United States Department of the Interior
BUREAU OF LAND MANAGEMENT
Las Cruces Field Office
1800 Marquess
Las Cruces, New Mexico 88005

IN REPLY REFER TO:
1610(030)

Dear Reader:

Enclosed for your review and comment is the Draft Resource Management Plan Amendment (RMPA) and Environmental Impact Statement (EIS) for Federal fluid minerals leasing and development in Sierra and Otero Counties. This document describes and analyzes alternative plans for managing Federal fluid minerals leasing and subsequent activities in Sierra and Otero Counties, New Mexico.

The purpose of this review is to help BLM in its decision making process. We welcome your comments. Comments on this document may be submitted to this off ice or presented verbally at the scheduled public hearings. Written comments should be addressed to:

Tom Phillips, RMPA/EIS Team Leader
Bureau of Land Management
Las Cruces Field Office
1800 Marquess
Las Cruces, New Mexico 88005

All written comments must be postmarked no later than February 20, 2001 in order to be considered in the Proposed RMPA/Final EIS. Where possible, include in your comments reference to the pages and paragraphs on which you are commenting.

The public hearings and open houses will be advertised in the local news media. They are scheduled as follows:

Date	**Time**	**City**	**Location**
Tuesday, January 9, 2001	7:00 p.m.	Roswell	Best Western Sally Port Inn, 2000 N. Main St.
Wednesday, January 10, 2001	7:00 p.m.	Alamogordo	Otero County Courthouse, Commission Chambers, Room 253, 1000 New York Ave.
Thursday, January 11, 2001	7:00 p.m.	T or C	Sierra County Commission Chambers, 100 North Date St.

A time limit for making public comments will be established based on the number of people wishing to make comments at each hearing.

An open house will immediately precede the public hearings, starting at 6 p.m. at the same locations. The open house will have displays providing information to explain the document and the environmental process followed. BLM specialists will be available to discuss the Draft RMPA/EIS.

Written and oral comments will be considered fully and evaluated in preparing the Proposed RMPA/Final EIS. If changes to this Draft document in response to comments are minor, the final document will include only those changes and will not be a full reprint. Therefore, reviewers are urged to retain this copy of the Draft RMPA/EIS to be used with the final document.

Sincerely,

Amy L. Lueders
Field Manager

Enclosure

RESOURCE MANAGEMENT PLAN AMENDMENT/ ENVIRONMENTAL IMPACT STATEMENT FOR FEDERAL FLUID MINERALS LEASING AND DEVELOPMENT IN SIERRA AND OTERO COUNTIES

Draft (X) **Final ( )**

LEAD AGENCY: U.S. Department of the Interior, Bureau of Land Management (BLM)

TYPE OF ACTION: Administrative

JURISDICTION: Sierra and Otero Counties, New Mexico

ABSTRACT

This Draft Resource Management Plan Amendment (RMPA) and Environmental Impact Statement (EIS) describes and analyzes alternative plans for managing Federal fluid minerals leasing and subsequent activities in Sierra and Otero Counties, New Mexico. managing Federal fluid minerals leasing and subsequent activities in Sierra and Otero Counties, New Mexico. Of the nearly 7 million acres of Federal, State, Tribal, and private lands in the two counties, the BLM Las Cruces Field Office administers approximately 1.8 million surface acres and 5 million acres with underlying Federal minerals.

Three alternatives have been considered. The No-action Alternative assumes that the existing management direction would continue. Compliance with laws and regulations would continue on a case-by-case basis. Alternatives A and B address existing legislative and regulatory requirements at a programmatic level, and/or place constraints if resource values are determined to be sufficiently high or protections are justified in the public interest. Decisions and analysis would be tiered from the RMPA/EIS, thereby expediting future NEPA analysis and other legal and regulatory requirements. Alternative A is BLM's preferred alternative, which implements existing laws, thereby protecting the environment to the extent deemed necessary while still meeting BLM's multiple use mandates.

When the RMPA is completed, it will provide a comprehensive framework for managing the BLM-administered public land and resources and for allocating their uses.

Date filed with the U.S. Environmental Protection Agency: November 9, 2000.

Comments on this Draft RMPA/EIS must be postmarked no later than February 20, 2001.

Comments should be addressed to:

Tom Phillips, RMPA/EIS Team Leader
Bureau of Land Management
Las Cruces Field Office
1800 Marquess
Las Cruces, New Mexico 88005

Recommended by:_____ Approved by_____

Las Cruces Field Manager New Mexico State Director

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*Note: All maps for Chapters 2 and 3 are located in the map section (following Chapter 5).

The large-scale maps listed below accompany the text of the Management Situation Analysis and are on file at the Las Cruces Office of the Bureau of Land Management.

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LIST OF ACRONYMS AND ABBREVIATIONS

ACEC	Area of Critical Environmental Concern
AD	anno Domini
ADT	average daily traffic
APD	Application for a Permit to Drill
Bbl	per barrel
BC	before Christ
bcf	billion cubic feet
BLM	Bureau of Land Management
BMP	best management practice
BOP	blowout preventer
C	Celsius
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CO_2	carbon dioxide
COA	conditions of approval
CRMP	Cultural Resource Management Plan
CSU	controlled surface use
CUA	common use area
dB	decibels
dBA	A-weighted sound level
DST	drill stem test
EIS	environmental impact statement
EO	Executive Order
EPA	U.S. Environmental Protection Agency
EPCRA	Emergency Planning and Community Right-to-Know Act
F	Fahrenheit
FEMA	Federal Emergency Management Agency
FLPMA	Federal Land Policy and Management Act
ft^2/day	square feet per day
FWS	U.S. Fish and Wildlife Service
GIS	geographic information systems
HMP	Habitat Management Plan

hp	horsepower
H_2S	hydrogen sulfide
IHICS	Integrated Habitat Inventory and Classification System
I-25	Interstate 25
KGRA	known geothermal resource area
Ldn	day-night noise level
Leq	equivalent sound level
Leq(h)	one-hour equivalent sound level
Fg/m	micrograms per cubic meter
mg/L	milligrams per liter
MCF	thousand cubic feet
MCFD	thousand cubic feet per day
MMCFD	million cubic feet per day
mph	miles per hour
MS	manual section
MSA	Management Situation Analysis
NAGPRA	Native American Graves Protection and Repatriation Act
NEPA	National Environmental Policy Act
NIA	Notice of Intent to Abandon
NMCRIS	New Mexico Cultural Resource Information System
NMDGF	New Mexico Department of Game and Fish
NMOGD	New Mexico Oil and Gas Division
NMED	New Mexico Environment Department
NMPM	New Mexico Prime Meridian
NMSU	New Mexico State University
NMTSD	New Mexico Traffic Safety Department
NMWQCC	New Mexico Water Quality Control Commission
NOI	Notice of Intent
NO_2	nitrogen dioxide
NO_x	nitrogen oxide
NOS	Notice of Staking
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NRCS	Natural Resource Conservation Service
NSO	no surface occupancy
NTL	Notice to Lessees

OHV	off-highway vehicle
ORV	off-road vehicle
PAC	primary activity centers
PILT	payment in-lieu of taxes
PL	Public Law
PLO	Public Land Order
PM_{10}	particulate matter of 10 microns or less
ppm	parts per million
PSD	Prevention of Significant Deterioration
PVC	polyvinyl chloride
R&PP	Recreation and Public Purpose
RCRA	Resource Conservation and Recovery Act
RFD	reasonable foreseeable development
RMP	Resource Management Plan
RMPA	Resource Management Plan Amendment
ROD	Record of Decision
ROS	Recreation Opportunity Spectrum
SEO	State Engineer's Office
SHS	standard habitat site
SHPO	State Historic Preservation Office
SLTC	standard lease terms and conditions
SO_x	sulfur oxide
SO_2	sulfur dioxide
SPCC	spill prevention, control, and countermeasure
SR	State Route
SS	special status
SSS	special status species
STATSGO	State Soil Geographic (Database)
SUPO	Surface Use Plan of Operation
T&E	threatened and endangered
TDS	Total Dissolved Solids
TL	timing limitation
TSCA	Toxic Substances Control Act
TSP	total suspended particulates
UIC	underground injection control
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey

VMT	vehicle miles traveled
VRM	Visual Resource Management
WQA	New Mexico Water Quality Act
WSA	Wilderness Study Area

SUMMARY

INTRODUCTION

The Las Cruces Field Office of the Bureau of Land Management (BLM) has prepared this Resource Management Plan Amendment (RMPA) and Environmental Impact Statement (EIS) to address Federal fluid minerals (oil, gas, and geothermal) leasing in Sierra and Otero Counties (referred to as the Planning Area). The RMPA amends the 1986 Resource Management Plan (RMP) for the White Sands Resource Area. The objective of the RMPA is to determine (1) which lands overlying Federal fluid minerals are suitable and available for leasing and subsequent development and (2) how those leased lands will be managed. The EIS identifies the potential impacts that alternative plans for fluid minerals leasing and subsequent activities could have on the environment and identifies appropriate measures to mitigate those impacts.

This RMPA/EIS, prepared to meet the current requirements of the Federal fluid minerals program, is not the final review upon which approval of all actions in the Planning Area will be based. Environmental analyses and additional National Environmental Policy Act (NEPA) compliance will be required for all site-specific actions. However, the scope of the site-specific approval process will be streamlined and facilitated by the programmatic evaluation of impacts contained in this RMPA/EIS.

Sierra and Otero Counties are located in south-central New Mexico. Of the approximately 7 million acres of Federal, State, tribal, and private lands in Sierra and Otero Counties, BLM administers approximately 1.8 million surface acres and 5 million acres of Federal fluid mineral (subsurface) estate. The latter is the area within which BLM has the authority to approve leases (including privately or State-owned surface acreage overlying Federally owned fluid minerals). Although BLM is responsible for considering potential impacts on all resources in the Planning Area regardless of ownership or management, BLM can make decisions regarding surface management for actions only on public land and subsurface Federal mineral estate (administered by BLM). Public land and private split-estate lands are referred to in this document as BLM's Decision Area.

The planning and environmental process began in October 1998 with scoping, a set of activities to identify issues early in the analysis. The results of scoping were documented in a Scoping Summary Report in January 1999. Data collection and preparation of the Management Situation Analysis continued from Fall 1998 through Spring 1999. A characterization of the existing environment is summarized in Chapter 3. This information contributed to the formulation of the alternatives, which are based on the management guidance to be applied to a set of resource concerns that were identified (Chapter 2). The impact assessment was conducted based on the reasonably foreseeable development of Federal fluid minerals over a period of the next 20 years (Appendix A-IV) and an understanding of

the standard operating procedures for fluid minerals exploration, development, production, and abandonment (as described in Appendix B).

ALTERNATIVES

A total of five alternatives were addressed. Two alternatives were considered but eliminated from further analysis and three alternatives were developed and evaluated in detail: No-action Alternative, Alternative A, and Alternative B. The alternatives were developed to respond to issues identified through the scoping process, explore alternatives to existing management direction, comply with BLM's planning guidelines for Federal fluid mineral resources, and comply with the Federal Land Policy and Management Act (FLPMA) requirement of managing public land for sustained yield and multiple use. The reasonable foreseeable fluid minerals development and associated surface disturbance predicted for the Planning Area over the 20-year planning period remains the same for each alternative. Therefore, the alternatives were formulated based on the extent of modification to the existing management situation as it applies to certain resources that were identified as concerns.

For fluid minerals, objectives for managing public lands and associated resources are defined in terms of the availability of land for leasing (closed or open to leasing) and management of lands that are open (with standard lease terms and conditions or stipulations).

Public land may be closed nondiscretionarily or discretionarily. Public land may be open with no specific management decisions defined, but is subject to standard lease terms and conditions. Or, lands open to leasing may be managed with constraints in the form of stipulations, which are conditions included in a lease when planning and environmental analyses have demonstrated that additional and more stringent protection is needed. The three types of lease stipulations used in this RMPA/EIS are (1) no surface occupancy, (2) controlled surface use, and (3) timing limitation.

The three alternatives are distinguished by the type and degree of constraints. The No-action Alternative represents the continuation of existing management. Compliance with laws and regulations would continue on a case-by-case basis. The objective of Alternative A is to modify the existing management direction to respond to legislative or regulatory requirements and/or management objectives that otherwise would be achieved on a case-by-case basis under the No-action Alternative (Existing Management). Alternative B also responds to legislative or regulatory requirements and/or management objectives, but provides a relatively greater emphasis on resource protection by imposing more constraints on fluid minerals leasing and development. A summary of leasing constraints is provided in Table S-1 at the end of this section.

At this Draft RMPA/EIS step of the environmental review process, BLM's preferred alternative is Alternative A. Alternative A would satisfy the requirement to establish fluid mineral determinations (i.e., identify lands available for leasing and how those leased lands are managed to adequately protect resources) while sustaining the ability to achieve the RFD and fulfilling BLM's mandate of multiple use and sustained yield as directed under FLPMA. However, based on the results of public review of and comment on this Draft RMPA/EIS, the Las Cruces Field Manager will recommend and the BLM State Director will select an alternative or a combination of the alternatives to be the Proposed RMPA and publish it along with the Final EIS. A final decision will be made after a 60-day Governor's Consistency Review and a 30-day protest period. A Record of Decision (ROD) and approved RMPA then will be published.

AFFECTED ENVIRONMENT

Chapter 3 addresses the existing condition of the human and natural environment that potentially could be affected by the alternatives. The majority of data and information was extracted and used from existing data on file at the Las Cruces Field Office of BLM. Data included published and unpublished reports, maps, and digital format (geographic information system) data. The affected environment is characterized for the following general resource concerns:

- lands and access
- geology and minerals
- soils
- water resources
- air quality
- noise
- vegetation
- wildlife
- special status species
- rangeland
- cultural resources
- paleontological resources
- recreation
- visual resources
- special management areas
- social and economic conditions

While data for these resources were being compiled, relevant geological data were compiled and reviewed to estimate the potential for oil and gas and geothermal resources in the Planning Area. These and other historical data served as a basis for estimating the fluid minerals development that is reasonably foreseeable over the planning period of the next 20 years.

ENVIRONMENTAL CONSEQUENCES

Using the information regarding the affected environment (Chapter 3), a description of the standard operating procedures for fluid minerals activities (Appendix B), and the reasonable foreseeable development (RFD) projected for the Planning Area (Appendix A-IV), the types of impacts that each

alternative could have on the resources were identified and quantified only to the extent practical for this programmatic document. No ground-disturbing activities would be authorized and result directly from the alternatives addressed in this document; however, leases issued subsequent to and associated with this document could result in surface-disturbing activities. Therefore, further site- and project-specific environmental evaluation is required prior to final approval of the activities.

As part of estimating the RFD, the potential for fluid mineral resources to exist in the Planning Area was derived from available geologic data. For oil and gas, the results indicate that there is medium and low potential throughout the Planning Area. For geothermal resources, several areas of high potential were identified. Although locations of future development are not assured, there are some historical data available and recent interest in fluid minerals that suggest locations likely to experience development. A recent gas discovery on Otero Mesa in southern Otero County suggests that as a location for additional gas development. Areas of high potential for geothermal resources within BLM's Decision Area occur in the vicinity of Truth or Consequences, Arrey, and Derry in Sierra County.

The RFD is a projection of the Federal fluid mineral actions that are likely to occur in the Planning Area over the next 20 years. For oil and gas resources, it is possible that three fields could be developed. The approximate number of acres that are projected to be disturbed directly from activities are 6,590 in the short term (one to three years from implementation of ground-disturbing actions) and 862 over the long term (up to 20 to 30 years). Based on historical information, it is likely that future wells drilled for Federal oil and gas resources would be on lands under the surface jurisdiction of the BLM. For geothermal resources, the approximate number of acres that are projected to be disturbed from geothermal activities are 26.6.

Impacts identified are summarized in Table S-2 at the end of this section. Alternative A incorporates many of the stipulations that are likely to accompany the current leasing process. The management guidance is more comprehensive in Alternative A relative to the No-action Alternative and consequently may allow for a more efficient leasing process. Alternative B provides greater protection to resources, with management emphasis on avoidance of impacts on selected resources. Overall, significant adverse impacts are not anticipated for environmental resources under any of the alternatives with the possible exception of visual resources. This is primarily the result of the comparatively small amount of surface disturbance projected for the RFD and assumes the inclusion of best management practices and other mitigating measures (Appendix A-III).

However, under certain circumstances, cumulative effects may result in significant impacts. Cumulative impacts, as defined by Title 40 of the Code of Federal Regulations, Part 1508.7, are those impacts that result from the incremental impact of an action "when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time."

This RMPA/EIS is programmatic in nature and too broad in scope to define the relationships between potential fluid minerals activities and other past, present, and reasonably foreseeable future actions since it is not known at this time which land will be available for leasing and how that land and associated resources will be managed for fluid minerals activities. Therefore, past, present, and potential reasonably foreseeable future actions are addressed generally in this document and will be considered on a case-by-case basis for each lease application and application for permit to drill (APD). In addition, because the RFD is the same for all alternatives, no variation in the level of cumulative impacts is anticipated among the alternatives.

Overall, the cumulative impacts for leasing activities are anticipated to be minimal for most resources over the 20-year planning time frame, due to the limited nature of expected surface disturbance unless a substantial amount of development were to occur in one area that has sensitive resource concerns. Potential cumulative impacts may be anticipated to occur on visual resources, wildlife habitat, groundwater levels, surface water quality, and socioeconomic resources, as described below.

Because of the open and undeveloped landscape within BLM's Decision Area, the potential exists for cumulative visual impacts if development occurs in visual proximity to other past, present, or reasonably foreseeable future actions. The greatest concern is if the combination of visual effects of the proposed action and other development were to result in a moderate to strong visual contrast to the setting. These types of cumulative impacts may be mitigated through siting and other proposed mitigation measures.

Another cumulative impact may result in the form of habitat fragmentation due to clearing for facilities and/or road development. Although the volume of anticipated road development is not large relative to the existing road network, the density or location of new access may have a cumulative effect on a previously undisturbed area. Although the associated road networks would not be particularly dense, especially given the existing access in the Planning Area and possibilities for co-location, the cumulative effect may be notable in terms of habitat fragmentation for larger wildlife. However, trips are expected to decrease once wells are in production since only maintenance visits are required.

With regard to groundwater resources, water demands such as irrigation and domestic needs due to population growth could make even the small water requirements for fluid minerals development a burden to the water system. Declining water levels are of concern to residents of Otero County; however, fluid minerals development on non-Federal land is not expected to greatly increase the water supply demands in the Planning Area by more than twofold. None of the other potential projects in the area are believe to impact the supply of groundwater resources.

Indirect impacts on surface water quality also may be cumulative due to incremental impacts of the actions taken within the Planning Area when added to other past, present, and future actions that could adversely affect downstream receiving waters.

Positive primary and secondary effects on local economies would be small in magnitude; thus, the total positive benefits are not anticipated to produce a significant cumulative impact. As a result, the adverse impacts associated with stress on communities due to rapid growth also is not anticipated as a long-term significant impact.

CONSULTATION AND COORDINATION

The analysis for this RMPA/EIS was completed in consultation with other agencies and the public. Agencies consulted include the U.S. Fish and Wildlife Service, New Mexico Department of Game & Fish, New Mexico Natural Resources Department, the State Historic Preservation Officer, and other Federal and State agencies and local governments as appropriate. Public scoping meetings were held in November, 1998, and written comments have been received from members of the public and representatives from the oil and gas industry. The Draft RMPA/EIS has been distributed to relevant agencies and the interested public for review and comments, which will be addressed in the Proposed RMPA/Final EIS.

TABLE S-1
SUMMARY OF LEASING CONSTRAINTS IN DECISION AREA BY ALTERNATIVE

Constraint	Alternatives		
	No-action Alternative (Existing Management)	**Alternative A**	**Alternative B**
Closed to Leasing			
Nondiscretionary Closure	# Old Air Force bombing and gunnery range # Public water reserves # Air navigation site # Wilderness Study Areas (WSAs)	# Old Air Force bombing and gunnery range # Public water reserves # Air navigation site # WSAs	# Old Air Force bombing and gunnery range # Public water reserves # Air navigation site # WSAs

TABLE S-1
SUMMARY OF LEASING CONSTRAINTS IN DECISION AREA BY ALTERNATIVE

Constraint	Alternatives		
	No-action Alternative (Existing Management)	**Alternative A**	**Alternative B**
Discretionary Closure	# Visual Resource Management (VRM) Class I # Areas of Critical Environmental Concern (ACECs, 6)	# Rattlesnake Hill Archaeological District # VRM Class I # ACECs (6)	# Watershed areas (5) # Special status species habitats # Percha Creek Riparian Habitat Area # Lake Valley Historic Townsite # Rattlesnake Hill Archaeological District # Jarilla Mountains # Tularosa River # Red Sands Off-road Vehicle (ORV) Area # VRM Classes I and II # VRM and ORV limited areas # Cuchillo Mountains Piñon Nut Collection Area # Lake Valley Back-country Byway # ACECs (6) # Nominated ACECs (8)

TABLE S-1
SUMMARY OF LEASING CONSTRAINTS IN DECISION AREA BY ALTERNATIVE

Constraint	Alternatives		
	No-action Alternative (Existing Management)	**Alternative A**	**Alternative B**
Open for Leasing			
No Surface Occupancy	# Caballo Mountain Communication Site # Recreation and Public Purpose (R&PPs) patents and leases # Ecological study plots (6) # Rattlesnake Hill Archaeological District # Tularosa River	# R&PPs # Community Pit 7 # Riparian/Wetlands/Playas # Ecological study plots (6) # Nutt and Otero Mesa desert grassland areas # Percha Creek Riparian Habitat Area # Lake Valley Historic Townsite # Lone Butte # Tularosa River	# R&PPs # Community Pit 7 # Riparian/Wetland/Playas # Ecological study plots (6) # Nutt and Otero Mesa desert grassland areas # Black-tailed prairie dog habitat # Lone Butte # Mormon Battalion Trail # Butterfield Trail # Jornada del Muerto Trail
Controlled Surface Use and Timing Limitation	# None	# Bighorn sheep habitat	# Bighorn sheep habitat

TABLE S-1
SUMMARY OF LEASING CONSTRAINTS IN DECISION AREA BY ALTERNATIVE

Constraint	Alternatives		
	No-action Alternative (Existing Management)	**Alternative A**	**Alternative B**
Controlled Surface Use	# Butterfield Trail # Jornada del Muerto Trail	# Berrendo Administrative Camp Site # Highly erosive and fragile soils # Watershed areas (5) # Big Game Habitat Areas # Crucial habitats # Special status species habitats # Jarilla Mountains # Mormon Battalion Trail # Butterfield Trail # Jornada del Muerto Trail # VRM Class II # VRM and ORV limited areas # Cuchillo Mountains Piñon Nut Collection Area # Lake Valley Back-country Byway # Nominated ACECs	# Berrendo Administrative Camp Site # Highly erosive and fragile soils # Big Game Habitat Areas # Crucial habitats # VRM Class III
Timing Limitation	# White Sands Missile Range Safety Evacuation Area	# White Sands Missile Range Safety Evacuation Area # Red Sands ORV Area	# White Sands Missile Range Safety Evacuation Area

TABLE S-2
SUMMARY OF POTENTIAL IMPACTS BY ALTERNATIVE

Resources	No-action Alternative (Existing Management)	Alternative A	Alternative B
Constraints	Within the Planning Area, lands administered by the military and National Park Service, as well as villages, towns, and incorporated cities are all nondiscretionarily closed to leasing. Within BLM's Decision Area: # Closed to leasing - 63,721 acres (3%) 46,047 acres nondiscretionary closures 17,673 acres discretionary closures # Open with stipulations - 243,784 acres (12%) # Open with standard lease terms and conditions (SLTC) - 1,747,500 acres (85%)	Within the Planning Area, lands administered by the military and National Park Service, as well as villages, towns, and incorporated cities are all nondiscretionarily closed to leasing. Within BLM's Decision Area: # Closed to leasing - 64,605 acres (3%) 46,047 acres nondiscretionary closures 18,557 acres discretionary closures # Open with stipulations - 1,209,307 acres (75%) # Open with STLC - 779,093 acres (38%)	Within the Planning Area, lands administered by the military and National Park Service, as well as villages, towns, and incorporated cities are all nondiscretionarily closed to leasing. Within BLM's Decision Area: # Closed to leasing - 325,155 acres (16%) 46,047 acres nondiscretionary closures 279,108 acres discretionary closures # Open with stipulations - 1,095,622 acres (63%) # Open with STLC - 632,228 acres (31%)

TABLE S-2
SUMMARY OF POTENTIAL IMPACTS BY ALTERNATIVE

Resources	No-action Alternative (Existing Management)	Alternative A	Alternative B
Lands and Access	Considering that a small percentage of land that could be disturbed to achieve the reasonable foreseeable development (RFD) scenario, and that the majority of designated lands are dispersed and most could be avoided, overall impacts on lands and access or on the ability to explore for or exploit fluid minerals would be expected to be minimal. Use of existing access is encouraged in order to avoid or minimize impacts. If new access were needed for fluid minerals activities, impacts from road construction would be unavoidable, but mitigable.	Under Alternative A, potential impacts would be the same as the No-action Alternative except that greater protection is afforded Community Pit 7 (80 acres, no surface occupancy).	Under Alternative B, potential impacts would be the same as Alternative A.

TABLE S-2
SUMMARY OF POTENTIAL IMPACTS BY ALTERNATIVE

Resources	No-action Alternative (Existing Management)	Alternative A	Alternative B
Mineral Resources	Production of fluid minerals is beneficial socioeconomically. Geothermal resources are renewable; however, oil and gas production results in an irreversible commitment of resources. Under the No-action Alternative, considering the large percentage of lands available for leasing and development, the ability to explore for and exploit fluid mineral resources is sufficient to achieve the RFD.	As explained for the No-action Alternative, production of fluid minerals is beneficial socioeconomically. Geothermal resources are renewable; however, oil and gas production results in an irreversible commitment of resources. Under Alternative A, the surface management constraints as well as required mitigation and best management practices imposed by Alternative A are not anticipated to significantly impact the ability to explore for or exploit oil and gas resources. However, some surface management requirements in certain areas potentially may burden a project financially. The costs of management versus anticipated revenue from a project may delay the project or make a project infeasible.	As explained for the No-action Alternative, production of fluid minerals is beneficial socioeconomically. Geothermal resources are renewable; however, oil and gas production results in an irreversible commitment of resources. Under Alternative B, protection of resources is greater. The ability to explore and exploit fluid mineral resources (that is, the ability to achieve the RFD) could be affected, and could be significantly affected locally, due to the increase in the acres of lands unavailable for leasing (discretionary closures) and stipulations of no surface occupancy (over Alternative A) in areas of medium potential for oil and gas and medium and high potential for geothermal resources. Also, as described under Alternative A, some surface management requirements in certain areas potentially may burden the project financially.

