all forest visitors. Additionally, Forest Service staff at the Pecos/Las Vegas Ranger District would provide and make available to forest visitors current information on project activity locations as well as recommended alternative routes and recreation areas. Effects of logging truck traffic are expected to be short term and the numbers of visitors affected is expected to be low, since the area generally receives low recreation use. As a result there would be minor adverse direct impacts in areas where recreational activities occur.

Logging truck traffic and harvesting activities may deter forest visitors from using the Project Area for recreational activities. This would be unavoidable but would only be a short-term effect for the duration of major project activities. The block sale salvage operations would generate the majority of these effects and would last for the first 2 years. Another potential impact to recreational use is impeding access to desired recreation areas. There are several informal and established elk hunting camps along FDR 92 that have been used by local visitors. If access to these areas is still provided, there would not be any impacts to elk hunters' desired visitor experiences. Similarly, if access is maintained for visitors that desire to use the Skyline Trail, there would be no effects on hikers' desired recreation activities. There would be no logging activity on weekends or holidays during hunting season, so effects to hunters would be minimized. Should access be denied to elk hunters or hikers, there would be short-term, negative impacts. However, these would not be adverse due to their temporary nature, and because the Project Area generally receives low recreation use.

Alternative 2 activities may diminish recreation opportunities that allow for desired visitor experiences. However, the ROS designations of SPM and RN allow for timber management and generally some evidence of Forest Service management was present prior to the Viveash Fire.

Harvesting activities in Alternative 2 may allow slash or unmerchantable trees to block access to recreational roads or trails within the Project Area. Slash or unmerchantable trees would be removed from all roads, trails, and access areas as soon as practical.

Under Alternative 2, the potential exists for adverse indirect effects on recreational resources if increased erosion and consequent water quality degradation in the Cow Creek drainage occurred. However, adverse effects with regard to erosion, water quality, and consequently fishing-related activities are not predicted (see Section 4.4.1).

By improving the transportation system and improving accessibility, long-term adverse effects could occur if the area becomes more popular and accessible to non-local visitors, and the local population that currently uses the Project Area is displaced. At the same time, by improving existing drainage conditions and reducing erosion and sedimentation into waterways, terrestrial and aquatic habitats,

and recreational opportunities that are wildlife-dependent and associated activities are expected to improve.

Cumulative Effects

The cumulative effects of this alternative would be increased logging truck traffic and potentially discouraging some recreational use. The harvesting on private land is mostly completed and would not generate a cumulative effect because it does not occur at the same time as harvesting on National Forest land. Overall, the cumulative effects would be minor and short term. The long-term effects would be positive due to a better road system, improved campground, and increased elk hunting opportunities.

Alternative 3

Direct, Indirect and Cumulative Effects

Effects of Alternative 3 on recreational resources would be similar to those for Alternative 2. Compared to Alternative 2, effects on recreational access and use would be less due to the smaller harvest area and subsequent reduction in logging truck traffic, thereby reducing the safety hazards. Under this alternative, there is a lower probability that access to desired recreation areas would be impeded than Alternative 2. Sights and sounds of logging activities would be reduced, so there may be a slight reduction in the minor impacts that might occur to visitors' desired recreation experiences.

Under Alternative 3, the potential for adverse indirect effects on recreational resources is lower than for Alternative 2. Category 3 and 4 watersheds would not incur salvage activities, so erosion and consequent effects on cold-water fish populations and fishing activities would potentially be less. Any indirect effects under Alternative 3 would be mitigated using the same measures mentioned in Alternative 2.

Alternative 4

Direct, Indirect, and Cumulative Effects

Effects on recreation under Alternative 4 would be similar to Alternative 1 (No Action) since there would be no commercial timber harvest. There may be some increased safety hazards and decreased access to desired recreation areas due to increases in vehicular traffic from recreational and commercial firewood users.

5.5.3.3 Recreational Fisheries

Recreational fishing occurred throughout the Project Area, however, it does not occur now due to the lack of fish. Thus, the alternatives would not be expected to impact recreational fishing opportunities.

5.5.4 Heritage Resources

The principal concern is that the salvage harvesting and road projects could damage or destroy heritage resources within the Project Area. In addressing this concern, potential direct, indirect, and cumulative effects of timber harvesting on heritage resources must be considered, and reasonable measures adopted to avoid or mitigate any adverse effects to heritage resources during or as a result of salvage harvesting.

The primary direct effects associated with the timber harvesting are:

- Ground-disturbing activities
- Unauthorized collection of artifacts or materials from heritage resource sites

In accordance with forest-wide guidelines, heritage resource sites would be avoided during timber harvest to prevent any direct effects to those resources. An inventory survey of the action areas has been completed and prior to implementing the project, all heritage resources found in the area would be clearly marked. Project supervisors, equipment operators, and other key personnel would be briefed on the location of those resources, and the need to avoid any impact to those resources would be emphasized. One exception to this would be the removal of timber from sites that may lie within public fuelwood areas and/or adjacent to roads. These sites would be treated before the area(s) is opened for product removal. This treatment would involve removal of timber from the sites by Forest Service personnel under the supervision of a Forest Service archeologist. Removal of fuelwood from the sites would not adversely affect them and would further insure protection of the sites by making them less likely to be intruded upon by fuelwood gatherers. Project personnel would also be instructed about the adverse effects of artifact collecting and the legal penalties for unauthorized collection. Finally, project activities would be monitored to ensure full compliance.

Potential indirect effects of the timber harvest are:

- Accelerated erosion of heritage resource sites from ground disturbance during timber harvesting

- A higher probability of looting and vandalism of heritage resource sites from increased access to the area as a result of road improvement

Potential damage to heritage resources as a result of increased access can be minimized by educating the public about the importance of heritage resources, by restricting access to heritage resource locations, and by monitoring activities in the Project Area. This problem is also of lesser concern given the nature of the heritage resources. Prehistoric sites in the burn area consist of small artifact scatters that are unlikely to draw the attention of pot hunters. Similarly, a large proportion of the historical sites evidence ephemeral herding, mining, or timber harvesting activities, and lack the extensive refuse deposits that are attractive to bottle hunters and other collectors.