TABLE S-2
SUMMARY OF POTENTIAL IMPACTS BY ALTERNATIVE

Resources	No-action Alternative (Existing Management)	Alternative A	Alternative B
Soils	While impacts on highly erosive and fragile soils would occur, such impacts can be mitigated through implementing mitigation procedures under STLC implemented through conditions of approval. Prime farmland may be taken out of production, but impacts would be expected to be short term. Impacts are expected to be minimal.	Under Alternative A, anticipated impacts on highly erosive and fragile soils would be similar to the No-action Alternative. Occupancy or use of such areas would be considered on a case-by-case basis and best management practices and conditions of approval could be imposed to mitigate potential impacts. Impacts would be expected to be minimal.	Under Alternative B, impacts on highly erosive and fragile soils would not occur on lands where there are additional discretionary closures. Otherwise, impacts anticipated under Alternative B are similar to Alternative A.

TABLE S-2
SUMMARY OF POTENTIAL IMPACTS BY ALTERNATIVE

Resources	No-action Alternative (Existing Management)	Alternative A	Alternative B
Watersheds and Water Resources	Under existing management, potential impacts on groundwater would be expected to be minimal. For surface water, based on the protection provided by existing management direction, impacts on surface water (including watersheds) are expected to be minimal.	Under Alternative A, potential impacts on groundwater are anticipated to be similar to the No-action Alternative. For surface water features such as watersheds, occupancy or use in sensitive areas would be considered on a case-by-case basis and impacts could be mitigated by implementing best management practices and other conditions of approval. Impacts on riparian, other wetlands, and playas would be minimized or eliminated by imposing the stipulation of no surface occupancy within 0.25 mile (400 meters). Impacts on other surface water features could be mitigated through avoidance, or implementation of best management practices and other conditions of approval. Impacts on surface water could be less than those identified under the No-action Alternative and would be expected to be minimal.	Under Alternative B, potential impacts on groundwater are anticipated to be similar to the No-action Alternative and Alternative A. For surface water, watershed areas would be closed to leasing, thereby minimizing or eliminating impacts of fluid minerals activities on watershed areas. Impacts on riparian, other wetlands, and playas would be minimized or eliminated by imposing the stipulation of no surface occupancy within 0.5 mile (800 meters). Impacts on other surface water features can be mitigated through avoidance, or implementation of best management practices and other conditions of approval. Impacts on surface water may be less than those identified under the No-action Alternative or Alternative A and would be expected to be minimal.
Noise	Depending on site-specific conditions, there would be noise impacts on human and wildlife receptors that could be reduced, but could not be eliminated.	Under Alternative A, potential impacts from noise would be the same as the No-action Alternative.	Under Alternative B, potential impacts from noise would be the same as the No-action Alternative and Alternative A.

TABLE S-2
SUMMARY OF POTENTIAL IMPACTS BY ALTERNATIVE

Resources	No-action Alternative (Existing Management)	Alternative A	Alternative B
Vegetation	Considering the small percentage of land that could be disturbed to achieve the RFD over a period of 20 years and with proper reclamation, potential impacts on vegetation in BLM's Decision Area would be expected to be minimal. However, if the RFD were realized and focused in one area, impacts on vegetation could be more substantial resulting in direct impacts such as loss of habitat and fragmentation of habitat, and indirect impacts such as loss of topsoil through erosion. Also, spread of noxious weeds by field activities could impact native vegetation. Impacts can be reduced by protective measures and reclamation under the provisions of SLTC implemented through conditions of approval. All ecological study plots have a stipulation of no surface occupancy; therefore, potential impacts would be minimized or eliminated in those areas.	Under Alternative A, anticipated impacts on vegetation would be expected to be the same as the No-action Alternative. Impacts could be reduced by protective measures and reclamation under SLTC and best management practices implemented through conditions of approval.	Under Alternative B, anticipated impacts on vegetation would be expected to be the same as the No-action Alternative and Alternative A.

TABLE S-2
SUMMARY OF POTENTIAL IMPACTS BY ALTERNATIVE

Resources	No-action Alternative (Existing Management)	Alternative A	Alternative B
Wildlife	As with vegetation, considering the small percentage of land that could be disturbed to achieve the RFD over a period of 20 years, impacts on wildlife in BLM's Decision Area in general would be expected to be minimal. However, if the RFD were realized and focused in one area, impacts from human activity, noise, and traffic on wildlife could be more substantial. Under existing management, wildlife and crucial habitat are managed for fluid minerals as open with SLTC. If impacts on important resources were identified during site-specific investigations, SLTC allow for relocating the site a distance of up to 656 feet (200 meters), which may not be adequate to avoid such resources. SLTC also allow for delaying activities up to 60 days, although birthing and nesting periods are often longer than 60 days. SLTC would not necessarily allow BLM to substantively mitigate impacts on wildlife and fish habitat Detrimental effects that could occur under existing management include:	Under Alternative A, impacts on wildlife would be reduced from the No-action Alternative. In particular, big game habitat areas would have a stipulation for controlled surface use; that is, site-specific fluid minerals operations would avoid known populations and habitat. Habitat suitable for bighorn sheep would be managed using reasonable measures necessary to protect potential habitat from degradation and minimize adverse impacts on occupied habitat during lambing season. Each exploration and development project would be reviewed carefully to identify potential effects on the species and habitat, and a high potential exists for imposing timing limitations and other conditions of approval resulting from BLM analysis. Crucial habitat (grasslands, montane scrub, and woodland/forest) would be managed under SLTC, with best management practices and other conditions of approval to minimize loss and fragmentation of habitat.	Under Alternative B, anticipated impacts on wildlife are expected to be the same as the No-action Alternative and Alternative A.

TABLE S-2
SUMMARY OF POTENTIAL IMPACTS BY ALTERNATIVE

Resources	No-action Alternative (Existing Management)	Alternative A	Alternative B
Wildlife (continued)	(1) disturbance of birthing areas, (2) road construction into isolated or unroaded areas, (3) disturbance to nesting and waterfowl, and (4) impacts on crucial habitat (e.g., loss, fragmentation).		
Special Status Species	Based on the protection provided by existing management direction, under the provisions of SLTC implemented through conditions of approval, potential impacts on special status species would be expected to be minimal. All exploration and development activities must follow requirements of Section 7 of the Endangered Species Act and current BLM policy. Under existing management, if impacts on special status species were identified during site-specific investigations, SLTC allow for relocating the site within a reasonable distance (e.g., as much as or more than 200 meters). SLTC also allow for delaying activities within a reasonable time period (e.g., as much as or more than 60 days).	Under Alternative A, impacts on special status species would be reduced from the No-action Alternative. In addition to the protective requirements under the No-action Alternative, special status species would be managed under the stipulation of controlled surface use. Site-specific fluid minerals operations would avoid known populations and habitat. Each exploration and development project would be reviewed carefully to identify potential effects on the species and habitat, and a high potential exists for imposing timing limitations and other conditions of approval resulting from BLM analysis. Potential impacts would be expected to be minimal.	Under Alternative B, occupied or essential habitat associated with special status species would be closed to leasing, thereby minimizing or eliminating impacts from fluid minerals activities on those species.

TABLE S-2
SUMMARY OF POTENTIAL IMPACTS BY ALTERNATIVE

Resources	No-action Alternative (Existing Management)	Alternative A	Alternative B
Cultural Resources	Based on the protection provided by existing management direction, impacts on cultural resources would be expected to be minimal. Potential impacts on cultural resources would be reviewed and considered in accordance with Section 106 of the National Historic Preservation Act using established procedures. Implementation of such procedures would be expected to result in avoidance of any identified adverse effects or satisfactory mitigation of those effects.	Under Alternative A, potential impacts on cultural resources of particular concern would be reduced from the No-action Alternative. More restrictive stipulations (controlled surface use, no surface occupancy, and discretionary closures) would further protect these important cultural resources. Other cultural resources would be protected as described under the No-action Alternative. Potential impacts would be expected to be minimal.	Under Alternative B, potential impacts on cultural resources of particular concern would be reduced further from Alternative A by managing these resources with even more restrictive stipulations. Other cultural resources would be protected as described under the No-action Alternative. Potential impacts would be expected to be minimal.
Recreation	Considering the small percentage of land that could be disturbed to achieve the RFD over a period of 20 years, and that the majority of designated recreation areas are dispersed and most likely could be avoided, impacts on recreation in general would be minimal. A portion of the recreation areas along the Tularosa River are managed allowing no surface occupancy; therefore, impacts would be minimized or eliminated in that area.	Under Alternative A, potential impacts on recreational resources in general and Tularosa River area would be the same as the No-action Alternative. Recreational resources of particular concern would be given more protection through stipulations (timing limitation or controlled surface use) intended to preserve the recreational experience.	Under Alternative B, potential impacts on recreational resources in general would be the same as the No-action Alternative. Recreational resources of particular concern would be given greater protection than Alternative A by closing them to leasing, thereby preserving the recreational experience and minimizing or eliminating potential impacts from fluid minerals activities.

TABLE S-2
SUMMARY OF POTENTIAL IMPACTS BY ALTERNATIVE

Resources	No-action Alternative (Existing Management)	Alternative A	Alternative B
Visual Resources	Under existing management, Visual Resources Management (VRM) Class I areas are closed to leasing and, therefore, no visual impacts would occur in these locations as a result of fluid minerals activities. VRM Classes II, III, and IV are managed with SLTC, under which development of facilities has the potential to result in significant visual impacts in some areas. Development likely would result in contrast of line, form, color, and texture to the characteristic landscape and would attract attention depending on the location and proximity to sensitive viewers. Impacts on other areas may occur due to the introduction of facilities that are not characteristic of the existing setting, but can be mitigated.	Under Alternative A, potential impacts on visual resources would be the same as the No-action Alternative except that a more restrictive stipulation (controlled surface use) on areas designated as VRM Class II would reduce impacts in these areas.	Under Alternative B, potential impacts on visual resources would be the same as Alternative A except that a more restrictive stipulation (controlled surface use) in areas designated as VRM Class III would reduce impacts in these areas.

TABLE S-2
SUMMARY OF POTENTIAL IMPACTS BY ALTERNATIVE

Resources	No-action Alternative (Existing Management)	Alternative A	Alternative B
Special Management Areas	Under existing management, Wilderness Study Areas (WSAs) and Areas of Critical Environmental Concern (ACECs) are closed to leasing, thereby minimizing or eliminating potential impacts on these resources from fluid minerals activities. Nominated ACECs are managed with SLTC; however, because these areas were nominated primarily to protect special status species and associated habitat, requirements for special status species described above would apply.	Under Alternative A, potential impacts on WSAs and ACECs would be the same as the No-action Alternative. Potential impacts on nominated ACECs could be reduced. In addition to the requirements described under the No-action Alternative, nominated ACECs would be managed with the stipulation of controlled surface use.	Under Alternative B, potential impacts on WSAs and ACECs would be the same as the No-action Alternative and Alternative A. Nominated ACECs would be closed to leasing, thereby minimizing or eliminating potential impacts from fluid minerals activities.
Social and Economic Conditions	The achievement of the RFD would result in positive primary and secondary economic effects as well as generate royalties and tax revenue. Environmental justice issues were considered and no significant adverse impacts that would disproportionately affect minority or low-income communities are anticipated at this time.	Under Alternative A, potential impacts would be the same as the No-action Alternative.	Under Alternative B, potential impacts would be the same as the No-action Alternative and Alternative A.

NOTE: Acreages are approximate

CHAPTER 1 – INTRODUCTION

1.1 PURPOSE AND NEED

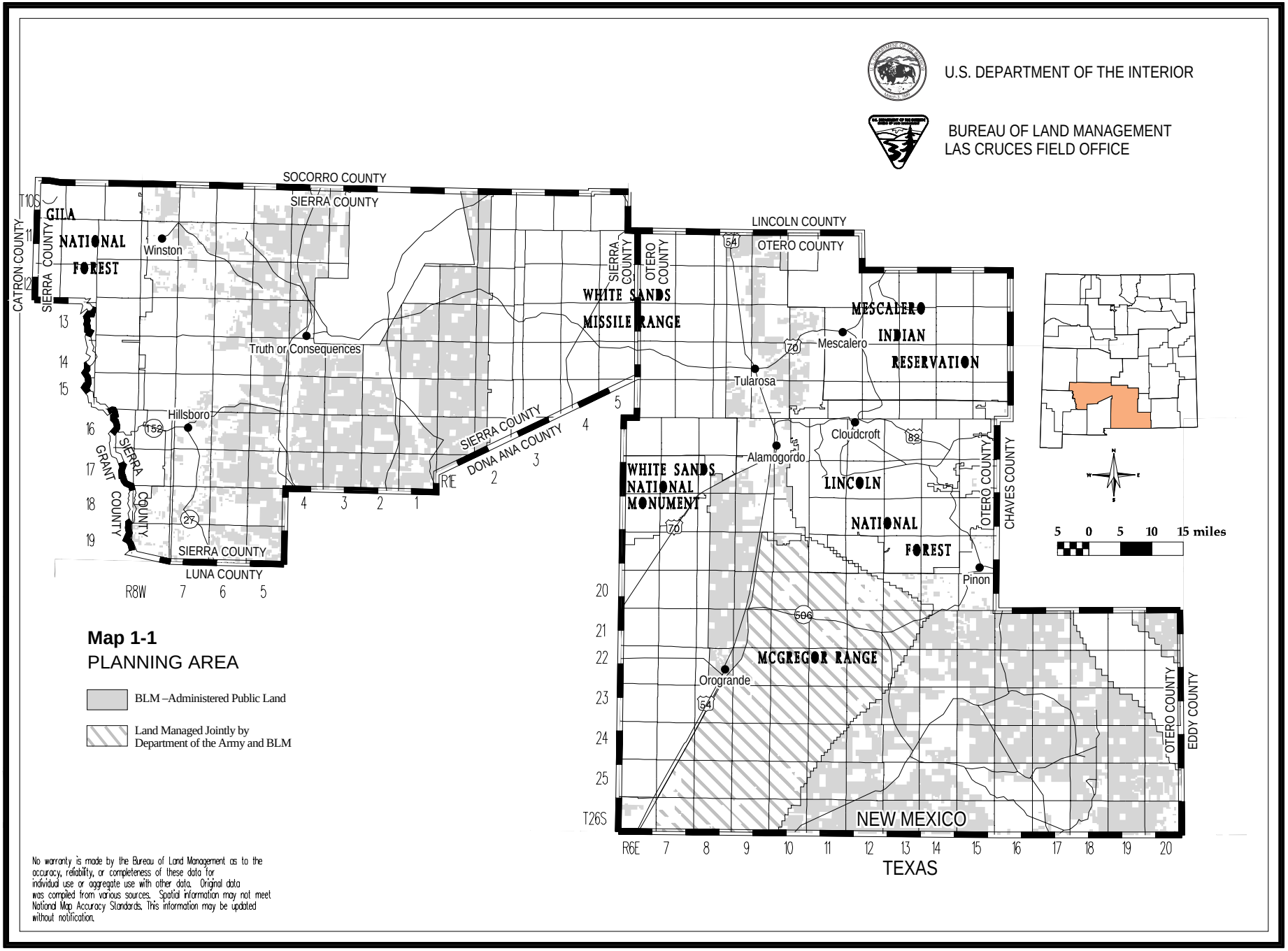
The Bureau of Land Management (BLM) has prepared this Resource Management Plan Amendment (RMPA) and Environmental Impact Statement (EIS) to address Federal fluid minerals (oil, gas, and geothermal) leasing and development in Sierra and Otero Counties (Map 1-1), formerly the White Sands Resource Area. The RMPA will amend the 1986 Resource Management Plan (RMP) for the White Sands Resource Area.

The Minerals Leasing Act of 1920, as amended, provides the Secretary of the Interior with authority to issue leases on lands where the mineral rights are held by the Federal government. This authority has been delegated to the BLM State Director. As of 1992, BLM is required to determine (1) which lands overlying Federal fluid minerals are suitable and available for leasing and subsequent development and (2) how those leased lands will be managed. Such determinations are required in every RMP prepared by BLM.

Although fluid minerals exploration has occurred in Sierra and Otero Counties, extensive development has not resulted. Oil and gas exploration has occurred within the Sierra and Otero Counties since at least 1925, when the first well was drilled in Otero County. To date, 98 wells have been drilled in the Planning Area, of which 74 are on Federal leases. Shows of oil or gas were reported for 21 of the wells on Federal leases. However, extensive field development has not resulted. Geothermal exploration also has occurred within Sierra and Otero Counties, often in conjunction with military or university (New Mexico State University) efforts to locate geothermal resources. Geothermal resources have been used in localized areas for space and swimming pool heating, particularly in the vicinity of Truth or Consequences.

In 1998, a gas find in Otero Mesa resulted in increased interest on the part of the oil and gas industry. Large increases in the number of lease nominations on public land prompted the BLM to review the 1986 RMP with regard to guidelines for fluid minerals leasing and development. Given the lack of direction in the existing 1986 RMP and the increasing level of interest in exploration, it was determined that an amendment to the 1986 RMP is required to guide leasing decisions on public land in order to comply with the 1992 supplemental guidelines described above (BLM Handbook H1624-1).

The BLM has issued mineral leases prior to the issuance of this document under existing RMP management policy, guidance, and decisions. However, the BLM deferred any new leasing pending completion of the RMPA/EIS. Lessees were given the option of voluntarily suspending existing leases for the duration of the RMPA/EIS process.


U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
LAS CRUCES FIELD OFFICE
SOCORRO COUNTY
SIERRA COUNTY
LINCOLN COUNTY
OTERO COUNTY
CATRON COUNTY
GILA NATIONAL FOREST
Winston
Truth or Consequences
Hillsboro
WHITE SANDS MISSILE RANGE
MESCALERO INDIAN RESERVATION
Mescalero
Tularosa
Cloudcroft
Alamogordo
WHITE SANDS NATIONAL MONUMENT
LINCOLN NATIONAL FOREST
Pinon
MCGREGOR RANGE
Orogrande
CHAVES COUNTY
EDDY COUNTY
GRANT COUNTY
DONA ANA COUNTY
LUNA COUNTY
NEW MEXICO
TEXAS
T10S
T26S
R8W
R1E
R6E
5 0 5 10 15 miles
Map 1-1
PLANNING AREA
BLM –Administered Public Land
Land Managed Jointly by Department of the Army and BLM
No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual use or aggregate use with other data. Original data was compiled from various sources. Spatial information may not meet National Map Accuracy Standards. This information may be updated without notification.

The result of the BLM planning process will be an RMPA that identifies which lands under BLM jurisdiction in Sierra and Otero Counties should be made available for development through leasing and what requirements, or stipulations, are needed to manage those lands and protect other resource values. Stipulations that will be attached to Federal fluid mineral leases may include controlled surface use, timing limitations, or no surface occupancy. The document also will identify the circumstances necessary for granting waivers, exceptions, or modifications to stipulations. Preparation of the RMPA is guided by BLM planning regulations (43 CFR 1600-1610) issued under the authority of the Federal Land Policy and Management Act of 1976 and by BLM Handbook H-1624-1 (Planning for Fluid Minerals Resources), and associated regulations.

The EIS will identify the potential impacts that alternatives for fluid minerals leasing and subsequent activities could have on the environment and identify appropriate measures to mitigate those impacts. The primary purpose is to analyze and document the direct, indirect, and cumulative impacts of reasonably foreseeable future actions resulting from Federally authorized fluid minerals activities. By law, these impacts must be analyzed before an agency makes an irreversible commitment of resources. In the fluid minerals program, this commitment occurs at the point of lease issuance (BLM Handbook H-1624-1 I.B.2.). The EIS prepared with the RMPA is intended to satisfy the requirements of the National Environmental Policy Act of 1969 (NEPA), Council on Environmental Quality regulations implementing NEPA (40 CFR 1500-1508), and other associated regulations.

This RMPA/EIS, prepared to meet current requirements of the Federal fluid minerals program, is not the final review upon which approval of all proposed actions in the Sierra and Otero Counties will be based. Rather, the RMPA will identify lands within BLM's jurisdiction that are available for leasing and how those leased lands will be managed. Decisions on all subsequent site-specific actions will be tiered from this RMPA/EIS. That is, further environmental analyses and additional NEPA compliance will be required; however, the scope of the site-specific approval process will be streamlined and facilitated by the planning and programmatic evaluation of impacts accomplished in the RMPA/EIS.

1.2 LOCATION

Sierra and Otero Counties are located in south-central New Mexico. The two counties are addressed in their entirety throughout this document, regardless of jurisdiction or ownership. This two-county area is referred to in this document as the Planning Area. Of the approximately 7 million acres of Federal, State, Tribal, and private lands in Sierra and Otero Counties, BLM administers approximately 1.8 million surface acres and 5 million acres of Federal fluid mineral (subsurface) estate. The latter is the area within which BLM is mandated and has the authority to approve leases (including private- or State-owned surface acreage overlying Federally owned minerals [referred to as split estate]). The BLM considers potential impacts on all resources in the Planning Area regardless of surface ownership or management, and makes decisions on Federal fluid mineral leases in consultation with those other

surface owners and managers. Public land and private split-estate lands are referred to in this document as BLM's Decision Area and includes approximately 2,058,099 acres.

1.3 PLANNING PROCESS FOR THE RMPA/EIS

The RMPA process employs the nine basic steps of the BLM planning process, which are listed below and described in the planning regulations (Manual 1617, Section .42):

- identification of issues
- development of planning criteria
- data and information collection
- management situation analysis
- formulation of alternatives
- estimation of effects of the alternatives
- selection of the preferred alternative(s)
- selection of the plan amendment
- monitoring and evaluation

The process requires the use of an interdisciplinary team of resource specialists to complete each step.

1.3.1 Step 1 – Identification of Issues

Issues were identified through the scoping process at the beginning of the project. Scoping, and the RMPA/EIS process, began with the publication in the *Federal Register* of the Notice of Intent (NOI) to amend the RMP, prepare an EIS, and conduct public scoping meetings. The NOI was published on October 15, 1998. In addition to the NOI, BLM prepared a scoping notice to send to approximately 700 agencies, interested organizations, and individuals in early October 1998. Also, a media release introducing the project and announcing the scoping meetings was prepared and issued on October 21, 1998 by the BLM to local and regional newspapers, television, and radio.

Three public scoping meetings were conducted by the BLM in early November 1998 (see Chapter 5, Section 5.4). A total of 36 people attended the three meetings and 102 oral comments were received. In addition to the comments received during the meetings, a total of 36 comment forms and letters were submitted to the BLM. Scoping ended on November 16, 1998; however, additional comments were accepted after that date.

All of the comments and questions received were compiled, reviewed, and analyzed to identify the issues to be addressed in the RMPA/EIS. Comments primarily addressed the RMPA/EIS process;

leasing; exploration, development, and production; lands and access; resources other than fluid minerals; socioeconomics; mitigation and reclamation; and operations and maintenance. The scoping process, including a summary of comments and issues, was documented in a Scoping Summary Report in January 1999 and sent to the interested parties on the mailing list. A complete record of scoping is on file at the BLM Las Cruces Field Office. The comments and issues, and where they are addressed in this document, are summarized in Table 1-1.

TABLE 1-1
ISSUES IDENTIFIED THROUGH THE SCOPING PROCESS

Issue	Section(s) is RMPA/EIS Where Issue is Addressed
Justify the need for this process and leasing deferment.	Chapter 1, Section 1.1
Provide adequate time for public review and response.	Chapter 1, Section 1.3.8
Consider mitigative effects of leasing, management options, and new technology.	Chapter 4; Appendices A-III, A-V, B
Provide an objective set of rules and criteria for decision making.	Chapter 1, Section 1.3
Consider a range of alternatives including least restrictive, balanced, and no leasing.	Chapter 2, Sections 2.3 and 2.4
Specify how existing lease rights would be impacted by the RMPA.	Chapter 2, Section 2.3
What will be the potential damage to lands due to construction and maintenance of roads during development and production?	Chapter 4 Appendix B
What will be the impacts on the existing transportation system?	Chapter 3, Section 3.4.5; Chapter 4, Section 4.2.1
Review existing RMPs to ensure consistency.	References
Clarify split estate rules.	Chapter 2, Section 2.2.1
What is the potential for land subsidence due to extraction of fluid mineral resources?	Chapter 4, Section 4.2.2
Concern about impacts on resources (soil, vegetation, wildlife and habitats, desert grassland habitat fragmentation, rangeland, cultural sites, recreation, and visual setting).	Chapter 4 Appendix B
What will be done to protect the aquifers and water quality in general?	Chapter 3, Section 3.7; Chapter 4, Section 4.2.4
Exclude Wilderness Study Areas (WSAs) and other proposed wilderness from leasing.	Chapter 2, Section 2.3.2; Chapter 4, Section 4.2.15
Prohibit activities in areas of critical environmental concern (ACECs).	Chapter 2, Section 2.3.2; Chapter 4, Section 4.2.15
Examine the importance of fluid mineral production to local economies.	Chapter 3, Section 3.19; Chapter 4, Section 4.2.16
What are potential impacts on the growth of the area and property values?	Chapter 3, Section 3.19; Chapter 4, Section 4.2.16
How will affected land be rehabilitated and will funds be assured for reclamation measures?	Chapter 4; Appendices A-III, B

1.3.2 Step 2 - Development of Planning Criteria

The planning criteria to guide the development of the RMPA/EIS include the following:

- comply with laws, executive orders, and regulations
- provide orderly leasing and development of fluid minerals while holding environmental damage to as minimum as practical
- provide for conservation of mineral resources
- provide for the rehabilitation of affected land
- minimize soil erosion
- provide for the protection of water resources
- provide for the protection and management of plant and animal special-status species
- provide for the protection and management of wildlife and wildlife habitat\
- provide for the protection of cultural and paleontological resources
- provide for the availability of recreation opportunities
- identify, protect, and enhance visual quality
- maintain public health and safety
- consider social and economic effects

1.3.3 Step 3 - Data and Information Collection

The majority of data and information was extracted and used from existing data on file at the BLM Las Cruces Field Office. Other data were obtained from relevant sources to update and/or supplement the BLM's data (see References). Data included published and unpublished reports, maps, and digital format (geographic information system). Resource concerns addressed include the following:

- lands and access
- geology and minerals
- soils
- water resources
- air quality
- noise
- vegetation
- wildlife
- special status species
- rangeland
- cultural resources
- paleontological resources
- recreation
- visual resources
- special management areas
- social and economic conditions

As a part of this step, relevant geological data were compiled and reviewed to estimate the potential for oil and gas and geothermal resources in the Planning Area. This and other historical data served as the basis for estimating the fluid minerals development that is reasonably foreseeable over the planning period of the next 20 years.

1.3.4 Step 4 - Management Situation Analysis

The purpose of the Management Situation Analysis (MSA) is to conduct a deliberate assessment of the current situation as it relates to Federal fluid minerals. The documentation is a compilation of information appropriate and commensurate with the planning issues. The MSA provides a profile of the resource concerns in the Planning Area, description of the existing management situation as it pertains to Federal fluid minerals, and analysis of opportunities to modify the existing management situation. The MSA and accompanying resource maps are on file at the BLM Las Cruces Field Office.

1.3.5 Step 5 – Formulation of Alternatives

Three alternatives were examined. The alternatives were developed to respond to issues identified through scoping, explore alternatives to the existing management situation, comply with BLM's planning guidelines for fluid mineral resources (Handbook H-1624-1), and comply with the Federal Land Policy Management Act (FLPMA) requirement of managing for sustained yield and multiple use on public land.

The No-action Alternative is the existing management situation and assumes that existing management would continue; that is, compliance with laws and regulations, and existing management plans, policies, decisions would continue on a case-by-case basis. Two alternatives were developed that are modifications to existing management. Alternative A incorporates legislative or regulatory requirements and/or management objectives that otherwise would be achieved on a case-by-case basis under existing management. Alternative B accomplishes the same objective as Alternative A, but provides a relatively greater emphasis on resource protection by imposing more constraints on fluid minerals leasing and development. The selection of Alternatives A or B would allow subsequent site-specific decisions and analyses to be tiered from the RMPA/EIS, thereby expediting future compliance with NEPA and other legal and regulatory requirements. The existing management situation and alternatives are described further in Chapter 2

The No-action Alternative assumes that the existing management situation will continue. Compliance with laws and regulations would continue on a case-by-case basis. Alternatives A and B address existing legislative and regulatory requirements at a programmatic level, and/or place constraints if resource values are determined to be sufficiently high or protections are justified in the public interest. Decisions and analysis would be tiered from the RMPA/EIS, thereby expediting future NEPA analysis and other legal and regulatory requirements. Alternatives and the existing management situation are described further in Chapter 2.

1.3.6 Step 6 – Estimation of Effects of Alternatives

A scenario of the reasonable foreseeable development (RFD) of fluid minerals within the Planning Area was developed in order to estimate the extent of potential impacts for each alternative. The beneficial and adverse impacts resulting from each of the alternatives were identified and evaluated. Mitigation measures also were considered in evaluating impacts. The baseline information that describes the existing environment in the Planning Area is included in Chapter 3, and environmental consequences are discussed in Chapter 4. The RFD used in the impact assessment is described in Chapter 2 and Appendix A-IV.

1.3.7 Step 7 – Selection of the Preferred Alternative

Based on the information generated in Step 6, the Las Cruces Field Manager identified and recommended Alternative A as the preferred alternative to the BLM State Director. The Draft RMPA/EIS then was completed and distributed to the public for review and comment. BLM presently is at this step of the process.

1.3.8 Step 8 – Selection of the Plan Amendment

Based on the results of the public review of and comment on this Draft RMPA/EIS, the Las Cruces Field Manager will recommend and the BLM State Director will select an alternative or a combination of the alternatives to be the Proposed RMPA and publish it along with the Final EIS. A final decision will be made after a 60-day Governor's Consistency Review and a 30-day protest period. A Record of Decision (ROD) and Approved RMPA then will be published.

1.3.9 Step 9 – Monitoring and Evaluation

Once the RMPA has been approved, it will serve as management guidance for Federal fluid minerals actions for BLM's Decision Area. The applicable stipulations will be attached to leases, and management prescriptions will be applied to site-specific areas in issuing use authorizations, permits to drill, and mitigation needs.

Over time, BLM will monitor and evaluate actions, resource conditions, and trends to determine the effectiveness of the RMPA and to ensure that implementation of the RMPA is achieving the desired results. The RMPA will be kept current through minor maintenance, amendments, or revisions as demands on resources change, as the resources change, or as new information is acquired.

1.4 RELATIONSHIP TO BLM POLICIES, PLANS, AND PROGRAMS

This document has been prepared to reflect and be consistent with current laws, regulations, and supplemental program guidance (BLM Manual Section 1624.2) for fluid minerals leasing and provide the public the opportunity to review leasing decision making.

The 1986 *White Sands Resource Management Plan* set forth decisions that are considered and will be incorporated appropriately into the RMPA. Since 1986, two RMPAs have addressed specific areas within the Planning Area. Fluid minerals leasing and development were addressed in the McGregor Range RMPA/EIS (BLM 1990) and those decisions will be carried forward unchanged. The RMPA (BLM 1997) that created five new ACECs in the Planning Area and expanded an existing ACEC closed those areas to leasing; the decisions within that RMPA also will be carried forward unchanged.

WSAs are designated by the Federal government and managed in accordance with the Wilderness Management Policy (BLM 1981). Two WSAs are included in BLM's Decision Area that have not received formal Congressional designation; these areas are managed under the Interim Management Policy Guidelines for Land Under Wilderness Review (BLM 1979).

CHAPTER 2 - ALTERNATIVES

2.1 INTRODUCTION

This chapter describes continuing management guidance and the alternatives examined for the Resource Management Plan Amendment/Environmental Impact Statement (RMPA/EIS). Continuing management guidance refers to the direction provided by legislation, the Resource Management Plan (RMP), and other relevant authority on public land within the Planning Area that applies to all alternatives. The section on alternatives describes the range of alternatives developed to address resource concerns identified through scoping.

The alternative selected and documented in the RMPA will update existing management decisions that pertain to fluid minerals leasing and development in the previous RMP. Those public land resources and programs not addressed in this document will continue to be managed under the existing RMP and RMPAs, and as outlined in the section on continuing management guidance.

2.2 CONTINUING MANAGEMENT GUIDANCE AND ACTIONS

This section describes the existing resource management guidance and actions in BLM's Decision Area. It is based on the more detailed discussions in Section 3.0 of the Management Situation Analysis on file at the Las Cruces Field Office of the Bureau of Land Management (BLM).

Overall guidance is provided through regulations and other mandates, which are provided in Appendix A-I. The information that follows pertains to public land in the Planning Area.

2.2.1 Lands and Access

Within the Planning Area, approximately 2,042,311 acres of public land have been withdrawn in order to protect special uses or resources, or to ensure public safety (this acreage was calculated by adding the acreage managed by the Department of Defense [both withdrawn and acquired], National Park Service, Bureau of Reclamation, and public water reserves). These areas include the White Sands Missile Range, Holloman Air Force Base, McGregor Range, Bureau of Reclamation projects, Federal Aviation Administration land, and others. Decisions regarding fluid minerals leasing are addressed in the legal documents enabling the withdrawals and will be carried forward unchanged.

BLM is responsible for ensuring that mineral development on split estates (privately or State-owned surface area overlying Federally owned minerals) occurs in accordance with existing statutes and

regulatory requirements, and that National Environmental Policy Act (NEPA) documentation considers impacts on surface area in the event of mineral development.

Where the surface is privately owned, the operator (i.e., the person who has taken formal responsibility for the operations conducted on the leased land) is responsible for reaching agreement with the private surface owner. The agreement should establish the requirements for the protection of surface resources and/or damages. In areas where actions on private surface may affect the surface of adjacent Federal or Indian lands, BLM may request submission of the private agreement. If the agreement is not adequate to protect adjacent Federal or Indian lands, the area may require additional protective measures. However, construction standards or mitigation measures more stringent than those otherwise provided by applicable agency standards or plans would not be required. Each Application for Permit to Drill (APD) or other application to conduct other surface-disturbing activities needs to include the name and contact information of the private surface owner. As applicable, BLM would invite the surface owner to participate in any on-site inspection conducted. In the absence of an agreement, BLM may permit the operations provided the operator has complied with the provisions of the law and Federal regulations. Regardless, BLM will require a surface use plan for all operations, including those on private surface. Surface protection and restoration requirements will be included in the surface use plan even if the agreement between the surface owner and the operator is silent in this regard.

The operator is responsible for making access arrangements with the private surface owner prior to entry for purposes of surveying and staking a well site location and/or access road. The operator may be required to obtain any cultural resource or threatened and endangered species clearances that may be necessary. However, if the private surface owner objects to either an inventory or mitigation, a written statement to that effect should be obtained from the surface owner. Documentation regarding the lack of survey and mitigation would be submitted by the operator to the BLM or the appropriate surface-management agency. The operator should be aware that the inability to obtain permission to conduct a survey or mitigation does not relieve BLM or other surface-management agency from its responsibilities as required by NEPA, the National Historic Preservation Act, Endangered Species Act, or other applicable regulations. BLM still must be responsible for preparing environmental documentation and initiation of any consultation with appropriate State or Federal agencies, as necessary. Operators should be aware of the potential for delays in approval of projects if extended consultation is required.

A number of areas within BLM's Decision Area have been designated for specific public uses, and the management to sustain those uses will continue. Designated areas are as follows:

- The Cuchillo Mountains Piñon Nut Collection Area is located in the northwest portion of the Planning Area. The trees in this area are maintained in order to provide personal and commercial piñon nut collection (Decision R-2 in the 1986 RMP).

- Community Pit 7, a mineral material area for public use, is located on 80 acres in Otero County approximately 14 miles north of Orogrande. Sand may be extracted from the pit during the week; however, extraction activities are suspended on weekends because it is used as a staging area for motorcycle use in the nearby Red Sands Off-road Vehicle (ORV) Area.

- Personal sales of red building stone occur in the Green Canyon Common Use Area, on approximately 5 acres in Sierra County.

- Sand and gravel may be extracted from Apache Canyon in Sierra County, as long as the arroyo banks are not disturbed.

- Decision L-1 in the 1986 RMP places surface use restrictions in areas of public water reserves pursuant to Congressional statutes permitting certain public land withdrawals. Specifically, the smallest legal subdivision surrounding a spring or water hole, or land within .25 mile (400 meters) of a spring or water hole on unsurveyed land, must be withdrawn from settlement, location, sale, or entry in order to reserve public use of the water reserve.

- Decision L-2 in the 1986 RMP prohibits subsurface use of land that was used as an impact area on the former Air Force bombing and gunnery range until the restriction is removed (Public Land Order 2569).

- Under the Recreation and Public Purposes (R&PP) Act, BLM has the authority to lease or patent land to governmental and nonprofit entities for public parks, building sites, or other public purposes. The proposed rule for oil and gas leasing notes that R&PP lands may be subject to leasing under stipulations, if appropriate. However, existing management generally prohibits surface occupancy to any use other than the intended R&PP use to protect recreation and public purpose facilities.

In order to accommodate BLM's multiple-use responsibilities, access and roads will be provided to most of those public lands that currently have none. Generally, maintenance and easement acquisition are conducted in support of resource management objectives. Easements are acquired on a case-by-case basis. Public demand, administrative needs, resource values or conflicts, and availability of existing access are criteria that guide prioritization of areas for access development. Roads are constructed only when existing roads cannot be used or where off-road travel is not possible because of terrain.

All roads are constructed or maintained in accordance with the BLM New Mexico Road Policy. Specific road construction and maintenance standards are determined on a case-by-case basis dependent on resource management needs, user safety, impacts on environmental values, and construction and maintenance costs. The process is coordinated with adjacent landowners and permittees as appropriate.

Specific management direction associated with access is intended to protect unique resources or values where BLM determines it necessary. This pertains to controlling surface use by limiting ORV use to existing roads and trails or closing areas to ORV use completely. ORV use restrictions are described further in the discussion of recreation resources.

2.2.2 Minerals

Mineral activities in the Planning Area include geophysical exploration for hydrocarbons and geothermal resources, exploration for oil and gas via wells, exploration and development of locatable materials, and extraction of mineral materials. The BLM is responsible for ensuring that mineral development occurs in such a way as to minimize environmental damage and provide for the rehabilitation of affected land.

The prime management concern that may involve the other mineral resources is the need for saleable minerals such as sand and gravel, caliche, and fill material. Sand and gravel probably would be needed for access road and drill pad development. Should production be established, additional gravel and/or sand would be required at the supporting ancillary facilities. When possible, sales of mineral materials are made from designated community pits, which helps to keep surface disturbance on public lands to a minimum (BLM 1984).

2.2.3 Soils

Federal legislative acts that BLM generally must consider in addressing the management and protection of soils and prime farmland include the Federal Land Policy and Management Act of 1976 (FLPMA), Clean Water Act, Farmland Protection Policy Act of 1984, Executive Order 11752 (December 1973), Executive Order 11988 (May 1977), and Soil and Water Resources Conservation Act of 1977.

The general management objectives stated in the 1986 RMP for soil resources are to maintain productivity, minimize erosion, and stabilize the resources. Management activities in areas of high erosion potential are designed to minimize surface disturbance to the extent possible. In addition, areas of soil disturbance would be reclaimed. Management of soils within Sierra and Otero Counties include coordination with the related programs of State, local, and other Federal agencies.

Existing management decisions in the RMP specific to soils include the watershed areas that are listed in Table 2-1. The primary management objectives of the watershed areas are to improve watershed values by reducing peak runoff rates, reduce sediment yields, improve water quality, and receive better on-site, long-term use of runoff. In each case, ORV use is limited to existing roads and trails.

TABLE 2-1
WATERSHED AREAS

RMP Decision	Description	Acres
W-1	Wind and Chess Draw (Cornudas Mountain)	34,499
W-2	Moccasin and Otto Draw (southwest of Piñon)	13,662
W-3	East of Tularosa and south of Tularosa River	17,046
W-4	Three Rivers (north of Tularosa)	12,741
W-5	East of Crow Flats	14,890

SOURCE: Bureau of Land Management 1986a, geographic information system database 1998
NOTE: Acres were calculated using current data in a geographic information system and may be different from acres published in the 1986 Resource Management Plan and subsequent *Federal Register* notice.

BLM is continuing erosion control work in specific areas in Otero County near Alamogordo, on the Batte, Virden, and Walker allotments. These projects involve creating frequent "gully-plugs" with heavy equipment along feeder drainages of major arroyos, beginning at the top of the watershed. This occurs in conjunction with chemical brush controls and grazing deferment. With this combination of management actions, large watershed areas are being improved.

2.2.4 Water Resources

Protection of water resources specific to fluid minerals development would be achieved through compliance with BLM regulatory requirements for onshore oil, gas, and geothermal operations. These regulations are discussed in Title 43 of the Code of Federal Regulations (CFR) Parts 3160 and 3162 and in the BLM Oil and Gas Adjudication Handbook 3203-1. Also, other regulations provide additional guidance as described below and in Appendix A-I.

Federal regulations regarding water resources are implemented and administered at the State level. The State of New Mexico establishes standards for State and interstate water bodies, assesses the quality of waters, adopts regulations, and develops programs and takes actions to protect and maintain water quality through the New Mexico Water Quality Control Commission (NMWQCC) New Mexico Office of the State Engineer (SEO), and New Mexico Oil and Gas Division (NMOGD) programs. Surface water flows are dictated primarily by existing water rights and irrigation requirements as administered by the SEO and U.S. Bureau of Reclamation.

The NMWQCC develops groundwater protection regulations and establishes standards for groundwater, assesses the quality of groundwater, and takes actions to protect and maintain groundwater quality. The comprehensive set of regulations is designed to protect all groundwater with total dissolved solids (TDS) concentrations of 10,000 milligrams per liter or less for present and potential future use as domestic and agricultural water supply (NMWQCC 1996). The general surface water standards are applicable at all times to all surface waters of the State, unless otherwise specified, and include site-specific standards for stream segments, including their designated uses for which the

water quality is to be maintained; numeric and narrative standards to sustain the uses; and specific numeric water quality standards for existing, attainable, and designated uses (NMWQCC 1996).

The principal mechanism regulating discharge to surface water, the Federal National Pollutant Discharge Elimination System permit, is administered by the NMWQCC on the delegated authority of the U.S. Environmental Protection Agency (EPA). Effluent regulations apply to specific discharges entering the public waters of the state, and in areas with only ephemeral streams or groundwater resources to protect water quality (40 CFR Part 133). In addition, stormwater discharge permits are required for construction activities disturbing 5 or more acres of land as covered under Section 402 (p) of the Clean Water Act.

Section 303(d) of the Clean Water Act requires states to identify waters that do not or are not expected to meet applicable water quality standards with technology-based controls alone. This identification of water-quality-limited waters is presented in a document called the 303(d) List, updated biennially. Once listed, the State is required to prioritize these waters, analyze the causes of the water quality problem, and allocate responsibility for controlling the pollution under a process known as the Total Maximum Daily Load process. This results in the determination of the amount of a specific pollutant that a water body or stream segment can receive without violating water quality standards and the apportionment to the different contributing sources of the pollutant loading. For a water-quality-limited stream segment that requires a total maximum daily load, the State must quantify the pollutant sources and allocate allowable loads to the contributing sources, both point and nonpoint, so that the water quality standards can be attained for that segment (New Mexico Environment Department 1998).

As of 1996, 47 numeric groundwater quality standards for various compounds had been adopted. In addition to the numeric standards, it is required that approximately 87 listed toxic pollutants not be present in concentrations which would create a lifetime risk of more than one cancer per 100,000 exposed persons at a place of present or reasonably foreseeable future use (NMWQCC 1996).

Also, New Mexico has received delegated authority from the EPA to implement, at the State level, the wastewater revolving loan program of the Clean Water Act (33 USC 1288), hazardous waste underground injection control (UIC), and public water supply programs of the Safe Drinking Water Act, and hazardous waste management and State underground storage tank programs of the Federal Resource Conservation and Recovery Act (RCRA). Other Federal programs such as Superfund, the uranium mill tailings programs, and the Waste Isolation Pilot Plant, are programs in which the State plays a role (NMWQCC 1996).

Section 319 of the Clean Water Act is a nonpoint source management program that allows states to establish projects for improving water quality with respect to nonpoint sources. No regulatory mechanism exists for implementation of this program.

Because so many activities may affect water quality, the New Mexico Water Quality Act (Chapter 74, Article 6 NMSA 1978) is one of numerous State laws involved in water quality protection. Other relevant legislation includes the Utility Operators Certification Act, Wastewater Facility Construction Loan Act, Oil and Gas Act, Environmental Improvement Act, Solid Waste Act, Hazardous Waste Act, Mining Act, and several laws giving authority to local governments to regulate water quality (NMWQCC 1996).

Groundwater is the major water source for livestock within the Planning Area, and currently the trend is to conserve more groundwater for future needs than is currently necessary. Water rights for the use of underground water in the State are administered by the SEO. Rules and regulations governing drilling of wells and appropriation and use of groundwater in New Mexico were formulated for the purpose of carrying out the provisions of the statutes governing underground waters and describing the present extent of all declared underground water basins in New Mexico. An application to appropriate groundwater within declared basins must be filed with, and a permit obtained from, the SEO. Wells may be drilled and groundwater appropriated outside of the boundaries of declared underground basins (in undeclared underground basins) for beneficial use within the State without the appropriator making application to the SEO subject only to prior and existing rights within such areas (SEO 1995).

To ensure orderly development of groundwater resources within the Tularosa Declared Basin, the Water Rights Division of the New Mexico SEO developed administrative criteria for a basin sub-area, which were adopted by the SEO in May of 1997. At present, most pending well applications are located near Alamogordo and Tularosa. The criteria provide administrative guidelines for processing water rights applications within that sub-area. Because of the high level of TDS in the basin, groundwater applications would be evaluated for their impact on dissolved solids as well as for their impact on water supplies. Applications outside the sub-area would be considered on a case-by-case basis. Further information can be obtained from the SEO Water Rights Division (SEO 1999b).

The SEO Water Rights Division has no jurisdiction on the undeclared basin in Otero County. Water is not appropriated and a well permit is not required to drill a water well in the undeclared basin. The area is regarded as low priority with the Water Rights Division because it is sparsely populated and few complaints have been filed regarding water issues (SEO 1999b).

Use of surface waters also requires water rights permitting, which is handled through the SEO under New Mexico Statutes 1978, Chapter 72, Water Law.

In oil, gas, and geothermal drilling programs, disposal UIC wells are designed for “well injection” of wastewater and are subject to the permitting and regulatory control provisions of the Federal Safe Drinking Water Act’s Underground Injection Control Program (40 CFR Parts 144 and 146.22) (40 CFR Parts 100 to 149, July 1, 1991 revision). A UIC permit from the NMOGD is required prior to drilling a new injection well. Injection pressures and volumes are monitored to ensure that potable aquifers are not affected adversely by injection of produced water. UIC-described practices are used

to protect against potential cross-contamination of groundwater supply aquifers from disposal wells. These described practices include well construction (e.g., entire well bore cased and cemented), restrictions on injection pressures, completion of mechanical integrity testing, and completion of detailed monitoring of produced and injected water volumes.

2.2.5 Air Quality and Meteorology

All BLM actions and use authorizations must comply with all applicable local, State, tribal, and Federal air quality law, statutes, regulations, standards, and implementation plans. Prior to implementation, all BLM-initiated or authorized activities within nonattainment areas must undergo a review and determination (when applicable) to determine conformity with the National Ambient Air Quality Standards, per 40 CFR part 93.150 et al. If the standards are being met, the area is designated as attainment, and if the status of attainment has not been verified through data collection, the area is unclassified. For permitting purposes, an unclassified area is treated as an attainment area. Sierra and Otero Counties are currently classified as in attainment with all State and Federal air quality regulations.

2.2.6 Noise

Noise-sensitive receptors are land uses associated with indoor and/or outdoor activities that may be subject to stress and/or significant interference from noise. They often include residential dwellings, mobile homes, hotels, motels, hospitals, nursing homes, educational facilities, recreational areas, and habitats of noise-sensitive wildlife species. An appropriate noise environment is necessary to prevent activity interference and annoyance.

There currently is no specific Federal, State, or local legislation that provides quantitative requirements for land use compatibility with noise sources within the Planning Area; however, all BLM actions and use authorizations must comply with applicable Federal regulations and guidelines described as follows.

The Noise Control Act of 1972 (PL 92-574) established a National policy "to promote an environment for all Americans free from noise that jeopardizes their public health and welfare." The Act provides for a division of powers between Federal, State, and local government, in which the primary Federal responsibility is for noise source emission control, with the states and other agencies retaining the rights to control noise sources and the level of noise within their communities and jurisdictions. Military aircraft are exempt from the requirements of this Act.

The EPA has published acoustical guidelines designed to protect public health and welfare with an adequate margin of safety. In the absence of State or local noise standards, the EPA guidelines (Table 2-2) serve as useful tools to assess the significance of an impact that may result from a source. Table 2-2 classifies the various areas according to the primary activities that are most likely to occur in each.

A review of the table shows that an indoor noise environment of 45 day-night sound level (Ldn) permits speech communication in homes, while an outdoor Ldn not exceeding 55 decibels (dB) permits normal speech communication. An equivalent sound level ($Leq_{(24)}$) of 70 dB is identified as protecting against damage to hearing.

TABLE 2-2
YEARLY AVERAGE* EQUIVALENT SOUND LEVELS IDENTIFIED AS REQUISITE TO PROTECT THE PUBLIC HEALTH AND WELFARE WITH AN ADEQUATE MARGIN OF SAFETY

	Measure	Indoor			Outdoor		
		Activity Interference	Hearing Loss Consideration	To Protect Against Both Effects[b]	Activity Interference	Hearing Loss Consideration	To Protect Against Both Effects[b]
Residential with outside space and farm residences	Ldn	45		45	55		55
	$Leq_{(24)}$		70			70	
Residential with no outside space	Ldn	45		45			
	$Leq_{(24)}$		70				
Commercial	$Leq_{(24)}$	[a]	70	70[c]	[a]	70	70[c]
Inside transportation	$Leq_{(24)}$	[a]	70	[a]			
Industrial	$Leq_{(24)}$[d]	[a]	70	70[c]	[a]	70	70[c]
Hospitals	Ldn	45		45	55		55
	$Leq_{(24)}$		70			70	
Educational	$Leq_{(24)}$	45		45	55		55
	$Leq_{(24)}$[d]		70			70	
Recreational areas	$Leq_{(24)}$	[a]	70	70[c]	[a]	70	70[c]
Farm land and general unpopulated land	$Leq_{(24)}$				[a]	70	70[c]

SOURCE: U.S. Environmental Protection Agency, March 1974

NOTES:

Explanation of identified level for hearing loss: the exposure period that results in hearing loss at the identified level is a period of 40 years.

* Refers to energy rather than arithmetic averages.

(a) Since different types of activities appear to have been associated with different levels, identification of a maximum level for activity interference may be difficult except in those circumstances where speech communication is a critical activity.

(b) Based on lowest level.

(c) Based only on hearing loss.

(d) An $Leq_{(8)}$ of 75 dB may be identified in these situations so long as the exposure over the remaining 16 hours per day is low enough to result in a negligible contribution to the 24-hour average; i.e., no greater than an equivalent sound level of 60 dB.

In some cases, Federally threatened and endangered wildlife species may be affected by elevated noise levels. High noise levels potentially can mask communications by wildlife that are used to attract mates and defend territories. No specific noise control requirements are available for wildlife species within the Planning Area.

The State of New Mexico and Sierra and Otero Counties do not have quantitative requirements for assessing the compatibility of a noise source with a land use.

2.2.7 Vegetation

The BLM is responsible for management and protection of vegetation that occurs on public land. A number of areas within BLM's Decision Area have been recognized as important vegetation communities or as ecological study plots. The 1986 RMP imposes a stipulation of no surface occupancy for the study plots, including Engle, Cuchillo, Nordstrom, Lee, Trujillo, and Danley.

The Cuchillo Mountains Piñon Nut Collection Area is located within the northwestern portion of the Planning Area. The trees in this area are maintained in order to provide personal and commercial piñon nut collections (Decision R-2 in the 1986 RMP).

The existing management measures that have been stipulated to improve vegetation and control noxious weeds include brush control, grazing deferment, erosion control, and prescribed burns.

Management of noxious weeds is directed by the Carlson-Foley Act of 1968, which directs agencies to destroy noxious weeds, and the Federal Noxious Weed Act of 1974 as amended, which requires agencies to (1) have an office or person trained to coordinate an undesirable plant management program, (2) adequately fund the program, and (3) conduct Integrated Weed Management. Also, BLM has entered into cooperative agreements with both Sierra and Otero Counties for the control of noxious weeds.