In assessing cumulative effects, consideration must be given to the combined effects of past actions on heritage resources in the Project Area and to anticipated future actions. Considered from this perspective, the planned salvage harvest would not contribute significantly to any cumulative adverse effects to heritage resource sites.

5.5.4.1 Mitigation Measures

The following mitigation measures would be implemented to avoid any direct impact to heritage resources:

- Flag and avoid all known heritage resource sites (with the exception of treatment as discussed above).

- Limit ground-disturbing activities in the vicinity of heritage resources.
- Locate skid trails to avoid channeling runoff toward those resource locations.
- Educate project personnel.
- Monitor site disturbance/vandalism.

5.5.4.2 Alternative Comparison

Direct, Indirect, and Cumulative Effects of All Alternatives

In general, none of the proposed action alternatives pose a threat to heritage resources in the Project Area. None of the action alternatives would result in any direct impacts to heritage resource sites, because the sites would be avoided. The exception to this would be treatment by Forest Service personnel of sites within or near areas proposed for fuelwood removal as discussed above. Project personnel would be cautioned against unauthorized artifact collection, and operations would be monitored for compliance with these restrictions. However, there is a possibility of inadvertent damage to a heritage resource site owing to inattention or miscommunication that is higher for Alternatives 2, 3, and 4 than for the No Action alternative.

Among the action alternatives, the potential for inadvertent damage to heritage resources appears slightly higher for Alternative 4 than for Alternatives 2 and 3. This judgment is based on the assumption that non-commercial firewood cutting permits are issued for the removal of downed hazard trees. Such public use is more difficult to regulate than centralized commercial operations, so there is a greater chance that heritage resource sites would be damaged by vehicle traffic.

Increased vehicle traffic associated with the timber salvage has the potential to increase surface runoff and soil erosion, which could damage heritage resource sites. The likelihood of such an indirect effect appears low for Alternative 3 because timber salvage would be limited to areas with less erodible soils, and for Alternative 4 because no heavy equipment would be utilized. The chances of erosion damage to heritage resource sites under Alternative 2 are slightly higher because of the greater area that would be impacted.

The second indirect effect considered was the possibility that heritage resource sites might be more subject to looting or vandalism as a result of greater public access or increased use as a result of the proposed actions. Alternatives 2 and 3 would temporarily make some heritage resource sites in the Project Area more accessible to ORV by creating skid trails and tracks. As the heritage resources in this area are not particularly attractive to pot hunters, however, the probability of looting or vandalism appears low. The issuance of firewood cutting permits proposed under Alternative 4 would increase the number of people using the area. Although large-scale looting is unlikely to be a problem, casual artifact collection from heritage resource sites would be more likely to occur.

A public concern was expressed about the potential vibration effect that log truck traffic may have on a National Register Historic Site situated along the haul route. However, Santa Fe National Forest determined that because of the distance from the Project Area, and because of the high volume of traffic along SH 50 and SH 63, the historic properties of concern lay outside the Area of Potential Effect as defined in 36 CFR 800.16. The National Advisory Council concurred with the

Forest Service's determination that there would be no adverse impact and this Historic Site was outside the Area of Potential Effects.

Direct, Indirect, and Cumulative Effects of All Action Alternatives

Avoidance of heritage resource sites during the planned timber salvage should prevent any further direct effects to the heritage resources, and adoption of other protective measures (including treatment of some sites as previously discussed) should minimize additional indirect effects based upon the water quality analysis. In assessing cumulative effects, consideration must be given to the combined effects of past actions on heritage resources in the Project Area and to anticipated future actions. Considered from this perspective, the planned timber harvest would not contribute to any cumulative adverse effects to heritage resource sites. Further, mitigation monitoring measures are expected to be effective in creating a low risk of damage to heritage resources based on past experiences with harvesting and road projects on the Santa Fe National Forest.

Most of the Project Area is managed by the Forest Service for sustainable timber harvest and wildlife habitat. In accordance with forest-wide guidelines, inventory surveys have been completed prior to past timber sales. The sites have been marked and avoided, so previous timber harvests have not directly affected the heritage resources. Some heritage resource sites were damaged or destroyed by the Viveash Fire and fire-suppression efforts, and heritage resources in the burn area may be impacted by increased erosion resulting from the loss of vegetative cover.

Planned projects in the immediate future are directed toward mitigation of the fire damage and should not contribute to any cumulative adverse effects to the heritage resources. Inventory survey of the Project Area has been completed on portions of the burned area to insure that fire-reclamation projects—including the planned salvage—do not further impact heritage resources. Heritage resources documented during the survey have been assessed for fire damage. Known sites in the burn area have already received damage assessments, and remediation measures would be implemented at approximately 20 of those sites during summer 2002. Any remediation measures required at newly documented sites would be undertaken in 2002 and beyond.

5.5.5 Roadless Areas

There are no roadless areas within the Project Area. The Pecos Wilderness Area borders the Project Area to the north, and a roadless area borders the Project Area to the east. The adjacent roadless areas were RARE II areas that were designated as nonwilderness in the FEIS for the Roadless Area Review and Evaluation (USDA Forest Service 1979). This project is consistent with the preferred alternative in the Forest Service Roadless Area Conservation FEIS (USDA Forest Service 2000c). The preferred alternative, if selected, would establish a rule that would "prohibit road construction, reconstruction, and timber harvest except for stewardship purposes within inventoried roadless areas, while excepting road reconstruction needed for road safety improvements and federal aid highway projects." No roadless areas were identified in the Project Area in that FEIS. Therefore, there would be no direct, indirect or cumulative effects on roadless areas from any of the alternatives.

5.6 SHORT-TERM USE AND LONG-TERM PRODUCTIVITY

5.6.1 Soil, Water Quality, Fish Habitat

5.6.1.1 Soil

The soil resource is a key ingredient for maintaining the long-term productive potential for an area. Erosion and effects that may be detrimental to the soil resource would be minimized through use of careful design and BMPs. Soil protection measures in the Forest Standards and Guidelines would maintain critical soil parameters and nutrients, ensuring long-term productivity.

5.6.1.2 Water Quality

Short-term effects of the proposed activities could include a small change in sediment delivery. Where increased sediment delivery is predicted, it could continue for an indefinite period of time, depending on vegetative recovery and maintenance of roads. These effects are negligible and would not affect long-term productivity. Beneficial uses, including a high-quality cold water fishery, would not be adversely affected.

5.6.1.3 Fish Habitat

The short-term use and long-term productivity of fisheries, fish habitat, and riparian ecosystems would not be impacted by the resource management activities in the alternatives examined under this EIS.

5.6.2 Wildlife

Since there would not be declines in existing suitable habitats for special status species and management indicator species, there would be no potential impacts to the maintenance and/or enhancement of long-term productivity for wildlife resources.

5.6.3 Scenic Resources

Scenic resources are expected to improve with the action alternatives and mitigation measures. Thus, long-term productivity of both recreational and scenic resources would improve under all alternatives.

5.7 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

5.7.1 Soil, Water Quality, Fish Habitat

5.7.1.1 Soil

Any soil lost from the Project Area would be considered an irreversible and irretrievable commitment of the soil resource. BMPs would be used to minimize soil productivity losses from timber harvesting and hazard tree removal. There would not be irretrievable loss of soil productivity as landings and skid trails would be ripped and seeded where productivity has been reduced.

5.7.1.2 Water Quality

None of the proposed activities by themselves would result in irretrievable effects.

5.7.1.3 Fisheries

There would not be irreversible and irretrievable commitments of fish and riparian resources under the alternatives examined under this EIS. The cumulative effects of the watershed monitoring and restoration planned as future foreseeable actions would be of benefit to sensitive fish populations, fish habitat, and riparian resources.

5.7.2 Socioeconomics

Alternative 1 would result in an irreversible and irretrievable loss of wood products through decay and reduction of the value of the dead trees as sawtimber.

5.7.3 Wildlife

Under all alternatives, the proposed actions and associated mitigation measures would not involve or invoke the irreversible and irretrievable commitment of wildlife resources.

5.7.4 Scenic Resources

Under all alternatives, the proposed actions and associated mitigation measures would not involve or invoke the irreversible and irretrievable commitment of scenic resources.

5.7.5 Transportation

Under all alternatives, the proposed actions and associated mitigation measures would not involve or invoke the irreversible and irretrievable commitment of transportation resources.

5.7.6 Forest Composition and Structure, and Timber Productivity

There would be no irreversible and irretrievable commitments of resources related to forest vegetation and timber resources.

5.8 UNAVOIDABLE ADVERSE ENVIRONMENTAL EFFECTS

5.8.1 Soil, Water Quality, Fish Habitat

5.8.1.1 Soil

Long-term soil productivity would not be adversely affected. However, soil erosion may contribute to a slight decrease in soil productivity.

5.8.1.2 Water Quality

None of the proposed activities would result in an unavoidable adverse environmental effect on water quality.

5.8.1.3 Fisheries

There are no unavoidable adverse environmental effects to fish habitat and riparian ecosystem.

5.8.2 Socioeconomics

None of the proposed activities would result in an adverse impact on socioeconomics.

5.8.3 Wildlife

There are no unavoidable adverse effects related to wildlife resources.

5.8.4 Scenic Resources

Under all alternatives, unavoidable effects to scenic resources would be the short-term adverse effects related to erosion and sediment-control measures that would be evident until native vegetation re-establishes and visual contrast recedes.

5.8.5 Forest Composition and Structure, and Timber Productivity

There are no unavoidable adverse effects related to forest vegetation and timber resources.

5.8.6 Heritage Resources

There would be no unavoidable adverse effects to heritage resources associated with the proposed action. Potential direct and indirect effects to heritage resource sites have been identified, and management actions have been proposed to avoid or minimize those effects.

5.9 POTENTIAL CONFLICTS WITH PLANS, POLICIES, AND OBJECTIVES OF OTHER JURISDICTIONS

Activities would be consistent with the Santa Fe National Forest Plan for all alternatives. None of the activities that would occur on public land would cause a significant cumulative effect on the resources discussed.

5.9.1 Soil, Water Quality, Fish Habitat

5.9.1.1 Soil

None of the proposed activities would result in a foreseeable conflict with other regulations or regulatory agencies.

5.9.1.2 Water Quality

The CWA requires federal agencies to comply with all federal, state and interstate, and local authorities in the control and abatement of water pollution. These authorities and their policies include the New Mexico Water Quality Control Commission, New Mexico Environment Department, USFWS, and Pueblos. All proposed activities would comply with these authorities.

5.9.1.3 Fisheries

There are no known conflicts of any of the alternatives with plans, policies, or objectives of other jurisdictions. The Pecos/Las Vegas Ranger District (Santa Fe National Forest) is working cooperatively with the New Mexico Department of Game and Fish in the management and protection of the Rio Grande cutthroat trout.

5.9.2 Economics

None of the proposed activities would result in a foreseeable conflict with other regulations or regulatory agencies.

5.9.3 Wildlife

There would be no potential conflicts of the alternatives considered with plans, policies, and objectives of the ESA or the Migratory Bird Treaty Act. The Pecos/Las Vegas Ranger District (Santa Fe National Forest) would work cooperatively with federal, state, local, and tribal agencies in implementing the Viveash Fire-related timber salvage activities and protection of threatened, endangered, or proposed species and management indicator species.

5.9.4 Scenic Resources

There are no other plans, policies, or objectives that have jurisdiction with regard to scenic resources in the Project Area.

5.9.5 Forest Composition and Structure, and Timber Productivity

There would be no potential conflicts of the alternatives considered with plans, policies, or objectives of NFMA.

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6.5 GLOSSARY

A

Adaptive Management—Adaptive management is a systematic, interdisciplinary process for continually improving management policies and practices by learning from the outcomes of operational programs through monitoring.

Affected Environment—The physical and human-related environment that is sensitive to changes resulting from the proposed actions.

Aggraded—A condition where sediment has accumulated in the stream channel.