Instruction Memorandum 99-178 instructs BLM to make changes to the list of Critical Elements of the Human Environment in BLM's NEPA handbook. Moreover, Executive Order 13112, Invasive Species, directs Federal agencies to restrict activities that facilitate the spread of such species. One of the new elements added to this list is invasive non-native species in order to require that these species, especially weeds, will be given thorough consideration in all NEPA documents.

2.2.8 Wildlife and Fisheries

BLM is responsible for the balanced management of public land and resources and their associated values. Fish and wildlife are designated major public land uses, and therefore are managed by the BLM. The objectives of BLM's wildlife management program are to ensure optimum populations and a natural abundance and diversity of fish and wildlife values by restoring, maintaining, and enhancing habitat conditions (BLM 1987).

The 1986 RMP provides guidance in the form of land use allocations. Site-specific management of fish and wildlife habitat occurs through habitat management plans. According to FLPMA and Department of the Interior policy (43 CFR Part 24.4), BLM is primarily a habitat manager.

Issues involving the management of resident fish and wildlife species (with the exception of migratory birds and endangered species) are managed by the State agencies with responsibilities for them. Existing wildlife management direction is shown in Table 2-3. The BLM works closely with the New Mexico Department of Game and Fish (NMDGF) to develop and implement habitat management plans, plan hunting strategies, and mitigate or avoid the impacts of BLM actions. Interagency coordination between BLM and NMDGF is accomplished through a Master Memorandum of Understanding that sets forth responsibilities for coordination, identifies issues of concern, and establishes methods of coordination.

TABLE 2-3
EXISTING WILDLIFE MANAGEMENT DIRECTION

RMP Decision	Area/Concern	Description	Decision
WL-2	Percha Creek Riparian Habitat Area	Protect riparian area (940 acres) for wildlife habitat, watershed values, recreation, and visual quality.	Limits ORV use to existing roads and trails.
WL-4	Otero Mesa Habitat Management Plan (Otero Mesa Habitat Area)	Provide adequate habitat for pronghorn (427,275 acres).	
WL-5	Caballo Mountain Habitat Management Plan (Caballo Mountain Deer Area)	Provide adequate habitat for mule deer (93,179 acres).	
WL-6	Sacramento Escarpment Habitat Management Plan (Sacramento Mountains Deer Area)	Provide adequate habitat for mule deer (170,275 acres).	
WL-8	Jornada del Muerto Habitat Management Plan and Nutt Area (Nutt and White Sands Antelope Areas)	Improve habitat and population size for pronghorn on the Jornada del Muerto (453,709 acres) and in the grasslands near Nutt, New Mexico (75,850 acres).	
ACEC	Three Rivers Petroglyph Site (1,130 acres).	RMP general management guidance; there are no specific decisions regarding the management of wildlife resources.	Closed to leasing
ACEC	Sacramento Escarpment (5,365 acres)	RMP general management guidance; manage big game habitat and compliance with special status species law and policy.	Closed to leasing
ACEC	Alkali Lakes (6,903 acres)	RMP general management guidance	Closed to leasing
ACEC	Alamo Mountains (2,525 acres)	Barbary sheep are managed to prevent habitat degradation while providing hunting opportunities for the public.	Closed to leasing
ACEC	Wind Mountain (2,472 acres)	Barbary sheep are managed to prevent habitat degradation while providing hunting opportunities for the public.	Closed to leasing

SOURCE: Bureau of Land Management 1986a, 1997b
NOTE: Acres were calculated using current data in a geographic information system and may be different from the 1986 Resources Management Plan and subsequent *Federal Register* notices.

BLM currently is implementing two Habitat Management Plans (HMPs). These include the Jornada del Muerto HMP and McGregor Range Co-Use Area HMP. Several plans have been identified for preparation. These include revision of the McGregor Range Co-Use Area HMP (in three pieces) to include the Otero Mesa grasslands east of McGregor Range, Percha Creek (riparian), Caballo Mountains (deer), Sacramento Escarpment (deer), and riparian in Sierra and Otero Counties.

Management issues for wildlife in general include maintenance and restoration of desert grassland, riparian, and arroyo habitats; improvement or maintenance of big game habitats and populations (particularly on the Jornada del Muerto, Otero Mesa desert grassland area, Sacramento Escarpment, foothills of the Sacramento Mountains, Brokeoff Mountains, San Andres Mountains, and Nutt desert grassland area); and the long-term decline of grassland birds and migratory birds in general.

2.2.9 Special Status Species

The Endangered Species Act, as amended, requires special protection and management for Federally listed threatened and endangered species, or species proposed to be listed as threatened and endangered. BLM also manages a large number of sensitive, non-Endangered Species Act species (BLM Sensitive and U.S. Fish and Wildlife species of concern) to avoid the need for listing as Federally endangered. The purpose of this management prior to Federal listing is to use the broader range of management options available to protect a species.

Other Federal laws and regulations, such as the Bald Eagle Protection Act, and Fish and Wildlife Coordination Act also may apply.

The Las Cruces Field Office of BLM currently is implementing reasonable and prudent measures, terms and conditions, and conservation recommendations from the 1997 Section 7 consultation on the 1986 RMP for the aplomado falcon, southwestern willow flycatcher, peregrine falcon, and Sacramento prickly poppy. Operating guidelines resulting from that consultation include the following:

- conduct a programmatic consultation on fluid minerals activities in Sierra and Otero Counties
- inventory and monitor riparian areas for the presence of southwestern willow flycatchers
- manage peregrine falcon nesting habitat according to *Peregrine Habitat Management in National Forests of New Mexico* (Johnson 1994)
- implement management of designated ACECs

- # study the habitat requirements of aplomado falcons and apply the results to public land management

The FWS opinion resulting from the 1997 consultation, and BLM policy, leads the Las Cruces Field Office to consider all riparian areas, desert grasslands, and areas with endemic species to be areas of management concern for special status species. Analysis and management of these areas, particularly grasslands, should include a broad ecosystem view as well as finer detailed analysis. ACECs have been designated to manage and protect some of the species; however, many areas have no protective designations.

In addition, BLM manages several special status species areas, which are areas that have been nominated as ACECs (BLM 1999b; Dunmire 1992). BLM policy on such areas is to manage the resources for which the area was nominated until these areas can be evaluated fully through the planning process (Manual 1613.21E).

2.2.10 Rangeland

Livestock grazing is authorized under the Taylor Grazing Act of 1934, FLPMA of 1976, and the Public Rangelands Improvement Act of 1978. BLM is directed to authorize and manage livestock grazing on public land under the principles of multiple use and sustained yield and to prevent the degradation of the rangeland resources by providing for their orderly use, improvement, and development.

BLM's Final Grazing Management Policy was established in 1982 and is now incorporated in BLM handbook's identified goals and objectives. This policy is consistent with BLM's responsibility to improve rangelands and manage grazing use on public land in compliance with laws and policies affecting the grazing management program. The intent of the policy is to make the grazing management program more efficient and cost effective through the use of a selective management approach. This is accomplished by assigning management priorities among allotments on public land based on similar resource characteristics, management needs, and both resource and economic potential for improvement.

Additional BLM policy for the management of livestock grazing is considered in the Proposed Statewide RMPA/FEIS for New Mexico Standards for Public Land Health and Guidelines for Livestock Grazing Management (BLM 2000). The standards describe conditions needed for healthy sustainable public rangelands and relate to all uses of public lands. The standards provide the measure of resource quality and functioning condition upon which the public land health will be assessed. In order to measure the effectiveness of each standard in specific areas, a set of measurable indicators and associated criteria were identified for each site-specific situation. Livestock grazing guidelines include management tools, methods, strategies, and techniques designed to maintain or achieve standards. In order to bring authorized grazing into compliance with NEPA, the BLM Las Cruces Field Office is preparing environmental assessments for grazing permit renewals for each allotment in Sierra and Otero

Counties. Changes to existing grazing practices may result in attainment of the new standards for public land health, based on the need to retain the integrity of the soil and the continued sustainability of ecological processes.

There are 33 allotments in BLM's Decision Area for which Allotment Management Plans have been implemented. These allotments are on grazing systems established in cooperation with individual permittees. The schedules allow for deferment on one or more pastures for a growing season or full year. Many ranchers are now practicing some type of grazing management through these or other grazing systems.

2.2.11 Cultural Resources

The BLM multiple use management policy relies on FLPMA as the primary basis for managing cultural resources on public land. FLPMA establishes a general policy of protecting the quality of historical and archaeological resources. Any proponent of future leasing, exploration, and development activities would be expected to provide the cultural resource inventories and subsequent reports needed for BLM to comply with Federal historic preservation laws.

The 1986 RMP provided protection for cultural resources then determined to be particularly significant. These decisions were as listed in Table 2-4.

The RMP also indicated Cultural Resource Management Plans would be prepared for Rattlesnake Hill, Alamo Mountain, Lone Butte, Butterfield Trail, Jornada del Muerto Trail, and archaeological sites on the McGregor Range. In addition, the RMP indicated that BLM would initiate a 10 percent sample survey of public land in Sierra and Otero Counties.

Sections of the Butterfield and Jornada del Muerto trails are protected by the 1986 RMP "no-surface-disturbance" decisions (C-6 and C-7); however, additional segments of these trails have been identified and are not specifically protected. The Cooke's Trail, also known as the Mormon Battalion Trail, was not identified when the RMP was prepared, and has no protection through the RMP. Similarly, the historic townsite of Lake Valley was not considered nor afforded any protection under the 1986 RMP.

TABLE 2-4
CULTURAL RESOURCE DECISIONS

RMP Decision	Description	Acres
C-1	ORV use was limited to existing roads and trails to protect the Three Rivers Petroglyph Site and Picnic Area, and 340 acres were fenced to eliminate livestock grazing.	1,130
C-2	Closed to ORV use and future rangeland improvements to protect the Rattlesnake Hill Archaeological District.	889
C-3	Designated no surface occupancy and closed to ORV use to protect the Alamo Mountain petroglyphs.	2,525
C-4	ORV use was limited to existing roads and trails within a 100-acre parcel to protect cultural resources at Lone Butte.	352
C-5	Closed to ORV use to protect cultural resources in a portion of the Jarilla Mountains.	803
C-6	Areas within 0.25 mile (400 meters) of well-preserved segments of the Butterfield Trail were closed to surface-disturbing activities.	1,178
C-7	Areas within 0.25 mile (400 meters) of well-preserved segments of the Jornada del Muerto Trail were closed to surface-disturbing activities.	4,448

SOURCE: Bureau of Land Management 1986a, geographic information system database 1998.
NOTE: Acres were calculated using current data in a geographic information system and may be different from the 1986 Resource Management Plan and subsequent *Federal Register* notices.

2.2.12 Paleontological Resources

In addition to FLPMA and NEPA, management of paleontological resources is directed by the National Historic Preservation Act of 1966 (as amended), National Natural Landmarks Program under the Historic Sites Act of 1935, and Executive Order 11593 (Protection and Enhancement of the Cultural Environment). Actions relating to the management and protection of paleontological and other resources are subject to the provisions in the NEPA Handbook H-1790-1, Section 516 DM6, Appendix 5. The BLM's objectives for paleontological resources are to manage them for their scientific, educational, and recreational values, and to mitigate adverse impacts on them (BLM Manual H-8270-1, General Procedural Guidance for Paleontological Resource Management). For future projects that may require surface disturbance, adherence to the guidelines and requirements in the General Procedural Guidance for Paleontological Resource Management document will be important to provide protection of those resources.

2.2.13 Recreation

The objective of the recreation program is to ensure the continued availability of quality outdoor recreation opportunities and experiences that are not readily available from other sources. Recreation programs are managed according to multiple-use principles, to protect the health and safety of the users, protect natural and cultural resource values, and promote public use and enjoyment of the public land. Management priority is given to undeveloped areas experiencing resource damage or user conflicts, or that are threatening visitor safety.

Currently, the BLM office in Washington, D.C. is developing a strategy to address the management of off-highway vehicle (OHV) use on public lands. This strategy is being developed through the summer of 2000 and will culminate in guidance provided by the Washington DC Office to the BLM Field Offices in November of 2000. This guidance will go into effect immediately; however, local implementation will vary depending on individual circumstances.

There may be a change in the terminology that is used regarding off highway travel due to the differences in the definitions. Off-road vehicles (ORVs) according to 43 CFR 8340.0-05 are vehicles capable of or designed to be driven off of roads, while the term OHV is meant to describe motor vehicles that are used off of artificially surfaced roads or trails. The use of the term OHV will help to clarify that vehicle designations apply to all vehicles traveling off of artificially surfaced roads and trails, regardless of whether those vehicles were designed to be driven off of roads.

For the purposes of this document, the use of the term ORV will be interchangeable with OHV. This will help the RMPA to remain consistent with the 1986 RMP and yet recognize that new policy is being developed that will apply to future vehicle use designations.

Public land is open for ORV use unless specifically designated for limited use or closed. BLM policy is to manage the ORV program to protect resources, promote safety, and minimize conflicts among the various uses of the land. Table 2-5 summarizes the limited or closed ORV areas.

In response to obvious increasing use of the unofficial ORV area known as Red Sands, the BLM intends to begin managing the area proactively for year-round ORV use. The trails have been inventoried for cultural resources. Mitigation is planned and an environmental assessment is being prepared for signing the trails, encouraging use of the trail system versus creation of new trails and "cross-country" use, and installing some basic visitor amenities such as a shade shelter and an informational kiosk.

TABLE 2-5
ORV LIMITED AND CLOSED AREAS

RMP Decision	Description	Acres
Areas in which ORV use is limited to existing roads and trails		
W-1	Wind and Chess Draw watershed area	34,499
W-2	Mocassin and Otto Draw watershed area	13,662
W-3	Watershed area east of Tularosa and south of Tularosa River	17,046
W-4	Three Rivers watershed area	12,741
W-5	Watershed area east of Crow Flats	14,890
WL-2	Percha Creek riparian area	276
C-1	Three Rivers Petroglyph Site and Picnic Area	1,130
VR-1	Sacramento Escarpment ACEC	5,365
C-4	Lone Butte Area	352
VR-2	Brokeoff Mountains VRM and ORV limited area	11,647
VR-3	Cornudas Mountains VRM and limited ORV area	2,533
VR-4	Cuchillo Mountains VRM and limited ORV area	5,947
Area designated as closed to ORV use		
VR-1	Vegetation study plot enclosures	3,159
C-2	Rattlesnake Hill Archaeological District	889
C-3	Alamo Mountains petroglyphs area	2,525
C-5	Jarilla Mountains	803

SOURCE: Bureau of Land Management 1986a, geographic information system database 1998
NOTE: Acres were calculated using current data in a geographic information system and may be different from acres published in the 1986 Resource Management Plan or subsequent *Federal Register* notices.

2.2.14 Visual Resources

The BLM Visual Resource Management (VRM) System is the basic tool for the inventory, planning, and management of visual resources in BLM's Decision Area. The primary character of each landscape should be retained, and each class within the VRM System prescribes the allowable level of modifications to remain within that guidance. Within the Planning Area, Areas of Critical Environmental Concern (ACECs), Wilderness Study Areas (WSAs), and areas along some roadways are among the

areas included within the visual classes that are more restrictive with regard to modifications in scenic quality.

Three areas are designated as "limited-ORV" areas for protection of visual resources—the Brokeoff Mountains, Cornudas Mountains area, and Cuchillo Mountains (refer to Table 2-5). The Jornada del Muerto and Butterfield Trails also are resources of visual concern. The two historic trails are partially protected by decisions in the 1986 RMP, which stipulate that no surface-disturbing activities can occur within 0.25 mile (400 meters) of either side of specific segments of the trail.

The Lake Valley Back-country Byway is a scenic and historic route in Sierra County, consisting of State Highway 152 from Interstate 25 to Hillsboro, and Highway 27 from Hillsboro to Nutt. Continuing management guidance is to protect the scenic value of the byway by minimizing visual intrusions.

2.2.15 Special Management Areas

The two WSAs in BLM's Decision Area—Brokeoff Mountains (30,838 acres) and Jornada Del Muerto (4,320 acres)—will continue to be managed under the Interim Management Policy Guidelines for Land Under Wilderness Review (BLM 1995) until the areas are either added to the National Wilderness Preservation System or removed from further wilderness consideration. This policy closes WSAs to Federal fluid minerals leasing. If designated as wilderness, the area will be managed under the Wilderness Management Policy (BLM 1981c). If removed from further wilderness consideration, the Brokeoff Mountains and Jornada del Muerto areas would be managed under the guidance prescribed by the RMPA for Federal fluid minerals leasing.

The BLM manages six ACECs in the Decision Area—Three Rivers Petroglyph Site (1,130 acres), Sacramento Escarpment (5,365 acres), Cornudas Mountain (861 acres), Alamo Mountain (2,525 acres), Wind Mountain (2,472 acres), and Alkali Lakes (6,903 acres). The ACECs are managed by direction provided in the Otero County ACEC RMPA (BLM 1997b). Some of the 1986 RMP decisions are superseded by the 1997 ACEC RMPA decisions including OGG-9 (changed from no surface occupancy of Sacramento Mountains ACEC to "closed"), visual designations for the ACECs, and ORV designations for the ACECs. The ACECs are closed to fluid minerals leasing.

Eight areas in BLM's Decision Area have been nominated to become ACECs (BLM 1999b; Dunmire 1992). The nominations are based primarily on the presence of special status species. Current managment of the nominated ACECs includes those reasonable measures necessary to protect significant resource values until the areas are fully evaluated through the resource management planning process. The nominated ACECs are listed below in Table 2-6 and described in Section 3.18.3.

TABLE 2-6
NOMINATED ACECs

Nominated ACEC	Acres
Brokeoff Mountains Nominated ACEC	3,834
Caballo Mountains Nominated ACEC	2,213
Jarilla Mountains Nominated ACEC	7,032
Mud Mountain Nominated ACEC	2,580
Percha Creek Nominated ACEC	940
Sacramento Mountains Nominated ACEC	2,381
Six Shooter Canyon Nominated ACEC	1,060
Pup Canyon Nominated ACEC	3,677

McGregor Range, public land withdrawn for military use, is managed by direction provided in the McGregor Range RMPA (BLM 1990a). BLM retains management responsibility for natural and cultural resources on McGregor Range. Leasing decisions for McGregor Range were made in the McGregor Range RMPA and are being carried forward unchanged.

2.2.16 Fire Management

Desert shrub communities have replaced grassland communities over the past 80 years in much of the area due to fire suppression and livestock grazing. Some of these desert shrub communities and the mountain ranges produce large amounts of fine fuels (e.g., grasses and shrubs). With little pressure from grazing, these areas may be susceptible to fires starting during dry thunderstorms. Under such circumstances, fires in these areas are often large and difficult to control.

At present, the fire management within the Planning Area administered by the BLM Las Cruces Field Office is in accordance with a number of existing fire management plans, as follows:

- Fort Bliss/McGregor 1st Combined Arms Support Battalion Fire Management Plan, 1997
- Interim Management Policy for Lands Under Wilderness Review, H-8550-1, 1995
- Las Cruces District Fire Management Plan, 1995
- White Sands Missile Range Catastrophic Fire Management Plan
- Gila and Lincoln National Forests Fire Management Plans
- White Sands National Monument Fire Management Plan

2.2.17 Hazardous Materials

The use, transport, and disposal of hazardous materials is regulated by the Resource Conservation and Recovery Act (RCRA), Emergency Planning and Community Right-to-Know Act (EPCRA), and Toxic Substances Control Act (TSCA). Most wastes generated at oil and gas production facilities are exempt from RCRA under the exploration and production exemption.

To ensure compliance, documentation for projects must include information on hazardous substances that would be used in quantities that meet or exceed the threshold planning quantities (generally 10,000 pounds or more), the quantity of each hazardous substance that would be used, and the methods of storage, transport, and disposal. Hazardous substances that must be declared are listed in the EPA's *Consolidated List of Chemicals Subject to Reporting Under Title III of the Superfund Amendment and Reauthorization Act (SARA) of 1986*. The BLM must be notified if a significant change occurs in the chemicals to be used in a proposed project.

Hazardous materials used and hazardous wastes generated at wellsites may include fuel, drilling fluids, pit sludges, and soils contaminated by exploration and production wastes. Solvents may be used on equipment, acids could be used in well stimulation, and fertilizers and herbicides could be used in reclamation. Due to the potential for spills, vehicles and equipment should be located away from streams. Any firewalls or containment dikes must be constructed and maintained around all storage facilities, and be designed to contain the full volume of the largest tank.

Any hazardous materials used and hazardous wastes generated during exploration and production must be contained prior to disposal, and disposed of at approved landfills. There are no landfills in New Mexico that accept hazardous waste, and the operator would be required to arrange for an out-of-state transfer if hazardous materials are to be generated.

2.3 ALTERNATIVES

NEPA, the BLM's land use planning regulations (43 CFR 1600), and BLM Handbook 1624-H require BLM to "rigorously explore and objectively evaluate all reasonable alternatives." Five alternatives were addressed. Two alternatives were considered but eliminated from further analysis, and three alternatives were developed and evaluated in detail.

2.3.1 Alternatives Considered but Eliminated from Further Analysis

In developing the alternatives, two were considered initially but eliminated prior to further analysis. These alternatives and the reasons for their elimination are described briefly below.

No New Leasing for Fluid Minerals Development

The Mineral Leasing Act gives the Secretary of the Interior discretionary authority to issue oil and gas leases. A decision for no leasing is made where it is determined that oil and gas leasing is not in the public's interest. However, the Secretary cannot be arbitrary and capricious in making such a decision. A decision for no leasing is reached only after careful consideration of conflicting resource values and uses and environmental consequences.

It is the policy of the BLM that lands generally are available for oil and gas leasing where measures can be taken to mitigate conflicts and environmental consequences to an acceptable level. Given the nature and success of such mitigation, and the mandate for multiple use of public land (FLPMA), a decision for no leasing covering all lands in the Planning Area or Decision Area would be arbitrary and capricious.

Therefore, an alternative of no leasing is unreasonable and eliminated from detailed study in this programmatic document. Rather, consideration of no leasing was analyzed in association with specific resource concerns as part of the alternatives analyzed. Where it was determined that even the most restrictive stipulation available (i.e., no surface occupancy) will not adequately mitigate conflicts or environmental consequences, so that leasing is not in the public's interest, then a decision for no leasing is considered.

Comprehensive No Surface Occupancy

This alternative would stipulate no surface occupancy throughout BLM's Decision Area. This would effectively limit drilling activities to directional drilling from surface area that is not administered by BLM and existing leases. Directional drilling becomes more difficult and risky the farther the surface location is from the bottom hole location, rendering large areas effectively closed to leasing. The constraint associated with this alternative would provide a level of protection to special management areas (e.g., WSAs, ACECs) consistent with the management objectives for those areas; however, as above, this alternative would stipulate no surface occupancy throughout BLM's Decision Area.

2.3.2 Plan Alternatives Considered

The three alternatives examined in this RMPA/EIS are (1) No-action Alternative (Existing Management), (2) Alternative A, and (3) Alternative B. The alternatives were developed to respond to issues identified through scoping, explore alternatives to the existing management situation, comply with BLM's planning guidelines for fluid mineral resources (Handbook H-1624-1), and comply with the FLPMA requirement of managing for sustained yield and multiple use on public land. The reasonable foreseeable fluid minerals development and associated amount of surface disturbance predicted for the Planning Area over the next 20 years (refer to Chapter 4 and Appendix A-IV) remains the same for each alternative. Therefore, the alternatives were formulated based on the extent of modification to the existing management situation as it applies to certain resources that were identified as concerns. It should be noted that development of existing leases would continue according to the terms of the lease.

Federal fluid mineral leasing and development may occur on lands where the surface is managed by Federal, State, or Indian agencies, or by private individuals. BLM's environmental objectives and constraints apply equally to these areas; however, such constraints are developed at the permit stage in consultation with the other surface-managing agency or the surface owner.

BLM's existing guidance prescribes objectives for managing public land and associated resources. For fluid minerals, the objectives are defined in terms of the availability of land for leasing (closed or open to leasing) and management of lands that are open to leasing (with standard terms and conditions or stipulations). A brief explanation follows and a more detailed discussion is provided in Appendix A-V.

Public land may be closed nondiscretionarily or discretionarily. A ***nondiscretionary closure*** would occur on those lands that must be closed for reasons (e.g., laws, regulations, orders) beyond the discretion of the BLM. A ***discretionary closure*** includes those lands where BLM has determined that fluid minerals leasing, even with the most restrictive stipulations, would not adequately protect other resources, values, or land uses.

Lands open for leasing may be open with no specific management decisions defined in an RMP. However, these areas are subject to the ***standard lease terms and conditions*** as defined on the lease form. Or, lands open for leasing may be managed with constraints in the form of stipulations, which are provisions that modify the standard lease rights, conditions included in a lease when environmental and planning analyses have demonstrated that additional and more stringent environmental protection is needed. The three types of lease stipulations are (1) ***no surface occupancy***, (2) ***controlled surface use***, and (3) ***timing limitation***. A stipulation of ***no surface occupancy***, as implied, does not allow the surface of a given area to be occupied. A stipulation of ***controlled surface use*** is used to identify constraints on surface use or operations that may otherwise exceed the mitigation provided by the standard lease terms and conditions and the regulations and operating orders. A stipulation of ***timing limitation*** prohibits fluid minerals activities for a specific period of time less than one year. Under certain conditions, BLM may grant waivers, exceptions, or modifications (Appendix A-V).

The three alternatives are distinguished by the type and degree of constraints. The No-action Alternative represents continued implementation of existing management plans, policies, and decisions. Compliance with laws and regulations would continue on a case-by-case basis. The other two alternatives represent modifications to existing management. Alternatives A and B address existing legislative and regulatory requirements at a programmatic level, and/or place constraints if resource values are determined to be sufficiently high or protections are justified in the public interest.

It should be noted that a number of the resource concerns occur, or cluster, in certain geographic areas as listed in Table 2-7. The areas of some of these resource concerns overlap. In those cases, the more restrictive stipulation is dominant and will serve as the management direction. For example, in the Sacramento Mountains, under Alternative A, the area of the Sacramento Escarpment ACEC, which is discretionarily closed to leasing, overlaps with the Sacramento Mountains Deer Area, which has a stipulation of controlled surface use. Where the area of discretionary closure overlaps with the area of controlled surface use, the area would be discretionarily closed to leasing.