Air Quality—Refers to standards for various classes of land as designated by the Clean Air Act, P.L. 88-206:Jan., 1988.

Airshed—A geographic area that, due to topography, meteorology, and climate, shares the same air.

Allowable Cut—Amount of timber which can be harvested in any given year.

Allowable Sale Quantity (ASQ)—The quantity of timber that may be sold, from the area of suitable land covered by the Forest Plan, for a time period specified by the Plan. This quantity is usually expressed on an annual basis as the "average annual allowable sale quantity."

Allochthonous—Organic matter in the stream that is produced outside of the stream, usually by riparian plants and trees. Autothonous organic matter is produced in the stream by algae and aquatic plants.

Alluvial—Materials transported and deposited by water.

Alternative—A mix of management prescriptions applied to specific land areas to achieve a set of goals and objectives. The alternative provides management direction for the proposed project that reflects identified public and management concerns for the Decision Area.

Analysis Area—The Analysis Area is the area that bounds the analysis for a particular resource and/or issue. It may be confused with the Project Area, which is the area within which the proposed activities are limited.

B

Background—That part of a scene, landscape, etc., which is furthest from the viewer, usually from 3 miles to infinity from the observer.

Basal Area—The area of the cross section of a tree stem near the base, generally at breast height and inclusive of bark.

Best Management Practices (BMPs)—Practices determined by the state to be the most effective and practical means of preventing or reducing the amount of water pollution generated by nonpoint sources to meet water quality goals.

Big Game—Those species of large mammals normally managed as a sport hunting resource.

Big Game Summer Range—A range, usually at higher elevation, used by deer and elk during the summer. Summer ranges are usually much more extensive than winter ranges.

Big Game Winter Range—A range, usually at lower elevation, used by migratory deer and elk during the winter months; more clearly defined and smaller than summer ranges.

Biological Diversity (Biodiversity)—The relative distribution and abundance of different plant and animal communities and species within an area.

Biological Evaluation—A documented USFS review of activities in sufficient detail to determine how an action or proposed action may affect any threatened, endangered, proposed, or sensitive species.

Board Foot (bf)—The amount of wood equivalent to 1 foot by 1-inch thick.

Broadcast Burn—Allowing a prescribed fire to burn over a designated area within well-defined boundaries for reduction of a fuel hazard or as a silvicultural treatment or both.

Browse—Twigs, leaves, and young shoots of trees and shrubs on which animals feed.

C

Canopy—The more-or-less continuous cover of branches and foliage formed collectively by the crown of adjacent trees.

Cavity—The excavated hollow in trees by birds or other natural phenomena; used for roosting and reproduction by many birds and mammals.

Cavity Excavator—An animal that constructs cavities in trees for nesting or roosting.

Channel Types—The following are the channel types, as defined by Rosgen 1994.

- A Type—is well confined and low sinuosity
- B Type—is moderately confined and moderate sinuosity
- C Type—is unconfined and moderate to high sinuosity
- D Type—is multiple channels and very high sinuosity

Chipping—The reduction of woody residue by a portable chipper to chips that are left to decay on the forest floor.

Classified Road—A road that is constructed or maintained for long-term highway vehicle use. Classified roads may be public, private, or forest development.

Clearcut Harvest—A harvest regeneration method under an even-aged silvicultural system in which the existing stand of trees is removed.

Climax—The culminating stage in plant succession for a given site where the vegetation has reached a highly stable condition over time and perpetuates itself unless disturbed by outside forces.

Climax Species—Those species that dominate a climax stand.

Code of Federal Regulations (CFR)—The listing of various regulations pertaining to management and administration of the National Forests.

Commercial Thinning—Tree thinning that produces merchantable material at least equal in value to the direct costs of harvesting.

Compaction—The packing together of soil particles by forces exerted at the soil surface, resulting in increased soil density.

Compartments—A geographic area delineated by a subwatershed drainage for management planning purposes.

Condition Class—A grouping of timber stands into size-age-stocking classes for Forest planning.

Conifer—Any of a group of needle and cone-bearing evergreen trees.

Council on Environmental Quality (CEQ)— An advisory council to the President, established by NEPA. It reviews federal programs for their effect on the environment, conducts environmental studies, and advises the President on environmental matters.

Cover—Vegetation used by wildlife for protection from predators or to escape the adverse effects of weather.

Cover complexity—Cover complexity is a qualitative rating of the combinations of different types of cover in one habitat unit. Greater cover complexity would be expected to yield greater fish abundance.

Cover/opening Ratio—The mixture of cover and forage areas on a unit of land, expressed as a ratio.

Cultural Resources—The remains of sites, structures, or objects used by humans in the past-historic or prehistoric.

Cumulative Effect—The impact on the environment that results from the incremental impact of the action when added to other actions. Cumulative impacts can also result from individually minor, but collectively significant, actions taking place over a period of time.

Cumulative Effects Area (CEA)—The area that is used for assessing cumulative impacts (see above).

D

Decision Area—The geographic area defining the scope of this document and the alternatives proposed by it.

Decommissioning—Some of the roads are discussed in terms of "decommissioning." This term is used to refer to a specific type of road closure. On a decommissioned road, access would be controlled by means of a moderately sized berm or "tank trap" impassable to vehicles but capable of being easily bulldozed to permit vehicle passage if the road is recommissioned in the future. For all decommissioned roads, water bars are installed, the road bed is seeded, all culverts are removed, and self-maintaining cross-road drainage is provided.

Developed Recreation—Recreation dependent on facilities provided to enhance recreation opportunities in concentrated use areas. Examples are ski areas, resorts, and campgrounds.

Diameter at Breast Height (dbh)—The diameter of a tree measured 4 ft, 6 inches above the ground.

Dispersed Recreation—Recreation that occurs outside of developed recreation sites requiring few, if any, facilities or other improvements and includes such activities as hunting, hiking, viewing scenery, and cross-country skiing.

Displacement of Soil—The movement of the forest floor (litter, duff, and humus layers) and surface soils from one place to another by mechanical forces such as a blade used in piling and windrowing. Mixing of surface soil layers by disking, chopping, or bedding operation is not considered displacement.