Each alternative is generally described below. Table 2-8, at the end of this chapter, is a summary of leasing constraints by alternative. Table 2-9, also at the end of this chapter, is a summary of the plan alternatives considered listing the resource categories and concerns and the constraints applied for each alternative. Maps 2-1, 2-2, and 2-3 illustrate the management objectives for each alternative. Those public land resources not addressed in the text, tables, or maps would continue to be managed as outlined in the section of this chapter that addresses continuing management guidance.

TABLE 2-7
GEOGRAPHIC AREAS WITH MULTIPLE RESOURCE CONCERNS

Geographic Area	Resource Concerns
Cuchillo Mountains	# Cuchillo Mountains limited ORV area # Cuchillo Mountains Piñon Nut Collection Area
Caballo Mountains	# Caballo Mountains Communication Site # Caballo Mountains Deer Area # Caballo Mountains Nominated ACEC # Potential bighorn sheep habitat
Sacramento Mountains	# Sacramento Mountains Deer Area # Sacramento Escarpment ACEC # Sacramento Mountains Nominated ACEC # Potential bighorn sheep habitat
Percha Creek	# Southwestern willow flycatcher # Riparian habitat # Percha Creek Riparian Habitat Area # Percha Creek Nominated ACEC
Jarilla Mountains	# Jarilla Mountains ORV closed area # Jarilla Mountains Nominated ACEC
Cornudas Mountains	# Wind and Chess Draw Watershed Area # Cornudas, Alamo, and Wind Mountains ACECs # Cornudas Mountains limited ORV area # Potential bighorn sheep habitat
Otero Mesa	# Alamo Mountains ACEC # Otero Mesa Habitat Area # Potential aplomado falcon range
Brokeoff Mountains	# Brokeoff MountainsWSA # Brokeoff Mountains VRM and ORV area # Brokeoff Mountains Nominated ACEC # Potential bighorn sheep habitat

No-action Alternative (Existing Management)

For this alternative, existing decisions and policy would remain in effect (Map 2-1). Leasing and development of fluid minerals would continue as specified in the existing RMP and RMPAs for this area. BLM would continue to implement standard lease terms and conditions to conduct operations in a manner that would minimize adverse impacts on resources, land uses, and users. Lease issuance and development of leases would continue to be considered on a case-by-case basis. In general, the constraints applied to meet existing management objectives of the No-action Alternative are summarized below. The categories listed below correspond to those in Table 2-9.

- Lands and Access—Land restrictions on leasing that were imposed in the RMP and subsequent RMPAs would be continued.

- Watersheds and Water Resources—Areas of highly erosive or fragile soils, riparian/other wetlands/playas, and watershed management areas would continue to be open to leasing with standard lease terms and conditions.
- Vegetation—Ecological study plots generally would continue to require no surface occupancy.

- Wildlife and Special Status Species—Designated habitat areas, crucial habitat, and special status species would continue to be managed as open to leasing with standard lease terms and conditions. The exception would be the Sacramento Mountains Deer Area, a portion of which coincides with the Sacramento Escarpment ACEC, which is discretionarily closed to leasing.

- Cultural Resources—Generally, cultural resource areas would continue to be open to leasing with standard lease terms and conditions. The exceptions are the Rattlesnake Hill Archaeological District, which has a stipulation of no surface occupancy, and two historic trails (Butterfield and Jornada del Muerto), which have stipulations of controlled surface use.

- Recreation and Visual Resources—Recreation areas and visual resources would continue to be managed as open to leasing with standard lease terms and conditions. The exceptions are certain areas along the Tularosa River, which have a stipulation of no surface occupancy, and areas designated as VRM Class I, which coincide with the six ACECs and, therefore, are discretionarily closed to leasing per the 1997 RMPA.

- Special Management Areas—WSAs are closed nondiscretionarily. If these WSAs were dropped from wilderness considerations by Congress and were not assigned other special status designations, they would be open to leasing with standard lease terms and conditions. ACECs are closed to leasing per the 1997 RMPA. Nominated ACECs currently are managed under standard lease terms and conditions.

Alternative A

The objective of Alternative A is to modify the existing management situation to respond to legislative or regulatory requirements and/or management objectives that otherwise would be achieved on a case-by-case basis under the No-action Alternative (existing management). In doing so, the major issues addressed include potential soil erosion, increasing protection of cultural resources sites, increasing protection of desert grassland habitat from fragmentation, and increasing protection of special status species and visual resources.

The departure that Alternative A makes from the No-action Alternative is summarized as follows:

- Land and Access—Management objectives would remain the same as the No-action Alternative with two exceptions. The Caballo Mountain Communication Site would be open to leasing with standard lease terms and conditions rather than the more restrictive stipulation of no surface occupancy. Community Pit 7 would have a stipulation of no surface occupancy to protect its public and resource values.

- Watersheds and Water Resources—Areas of highly erosive or fragile soils, and watersheds would be managed as open to leasing with a stipulation of controlled surface use, and riparian/other wetlands/playas would be managed as open to leasing but with no surface occupancy within 0.25 mile (400 meters).

- Vegetation—Management objectives would remain the same as the No-action Alternative.

- Wildlife and Special Status Species—Designated habitat areas and special status species areas would be managed as open to leasing with stipulations of controlled surface use. An exception to this is the Nutt and Otero Mesa desert grassland habitat areas, which would be managed as open to leasing with a stipulation of no surface occupancy except within 492 feet (150 meters) of roads in order to limit further fragmentation of that habitat. Also, Percha Creek Riparian Habitat Area which would be managed as open to leasing with a stipulation of no surface occupancy. Habitat suitable for bighorn sheep would be managed as open for leasing with a stipulation for controlled surface use and timing limitations (except where habitat of the Sacramento Mountains overlaps with the Sacramento Escarpment ACEC). The portion of the Sacramento Mountains Deer Area that coincides with the Sacramento Escarpment ACEC would continue to be closed discretionarily. Crucial habitat would continue to be managed under standard lease terms and conditions.

- Cultural Resources—Protective constraints would increase. The Jarilla Mountains and three historic trails would be managed as open to leasing with stipulations of controlled surface use. Lake Valley Historic Townsite and Lone Butte would be managed as open to leasing with a stipulation of no surface occupancy. Rattlesnake Hill Archaeological District would be

discretionarily closed to leasing and areas surrounding the Rattlesnake Hill Archaeological District would be managed as open to leasing with a stipulation of no surface occupancy.

- Recreation and Visual Resources—Protective constraints would increase for several resource areas. VRM Class II areas, Cornudas Mountains, Cuchillo Mountains, Cuchillo Mountains Piñon Nut Collection Area, Brokeoff Mountains VRM and ORV limited area, and Lake Valley Back-country Byway would be managed as open to leasing with controlled surface use, and the Red Sands ORV Area would be managed as open to leasing with a stipulation of timing limitation. Management objectives would remain the same as the No-action Alternative for areas along the Tularosa River (no surface occupancy), and VRM Class I areas (discretionary closures), VRM Classes III and IV (standard lease terms and conditions).

- Special Management Areas—WSAs would remain nondiscretionarily closed to leasing. If these WSAs were dropped by Congress from wilderness considerations, they would be leased with stipulations of controlled surface use. ACECs would remain discretionarily closed to leasing. Nominated ACECs would be open to leasing with a stipulation for controlled surface use.

Alternative B

Alternative B would accomplish the same objectives as Alternative A, but would provide a relatively greater emphasis on resource protection by imposing more constraints on fluid minerals leasing and development.

As with the other alternatives, development of existing leases would continue according to the terms of the lease. BLM would consult with the lessees to implement management constraints on existing leases or require protective measures as conditions of approval of APDs.

The departure that Alternative B makes from the other alternatives is summarized by resource concerns as follows:

- Lands and Access—Management objectives would be the same as Alternative A.

- Watersheds and Water Resources—Areas of highly erosive or fragile soils would be managed as open to leasing with a stipulation of controlled surface use. Riparian/other wetland/playa areas would be managed as open to leasing with a stipulation of no surface occupancy within 0.5 mile (800 meters). Watershed areas would be discretionarily closed to leasing (and no geophysical exploration would be allowed).

- Vegetation—Management objectives would remain the same as the No-action Alternative and Alternative A.

- Wildlife and Special Status Species—Percha Creek Riparian Habitat Area and occupied or essential habitat of special status species would be discretionarily closed to leasing. Also, the portion of the Sacramento Mountains Deer Area that coincides with the Sacramento Escarpment ACEC would be discretionarily closed. The Nutt and Otero Mesa desert grassland habitat areas would be managed as open to leasing with a stipulation of no surface occupancy except within 492 feet (150 meters) of roads in order to limit further fragmentation. Designated big game habitat areas would be managed as open to leasing with a stipulation for controlled surface use. Potential habitat of bighorn sheep would be managed as open to leasing with stipulations of controlled surface use and timing limitation. Crucial habitat would be managed under standard lease terms and conditions.

- Cultural Resources—Lone Butte would be managed as open to leasing with a stipulation of no surface occupancy (as for Alternative A). Protective constraints for other cultural resources would increase including Lake Valley Historic Townsite (discretionary closure), Jarilla Mountains (discretionary closure), Rattlesnake Hill Archaeological District (discretionary closure of District and adjacent areas), and three historic trails (Mormon Battalion, Butterfield, and Jornado del Muerto, no surface occupancy).

- Recreation and Visual Resources—Protective constraints would increase for several resources. Areas along the Tularosa River; Red Sands ORV Area; VRM Class II areas; Cuchillo Mountains Piñon Nut Collection Area; Cornudas Mountains, Cuchillo Mountains; and Brokeoff Mountains VRM and ORV limited area, and Lake Valley Back-country Byway would be discretionarily closed to leasing. VRM Class III areas would be managed as open to leasing with controlled surface use. VRM Class I areas would continue to be discretionarily closed and VRM Class IV areas would remain open to leasing with standard lease terms and conditions .

- Special Management Areas—WSAs would be closed nondiscretionarily. If these WSAs were dropped by Congress from wilderness considerations, they would be closed discretionarily. ACECs would remain discretionarily closed to leasing and nominated ACECs would be discretionally closed to leasing.

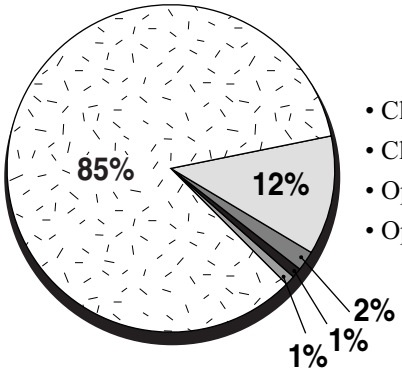
2.4 COMPARISON OF ALTERNATIVES

Since the three alternatives are distinguished primarily by type and degree of constraints, areas associated with the various constraints of each alternative are compared in Table 2-10. Table S-2, Summary of Impacts, summarizes the potential impacts estimated for each alternative. Also, Figure 2-1 illustrates the percentages of areas closed or open to leasing within BLM's Decision Area. Also, refer to Maps 2-1, 2-2, and 2-3.

FIGURE 2-1
MANAGEMENT GUIDANCE IN DECISION AREA BY ALTERNATIVE

No-action Alternative

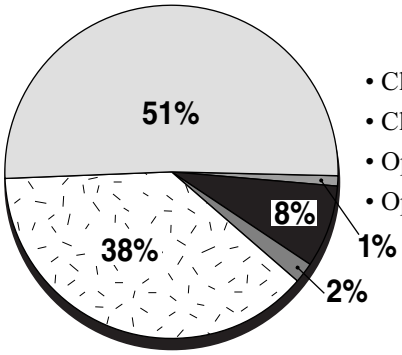
• Open with standard lease terms and conditions: 1,745,500 acres (85%)



• Closed nondiscretionarily: 46,047 acres (2%)
• Closed discretionarily: 17,673 acres (<1%)
• Open with no surface occupancy: 4,281 acres (<1%)
• Open with other stipulations: 239,503 acres (12%)

Alternative A

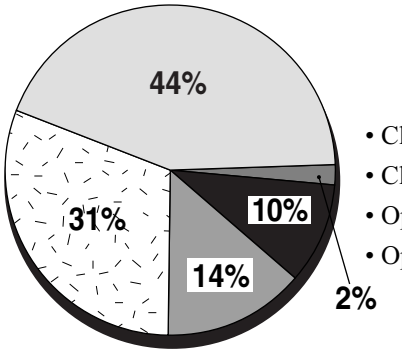
• Open with standard lease terms and conditions: 779,093 acres (38%)



• Closed nondiscretionarily: 46,047 acres (2%)
• Closed discretionarily: 18,557 acres (<1%)
• Open with no surface occupancy: 160,435 acres (8%)
• Open with other stipulations: 1,048,872 acres (51%)

Alternative B

• Open with standard lease terms and conditions: 632,228 acres (31%)



• Closed nondiscretionarily: 46,047 acres (2%)
• Closed discretionarily: 279,108 acres (14%)
• Open with no surface occupancy: 201,809 acres (10%)
• Open with other stipulations: 893,813 acres (44%)

TABLE 2-10
MANAGEMENT GUIDANCE IN DECISION AREA BY ALTERNATIVE
(approximate acres)

Constraints	No-action Alternative	Alternative A	Alternative B
Closed to Leasing			
Nondiscretionary closure	46,047	46,047	46,047
Discretionary closure	17,673	18,557	279,108
Total closed to leasing	*63,720*	*64,604*	*325,155*
Open to Leasing			
No surface occupancy	4,281	160,435	201,809
Controlled surface use and timing limitation	0	162,497	80,248
Controlled surface use	2,915	856,162	812,984
Timing limitation	236,588	30,213	581
(Total open with other constraints[1])	(243,784)	(1,209,307)	(1,095,622)
Standard lease terms and conditions	1,745,500	779,093	632,228
Total open to leasing	*1,989,248*	*1,988,400*	*1,727,850*

SOURCE: Bureau of Land Management database 1999
NOTES: [1]Includes the constraint categories of controlled surface use and timing limitation, controlled surface use, and timing limitation, but not the category of no surface occupancy.

Under all alternatives, certain lands are closed to leasing. The number of acres of public land nondiscretionarily closed to leasing remain constant under all three alternatives. These closures total approximately 46,047 acres (about 2 percent). The amount of land discretionarily closed to leasing increases from less than 1 percent under the No-action Alternative and Alternative A to about 14 percent under Alternative B.

Under the No-action Alternative, and fluid minerals leasing and development would continue under existing management direction. A substantial amount of land open to leasing could be leased with standard lease terms and conditions—about 85 percent. Less than 1 percent could be leased with a stipulation of no surface occupancy and about 12 percent could be leased with stipulations for controlled surface use or timing limitation. However, to ensure compliance with applicable regulations, potential impacts would have to be identified on a case-by-case basis at the time of the APD and measures to mitigate potential impacts would have to be determined and applied as conditions of approval. Assuming that the lessee/operator would conform to the conditions of approval and other requirements (refer to Appendices A-I and A-III), impacts on resource concerns are not anticipated to be significant (except possibly visual resources) and industry would have the ability to achieve the reasonable foreseeable development (RFD). However, the lack of management direction that would result from this alternative may affect lessees in terms of the efficiency of the leasing and APD approval processes.

Alternative A incorporates legislative and regulatory requirements and/or management objectives that likely would be specified on a case-by-case basis under existing management (No-action Alternative). The amount of lands discretionarily closed to leasing would increase to 18,351 acres (less than 1 percent). The amount of land open to leasing with a stipulation of no surface occupancy would increase

to 160,435 acres, or about 8 percent. The amount of land that could be leased with standard lease terms and conditions would decrease to 779,093acres (38 percent). The greatest increase would be in the amount of lands open to leasing with other constraints (i.e., controlled surface use, timing limitation, or both), which would be approximately 1,048,872 acres (51 percent).

While this alternative represents an increase in constraints beyond the existing management situation (No-action Alternative), Alternative A allows for implementing the least restrictive constraints that would provide adequate resource protection while allowing fluid minerals leasing and development to occur. Given the levels of potential for fluid minerals development, the constraints under this alternative are not anticipated to affect the ability to explore for and develop fluid mineral resources and achieve the RFD. Alternative A consolidates the requirements and objectives at this programmatic level, which would clarify the leasing process for both industry and BLM, and would streamline the NEPA process for site-specific actions. As with the No-action Alternative, impacts on resource concerns are not anticipated to be significant (except possibly visual resources) assuming that the lessee/operator would conform to the conditions of approval and other requirements (refer to Appendices A-I and A-III).

Alternative B provides for greater protection of resource concerns. The increase in protection is most evident in the amount of lands discretionarily closed, which would increase to approximately 279,108 acres (14 percent) of the Decision Area land. The amount of land open to leasing with a stipulation of no surface occupancy would increase to approximately 201,809 acres (10 percent). The amount of land open to leasing with other constraints (i.e., controlled surface use, timing limitation, or both) would be approximately 893,813 acres (44 percent). The amount of land that could be leased with standard lease terms and conditions would decrease to approximately 632,228 acres (about 31 percent). As with the No-action Alternative and Alternative A, impacts on resource concerns resulting from fluid minerals development are not anticipated to be significant assuming that the lessee/operator would conform with conditions of approval and other requirements (refer to Appendices A-I and A-III).

While providing more protection for resource concerns than the No-action Alternative and Alternative A, the increased amount of land closed to leasing in Alternative B would limit the spatial area in which to explore for and develop fluid minerals in certain locales. This potentially could reduce the opportunity and/or increase the cost to achieve the RFD estimated for oil and gas.

Also, public lands would be closed in areas of high potential for geothermal resources; however, since most geothermal resources are developed in proximity to population areas (not on public land), it is not anticipated that these discretionary closures would have an effect on the ability to achieve the RFD for geothermal resources.

BLM's preferred alternative is Alternative A. Implementation of Alternative A would satisfy the requirement to establish fluid mineral determinations (Chapter 1). That is, public lands available for leasing are identified as well as how those lands and associated resources would be managed to

adequately protect resource values (Appendix A-VI) while sustaining the ability for the fluid minerals industry to achieve the RFD and fulfilling the policy of multiple use and sustained yield of public lands as directed under FLPMA. Based on the results of the public review and comment on this Draft RMPA/EIS, the Las Cruces Field Manager will recommend and the BLM State Director will select an alternative or a combination of alternatives to be the proposed RMPA and publish it along with the Final EIS. A final decision will be made after a 60-day Governor's Consistency Review and a 30-day protest period. A Record of Decision (ROD) and approved RMPA then will be published.

TABLE 2-8
SUMMARY OF LEASING CONSTRAINTS IN DECISION AREA BY ALTERNATIVE

Constraint	Alternatives		
	No-action Alternative (Existing Management)	**Alternative A**	**Alternative B**
Closed to Leasing			
Nondiscretionary Closure	# Old Air Force bombing and gunnery range # Public water reserves # Air navigation site # Wilderness Study Areas (WSAs)	# Old Air Force bombing and gunnery range # Public water reserves # Air navigation site # WSAs	# Old Air Force bombing and gunnery range # Public water reserves # Air navigation site # WSAs
Discretionary Closure	# Visual Resource Management (VRM) Class I # Areas of Critical Environmental Concern (ACECs, 6)	# Rattlesnake Hill Archaeological District # VRM Class I # ACECs (6)	# Watershed areas (5) # Special status species habitats # Percha Creek Riparian Habitat Area # Lake Valley Historic Townsite # Rattlesnake Hill Archaeological District # Jarilla Mountains # Tularosa River # Red Sands Off-road Vehicle (ORV) Area # VRM Classes I and II # VRM and ORV limited areas # Cuchillo Mountains Piñon Nut Collection Area # Lake Valley Back-country Byway # ACECs (6) # Nominated ACECs

TABLE 2-8
SUMMARY OF LEASING CONSTRAINTS IN DECISION AREA BY ALTERNATIVE

Constraint	Alternatives		
	No-action Alternative (Existing Management)	**Alternative A**	**Alternative B**
Open for Leasing			
No Surface Occupancy	# Caballo Mountain Communication Site # Recreation and Public Purpose (R&PPs) patents and leases # Ecological study plots (6) # Rattlesnake Hill Archaeological District # Tularosa River	# R&PPs # Community Pit 7 # Riparian/Other Wetlands/Playas # Nutt and Otero Mesa desert grassland habitat areas # Ecological study plots (6) # Percha Creek Riparian Habitat Area # Lake Valley Historic Townsite # Lone Butte # Tularosa River	# R&PPs # Community Pit 7 # Riparian/Other Wetland/Playas # Nutt and Otero Mesa desert grassland habitat areas # Ecological study plots (6) # Black-tailed prairie dog habitat # Lone Butte # Mormon Battalion Trail # Butterfield Trail # Jornada del Muerto Trail
Controlled Surface Use and Timing Limitation	# None	# Bighorn sheep habitat	# Bighorn sheep habitat

TABLE 2-8
SUMMARY OF LEASING CONSTRAINTS IN DECISION AREA BY ALTERNATIVE

Constraint	Alternatives		
	No-action Alternative (Existing Management)	**Alternative A**	**Alternative B**
Controlled Surface Use	# Butterfield Trail # Jornada del Muerto Trail	# Berrendo Administrative Camp Site # Highly erosive and fragile soils # Watershed areas (5) # Big Game Habitat Areas # Special status species habitats # Jarilla Mountains # Mormon Battalion Trail # Butterfield Trail # Jornada del Muerto Trail # VRM Class II # VRM and ORV limited areas # Cuchillo Mountains Piñon Nut Collection Area # Lake Valley Back-country Byway # Nominated ACECs	# Berrendo Administrative Camp Site # Highly erosive and fragile soils # Big Game Habitat Areas # VRM Class III
Timing Limitation	# White Sands Missile Range Safety Evacuation Area	# White Sands Missile Range Safety Evacuation Area # Red Sands ORV Area	# White Sands Missile Range Safety Evacuation Area

NOTE: The areas of some of these resource concerns overlap. In those cases, the more restrictive stipulation is dominant and will serve as the management direction.

TABLE 2-9
PLAN ALTERNATIVES CONSIDERED

Resource Concern	No Action	Alternative A	Alternative B
Lands and Access			
White Sands Missile Range Safety Evacuation Zone (Map 3-2)	TL	TL	TL
Old Air Force boming and gunnery range (Map 3-2)	NC	NC	NC
Caballo Mountain Communication Sie (Map 3-2)	NSO	SLTC	SLTC
Recreation and Public Purposes Leases and Patents	NSO	NSO	NSO
Public Water Reserves	NC	NC	NC
Community Pit 7	SLTC	NSO	NSO
Air Navigation site	NC	NC	NC
Berrendo Administrative Camp Site	SLTC	CSU	DC
Watersheds and Water Resources			
Highly erosive and fragile soils (Map 3-5)	SLTC	CSU	CSU
Riparian/Wetlands/Playas (Map 3-7)	SLTC	NSO	NSO
Watershed Areas (Map 3-5)	SLTC	CSU	DC
Ecological Study Plots (Map 3-7)	NSO	NSO	NSO
Wildlife and Special Status Species			
Big game habitat areas (Map 3-7)	SLTC	CSU	CSU
Crucial habitats (Map 3-7)	SLTC	CSU	CSU
Nutt and Otero Mesa desert grassland habitat areas (Map 3-7)	SLTC	NSO	NSO
Special status species habitats (Map 3-8)	SLTC	CSU	DC
Habitat suitable for bighorn sheep (Map 3-7)	SLTC	CSU	DC
Percha Creek Riparian Habitat Area (Map 3-8)	SLTC	NSO	DC
Cutural Resources			
Lake Valley Historic Townsite (Map 3-10)	SLTC	NSO	DC
Rattlesnake Hill District (Map 3-10)	NSO	DC	DC
Lone Butte (Map 3-10)	SLTC	NSO	NSO
Jarilla Mountains (Map 3-10)	SLTC	CSU	DC
Mormon Battalion Trail (Maps 3-9 and 3-10)	SLTC	CSU	CSU

TABLE 2-9
PLAN ALTERNATIVES CONSIDERED

Resource Concern	No Action	Alternative A	Alternative B
Butterfield and Jornada del Muerto Trails (Maps 3-9 and 3-10)	CSU	CSU	NSO
Recreation and Visual Resources			
Tularosa River (Map 3-10)	NSO	NSO	DC
Red Sands ORV Area (Map 3-10)	SLTC	TL	DC
VRM Class I (Map 3-9)	DC	DC	DC
VRM Class II (Map 3-9)	SLTC	CSU	DC
VRM Class III (Map 3-9)	SLTC	SLTC	CSU
VRM Class IV (Map 3-9)	SLTC	SLTC	SLTC
VRM and ORV limited areas (Map 3-10)	SLTC	CSU	DC
Cuchillo Mountains Piñon Nut Collection Area (Map 3-10)	SLTC	CSU	DC
Lake Valley Back-country Byway (Map 3-10)	SLTC	CSU	DC
Wilderness Study Areas (3-10)	NC	NC	NC
Areas of Critical Environmental Concern (ACECs) (Map 3-10)	DC	DC	DC
Nominated ACECs (Maps 3-8 and 3-10)	SLTC	CSU	DC

NOTES: NC = Nondiscretionary closure
DC = Discretionary closure
NSO = No surface occupancy
CSU = Controlled surface use
TL = Timing limitation
SLTC = Standard lease terms and conditions

CHAPTER 3 - AFFECTED ENVIRONMENT

3.1 INTRODUCTION

This chapter provides a summary of the existing environment within the Planning Area. Generally, the discussion is limited to the resource concerns that could be affected by fluid minerals leasing and subsequent activities. These resource concerns have been identified as part of the issues listed in Chapter 1, and/or need to be described for an overall understanding of the affected environment and identified issues.

Much of the information in this chapter is summarized from material contained in the Management Situation Analysis (MSA). In preparing the MSA, environmental resource data were collected and compiled using existing data from several sources. The majority of the data were provided by the Las Cruces Field Office of the Bureau of Land Management (BLM) from Federal, State, county, and local agencies including but not limited to the U.S. Geological Survey, U.S. Fish and Wildlife Service, New Mexico Department of Game and Fish (NMDGF), other State agencies, counties, and other public and private sources. Data included published and unpublished reports, maps, and digital format (geographic information system [GIS]). The data compiled represent a level of detail appropriate for and commensurate with the programmatic nature of this Resource Management Plan Amendment/Environmental Impact Statement (RMPA/EIS). Where data were lacking, the data were interpreted from the best available sources. Field verification of the data was not conducted. Sources used in the preparation of this RMPA/EIS are listed in the References section.

GIS has been used extensively to capture, manage, analyze, and display the geographic data for this RMPA/EIS. In particular, GIS was used effectively to execute certain complex spatial analyses. It is important to note that there are differences between the areal data estimated for the 1986 Resource Management Plan (RMP) and the more recent GIS data. For the purposes of this RMPA/EIS, the more up-to-date GIS data have been used.

Maps summarizing environmental resource information relevant to the RMPA/EIS planning and analysis are provided in the map section of this document. More comprehensive resource maps were prepared in conjunction with the MSA (refer to Chapter 1 and List of Maps). The MSA and accompanying maps are available for review at the Las Cruces Field Office of BLM.

In accordance with the National Environmental Policy Act regulations codified in 40 CFR 1502.15, the affected environment section discusses the existing condition of the human and natural environment that potentially could be affected, beneficially and adversely, by the alternatives. The affected environment is characterized for the following resource concerns:

- Physiography and Topography
- Climate and Meteorology
- Lands and Access
- Geology and Minerals
- Soils
- Water Resources
- Surface Water
- Groundwater
- Air Quality
- Noise
- Vegetation
- Wildlife
- Special Status Species
- Livestock Grazing
- Cultural Resources
- Paleontological Resources
- Recreation
- Visual Resources
- Special Management Areas
- Social and Economic Conditions

3.2 PHYSIOGRAPHY AND TOPOGRAPHY

The Planning Area is located in south-central New Mexico, encompassing Sierra and Otero Counties. The area lies within the Basin and Range physiographic province with the exception of the northeastern-most corner of Otero County, which is in the Great Plains province. Typical features of the Basin and Range physiographic province include rugged and steep fault-block mountain ranges, broad basins, and more gentle volcanic landforms. From the northwest to the southeast boundaries of the Planning Area, important features include the Cuchillo Mountains (covered by the Mogollon-Datil volcanic field), Palomas and Engle Basins, Rio Grande Valley, Caballo and Turtleback Mountains, Jornada del Muerto Basin, San Andres Mountains, Tularosa Basin, Sacramento Mountains, Otero Mesa, and Brokeoff and Guadalupe Mountains. Other prominent topographic features of the Planning Area include Crow Flats, Hueco Basin, Jarilla Mountains, Godfrey Hills, Chupadera Mesa, and the foothills of the Black Range and Mimbres Mountains.

The average elevation in the Planning Area is approximately 4,500 to 5,000 feet, ranging from approximately 3,650 feet in southeastern Otero County (valley areas of Crow Flats) to approximately 11,808 feet in the Sacramento Mountains (Sierra Blanca Peak) (BLM 1981a, 1985b).

3.3 CLIMATE AND METEOROLOGY

Southern New Mexico has an arid to semi-arid continental climate with mild winters and hot summers. The climate is determined primarily by a subtropical high pressure system. As the summer Bermuda High intensifies and moves westward, the predominant wind flow is from the southeast. This wind pattern brings in moist air from the Gulf of Mexico and provides a summer maximum precipitation pattern through localized thunderstorms. July, August, and September are the wettest months of the

year. As winter approaches and the Bermuda High weakens, polar masses intrude into the area and the general wind pattern is from the northwest and west. Average precipitation below 6,000 feet is between 8 and 10 inches annually and between 14 and 16 inches at higher elevations.

The average annual temperature in the Planning Area is approximately 60 degrees Fahrenheit (EF) (15.6 degrees Celsius [EC]). The average maximum temperature in July is approximately 96EF (35.6°C) with maximum readings generally over 100EF (37.8°C). The average minimum temperature in January is approximately 39EF (3.9EC) with minimum readings generally in the low 20s (-6.7 to -4EC).

Wind speeds average approximately 6 to 10 miles per hour on an annual basis in the Planning Area and generally are highest in the spring (March to May). These spring winds are generally from the west and may exceed 30 miles per hour. Locally strong winds associated with summer thunderstorms may come from any direction and frequently exceed 30 miles per hour, but are usually brief in nature.

3.4 LANDS AND ACCESS

This section summarizes the lands and access components within the Planning Area including jurisdiction/surface ownership, existing land uses, utilities and rights-of-way, and access and transportation.

3.4.1 Jurisdiction/Surface Ownership

Jurisdictions shown on Map 3-1 depict the lands administered by Federal, State, and local agencies, and lands privately owned. The Planning Area contains about 7 million acres, of which the BLM manages more than 1.8 million (exclusive of the 606,198 acres of McGregor Range managed cooperatively with the military). In addition to the surface ownership, BLM also administers approximately 5 million acres of Federal mineral estate. Other jurisdictions within the two counties include the following:

- Federal
  - Department of Agriculture
    - Gila National Forest
    - Cibola National Forest
    - Lincoln National Forest

Department of Defense
- White Sands Missile Range
- Holloman Air Force Base
- Fort Bliss Military Reservation

Department of the Interior
- BLM
- White Sands National Monument
- Bureau of Reclamation

Mescalero Apache Indian Reservation

State
New Mexico State Trust Land

Private Land

The land ownership in the Planning Area resembles a checkerboard pattern. Acres associated with jurisdictions in the Planning Area are shown in Table 3-1. Private (or patented) land and State Trust Land include split estate; that is, privately owned or State-administered surface land overlying Federal fluid mineral estate.

Although inholdings, lease agreements, joint ownership, cooperative agreements, and other land ownership situations may be present in the Planning Area, they are not depicted on Map 3-1.

3.4.2 Existing Land Uses

The Planning Area comprises two counties characterized by their rural qualities, vast open spaces, and generally sparse population (Map 3-2). Otero County maintains a comprehensive plan for management direction, the Otero County Comprehensive Plan (May 1998). Sierra County does not have a general plan; the County uses the South Central New Mexico Overall Economic Development Program as management framework (July 1998).

Residential, commercial, and public uses in Otero County are concentrated in the communities of Alamogordo, Tularosa, Orogrande, and around Holloman Air Force Base. In Sierra County, these uses are located primarily within the communities of Truth or Consequences, Williamsburg, Hillsboro, Cuchillo, and Kingston. Rural residential and commercial properties are sparsely located throughout the Planning Area.

TABLE 3-1
LAND STATUS IN ACRES[a]

Landowners/Managers	Sierra County	Otero County	Total
Federal			
Department of Agriculture			
Forest Service	375,158	558,948	934,106
Department of Defense			
Military Withdrawn	523,423	713,304	1,236,727
Military Acquired	0	69,449	69,449
McGregor Range[b]	0	606,198	606,198
Department of the Interior			
Bureau of Land Management	781,825	924,828	1,706,653
National Park Service	0	92,394	92,394
Bureau of Reclamation	36,851	0	36,851
Other			
Public Water Reserves	200	492	692
Total Federal	1,717,457	2,965,613	4,683,070
Tribal			
Mescalero Apache Indian Reservation	0	459,887	459,887
State of New Mexico			
State Trust Land	283,979	339,484	623,463
Split estate[c] (State Trust Land surface/Federal fluid minerals)	(5,667)	(9,404)	(15,071)
Private			
Private Land	709,323	473,815	1,183,138
Split estate[c] (Private surface/Federal fluid minerals)	(217,503)	(133,943)	(351,446)
Total acreage (split estate not counted)	2,710,758	4,238,799	6,949,557

SOURCE: Bureau of Land Management, Las Cruces Field Office and New Mexico State Office, 1998
NOTES:

[a] Inland water areas included in ownership

[b] McGregor Range is cooperatively managed by the BLM and U.S. Army

[c] Surface acreage only is included in total

Agricultural uses are associated primarily with livestock production, including cattle, hogs, sheep, and chickens. There is limited crop production of hay, barley, and wheat. Pecan orchards are grown in the Alamogordo area.

The primary use of public land is livestock grazing. Mining, mineral material excavation, rights-of-way, leasing, and dispersed recreation constitute the other uses occurring on public lands. The BLM currently administers mineral materials leases on approximately 114 acres within BLM's Decision Area. Current uses of particular concern include Community Pit 7, a public source of sand and gravel, and the Caballo Mountain Communication Site. Military and space exploration research activities occur on some Federal land within the Planning Area, including McGregor Range, Holloman Air Force Base, and White Sands Missile Range. Some of the land associated with military activities has been

withdrawn from public use or its use is regulated to protect public safety, such as the former Air Force bombing and gunnery range in southern Otero County.

In accordance with the Recreation and Public Purposes (R&PP) Act, BLM has the authority to lease or patent public land to governmental or nonprofit entities for public parks, building sites, or other public purposes. Currently, there are a total of 32 R&PP patents or leases—12 in Sierra County and 20 in Otero County. At present, the total number of acres involved in the 32 sites is about 1,799 with 218 acres in Sierra County and 1,581 in Otero County. Land uses occurring on land leased or patented under the R&PP within the Planning Area include landfills, recreation (parks, shooting ranges), and other public purposes (e.g., a fire station and sewage treatment plant). Lessees or owners are generally a city or county, but may include State agencies, school districts, or nonprofit associations.

Public water reserves are another protected use on public land. The reserves, about 40 acres each, are withdrawn land for the purpose of protecting water resources. Public water reserves are defined as the legal subdivision or area within 0.25 mile (400 meters) of a spring or water hole.
There are no commercial timber resources located on public land. Noncommercial timber resources include piñon-juniper forests at higher elevations and broadleaf species such as cottonwoods and Gambel oaks along Tularosa River and Three Rivers Creek.

3.4.3 Future Land Use

According to information from county and BLM management plans, general trends of future land use within the Planning Area include residential, commercial, and industrial growth that is anticipated to develop in areas surrounding the current population centers.

The primary objective of the Otero County Comprehensive Plan is to protect and enhance the scenic beauty and diversity of the land while accommodating growth. The primary objective of the Sierra County Council of Governments' overall economic development program is to promote sufficient economic opportunity within the County for residents to find suitable and adequately compensated employment. This is to be accomplished with an increase in outside economic investment and an increase in the values of goods and services produced within the County.

Future land uses anticipated on public land generally include granting additional rights-of-way, grazing and minerals leases, and recreation.

3.4.4 Utilities and Rights-of-way

This category includes electric transmission and distribution lines, pipelines, fiber optic corridors, transportation corridors, and the corresponding rights-of-way. Within the Planning Area, there are numerous electrical transmission and distribution lines, as well as telephone lines and various natural gas, water, sewer pipelines, and two long-distance petroleum product pipelines. Petroleum product lines include the Navajo Pipeline and Diamond Shamrock Pipeline, both in Otero County (the lines parallel each other and both cross Otero Mesa) (Map 3-2). Currently, there are approximately 3,810 acres of rights-of-way granted by BLM.

3.4.5 Access and Transportation

The main component of the transportation system within the Planning Area is the roadway network. Two rail lines are present, one each in Sierra and Otero Counties. Map 3-2 depicts access and transportation in the Planning Area.

Transportation System

Access in the Planning Area is based entirely on the use of County and State roads and U.S. highways. Primary transportation routes in the Planning Area include County Roads 59, 52, 27, 26, 142, and 24; State Routes 82, 70, and 506; and Interstate 25 (I-25). The only access road in the Planning Area for which BLM is responsible for maintenance and control is the road to the Caballo Mountain radio communications site in Sierra County.

Several roads in the Planning Area are closed periodically to ensure public safety during military exercises. Closures affect US 54 and 70, and State Route 506 within the Planning Area; these roads are major arterials in Otero County.

There are several thousand acres of public land that do not have direct access. These generally are located where large amounts of private and State Trust Land are interspersed with public land in a checkerboard pattern. Some areas of concern include the Cuchillo Mountains, Animas Hills, and Piñon area.

Lake Valley Backcountry Byway is the only National Backcountry Byway in BLM's Decision Area. This route includes State Highways 152 and 27. The Byway begins at the junction of I-25 and State Highway 152 and proceeds west to the historic town of Hillsboro. The Byway route then turns south onto State Highway 27 towards the historic mining town of Lake Valley and ends at Nutt where State

Highway 27 intersects State Highway 26. The route features scenic views of the Black Range Mountains, Caballo Mountains, Cooke's Peak, and Las Uvas Mountains.

The total mileage of major roadways in the Planning Area (listed in Table 3-2) is approximately 716 miles. Many light-duty and four-wheel drive roads also traverse the area.

Traffic Volumes and Roadway Capacities

The New Mexico State Highway Department reports average daily traffic (ADT) counts by roadway within individual counties. The ADT counts are reported in milepost increments with similar ADTs within each county. ADT counts may vary by as much as 5,000 vehicles on the same stretch of roadway depending upon the surrounding land use (i.e., rural versus urban areas). This factor makes documenting ADT counts by roadway and county difficult. Table 3-2 shows ADT volumes for roads in Sierra and Otero Counties and New Mexico State highways. Only those roads that are at least 10 miles long with an ADT count greater than that of State Highway 506, or an ADT volume of 30, are shown.

TABLE 3-2
AVERAGE DAILY TRAFFIC VOLUMES
(STATE, AND INTERSTATE ROADS LONGER THAN 10 MILES WITH AN ADT VOLUME OF 30 OR GREATER)

Road	Length (miles)	ADT 1997	Road	Length (miles)	ADT 1997
NM 24	26.5	589.0	US 70	259.3	1754.0
NM 130	21.9	650.0	US 82	43.7	2215.0
NM 244	29.4	287.0	I-25	104.1	2649.5
NM 506	31.9	30.0	NM 59	23.1	217.0
NM 26	37.2	40.0	NM 142	10.1	138.0
NM 27	30.2	73.0	NM 152	66.1	311.4
NM 52	38.8	290.0	NM 187	36.2	1266.0
NM 181	11.8	782.4	NM 51	17.9	2075.0
NM 1	10.9	40.1	NM 6563	15.5	657.0
US 54	101.6	5960.0	—	—	—

SOURCE: New Mexico State Highway and Transportation Department 1999

Traffic Accidents

Total accident counts by year and county are available from the New Mexico Traffic Safety Department (NMTSD). NMTSD had Otero County data for the years 1995, 1996, and 1997, and Sierra County data available for 1996 and 1997. Data from both counties are reported in Table 3-3.

TABLE 3-3
ACCIDENT TOTALS BY YEAR

Year	Sierra County Number of Accidents	Otero County Number of Accidents
1997	158	524
1996	171	497
1995	Not Available	410

SOURCE: New Mexico Traffic Safety Department 1999

Accidents in Otero County have been increasing over the past three years of available data to a high of 524 in 1997. Sierra County saw a slight drop in accidents from 1996 to 1997. Accident counts by segment for Federal and State highways in both counties were available for the period 1995 to 1997 and is reported in Table 3-4. Accident counts for individual County roads were not available.

All of the Federal and State roadways within the two counties showed an increase in traffic accidents from the year 1995 to 1997. The exception was US 82 in Otero County, which experienced a decrease in traffic accidents, and US 54 in Otero County, which had the same number of accidents in both 1996 and 1997.

TABLE 3-4
FEDERAL AND STATE HIGHWAY ACCIDENT TOTALS
BY ROADWAY SEGMENT AND YEAR

	1995	1996	1997
Sierra County			
Federal Highways			
I-25 (Milepost 52.03 to 104.2)	65	79	83
Otero County			
State Roads			
US 82 (Milepost 0.0 to 43.75)	173	206	202
US 54 (Milepost 0.0 to 107.6)	812	165	165
US 70 (Milepost 177.8 to 259.5)	82	94	109

SOURCE: New Mexico Traffic Safety Department 1999

3.5 GEOLOGY AND MINERALS

3.5.1 Tectonics and Structural Regime

The Basin and Range physiographic province of New Mexico is highly influenced by the Rio Grande Rift with the exception of the westernmost quarter of Sierra County, which is covered by the Mogollon-Datil volcanic field. The Rio Grande Rift is a series of north-south trending basins, which in southern New Mexico widens into a series of parallel basins separated by intrarift horsts. From west to east

these Tertiary age tectonic features are Palomas and Engle Basins, Caballo Uplift, Jornada del Muerto Basin, San Andres Mountains, Tularosa Basin, Otero Platform and Sacramento Uplift, Salt Basin, and Guadalupe Uplift. Map 3-3 provides the locations of the physiography/tectonic features.

3.5.2 Stratigraphy

Only minor stratigraphic differences are present in Otero and Sierra Counties indicating that the areas have similar geologic histories. Variation in thickness, lithologic character, and/or presence of a formation within the local stratigraphic columns are related to depositional environments during tectonically active periods of geologic time. Tectonically active geologic time periods for the Planning Area include mountain building in the Pennsylvanian, Tertiary basin and range faulting, and late Tertiary rifting.

The pre-Pennsylvanian deposition generally was similar throughout the Planning Area. Cambrian through Mississippian time is represented by clastic and carbonate rocks of shallow marine origin. The Pennsylvanian rocks indicate a period of increased tectonic activity with areas like the Pedernal Uplift providing sediments for the basins. The basins collect thick sequences of clastic continental-dominated sediments near the uplifts with marine and near-marine clastic and carbonate facies within the basins.

Mesozoic rocks appear to be thin to nonexistent in most of the Planning Area. An exception is a potentially thick section of Cretaceous formations on both sides of the Caballo Uplift in the Palomas-Engle and Jornada del Muerto Basins (Foster 1978). Tertiary basin-fill sediments are found in great thicknesses in the basins and Tertiary intrusions also are present. The basin sediments are typically continental in origin.

3.5.3 Leasable Minerals

In keeping with the RMPA focus on fluid minerals leasing and development, the following description includes the potential ranking of fluid minerals and a brief discussion of the reasoning behind the ranking. A more detailed description of the fluid mineral potential is provided in Appendix A-IV.

Oil and Gas Resources

While oil and gas production currently does not exist in the Planning Area, the presence of source rock and reservoir strata is fairly well documented throughout the Planning Area. Occurrences of oil and gas

shows are noted in both the dominant Paleozoic section as well as the limited Cretaceous section. No area has been ranked as having "no potential" or "high potential" for oil and gas.

To distinguish the medium and low potential areas, the tectonic areas were evaluated for evidence of whether the trapping mechanism for the oil and gas resource likely would be present. In the Basin and Range province it was determined that while the source rock, thermal maturity, and reservoir rock likely would be present, the trap in the horst may be either nonexistent (breached) or likely to have been flushed by fresh waters. Therefore, the horst blocks or uplifted areas (Caballo Uplift, San Andres Mountains, Sacramento Uplift, and Guadalupe Uplift) with the exception of the Otero Platform have been given a low potential ranking. The Otero Platform is only partly uplifted and a large portion of its stratigraphic section is still beneath the subsurface. Map 3-3 presents the potential for oil and gas resources.

Thick, abundant, Pennsylvanian brown-to-black carbonaceous shales are potential source rocks, the dark basinal Devonian shales as secondary source rocks (Bulter 1988). Other favorable hydrocarbon source rocks are found in the Mississippian and Permian shales and carbonates (Bulter 1988; Grant and Foster 1989).

The evidence of thermal maturation for the source rocks indicates the presence of oil and gas shows throughout the Planning Area. A total of 98 wells have been drilled in Sierra and Otero Counties (35 and 63, respectively); at least 28 percent of these wells (27 wells) reported shows of oil and gas. Four of these wells potentially had significant gas production (refer to Appendix A-IV, Table A-3) and had they been near infrastructure, they may have been gas production wells. One of these wells is the recent Harvey Yates #1Y Bennett Ranch (Section 14, T. 26 S., R. 12 E., New Mexico Prime Meridian [NMPM]) which, depending upon success in the offsets, may warrant development of the infrastructure needed for production.

Reservoir rocks are almost ubiquitous in the Paleozoic stratigraphic section—of note are the Permian and Pennsylvanian bioherms and siliciclastic strata, Mississippian bioherms, and carbonates of the Silurian and Ordovician (Bulter 1988). Numerous opportunities appear to be available for trapping of hydrocarbons including wedge on wedge (unconformity pinchouts), stratigraphic pinchouts, biohermal, fault, and anticlines (Bulter 1988; Grant and Foster 1989). Pennsylvanian and Permian bioherms are likely to be more abundant near the temporal highs (Pedernal Uplift). Oil and gas accumulations in the Silurian and Ordovician may depend on structural trapping rather than stratigraphic facies changes (Bulter 1988).

Mesozoic rocks appear to be thin to nonexistent in most of the Planning Area and therefore potential is limited. An exception is a potentially thick section of Cretaceous sediment with oil and gas shows on both sides of the Caballo Uplift in the Palomas-Engle and Jornada del Muerto Basins (Foster 1978). Tertiary basin-fill sediments are found in great thicknesses in the basins and Tertiary intrusions also are

present. The basin sediments typically are continental in origin and are not oil and gas prone; shows seen in these sediments are believed to be due to older sources. The igneous intrusions near hydrocarbon accumulations are believed to destroy the hydrocarbons.

Geothermal Resources

Sierra and Otero Counties are located within the Rio Grande Rift, which is one of the three principal geothermal areas in New Mexico (Hatton 1978). While no known geothermal resource areas (KGRAs) have been identified in the Counties, anomalously warm springs (surface temperatures at least 50EF (10°C) above mean annual air temperature) and wells (thermal gradients exceeding 86EF (30°C)/per kilometer) have been recorded in the counties indicating geothermal potential (Callender and others 1983; Sammel 1979; Summers 1976; Trainer 1975; Witcher 1988). Both convection (hot-water-dominated) and conduction-dominated geothermal resources have been documented in Sierra and Otero Counties (Brookins et al. 1981; Muffler 1979; Sammel 1979; Witcher 1988).

Conduction-dominated geothermal systems are associated with the flanks of deep sedimentary basins and originate from deeply circulating groundwater along basin-bounding faults. These geothermal systems are believed to be very abundant in New Mexico, especially associated with the Basin and Range province; however, due to typical depth of the resource, the risk associated with exploration and development of the resource is believed to be high (Brookins et al. 1981; Sammel 1979; Witcher 1988).

Convection systems, less abundant in New Mexico, are associated with Quaternary igneous rocks and may be in part heated by magmatic activity (Brookins et al. 1981). While the exact origin of the heat source may not always be known, the anomalous temperature in spring or well discharges is a reliable criteria of the existence of convective systems (Witcher 1988). These convective geothermal resources typically are characterized as having structurally high and usually exposed faulted and fractured bedrock. The convective geothermal resource usually is found at shallower depths than conductive-dominated systems and its presence has been confirmed with a well or spring; therefore, the exploration and development risks are lower.

Geothermal resources identified in the Planning Area are low temperature (less than 194EF (90°C)) resources. While these resources are not suitable for electrical power generation, their uses include, but are not limited to, space and domestic water heating, crop drying, greenhouse heating, animal husbandry, fish hatching and farming, biodegradation and fermentation processes, de-icing, soil warming, low temperature refrigeration cycles, drying and curing of concrete, distillation and evaporation cycles, and hot water spas and baths. The drawback to the production of geothermal resources is that since the energy from these resources is transported as hot water, the user must be located near the production site (Sammel 1979; Starkey and Icerman 1983). Therefore, while an area

may have a high to moderate potential for geothermal resources, exploration and/or development may not occur if a potential end user is not near or identified. Map 3-4 presents the potential for geothermal resources.

Areas of the Planning Area that have had geothermal development or have been noted by authors as having potential for geothermal development were given the ranking of high potential. These areas include Truth or Consequences (Sierra County), Derry Warm Springs (Sierra County), and McGregor Range Camp (Otero County) (Hatton 1978; Muffler 1979; Starkey and Icerman 1983; Summers 1976). Recent geothermal exploration indicates that an area near Hillsboro also appears to have high potential (Witcher, personnel communications, 1998).

Coal Resources

Minor amounts of sub-bituminous coal have been extracted from the Engle coal field east of the Caballo Mountains. A larger and more promising coal deposit, the Sierra Blanca coal field, extends southward from Carrizozo in Lincoln County to the Three Rivers area of Otero County (Tabet and Frost 1978). Although coal production from this deposit has occurred in Lincoln County, none is known to have taken place in Otero County (BLM 1985b).

3.5.4 Locatable Minerals

The locatable mineral resources of the area are diverse and include gold, silver, copper, lead, zinc, iron, molybdenum, cement-quality limestone, gypsite, turquoise, beryllium and other rare earth minerals, tin, uranium, alunite, zeolites, fluorite, and manganese.

Production of locatable minerals from public land within the Planning Area is sporadic. The potential is moderate to high in many areas throughout the Planning Area, typically located in the uplifts or horst blocks. In recent years, a nepheline syenite mine was established at Wind Mountain in Otero County prior to the mountain becoming an Area of Critical Environmental Concern (ACEC). Currently, efforts are underway to re-open the open-pit copper mine at Copper Flats in Sierra County.

3.5.5 Saleable Minerals

Sand, gravel, and stone are the most common saleable mineral materials in the Planning Area and generally are found along mountain pediments, particularly the eastern edge of the Sacramento Escarpment, and in arroyos adjacent to mountain uplifts. Eolian sand is found within the Tularosa and

Jornada del Muerto Basins. Cinders, fill material, building stone, and clay occur in minor amounts throughout the Planning Area.

Sales of mineral materials are made, when possible, from designated community pits. Existing community pits are Community Pit No. 4 northeast of Tularosa (Section 6, T. 14 S., R. 10 E., NMPM) and Community Pit No. 7 about 25 miles south of Alamogordo (Sections 9 and 10, T. 20 S., R. 9 E., NMPM).

Access to Community Pit No. 4 (Coyote Canyon) is problematic, decreasing its viability as a source of sand and gravel. Community Pit No. 7 (Escondida) is an important source of blow sand; however, the eastern portion of the community pit area has been largely depleted. Weekend use of Community Pit No. 7 is not authorized due to heavy use of the area by motorcycle recreationists (Red Sands Off-road Vehicle (ORV) Area). Community Pit No. 7 is the staging area for an annual motorcycle race held in mid-February. Extraction operations are suspended for one week to accommodate the race.

In addition to the community pits, there are two established Common Use Areas (CUAs), both in Sierra County. The 5-acre Green Canyon CUA, also known as the Garfield CUA due to its proximity to the town, is a source of red building stone located in Section 29, T. 17 S., R. 4 W., NMPM. Sales are for personal use only, not to exceed 110 tons per family per year. No mechanized equipment is allowed. The Apache Canyon CUA is a source of arroyo sand and building stone. The area is less than 1 acre within the Apache Canyon arroyo in Section 20, T. 16 S., R. 4 W., NMPM. Material is extracted only from the arroyo bottom and gravel bars, without disturbing vegetation. No disturbance is allowed within 5 feet (1.5 meters) of the arroyo bank and vehicles are restricted to the road.

Materials can be obtained from various locations throughout the Planning Area. In 1988, one pit in Sierra County and 11 pits in Otero County were producing sand and gravel (Barker et al. 1988). An expanding population coupled with major road work has increased the demand for sand and gravel resources. Except for site-specific construction projects, it is not probable that these resources will be needed from public land.