Duff—An organic surface soil layer below the litter layer in which the original form of plant and animal matter cannot be identified with the unaided eye.

E

Ecosystem—Any community of organisms along with its environment, forming an interacting system.

Ecotone—The boundary or transition zone between adjacent plant communities.

Edge—Where plant communities meet or where successional stage or vegetation conditions within the plant community come together.

Effects (or impacts)—Environmental consequences (the scientific and analytical basis for comparison of alternatives) as a result of a proposed action. Effects may be either direct, which are caused by the action and occur at the same time and place, or indirect, which are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable or cumulative.

Endangered Species—Any plant or animal species that is in danger of extinction throughout all or a significant portion of its range (Endangered Species Act of 1973).

Endemic—Native to or confined to a certain region.

Environment—The aggregate of physical, biological, economic, and social factors affecting organisms in an area.

Environmental Assessment (EA)—A concise public document which serves to (a) briefly provide sufficient evidence and analysis for determining whether to prepare an EIS or a finding of No Significant Impact, (b) aid an agency's compliance with NEPA when no EIS is necessary, or (c) facilitate preparation of an EIS when necessary.

Environmental Impact Statement (EIS)—A detailed summary prepared by the responsible official in which a major federal action that significantly affects the quality of the human environment is described, alternatives to the proposed action provided, and the effects analyzed.

Ephemeral Streams—Streams that flow only as a direct response to rainfall or snowmelt events. They have no baseflow.

Epidemic—The populations of plants, animals and diseases that build-up, often rapidly, to highly abnormal and generally injurious levels.

Erosion—The detachment and transport of individual soil particles by wind, water, or gravity.

Eutrophication—The process of excessive addition of inorganic nutrients, organic matter, and/or silt to lakes and reservoirs, leading to increased biological production and a decrease in volume.

Even-aged Management—The application of a combination of actions that result in the creation of stands in which trees of essentially the same age grow together. Clearcut, shelterwood, or seedtree harvest methods produce even-aged stands.

Even-aged Stands—Stands in which all trees are of about the same age (a spread of 10 to 20 years is generally considered one age class).

F

Fauna—Animals, including lesser forms such as insects, mites, etc.

Federal Candidate Taxa—A classification category for those threatened, endangered, and sensitive plants or animals listed in the Federal Register (Sept. 27, 1985), and other plants recommended for addition to the Federal Candidate list.

Flatwater—Flatwater is slower flowing water that does not have the turbulence associated with a riffle due to lower gradient or greater

depth. For the fisheries survey, flatwater was classified as run, glide, or pocketwater.

Floodplain—The lowland and relatively flat areas adjoining inland and coastal waters, including, at a minimum, that area subject to a 1 percent or greater chance of flooding in any given year.

Flora—Plants

Forage—All browse and non-woody plants that are available to livestock or game animals and used for grazing or harvested for feeding.

Forage Areas—Vegetated areas with less than 60 percent combined canopy closure of tree and tall shrub (greater than 7 feet in height).

Forb—An herbaceous plant that is not a graminod.

Foreground—That part of a scene, landscape, etc., that is nearest to the viewer, and in which detail is evident, usually ¼ to ½ mile from the observer.

Forest Road—A road wholly or partially within or adjacent to a National Forest System boundary that is necessary for the protection, administration, and use of National Forest System lands, which the USFS has authorized and over which the agency maintains jurisdiction.

Fry—Recently hatched fish.

Fuel Treatment—Manipulation or reduction of natural or activity fuels (generated by a management activity such as slash left from logging) to reduce fire hazard.

Fuels—Combustible materials present in the forest that potentially contribute a significant fire hazard.

G

Genetic Seedlings—Tree seedlings from a genetically superior seed source. The seeds are collected from trees displaying exceptional form and raised in nurseries during outplanting. The seedlings usually have faster growth rates than naturally regenerated seedlings.

Graminoid—All grasses and grasslike plants, including sedges and rushes.

Group Selection—An uneven-aged silvicultural harvest system in which all trees in a small group are removed for regeneration purposes. The size of the group is small enough in area that all subsequent regeneration will be influenced by the surrounding uncut stand. Cuts are generally 0.25–2.0 acres in size.

Growing Season—That part of the year when temperatures and moisture are favorable for vegetation growth.

H

Habitat—The sum total of environmental conditions of a specific place occupied by a wildlife species or a population of such species.

Habitat Type—An aggregation of all land areas potentially capable of producing similar plant communities at climax stage.

Hardwood—A broad-leaved tree.

Hiding Cover—Vegetation capable of hiding 90 percent of a standing adult deer or elk at 200 feet or less. Includes some shrub stands and all forested stand conditions with adequate tree stem density or shrub layer to hide animals. In some cases, topographic features also can provide hiding cover.

High Risk—Individual or groups of trees that are live (green) but that have the physical characteristics favorable to insect infestation or disease infections. Trees in this category are subject to mortality and loss of economic value.

I

Immature Timber—Trees that have not attained full development, especially height.

Immediate Foreground—The part of the foreground that is extremely critical for visual detail, usually within 400 feet of the observer.

Indicator Species—See Management Indicator Species.

Indirect Effects—Secondary effects that occur in locations other than the initial action or significantly later in time.

Individual Tree Selection—An uneven-aged silvicultural harvest system that removes selected trees of all size classes on an individual basis.

Intensive Management—A high investment level of timber management that includes precommercial and commercial thinnings, plantings with genetically improved stock, control of competing vegetation, and other practices that increase tree growth.

Interdisciplinary (ID) Team—A group of professional specialists with expertise in different resources that collaborate to develop and evaluate management alternatives.

Interdisciplinary Approach—Utilization of one or more individuals representing areas of knowledge and skills focusing on the same task, problem, or subject. Team member interaction provides needed insight to all stages of the process.

Intermediate Harvest—Any removal of trees from a stand between the time of its formation and the regeneration cut. Most commonly applied intermediate cuttings are release, thinning, sanitation, and salvage.

Intermittent Stream—A stream that runs water in most months, but does not run water during the dry season of most years.

Invertebrates—Animals having no backbone such as earthworms, insects, and lesser animals.