3.6 SOILS

Soils within the Planning Area typically consist of loam; silty clay loams; and sandy, gravelly, gypsiferous, or cobbly loams. Rock outcrop is common. The soils are developed on a range of parent materials including underlying igneous and metamorphic rocks, limestone, shale, sandstone, gypsum beds, and alluvial and eolian deposits.

Several soil types are represented in the Planning Area. The soils are typically well drained to excessively drained. The profiles range from deep, nearly level to gently sloping silt and silty clay loam soils developed on low lying areas, to shallow, moderately steep to steep calcareous gravels and gravelly loam soils developed on upland features.

Erosion caused by water and wind processes is a primary consideration in the Planning Area. Susceptibility to erosion varies depending on soil type, slope, and vegetation cover. Some of the soils may be classified as prime farmland.

3.6.1 Soil Erosion

The potential for soil erosion is the result of several factors including slope, parent material, vegetation cover, climate, and the physical/chemical characteristics of the soil. The Natural Resources Conservation Service (NRCS, formerly the Soil Conservation Service) has mapped general and high detail soil units in portions of Sierra and Otero Counties. The NRCS soil survey publications were referenced for this study of the Planning Area. Erosion potential designations of slight, moderate, high, and severe, assigned by the NRCS, are used to indicate how susceptible soils are to increased erosion due to disturbances such as removal of vegetation, construction activities, and vehicular activity.

The most active wind erosion occurs during the spring in dune areas of sandy gypsiferous loam soils typical of the Alamogordo-Gypsum Land-Aztec soils located to the west of Alamogordo and in the Crow Flats area in Otero County, Pintura-Dona Ana sandy soils located in the Orogrande area, Simona-Delnorte-Nickel soils to the east of Engle in Sierra County, and Nickel-Bluepoint and Glendale-Gila-Brazito soils in the Rio Grande Valley of Sierra County.

Soils susceptible to water erosion have the potential to produce high sediment loads in nearby streams. Two independent studies and BLM rangeland inventories conducted within the Planning Area have identified areas of high sediment yield. Soil types susceptible to water erosion in Sierra County include sparsely vegetated Nickel-Bluepoint soils of the Rio Grande Valley and Simona-Delnorte-Nickel soils east of the Caballo Mountains. In Otero County, valley slopes dissected by erosion gullies have been mapped in Holloman-Gypsum Land-Yesum soils in the Crow Flats area and west of Alamogordo. Other generalized soil types exhibiting severe erosive characteristics are Prelo-Tome-Largo soils of the Tularosa River Valley, and Badland soils (mapped as Alamogordo-Gypsum Land-Aztec soils) to the east of Tularosa and Three Rivers in north-central Otero County. Predominant soil types exhibiting highly erosive and fragile characteristics are presented on Map 3-5.

Other areas with soils susceptible to water erosion in the Planning Area include gravelly soils at the base of mountain ranges and steep hillslopes, pediments, alluvial fans; and gravelly sand along river breaks in Sierra County.

3.6.2 Prime Farmland

As defined by the U.S. Department of Agriculture, prime farmland soils have characteristics that are best suited for the economic production of sustained high crop (food, seed, forage, fiber, and oilseed) yields. These soils have a sufficiently long growing season and need only to be treated and managed using acceptable farming methods, which generally result in the least damage to the environment. Prime farmland soils are typically made up of loam, silt, silt loam, and clay loam developed on floodplains. With the availability of a dependable and adequate water supply (e.g., irrigation), some soils in the Planning Area may be suitable as prime farmland. Within the Planning Area, Caballo and Elephant Buttes Reservoirs in the Rio Grande Valley have created a dependable irrigation water source for agricultural development on Glendale-Gila-Brazito type soils of Sierra County. Other diversions from a finite number of smaller rivers and creeks also support prime farmland in Sierra County. Potential prime farmland in Otero County is generally limited to irrigated Prelo-Tome-Largo soils along the Tularosa River and on irrigated lands within the Crow Flats area. Map 3-5 shows areas within the Planning Area capable of prime farmland development including nonirrigated areas. The NRCS publications further delineate high detail soil types capable of supporting prime farmland development.

3.7 WATER RESOURCES

3.7.1 Groundwater

The Planning Area is characterized by north-trending, sub-parallel mountain ranges separated by basins filled with alluvial material. Some of the basins may contain up to 9,000 feet of basin-fill, but the most permeable layers and most of the recoverable groundwater is in the upper 1,000 feet of the basin units. The basin-fill material is important in the consideration of regional groundwater supplies (BLM 1984).

There is an increasing need for groundwater in the Planning Area for rangeland and municipal uses. In order to protect existing groundwater from impairment, 11 underground water basins (for which all or part are within the Planning Area) have been "declared" by the State Engineer (New Mexico Water Quality Control Commission [NMWQCC] 1996). The declared basins include the Rio Grande, Lower Rio Grande, Hot Springs, Las Animas Creek, Tularosa, Nutt-Hockett, Mimbres Valley, Hondo, Hueco, Penasco, and Gila-San Francisco Declared Basins (BLM 1984). The area located in

southeastern Otero County has not been declared and is referred to as the "undeclared basin." Map 3-6 illustrates the location of the declared and undeclared basins in the Planning Area.

Groundwater in the Planning Area occurs in valley-fill deposits, basin-fill deposits, and in consolidated rock. Valley-fill aquifers consists of floodplain and channel deposits of the major rivers such as the Rio Grande and its tributaries. Groundwater can be found as shallow as 10 feet (3 meters) below surface in the valley-fill aquifers in the Rio Grande Valley. Recharge occurs by precipitation and movement of water from rivers toward the aquifers. Discharge occurs by evapotranspiration and groundwater withdrawals (Anderholm et al. 1995).

The basin-fill aquifers consist mainly of unconsolidated to semi-indurated sedimentary deposits. The material is generally of Quaternary and Tertiary ages and ranges from poorly sorted to moderately sorted mixtures of gravel, sand, silt, and clay from consolidated rock in the nearby mountain ranges. Evaporite deposits, limestone, conglomerate, and volcanic rocks are present in places. Most of the groundwater occurs under water-table (unconfined) conditions; however, due to the wide range in permeability of the basin deposits, some groundwater occurs under artesian conditions. Groundwater in the basins is primarily recharged by ephemeral streams draining the surrounding mountains and discharging either across the permeable alluvial fans at the mouths of the steep canyons or by underflow in these canyons, which enters the alluvial fan directly. Discharge can occur by evapotranspiration, movement to rivers and streams, groundwater withdrawals, or through springs emerging at the surface (BLM 1984).

As part of a comprehensive geographic approach to protect all the State's water resources, the NMWQCC recognizes 11 distinct water quality basins in the State, which are identified mainly by surface hydrology. Several of these basins are considered "closed" basins, meaning that each basin completely contains all the surface flows within its boundaries (NMWQCC 1996). One of the closed basins, the Central Closed Basin, occupies the majority of the Planning Area, with the exception of the extreme western end of Sierra County and the northeastern section of Otero County. The Central Closed Basin impacts groundwater quality in the Planning Area because saline groundwater results from the concentration of salts by evaporation in the topographically lower parts of the closed basin (Garza and McLean 1971).

Consolidated rock in the Planning Area consists mostly of sedimentary and volcanic rock, with lesser amounts of metamorphic and igneous rock. This rock makes up the mountain ranges that border the basins and is the principal source of sedimentary material in the basin-fill deposits. Consolidated rock typically exhibits very low permeability and very low rates of groundwater flow. Well yields in consolidated rock are generally low and occur by interception of water in fracture zones (Brady et al. 1984).

Hydraulic conductivity is relatively large in the coarse-grained alluvial fan deposits near the mountain fronts of the basins. Fine-grained fan deposits and lacustrine deposits basin-wide are characterized by

relatively small hydraulic conductivity. Large ratios of horizontal to vertical hydraulic conductivity are due to discontinuous, thinly bedded clay units throughout much of the basin-fill deposits (Garza and McLean 1971).

Depth to groundwater in most of the Planning Area is less than 500 feet (152 meters). Two areas of Sierra County contain groundwater at depths greater than 500 feet (152 meters), located at the extreme western and eastern edges of the County. Three areas in Otero County also contain groundwater at depths greater than 500 feet (152 meters)—two areas located at the northern end of the County and one larger area located to the south (Brady et al. 1984). More comprehensive information can be found in individual basin reports available for review at the Las Cruces Field Office of BLM.

Approximately 90 percent of the population of the State depends on groundwater for its drinking water. Nearly one half of the total water used for all purposes in New Mexico is groundwater. In many locations groundwater is the only available water supply and the Planning Area is no exception (NMWQCC 1996).

The NMWQCC has regulations in place controlling discharges onto or below the surface of the ground to protect all groundwater that has an existing concentration of 10,000 milligrams per liter (mg/L) or less of total dissolved solids. The NMWQCC has established a set of numeric groundwater standards based on the regulations governing groundwater. Groundwater quality in the Planning Area is highly variable depending upon the types of soluble minerals found in the water-bearing strata of the individual basins (BLM 1984).

The New Mexico Environment Department maintains an inventory of known groundwater contamination cases in the State. Records indicate that both public and private water supply wells have been impacted by contamination. The NMWQCC has identified both point source and nonpoint source contamination in groundwater of the Planning Area. Factors affecting aquifer vulnerability include preferential flow pathways, clay and organic matter content of soils, and oxidation-reduction potential. Portions of aquifers located in the Planning Area are considered highly vulnerable to contamination from surface water discharges in areas of a shallow water table where the vadose zone is highly fractured. Further information on aquifer vulnerability can be located at the NMWQCC office in Santa Fe (NMWQCC 1996).

Most of the groundwater in the Planning Area is used for municipal, industrial, military, agricultural, rural domestic, and livestock purposes. The primary use of water on the public rangeland is by livestock and wildlife. Most of the water provided for this purpose is depleted either as (1) water consumed by animals, or (2) evaporation from facilities constructed to furnish water supplies. These facilities include storage tanks and troughs that hold water from windmills and springs, and earthen stock tanks that generally receive water from surface sources (BLM 1984).

The State Engineer's Office (SEO) has summarized water use in Sierra and Otero Counties for 1995. In both counties, nine major uses of water include public water supply, domestic, irrigated agriculture, livestock, commercial, industrial, mining, power, and reservoir evaporation (SEO 1999a).

In Otero County, the lowest groundwater withdrawal rate was for mining (20 acre-feet/year), and the highest rate was for irrigated agriculture (29,219 acre-feet/year). There were no withdrawals for power and reservoir depletion uses. The lowest groundwater depletion rate in Otero County was for mining (4 acre-feet/year), and the highest rate was for irrigated agriculture (23,767 acre-feet/year) (SEO 1999a).

In Sierra County, the lowest groundwater withdrawal rate was for mining (18 acre-feet/year), and the highest rate was for irrigated agriculture (15,013 acre-feet/year). There were no withdrawals for commercial, power, and reservoir evaporation uses. The lowest groundwater depletion rate in Sierra County was for mining (4 acre-feet/year), and the highest rate was for irrigated agriculture (9,796 acre-feet/year) (SEO 1999a).

Appendix C summarizes various information for the undeclared basin and the declared basins including aquifers, water quality, and problems. Information on water quality and quantity with the basins has been gathered from various sources and is more extensive for some basins than others. Additionally, not all basins have had basin-wide studies conducted but rather smaller studies on local groundwater occurrence.

3.7.2 Surface Water

The Planning Area consists of major portions of three closed hydrologic basins—Jornada del Muerto, Tularosa Basin, and Salt Basin—and minor parts of the Mimbres and Pecos River closed basins. Closed basins completely contain all surface water flow within their boundaries (NMWQCC 1975). The remainder of the Planning Area is located within an approximately 50-mile segment of the Rio Grande hydrologic basin. These hydrologic basins are shown on Map 3-6.

Occurrence and quality of surface water varies greatly and is unevenly distributed across the Planning Area (Weir 1965). Perennial streamflow is limited to the Rio Grande and streams that drain the mountains along the eastern boundary of the Tularosa Basin. In addition, water occurs as seeps and springs across the Planning Area, sometimes at the headwaters of perennial flows or more often appearing as minor contributing flows to the streams (Garza and McLean 1971).

Only the large drainage areas have appreciable baseflow, which is derived largely from groundwater. Part of the total annual snowmelt and storm runoff recharges the alluvium aquifers throughout the basins (Garza and McLean 1971). Overall, tributaries flow mainly during storm events but quickly cease to flow due to loss by infiltration to the alluvium and by evaporation (Ellis 1991). The closed basins contain playas that form ephemeral lakes during rainy periods and alkali flats upon drying (BLM 1981a).

Surface water storage reservoirs also occur in the area. These include the Elephant Butte Reservoir, used for irrigation storage and hydroelectric power generation, and Caballo Reservoir used for irrigation storage. Both reservoirs are located on the Rio Grande in Sierra County. There are no rivers or segments of rivers in the Planning Area that are designated as wild and scenic.

Floodplains are land areas susceptible to being inundated from any source and include small and often dry water courses and areas along rivers, streams, and lakes. Floodplains are delineated on Flood Insurance Rate Maps and Flood Hazard Boundary Maps issued by the Federal Emergency Management Agency (FEMA) on a county-wide basis. Floodplain management is covered by Executive Order 11988 (42 CFR 26951, 1977) and BLM Manual 7221.

3.8 AIR QUALITY

Generally, the air quality in the Planning Area is good. The air quality does not exceed State or Federal ambient air quality standards. There are several Prevention of Significant Deterioration Class I areas adjacent to or near the Planning Area. In Otero County, the Guadalupe Mountains National Park in Texas are adjacent to the Planning Area to the south, the Carlsbad Caverns National Park are approximately 10 miles east of the Planning Area, and the White Mountain Wilderness Area is approximately 3 miles north of the Planning Area. In Sierra County, Bosque del Apache Wildlife Refuge (Wilderness Area) is approximately 13 miles north of the Planning Area, and the Gila Wilderness Area is approximately 10 miles west of the Planning Area. These Class I areas have more restrictive air quality permitting requirements. The remainder of the Planning Area is designated as PSD Class II.

Currently, the State of New Mexico has only one monitoring station located in Sierra and Otero Counties. This monitoring station only records data for particulate matter of 10 microns or less (PM_{10}) and is located in La Luz, approximately 5 miles north of Alamogordo, New Mexico.

The most recent data (March 1999) list the highest 24-hour concentration recorded in the past year as 70 micrograms per cubic meter ($\mu g/m^3$). The second highest 24-hour value is 41 $\mu g/m^3$. The average of the 10 highest readings in the past year is 34 $\mu g/m^3$ (U.S. Environmental Protection Agency 1999).

The lower Rio Grande Valley near the urban areas of Las Cruces, New Mexico; El Paso, Texas; and Juarez, Mexico have generally poor air quality. Portions of the urban area of El Paso are classified as nonattainment for several pollutants. These include particulate matter of 10 microns or less (moderate), ozone (serious), and carbon monoxide (moderate). These events of poor air quality are more likely to occur in the winter when temperature inversions prevent the transport and dispersion of pollutants. Polluted air has the potential to travel up the Rio Grande Valley and north via the Tularosa Basin into portions of the Planning Area. Blowing dust also contributes to air pollution events especially during the windy spring months. Dry, sparsely vegetated soils and unpaved roads are the main sources of particulate matter.

3.9 NOISE

Noise is generally defined as unwanted or annoying sound that is typically associated with human activity and interferes with or disrupts normal activities. Although exposure to high noise levels has been demonstrated to cause hearing loss, the principal human response to environmental noise is annoyance. The response of individuals to similar noise events is diverse and influenced by the type of noise, perceived importance of the noise and its appropriateness in the setting, time of day and type of activity during which the noise occurs, and sensitivity of the individual. Airborne sound is a rapid fluctuation of air pressure above and below atmospheric pressure. Sound levels are usually measured and expressed in decibels (dB). Most of the sounds one hears in the environment do not consist of a single frequency, but rather a broad band of frequencies differing in sound level. The intensities of each frequency add to generate sound. The method commonly used to quantify environmental sounds involves evaluating all of the frequencies of a sound according to a weighting system which reflects that human hearing is less sensitive at low frequencies and extremely high frequencies than at the mid-range frequencies. This is called "A" weighting, and the decibel level measured is called the A-weighted sound level (dBA). A sound level range of 0 to 10 dB is approximately the threshold of human hearing and is barely audible under extremely quiet listening conditions. Normal speech has a sound level of approximately 60 dB. Sound levels above about 120 dB begin to be felt inside the human ear as discomfort and eventually pain at still higher levels.

Although the A-weighted sound level may provide an adequate indication of the level of environmental noise at any instant in time, community noise levels vary continuously. Most environmental noise includes a conglomeration of noise from distant sources that create a relatively steady background noise in which no particular source is identifiable. A single descriptor called the Leq (equivalent sound level) is used. Leq is the energy-mean A-weighted sound level during a measured time interval. It is the “equivalent” constant sound level that would have to be produced by a given source to equal the fluctuating level measured. Leq(h) is the one-hour equivalent sound level.

Day-night noise level (Ldn) is the weighted 24-hour average sound level. It is calculated by adding 10 decibels to the sound level at night (10:00 p.m. to 7:00 a.m.). The penalty is added to account for the increased sensitivity to noise during the quiet nighttime hours. Sound levels of typical noise sources and noise environments are presented in Table 3-5.

3.9.1 Existing Noise Environment

The Planning Area is primarily undeveloped with vast open spaces. Land uses vary from sparsely populated rural regions to residential, commercial, and public uses in various small communities within Sierra and Otero Counties. Portions of the Planning Area consist of recreational (hiking, camping, rockhounding, birdwatching, hunting, and off-road vehicles) and agricultural (livestock and crop production) uses. The primary uses on public land are livestock grazing and mining, mineral material excavation, and dispersed recreation.

Baseline ambient hourly sound levels typically range from 35 to 70 dBA depending on the population density, distance to county and State roads, U.S. highways, and commercial and industrial noise sources (Dames & Moore, from numerous project sound level measurements). In some areas, noise from military aircraft overflights from various bases and other activities contribute to the noise environment.

3.10 VEGETATION

Information on the existing vegetation within Sierra and Otero Counties was obtained from BLM sources, including the *White Sands Resource Area Management Situation Analysis* (BLM 1984), *White Sands Resource Area Draft Resource Management Plan/Environmental Impact Statement* (BLM 1985b), and from Dick-Peddie (1993).

Eight major physiognomic vegetation types were identified for Sierra and Otero Counties including grasslands, desert scrub, montane scrub, woodland/forest, arroyos, malpais, riparian/other wetlands, and other (cropland). These major vegetation types are shown on Map 3-7. Grasslands and desert scrub occupy the greatest area. Factors such as soils, topography, elevation, temperature, and precipitation have a direct influence on the distribution of vegetation occurring on the various sites. Six ecological study plots have been established in BLM's Decision Area. These areas are subject to more stringent surface use management in the current RMP in order to protect resource values (native species, especially grasses).

Three vegetation types have been identified as particular concerns due to their habitat value for special status species: grasslands, woodlands forest, and riparian types.

TABLE 3-5
SOUND LEVELS OF TYPICAL NOISE SOURCES AND NOISE ENVIRONMENTS
(A-WEIGHTED SOUND LEVELS)

Noise Source (at a Given Distance)	Scale of A-Weighted Sound Level in Decibels	Noise Environment	Human Judgment of Noise Loudness (Relative to a Reference Loudness of 70 Decibels[a])
Military jet take-off with after-burner (50 feet [15 meters]) Civil Defense siren (100 feet [30 meters])	140 130	Carrier flight deck	
Commercial jet take-off (200 feet [61 meters])	120		*Threshold of pain* 32 times as loud[a]
Pile driver (50 feet [15 meters])	110	Rock music concert	16 times as loud[a]
Ambulance siren (100 feet [30 meters]) Newspaper press (5 feet [1.5 meters]) Power lawn mower (3 feet [0.92 meter])	100		*Very loud* 8 times as loud[a]
Motorcycle (25 feet [7.6 meters]) Propeller plane flyover (1,000 feet [305 meters]) Diesel truck, 40 mph (50 feet [15 meters])	90	Boiler room Printing press plant	4 times as loud[a]
Garbage disposal (3 feet [0.92 meter])	80	High urban ambient sound	2 times as loud[a]
Passenger car, 65 mph (25 feet [7.6 meters]) Living room stereo (15 feet [4.6 meters]) Vacuum cleaner (3 feet [0.92 meter]) Electronic typewriter (10 feet [3 meters])	70		*Moderately loud* 70 decibels[a] (Reference loudness)
Normal conversation (5 feet [1.5 meters]) Air conditioning unit (100 feet [30 meters])	60	Data processing center Department store	one-half as loud[a]
Light traffic (100 feet [30 meters])	50	Private business office	one-quarter as loud[a]
Bird calls (distant)	40	Lower limit of urban ambient sound	*Quiet* one-eighth as loud[a]
Soft whisper (5 feet [1.5 meters])	30 20 10 0	Quiet bedroom Recording studio	*Just audible threshold of hearing*

SOURCE: Compiled by Dames & Moore from numerous sources including but not limited to Federal Transit Administration 1995, General Radio 1972, Harris 1991, U.S. Department of Housing and Urban Development 1977, U.S. Environmental Protection Agency 1980.

3.10.1 Grasslands

Grasslands occur throughout the Planning Area at all elevations, and generally habitats consist of grass flats (low swales that receive flood overflow), grass hills, grass rolling uplands (nonswale, isolated pocket settings), and grass mountains (slopes of mountain ranges above the surrounding uplands). Grasslands cover approximately 1,849,277 acres in the Planning Area and 585,831 acres in BLM's Decision Area. Salt flats, or playas, occur within the Planning Area and have been identified by the BLM as resources of concern because these areas are sensitive to surface disturbance (e.g., wind erosion on salt flats, playas as spring habitat for shore and wading birds). Droughts are common in these regions and must be anticipated in management practices.

The predominant species in lower elevations include black grama, blue grama, tobosa, alkalai sacaton, burrograss, sand dropseed, mesa dropseed, ring muhly, and fluffgrass. In higher elevations, curl-leaf muhly, black grama, three-awns, sideoats grama, mountain muhly, spike muhly, and needle and thread predominate. Grasslands on sandy soils that contain dropseed, alkali sacaton, and Indian rice grass are designated as mid grass vegetation.

Encroachment of desert scrub onto grasslands has been occurring over the past 80 to 90 years. This shift may be attributed to a combination of climatic change, introduction of roads, extensive livestock grazing, and concurrent interruption of naturally occurring fire (Dick-Peddie 1975; Neilson 1986). Grass species that are highly palatable, such as black grama, provide a highly desirable livestock forage. Of particular concern are two remnant areas of desert grassland patches within BLM's Decision Area, which provide habitat for pronghorn (and coincide with the Otero Mesa Habitat Management Area and Nutt Antelope Area).

3.10.2 Woodland/Forest

Woodland/forest vegetation types are found at the higher elevational limits of the Planning Area, which receive the greatest amounts of precipitation. These species occupy shallow soils and are predominantly on the north-facing slopes of the mountains and hills. Woodland/forest habitat types are associated primarily with the Caballo, Sacramento, San Andres Mountains, and Black Range, and habitats consist of piñon-juniper woodlands (generally on mountain ranges about 6,000 feet), montane coniferous forest (on mountain ranges between 8,000 to 10,000 feet), and subalpine coniferous forest (on mountain ranges between 9,500 and 12,000 feet). Woodlands/forests occur on approximately 1,849,304 acres in the Planning Area and 118,626 acres in BLM's Decision Area.

While juniper usually is not considered a desirable species, the trees in this area do not form a continuous canopy, but are in scattered clumps that provide wildlife cover. The piñon provides food for wildlife, and several species of browse plants also provide excellent deer habitat.

Understory vegetation consists primarily of grasses, blue grama, black grama, sideoats grama, algerita, and galleta. This also represents higher average elevations and should be considered a transition zone as reflected by the presence of ponderosa pine, Gambel oak (oakbrush), serviceberry, and some of the ash species.

Besides providing forage, uses of these areas that should be considered in any management program include the use of trees for posts and firewood, and the management of piñon stands for greater production of nuts.

3.10.3 Riparian/Other Wetlands/Playas

The riparian vegetation type currently identified within BLM's Decision Area accounts for approximately 14.5 miles along creeks and surrounding seeps and springs. It is very important as a habitat type. In addition, arroyos, playas, and salt flats are likely to be classified as Waters of the United States and therefore subject to Section 404 of the Clean Water Act. Within BLM's Decision Area, there are approximately 3,351 acres of playas identified. Intermittent streams, mud flats, and sand flats also are considered Waters of the United States. Some of the larger, more important riparian areas in the Planning Area include the Elephant Butte and Caballo Reservoirs and along the Rio Grande, the south fork or Palomas Creek, Berrenda Creek, Tularosa River, and Percha Creek.

Riparian vegetation along the Rio Grande consists of dense stands of trees and shrubs that form "bosques" (Dick-Peddie 1986). The composition ranges from pure stands of salt cedar, bank willow, and willows mixed with mesquite and four-wing saltbrush. Open areas usually are dominated by saltgrass with seep willow on the perimeters. Cottonwood trees are scattered along the Rio Grande and dominate the bosques in some areas, but usually contain tree willow.

These areas can provide excellent food and cover for wildlife and smaller game animals. Generally water is plentiful in these areas and more reliable for wildlife as well as livestock.

3.10.4 Noxious Weeds

The major poisonous plants that occur in the Planning Area are locoweed, mustard, and milkweed. Primary plants that are undesirable for livestock include oak, mustards, cocklebur, and snakeweed.

Noxious weeds that are listed for the BLM Las Cruces Field Office (1996a, 1997a) include Russian knapweed (*Centaurea repens*), hoary cress (*Cardaria draba*), Canada thistle (*Cirsium arvense*), Malta starthistle (*Centaurea melitensis*), leafy spurge (*Euphorbia escula*), musk thistle (*Carduus*

nutans), yellow starthistle (*Centaurea solstitialis*), and African rue (*Peganum harmala*). Because of the invasive nature of these plant species, and an increasing dominance at the expense of economically important native species, land management policies should be cognizant of activities that facilitate the spread of weeds, and conversely, of measures that help prevent infestations and spread of these noxious species.

Noxious weed distribution was mapped for Otero County by the Natural Resource Conservation Service. Infestations of African rue occur east and southeast of Alamogordo along U.S. Highway 54 and also east of this highway between Alamogordo and Tularosa. Russian knapweed also occurs in this area, but mostly between Alamogordo and Tularosa. Other noxious weed species are less pronounced, having more scattered distributions. The exception is a concentration of common burdock east of Alamogordo.