Irretrievable—Applies to losses of production, harvest, or a commitment of renewable natural resources. For example, some or all of the timber production from an area is irretrievably lost during the time an area is used as a winter sports (recreation) site. If the use is changed, timber production can be resumed. The production lost is irretrievable, but the action is not irreversible.

Irreversible—Applies primarily to the use of nonrenewable resources, such as minerals or cultural resources, or to those factors that are renewable only over long time spans, such as soil productivity. Irreversible also includes loss of future options.

Issue—A subject or question of public discussion or interest to be addressed or discussed in the planning process.

L

Land Allocation—The assignment of a management emphasis to particular land areas with the purpose of achieving goals and objectives. Land allocation decisions are documented in environmental analysis documents such as the Idaho Panhandle National Forests' Final EIS and Forest Land and Resource Management Plans.

Landtype—A unit of land with similar designated soil, vegetation, geology, topography, climate, and drainage. The basis for mapping units in the land systems inventory.

Limiting Factor—The environmental influence that exceeds the tolerance limit of an animal to restrict it in its activities, functions, or geographic range.

Limnology—The study of bodies of inland waters, as lakes and ponds, especially with reference to their physical and biological features.

Linkage—A belt or band of cover or habitat that allows animals to move from one location to another.

Litter—An organic surface soil layer usually composed of identifiable leaves, branches, or other vegetative material, and animal remains.

Lodgepole Pine—See Timber Types.

Long-term Sustained Yield—The estimated timber harvest that can be maintained indefinitely over time, once all stands have been converted to a managed state under a specific management intensity consistent with multiple-use objectives.

Lop and Scatter—Fuel treatment where, following tree felling, limbs and branches are cut off and scattered in the unit.

M

Management Area—Geographic areas, not necessarily contiguous, that have common management direction, consistent with the Forest Plan allocations.

Management Direction—A statement of multiple use and other goals and objectives, along with the associated management prescriptions and standards and guidelines to direct resource management.

Management Indicator Species—A species selected because its welfare is presumed to be an indicator of the welfare of other species sharing similar habitat requirements. A species of fish, wildlife, or plants that reflect ecological changes caused by land management activities.

Management Prescriptions—A set of land and resource management policies that, as expressed through Standards and Guidelines, creates the Desired Future Condition over time.

Mature Timber—Trees that have attained full development, particularly height.

Middleground—The part of a scene or landscape that hits between the foreground and background zones.

Minimum Management Requirement (MMR)—Minimum standards for resource protection to meet the goals and objectives of the National Forest System.

Mitigation—Actions to avoid, minimize, reduce, eliminate, replace, or rectify the impacts of a management practice.

Mixed Conifer—See Timber Types.

Model—A formalized expression of a theory to describe, analyze, or understand a particular concept.

Monitoring and Evaluation—The evaluation, on a sample basis, of Forest Plan management practices to determine how well objectives are being met, as well as the effects of those management practices on the land and environment.

Mortality—In forestry, trees in a stand that die of natural causes.

Mountain Pine Beetle—The common name for the bark beetle (*Dendroctonous Ponderosae Hopkins*), which is the most destructive insect pest in the intermountain west.

Mulching—Covering the surface of the soil with natural (e.g., litter) or deliberately applied organic materials (e.g., straw, wood chips, foliage).

N

National Environmental Policy Act (NEPA) Process—An interdisciplinary process that concentrates decisionmaking around issues, concerns, alternatives, and the effects of alternatives on the environment.

National Forest Management Act (NFMA)—Law passed in 1976 as an amendment to the Forest and Rangeland Renewable Resources Planning Act, requiring preparation of Regional Guides and Forest Plans, and the preparation of regulations to guide that development.

Natural Regeneration—Reforestation of a site by natural seeding from the surrounding trees. Natural regeneration may or may not be preceded by site preparation.

No Action Alternative—The No Action alternative is required by regulations implementing the NEPA (40 CFR 1502.14). The No Action alternative provides a baseline for estimating the effects of other alternatives. When a project activity is being evaluated, the No Action alternative is defined as one where current management direction would continue unchanged.

Noxious Weed—A plant species that is highly injurious or destructive and has a great potential for economic impact.

O

Obliteration—Obliteration of an existing road would involve removal of all culverts, establishing permanent drainages, and recontouring of the road surface.

Old Growth Habitat—Habitat for certain wildlife that is characterized by mature coniferous forest stands with large snags and decaying logs.

Oligotrophic—An oligotrophic lake or reservoir is low in nutrients and organic productivity. Oligotrophic lakes are usually deep, with nutrient-poor sediments, few macrophytes, and large amounts of dissolved oxygen.

Open Road Density—A standard set in the Forest Plan that is applied to most Management Areas important to big game. This road density standard of ¾ mile of open road per square mile of habitat correlates directly to the elk habitat effectiveness of the area (i.e., 68 percent).

Optimum Habitat—The amounts and arrangement of cover and forage that results in the greatest level of production that is consistent with other resource requirements.

Overstory—The portion of trees in a forest that form the uppermost layer of foliage.

Overstory Removal—A harvest method that removes the overstory of a two-story stand and leaves the smaller understory for further development.

P

Partial Cut—Term to relate harvest units where many trees are left and forested appearance is retained. Partial cutting usually provides no long-term benefits to forest health and productivity.

Particulates—Small particles suspended in the air and generally considered pollutants.

Pathogen—A specific causative agent of disease, such as a virus.

Peak Flow—The greatest flow attained during the melting of the winter snowpack.

Pelagic Zone—It is the open water zone in a lake that is characterized by freely floating organisms (zooplankton and phytoplankton) and certain fish species.

Perennial Streams—Streams that flow continuously throughout the year.

Pioneer Species—A plant capable of invading a bare site (newly exposed soil surface) and persisting there until replaced by another species or community as succession progresses.

Plant Community—An assembly of plants living together.

Pole Timber—Trees of at least 5 inches in diameter at breast height (DBH), but smaller than the minimum utilization standard for sawtimber.

Pool Tail Embeddedness—Pool tail embeddedness is the degree to which larger particles are covered or surrounded by finer sediments in the downstream end of the pool. A qualitative rating was assigned. The pool tail is where salmonids generally create redds for spawning. Greater pool tail embeddedness would be expected to reduce biotic productivity.

Pools—Pools are very slow or stagnant water that form were the channel bottom is substantially lower in elevation than upstream or downstream. For the fisheries survey, pools were classified by the feature that caused the pool to form. These features are undesignated, artificial, beaver, bedrock, boulder, culvert, large woody debris, meander, and rootwad.

Precommercial Thinning—The practice of removing some of the trees of less than marketable size from a stand so that the remaining trees will grow faster.

Preferred Alternative—The alternative recommended for implementation in the EIS (40 CFR 1502.14).

Prescribed Burning—The application of fire to fuels in either a natural or modified state under such conditions as to allow the fire to be confined to a predetermined area and at the same time to produce the intensity of heat and rate of spread required to further certain planned objectives (i.e., silviculture, wildlife management, reduction of fuel hazard, etc.).

Prescription—Management practices selected and scheduled for application on a designated area to attain specific goals and objectives.

Private Road—A road under private ownership authorized by an easement to a private party, or a road that provides access pursuant to a reserved or private right.

Project Area—The Project Area is the area within which the proposed activities are limited. It may be confused with the Analysis Area, which is the area that bounds the analysis for a particular resource and/or issue.

Public Road—A road open to public travel that is under the jurisdiction of and maintained by a public authority such as states, counties, and local communities.

Puddling, Soil—A physical change in soil properties due to shearing forces that alters soil structure and porosity. Puddling occurs when the soil is at or near liquid limit.

R

Range of Alternatives—An alternative is one way of managing the National Forest, expressed as management emphasis leading to a unique set of goods and services being available to the public. A range of alternatives is several different ways of managing the Forest, offering many different levels of goods and services.

RARE II—The acronym for the second Roadless Area Review and Evaluation conducted by the Forest Service in 1979 that resulted in an inventory of roadless areas considered for potential wilderness designation.

Recreation Opportunity Spectrum (ROS)—A system for defining the types of outdoor recreation opportunities the public might desire and identifies that portion of the spectrum a given area might be able to provide. It is used for planning and managing the recreation resource and recognizes recreation activity, setting, and experience opportunities.

Reforestation—The natural or artificial restocking of an area with forest trees.

Regeneration—The renewal of a tree crop, whether by natural or artificial means. This term may also refer to the crop itself (i.e., seedlings or saplings).

Regeneration Harvest—Used in reference to harvest methods that remove an existing stand to prepare the site for regeneration.

Rehabilitation—To return environments into good health.

Release—Freeing trees from competition for light, water, and nutrients by removing or reducing the vegetation growth that is overtopping or closely surrounding them.

Research Natural Area—An area in as near a natural condition as possible, that exemplifies typical or unique vegetation and associated biotic, soil, geological, and aquatic features. The area is set aside to preserve a representative sample of an ecological community primarily for scientific and educational purposes; commercial and general public use is not allowed.

Residual Stand—The trees remaining standing after some activity, such as an individual tree selection.

Restricted Road—A National Forest road or segment that is restricted from a certain type of use or all uses during certain seasons of the year or yearlong. The use being restricted and the time period must be specified. The closure is legal when the Forest Supervisor has issued and posted an order in accordance with 36 CFR 261.

Riffles—Riffles are relatively fast flowing water that has a substantial amount of turbulence. For the fisheries survey three types of riffles were recorded including low gradient riffles, high gradient riffles, and cascades.

Riparian—Pertaining to areas of land directly influenced by water. Riparian areas usually have visible vegetative or physical characteristics reflecting this water influence.

Stream sides, lake borders, or marshes are typical riparian areas. Riparian vegetation borders watercourses, lakes, or swamps; it requires a high water table.

Road—A vehicle travel way of over 50 inches wide.

Road Maintenance—The upkeep of the entire Forest Development Transportation Facility including surface and shoulders, parking and side areas, structures, and any traffic control devices as are necessary for its safe and efficient utilization.

Roadless Area—A National Forest System area that is larger than 5,000 acres or, if smaller than 5,000 acres, is contiguous to a designated wilderness or primitive area; contains no roads, and has been inventoried by the Forest Service for possible inclusion into the wilderness preservation system.

Rotation—The planned number of years required to establish (including the regeneration period) and grow timber to a specified condition or maturity for regeneration harvest. Selected management prescriptions provide the basis for the rotation age.

S

Salvage Harvest—Intermediate harvests made to remove trees that are dead or in imminent danger of being killed by injurious agents such as insects.

Sanitation Harvest—Intermediate harvests made to remove dead, damaged, or susceptible trees to prevent the spread of pests or pathogens.

Sawtimber—Trees containing at least one 12-foot sawlog or two non-contiguous 8-foot logs, and meeting regional specifications for freedom from defect.

Scoping—The procedures by which the Forest Service determines the extent of analysis necessary for a proposed action, i.e., the range of actions, alternatives, and impacts to be addressed, identification of significant issues related to a proposed action, and establishing the depth of environmental analysis, data, and task assignment.

Scree—Any slope covered with loose rock fragments.

Sediment—Any material carried in suspension by water that will ultimately settle to the bottom. Sediment has two main sources—from the channel itself and from upslope areas.

Seed Tree—A tree selected as a natural seed source within a shelterwood or seed tree harvest cut; sometimes also reserved for seed collection.

Seed Tree Harvest—An even-aged regeneration harvest of a portion of the mature timber from an area, except for a small number of seed bearing trees left singly or in small groups for regeneration of a stand.

Seedlings and Saplings—Non-commercial size young trees.

Selection Harvest—The periodic removal of trees, usually at 10- to 20-year intervals, individually or in small groups, from an uneven-aged forest in order to realize yield and establish regeneration or irregular constitution.

Sensitive Species—Those species identified by the Regional Forester for which population viability is a concern as evidenced by significant current or predicted downward

trends in population numbers or density or habitat capability that would reduce a species' existing distribution.

Seral—A biotic community that is a developmental, transitory stage in ecological succession.

Series—A group of habitat types having the same climax tree species.

Shelterwood Harvest—An even-aged regeneration harvest of a portion of the mature stand while retaining a portion of the stand as a source for seed and protection during the regeneration period.

Silvicultural System—A management process whereby forests are tended, harvested, and replaced, resulting in a forest of distinctive form. Systems are classified according to the method of carrying out the cuttings that remove the mature crop and provide for regeneration, and according to the typed of forest thereby produced.

Silviculture—The art and science of growing and tending forest vegetation, i.e., controlling the establishment, composition, and growth of forests, for specific management goals.

Site Preparation—A general term for a variety of activities that remove or treat competing vegetation, slash, and other debris that may inhibit the establishment of regeneration.

Site Productivity—Production capability of specific areas of land.

Slash—The residue left on the ground after felling and other silvicultural operations and/or accumulating there as a result of storm, fire, girdling, or poisoning of trees.

Snag—A standing dead tree usually without merchantable value for timber products, but may have characteristics of benefit to some cavity nesting wildlife species.

Special Use Permit—A permit issued under established laws and regulations to an individual, organization, or company for occupancy or use of National Forest land for some special purpose.

Stand—A community of trees or other vegetation uniform in composition, constitution, spatial arrangement, or condition to be distinguishable from other adjacent communities.

Stand Replacing Fire—A fire that consumes an entire stand of trees. These fires are generally quite hot and can burn hundreds of acres.

Stocking—The degree to which trees occupy the land, measured by basal area and/or number of trees by size and spacing, compared with a stocking standard; that is, the basal area and/or number of trees required to fully utilize the land's growth potential.

Stream Order—It is often convenient to classify streams within a drainage basin by systematically defining the network of branches. Each nonbranching channel segment (smallest size) is designated a *first-order stream*. A stream which receives only first-order segments is termed a *second-order stream*, and so on. The order of a particular drainage basin is determined by the order of the principle or largest segment.

Stream Segment of Concern—Designation of streams identified for special emphasis as part of the State Antidegradation Policy. Local working committees are charged with

development of site-specific BMPs for the stream and associated watershed.

Streambed Particle Size Distribution—A graphical representative of the size and class composition of the streambed at a cross section of a stream reach. The composition is determined by statistically valid sampling of the particles comprising the streambed in the cross section. It is not based on the area covered by the individual particles.

Succession—The progressive changes in plant communities toward climax habitat.

Successional Stage—A stage or recognizable condition of a plant community which occurs during its development from the bare ground to climax habitat.

Suitable Forest Land—Forest land (as defined in CFR 219.3, 219.14) for which technology is available that will insure timber production without irreversible resource damage to soils, productivity, or watershed conditions; for which there is a reasonable assurance that such lands can be adequately restocked (as provided in CFR 219.14); and for which there is management direction that indicates that timber production is an appropriate use of that area.

Sustained Yield—See long-term sustained yield.

T

Talus—The loose accumulation of fragmented rock material on slopes, such as at the base of a cliff.

Thermal Cover—Vegetative cover used by animals to modify the adverse affects of weather.

Thinning—Cutting in even-aged stands to redistribute growth potential or benefit the quality of the residual stand.

Threatened Species—Any species of plant or animal that is likely to become endangered within the foreseeable future throughout all or a significant portion of its range.

Tiering—Refers to the coverage of general matters in broader EISs or EAs with subsequent other related statements in the EAs incorporated, by reference. The discussions contained in the previous document are incorporated, solely for issues specific to the statement subsequently prepared.

Timber Types—A descriptive classification of forest land based on present occupancy of an area by tree species (i.e., lodgepole, mixed conifer). More appropriately called cover types, this category is further defined by the composition of its vegetation and/or environmental factors that influence its locality.

Trophic State—The state of nutrient enrichment of a lake or reservoir.

U

Unclassified Road—A road that is not constructed, maintained, or intended for long-term highway use, such as roads constructed for temporary access and other remnants of short-term use roads associated with fire suppression, timber harvest, and oil, gas, or mineral activities, as well as travel ways resulting from off-road vehicle use.

Understory—Vegetation (trees or shrubs) growing under the canopy formed by taller trees.

Unevenaged Management—The application of a combination of actions needed to simultaneously maintain continuous high-forest cover. Harvest systems that develop or maintain unevenaged stands are individual tree and group selection.

Ungulate—A mammal having hoofs, i.e., deer, elk, and moose.

Unroaded Area – An area that does not contain classified roads.

V

Vertebrates—Animals having a backbone, or a spinal column, including mammals, fishes, birds, reptiles, and amphibians.

Viable Population—A population that has adequate numbers and dispersion of reproductive individuals to ensure the continued existence of the species population on the planning area.

Viewshed—Subunits of the landscape where the scene is contained by topography similar to a watershed.

Visual Condition Class (VCC)—A measure of the level of disturbance to the visual resource, expressed in acres. The visual condition classes are used as indicators to measure the existing conditions and effects of alternatives.

Visual Quality Objective (VQO)—A system of indicating the potential expectations of the visual resource by considering the frequency an area is viewed and the type of landscape.

Visual Resource—The composite of landforms, water features, vegetative patterns, and cultural features which create the visual environment.

W

Water Yield—The measured output of the forest's streams.

Watershed—Entire area that contributes water to a drainage system or stream.

Wetlands—Areas that are inundated by surface or ground water with a frequency sufficient to 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, wet meadows, river overflows, mud flats, and natural ponds.

Wilderness—All lands included in the National Wilderness Preservation System by public law; generally defined as undeveloped federal land retaining its primeval character and influence without permanent improvements or human habitation.

Wildfire—Any wildfire not designated and managed as a prescribed fire with an approved prescription.

Wildlife Diversity—The relative degree of abundance of wildlife species, plant species, communities, habitats, or habitat features.

Windrowing—Slash or debris piled in a row along the contour of the slope.

Y

Yarding—A method of bringing logs into a roadside area or landing for truck transport. Methods may include forms of skyline cable logging systems, ground-based skidding, balloon, helicopter, etc.

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