3.11 WILDLIFE

Information regarding wildlife species that are present within the Planning Area was gathered from the BLM and NMDGF. The BLM maintains an inventory of wildlife in the Integrated Habitat Inventory and Classification System (IHICS). The IHICS is designed to assist in accumulating, storing, retrieving, and analyzing data on wildlife, as well as on vegetation, soils, landforms, climate, and other ecosystem determinants as they relate to wildlife resources. Inventories were conducted for the *White Sands Resource Area Management Situation Analysis* (1984). Selected habitat sites were sampled for vertebrate species for the *Draft Grazing Environmental Impact Statement for the Southern Rio Grande Planning Area* (BLM 1981b). The Southern Rio Grande Planning Area includes parts of Sierra, Luna, and Dona Ana Counties.

3.11.1 Standard Habitat Types

Wildlife in the Planning Area is associated with specific habitat types (SHS) as identified by the BLM. These SHSs are delineated according to the vegetation type present, landforms, and soil types. For the purposes of this document, the SHSs have been combined into seven groups under broader habitat type definitions. These groupings are based on similarities in vegetation between SHSs. Table 3-6 provides a list of which SHSs are within each group. Several SHSs are found in both Sierra and Otero Counties, while others are limited to only one area, as indicated on Table 3-6. Map 3-7 depicts the broader vegetation types. Several key habitat types are discussed in Section 3.10 and additional information is available in Appendix D-III and the MSA.

There have been changes in the distribution and amount of each habitat type over time resulting from human activities such as livestock grazing, road construction, and the introduction of exotic (non-native) species. It is estimated that overall there has been a 37 percent increase in creosote-dominated habitat

types, a 2 percent increase in half-shrub types, a 7 percent increase in mesquite-dominated types, and a 17 percent increase in mixed shrub habitat type (Howard, personal communication, 1999). These types generally have resulted in an overall loss (62 percent) of grasslands, which are preferred by many wildlife species.

The SHSs are an important wildlife management tool for the BLM. The BLM maintains lists of vertebrate species associated with each of the SHSs. These lists differ slightly between counties depending on specific habitat features within each SHS.

TABLE 3-6
HABITAT TYPES IN SIERRA AND OTERO COUNTIES

Type	Standard Habitat Sites	Acres	
		Planning Area	Decision Area
Grasslands	Grass Flat (S,O) Grass Hill (O) Grass Mountain (S,O) Grass Rolling Upland (S,O) Half-Shrub Hill Half Shrub Rolling Upland (S) Salt Flat (O)	1,849,277	585,831
Desert Scrub	Creosote Breaks (S) Creosote Hills (O) Creosote Rolling Upland (S,O) Mesquite Rolling Upland (S,O) Mesquite Sand Dune (S,O) Mixed Shrub Rolling Upland (S)	2,774,236	1,183,512
Montane Scrub	Mixed Shrub Montane (S)	56,424	25,000
Woodland/Forest	Piñon-Juniper Grass Mountain (S,O)	1,849,304	118,626
Arroyo	Arroyo (S,O)	38,295	21,335
Malpais	Malpais Rock (S)	32,969	54
Riparian/Wetlands/Playas	Riparian (S,O)	14,390	5,762
Unclassified and Miscellaneous Vegetation Types	(Alpine Tundra [O] Sand Dunes [S])	334,064	112,959
Total Acres		6,949,557	2,053,029

SOURCE: Bureau of Land Management 1999a, b
NOTE: S = Sierra County; O = Otero County

3.11.2 Wildlife

Big Game

Pronghorn and mule deer occur throughout the Planning Area and utilize several of the SHSs listed above. Two elk herds are present in the Planning Area. The NMDGF tracks these animals and maintains information about total animal populations, habitat and population trends, areas of critical

habitat, winter range, and areas of population concentrations. The wildlife habitat map (Map 3-7) delineates the boundaries of five habitat areas.

Pronghorn inhabit the Otero Mesa Management Area on Otero Mesa in Otero County and the Nutt Antelope Area east of SR 85 in Sierra County. Pronghorn are associated most commonly with grass flats, grass hills, and grass rolling uplands. The two habitat areas are desert grassland patches, which are remnants of a habitat type that was more dominant historically. However, degradation and conversion to desert scrub has been occurring over the past 80 to 90 years as a combined result of climatic change, introduction of roads, extensive livestock grazing, and concurrent interruption of naturally occurring fire.

The Caballo Mountains Deer Habitat Area, Sacramento Escarpment Deer Habitat Area, and Jornada del Muerto Habitat Area support deer populations and have been identified by the BLM as resources of concern. There are few habitat sites within the Planning Area that provide the biological requirements for significant numbers of big game species other than those mentioned above; however, infrequent occurrences of elk, bear, turkey, and mountain lion have been recorded. Elk move onto McGregor Range, although most elk in the area are year-round residents. No defined winter or calving areas are present (Massey, personal communication, 1999). Elk and bear occasionally are seen in the Brokeoff Mountains and along the lower elevations of the Sacramento Mountains, Guadalupe Mountains, and Black Range; however, these areas are not essential to either elk or bear population viability because of more suitable habitat located outside of the Planning Area. Turkey have been seen in the areas mentioned above with the exception of the Brokeoff Mountains. Habitat for turkey is not essential in any of these areas for the same reasons as for those of elk and bear. Mountain lions occur predominantly in the more rugged mountainous areas of the Brokeoff, Sacramento, Guadalupe, San Andres, and Caballo Mountains and Black Range. Locations and numbers of mountain lion at any one time are dependent on the presence of prey species, which in turn is related to the suitability of the habitat for prey.

The NMDGF has developed goals for increasing the existing populations of desert bighorn sheep. These goals are documented in *New Mexico's Long Range Plan for Desert Bighorn Sheep Management 1995-2002* (NMDGF 1995). Potential reintroduction sites for the bighorn are located within the Planning Area. Sites with suitable habitat parameters for bighorn sheep are located in the Caballo, Sacramento, and Guadalupe Mountains. Secondary reintroduction sites include the Brokeoff and Cornudas Mountains (Massey, personal communication, 1999). The Caballo Mountains provide a potential movement corridor for bighorn sheep from the Fra Cristobal Mountains (Snyder, personal communication, 1999).

Small Game

Major species of upland game birds include Gambel's quail, scaled quail, and mourning dove. Gambel's quail occur in the more mesic habitat sites, whereas scaled quail utilize those that are more xeric. Population numbers of quail, both Gambel's and scaled, fluctuate depending in part on precipitation and quality of habitat. Mourning dove occur throughout the Planning Area with concentrations favoring those areas where water is present. Jackrabbits and cottontail rabbits also are common in the area, utilizing most habitat sites (BLM 1985b).

Nongame

Many nongame species including raptors, small mammals, birds, reptiles, and amphibians, occur throughout the Planning Area. Lake Holloman, a man-made impoundment, provides a perennial source of freestanding water and receives use from a variety of shorebirds.

Raptors

Raptors (eagles, hawks, and owls) are common throughout the Planning Area. Wintering raptors often are associated with habitats associated with water and open grassland areas where prey species are abundant. Raptors that are associated with several SHSs within the Planning Area include sharp-shinned hawk, prairie falcon, Cooper's hawk, red-tailed hawk, Swainson's hawk, ferruginous hawk, and golden eagle. Bald eagles winter in the area, roosting in the mountains near water and foraging into the surrounding lower elevations. Owls in the area include great-horned owl, western screech owl, long-eared owl, and northern pygmy owl.

Waterfowl

Waterfowl occurrences in the Planning Area are limited to those habitat sites where freestanding water is available. Earthen stock tanks are utilized seasonally; however, habitat along the Rio Grande, and in Caballo and Elephant Butte Reservoirs and Lake Holloman, is more abundant and desirable. The Rio Grande corridor is a major migration route for waterfowl, raptors, and passerines.

Fisheries

Fisheries in the Planning Area include Caballo Reservoir, Elephant Butte Reservoir, portions of the Rio Grande, Three Rivers, and Tularosa Creek. Records indicate that Three Rivers contains some

concentrations of brook trout, which is the sole species known to occupy this aquatic habitat. The Tularosa Creek contains both rainbow and brown trout.

3.12 SPECIAL STATUS SPECIES

An estimated 10 Federally listed threatened and endangered species and 45 other special status species (Federal candidate, Federal proposed, BLM sensitive, and State-listed) are known or potentially could occur on public land within the Planning Area. A list of the special status species in the Planning Area and on public land is provided in Appendix D-I. Special status species accounts for those species most likely to occur on public lands are provided in Appendix D-II. Some special status species are dependent on specific habitats. Other species have an extremely restricted distributional range and are known as endemic species; a variety of endemic species are present within Sierra and Otero Counties. Many of the more mobile species (birds, large mammals) can use several different habitat types. Appendix D-III provides a list of the special status species that are most likely to occur in BLM's Decision Area.

The following sections describe the (1) special status species that potentially could occupy the general habitat types in the Planning Area, (2) endemic species, and (3) six special status species (SSS) areas on public land.

3.12.1 Special Status Species Habitats

The variety of habitats in Sierra and Otero Counties (see Map 3-7) provide important environments (for growth, foraging, cover, and reproduction and rearing) for a number of special status species. Of these habitat types, grasslands, riparian, and woodland/forest habitats are the most important to special status species. The species associated with each of the important habitat types are summarized briefly below.

Grasslands

A number of special status species are dependent on grassland habitats including Guadalupe rabbitbrush, grama grass cactus, aplomado falcon, black-footed ferret, mountain plover, Arizona black-tailed prairie dog, Baird's sparrow, ferruginous hawk, and western burrowing owl.

Woodland/Forest

A number of species are dependent on woodland/forest habitats and include Glass Mountain coral root, Kuenzler hedgehog cactus, Todsen's pennyroyal, gray-footed chipmunk, Mexican spotted owl, northern goshawk, Sacramento Mountain salamander, and numerous bat species (foraging and roosting).

Riparian

Species dependent on riparian habitat types include Sacramento prickly poppy, Sacramento Mountains thistle, Wright's marsh thistle, brown pelican, interior least tern, whopping crane, southwestern willow flycatcher, bald eagle, Chiricahua leopard frog, Arizona southwestern toad, black tern, New Mexico jumping mouse, northern goshawk, white-faced ibis, yellow-billed cuckoo, and numerous bat species (foraging for insects).

3.12.2 Endemic Species

A variety of endemic species, or species whose occurrence is restricted to a small area, are present within Sierra and Otero Counties. These endemic species and their area of occurrence (listed in parentheses) are as follows: Sacramento prickly poppy (Sacramento Escarpment); Sacramento Mountain thistle (Sacramento Mountains); Villard's pincushion cactus (Sacramento Escarpment); Guadalupe Mountain mescal bean (Brokeoff Mountains); Duncan's cory cactus (Mud Mountains in New Mexico, but also present in Big Bend National Park in Texas); gypsum scalebroom (Alkali Lakes in New Mexico and Texas); Todsen's pennyroyal (San Andres Mountains on west side of Tularosa Basin and Sacramento Mountains on east side of Tularosa Basin); gypsum ringstem (Pup Canyon); gypsum blazingstar (Pup Canyon); Sierra Blanca cliffdaisy (Sacramento Mountains); Mineral Creek Mountain snail (Mineral Creek), Cornudas Mountain land snail (Cornudas Mountains); Organ Mountain Colorado chipmunk (Organ Mountains); White Sands pupfish (White Sands Missile Range).

The table in Appendix D-III provides a list of the special status species that are most likely to occur in BLM's Decision Area within standard habitat types.

3.12.3 Nominated ACECs

Eight areas in BLM's Decision Area have been nominated to become ACECs (Dunmire 1992, BLM 1999b). The nominations are based primarily on the presence of special status species. The nominated ACECs are shown on Map 3-8 and listed is Section 3.18.3.

3.13 RANGELAND

Rangeland within the Planning Area occurs on private land and lands administered by State, Forest Service, Mescalero Apache Indian Tribe, and BLM. Grazing use is primarily by cattle, sheep, and horses. BLM authorizes grazing on approximately 805,640 acres of public land in Sierra County and approximately 933,269 acres of public land in Otero County (BLM 1998a).

Range production for livestock, described as *Acres Per Animal Unit – Yearlong*, has been described and categorized for the Planning Area. *Acres Per Animal Unit – Yearlong* is defined as the number of acres required to support one cow-calf unit for one year. Range production categories vary from a relatively high level of production as in Class B (37 to 43 acres per animal unit – yearlong) to relatively low areas of production as in Class G and H (265 or greater acres per animal unit – yearlong). Table 3-7 lists the range production classes and the number of acres within each of the classes in the Planning Area. Class E (75 to 119 acres per animal unit - yearlong) contains the largest number of acres (3,168,000 acres) while Class B (37 to 43 acres per animal unit) has the smallest number of acres (7,000 acres).

TABLE 3-7
RANGELAND PRODUCTION CLASSES AND ACREAGES

Range Production Classes	Acres/Animal Unit Yearlong	Head/Section Yearlong	Approximate Acres
Class B	37 to 43	17.30 to 14.80 head	7,000
Class C	44 to 54	14.55 to 12.08 head	572,000
Class D	55 to 74	11.64 to 8.65 head	1,799,000
Class E	75 to 119	8.30 to 5.98 head	3,168,000
Class F	120 to 264	5.33 to 2.42 head	1,061,000
Class G	265 and more (high elevations)	8 head or less (high elevations)	112,000
Class H	265 and more	3 head or less	227,000

SOURCE: Department of Agricultural Economics and Agricultural Business, Agricultural Experiment Station, and New Mexico State University, n.d.

More productive areas, such as Class C, occur along the southern end of the Sacramento and Brokeoff Mountains, and the foothills to the east of the Black Range and Mimbres Mountains. Least productive areas, such as Class G and H, occur in the Black Range, Malpais, and portions of the White Sands Missile Range.

On public land, there are 248 grazing allotments in Sierra and Otero Counties. Acreage and forage allocation by allotment for Sierra and Otero Counties are on file at the Las Cruces Field Office of BLM.

3.14 CULTURAL RESOURCES

BLM defines a *cultural resource* or *cultural property* as:

> a definite location of human activity, occupation, or use identifiable through field inventory (survey), historical documentation, or oral evidence. The term includes archaeological, historic, or architectural sites, structures, or places with important public and scientific uses, and may include definite locations (sites or places) of traditional cultural or religious importance to specified social and/or cultural groups (BLM Manual 8100, *Cultural Resource Management*)

No systematic, complete inventory of cultural resources has been undertaken in either Sierra or Otero County, but thousands of archaeological and historical sites have been recorded.

3.14.1 Cultural History

More than seven decades of intermittent research has demonstrated that human societies have occupied the Planning Area for approximately 12,000 years, and perhaps substantially longer.
The earliest occupants, whom archaeologists call Paleoindians, occupied the region from about 10,000 to 6000 or 7000 BC. Remnants of the Paleoindian era are rare, because these earliest occupants lived in small groups, left little durable evidence of their presence, and the archaeological evidence that was left has been subject to millennia of erosion.

Archaeologists call the long period from about 6000 or 7000 BC to about AD 200 the Archaic era. Archaic sites are much more common than Paleoindian sites. Sizeable villages of pit houses, probably representing winter settlements of populations that dispersed during other seasons of the year, date from as early as the Keystone phase (4300-2500 BC). Sites with small numbers of pit houses become much more common during the late Archaic era. Corn was being grown as early as about 1000 BC, as evidenced in sites such as Fresnal Shelter in Otero County.

The subsequent period from about AD 200 to about 1400 or 1500 is called the Formative or Ceramic era. Sherds of broken ceramic vessels are extremely durable and are key pieces of archaeological evidence of the Formative era. Ceramic era sites dominate the archaeological record of the region.

Archaeologists classify the Ceramic era sites in the Planning Area as reflecting the Mogollon culture. These sites in Otero County and eastern Sierra County are considered to be part of the Jornada branch of the Mogollon. Sites in western Sierra County are part of the Mimbres branch.

A Jornada Mogollon village site and numerous images pecked onto boulders (petroglyphs) at Three Rivers in northern Otero County constitute one of the most spectacular archaeological sites on public land in the Planning Area. Other petroglyphs at Alamo Mountain, and clusters of Mogollon archaeological sites at the Jarilla Mountains, Rattlesnake Hill, and Lone Mountain are other major archaeological resources on public land in the Planning Area. The Mogollon cultural system appears to have collapsed in the mid-1400s, or at least changed so drastically that it left an essentially invisible archaeological record.

Very little is known about the peoples occupying the Planning Area when the first Spanish expeditions passed through south-central New Mexico in the 1580s. By the late 1600s, various groups of Apaches moved into southern New Mexico and came to dominate this territory.

Spanish era settlement in New Mexico focused on the Rio Grande Valley well to the north of Sierra and Otero Counties. A major route of travel between Mexico and the New Mexican colony was developed along the Rio Grande at the end of the sixteenth century. The trail, known as the Camino Real or Chihuahua Trail, generally ran adjacent to the river, except for a 90-mile segment known as the Jornada del Muerto. Portions of this trail are on public land in Sierra County.

The Spanish waged campaigns against the Apaches throughout southern New Mexico, but did not settle in the region. The only Spanish settlement in southwestern New Mexico, dating from early in the 1800s, was at the Santa Rita mine in what is now Grant County.

Mexico gained independence from Spain in 1821. Mexican agricultural settlement began expanding north from the El Paso area in the 1840s with the settlement of Dona Ana and Las Cruces in the Rio Grande Valley. At this time Mexico lost New Mexico to the United States as a result of the Mexican War of 1846-1848, and the Gadsden Purchase was ratified in 1854. Remnants of the Cooke's Wagon Road, also known as the Mormon Battalion Trail, created during the Mexican War, are on public land in Sierra County.

The United States invested considerable military efforts to control the Apaches. Fort Thorn and Fort Craig were established in the Rio Grande Valley to the south and north of Sierra County in 1853 and 1854, respectively. In the late 1850s, native New Mexicans cautiously began to expand into the river valley between these forts in what is now Sierra County. Fort McRae, built in 1863 near where Elephant Butte Reservoir is now, provided additional protection, but the Civil War diverted military efforts against the Apaches. Southern New Mexico was part of the Confederacy for about a year from mid-1861 through mid-1862.

By the beginning of the 1870s, relations with the Apaches shifted from hostilities to reciprocal trade and many Apaches were relocated to reservations. The Mescalero Reservation, which is partly in northeastern Otero County, was established in 1873.

Remnants of the "upper route" of the Butterfield Trail, a U.S. Army-protected travel route used prior to August 1859, are on public land in southern Otero County.

Although some discoveries of gold and silver ore were made somewhat earlier than the 1870s, mining in the Planning Area was not seriously pursued until the Apaches were controlled. Discovery of gold and silver in the 1870s and 1880s led to the establishment of numerous mining communities in this area, including Winston, Chloride, Kingston, Hillsboro, and Lake Valley. Lake Valley suffered boom and bust cycles and is essentially a ghost town today, as are virtually all of the mining communities founded in the Planning Area during the nineteenth century. Lake Valley is partially on public land and BLM manages the site for heritage tourism.

Ranching is another major theme of historic Euro-American settlement in the Planning Area, although large-scale cattle ranching dates only from the 1880s, when railroads arrived in the territory.

During World War II the Federal government purchased many large ranches in Otero County and converted them to military ranges. Some of the ranch headquarters abandoned at that time have been recognized as important properties representing the history of ranching. Military training and research remains a primary activity in much of Otero County.

The completion of Elephant Butte Dam on the Rio Grande in 1916 provided more stable agricultural water supplies. Agriculture, particularly the farming of cotton, alfalfa, vegetables, and pecans, along with military training and research, growing trade across the international border, and "Sun Belt" retirement dominate much of the local economy today.

3.14.2 Archaeological and Historical Sites

When the White Sands RMP (BLM 1986a) was prepared, it was estimated that fewer than 250 archaeological and historical sites had been recorded in Sierra and Otero Counties during survey of approximately 50 square miles. The extent of inventory represented only about two percent of the approximately 2,741 square miles of public land within those counties. These data suggested there is an average of almost five sites per square mile, and a total of more than 13,000 archaeological and historical sites on the public land within the Planning Area.

Fifty-one sites within the two counties are listed on the National Register of Historic Places; none occur on public land managed by the BLM. The BLM has been involved in cooperative efforts to list the

Three Rivers Petroglyphs and the historic mining town of Lake Valley, but these nominations are not completed. In addition, the BLM has closed several areas to ORV use to protect cultural resources. These areas include the Rattlesnake Hills Archaeological District, Lone Butte, and Jarilla Mountains.

More than 550 archaeological and historical sites have been recorded during surveys conducted for BLM projects over the last 13 years. This is an average of more than 19 sites per square mile, which is almost four times higher than estimated in 1985. These numbers suggest that there could be more than 50,000 archaeological and historical sites on public land within Sierra and Otero Counties.

The New Mexico Cultural Resource Information System (NMCRIS) has information about approximately 2,200 cultural resource surveys conducted since 1930 within Sierra and Otero counties. More than 1,560 of these surveys have been completed since 1985, with approximately 100 to 150 projects being completed annually since then for an average of about 130 projects per year. These data indicate that BLM projects constitute about 25 percent of the surveys that have been conducted annually within the Planning Area since the White Sands RMP was completed.

Information about the extent of field survey is available for about 2,190 of these projects (92 percent), and it is estimated that they encompassed about 1,130 square miles or approximately 10 percent of the Planning Area. More than 64 percent of the surveys recorded no archaeological or historical sites, but the others discovered an aggregate of 16,059 sites.

The largest surveys were conducted on military facilities in Otero County, including the McGregor Range, White Sands Missile Range, and Holloman Air Force Base. Lesser, but above average, levels of survey seem to be associated primarily with timber sales in the Sacramento Mountains. Few of the large surveys have been conducted on public land managed by the BLM. Although BLM projects account for about 25 percent of the projects conducted since 1985, they encompass only about five percent of the surveyed areas within the Planning Area. However, the BLM projects account for approximately 10 percent of the sites entered into the NMCRIS inventory since 1985. Accordingly, the average of about 19 sites per square mile on post 1985-BLM projects is somewhat higher than the average of about 12 sites per square mile for all NMCRIS surveys. This average suggests there could be a total of approximately 130,000 archaeological and historical sites in the Planning Area. At the rate of survey since 1985, it would take about two centuries to complete the inventory of Sierra and Otero Counties.

In general, the number of recorded archaeological and historical sites correlates with the extent of survey. Therefore the lack of recorded archaeological and historical sites in many parts of the Planning Area does not necessarily mean there are no cultural resources present. Instead, it is much more likely to mean that little survey has been conducted in those areas, and when surveys are undertaken, archaeological and historical sites are likely to be found.

The cultural resource studies conducted in Sierra and Otero Counties, since the White Sands RMP was completed, have recorded more of the types of archaeological and historical sites identified in that RMP. The additional data have refined but not significantly modified the general outline of the cultural history of the region. The White Sands RMP included a map modeling the general variation in the distribution of archaeological and historical sites within the Decision Area. That model still reflects the current understanding of the general distribution of archaeological and historical sites, but is likely to be refined as survey data accumulate.

3.14.3 Traditional Cultural Places and Lifeway Values

No American Indian religious sites or traditional cultural places have been identified within the Planning Area. The Mescalero Apache Reservation is in northeastern Otero County and members of this tribe visit the Three Rivers Petroglyphs and apparently regard it as a sacred place. The hot springs near Truth or Consequences may have been regarded as sacred by the Apache, but these springs do not appear to be part of contemporary sacred or religious practices for any American Indian group.

Other than the Mescalero Apache, the only other Federally recognized American Indian group residing in the immediate vicinity of the Planning Area is Ysleta del Sur Pueblo (Tigua Reservation) southeast of El Paso. The Tortugas and Piro-Manso-Tiwas are Indian/Hispanic communities in the Las Cruces area, but have not been Federally recognized as Indian tribes. Other more distant groups may very well have traditional cultural interests in Sierra and Otero Counties.

In 1996, the BLM, in cooperation with the Forest Service, completed a cultural affiliation study for New Mexico and Arizona cultures in compliance with the Native American Graves Protection and Repatriation Act (NAGPRA) (U.S. Department of Agriculture, Forest Service, Southwestern Region 1996). The purpose of this study was to determine which American Indian groups might claim affiliation to human remains, funerary objects, sacred objects, and objects of cultural patrimony associated with archaeologically defined cultures. The three archaeological cultures relevant for Sierra and Otero Counties include the Jornada Mogollon (AD 200-1400), Upland Jornada Mogollon (AD 500-1450), and Upland Mogollon. No modern American Indian groups were definitely identified as culturally affiliated with either the Jornada or Upland Jornada Mogollon archaeological cultures. The Jornada Mogollon was identified as possibly associated with historic groups in northern Chihuahua that lost their cultural identity or possibly the Piro. The Piro were puebloan villagers who suffered from Apache raiding during the Spanish colonial era. Remnants of this group moved south with the Spanish when they were expelled by the Pueblo Revolt in 1680, and founded Ysleta del Sur Pueblo. The Hopi Tribe, Pueblo of Zuni, and Pueblo of Acoma were determined probably to be affiliated culturally with the Upland Mogollon culture.

3.15 PALEONTOLOGICAL RESOURCES

Sierra and Otero Counties include a broad diversity of geologic formations and structures. The geology map prepared in conjunction with the MSA shows the outcrops or exposures of 90 geologic units in the Planning Area (Anderson et al. 1997). These units are evidence of a long and varied geologic history. Section 3.5 of this document describes the general geology and stratigraphy of the Planning Area.

The geologic units in Sierra and Otero counties range from almost two billion years old to the present (Table 3-8). Almost all fossils are found in sedimentary deposits. Sedimentary rocks form in marine and nonmarine environments and include sandstone, siltstone, shale, and limestone. The rocks of the Precambrian include a complex of gneiss, with metasedimentary and metavolcanic rocks intruded by granites. The formations of the Early Paleozoic include interbedded limestones, sandstones, and shales as well as conglomerates, quartzite, and dolomites. The formations represent approximately 320 million years and are characterized in New Mexico by widespread deposition of primarily marine sediments with invertebrate fossils. Early Paleozoic rocks (pre-Mississippian) crop out in southern New Mexico and are generally sparsely fossiliferous. Rocks of the Early Paleozoic crop out along escarpments of the Sacramento, San Andres, Oscura, Organ, Caballo, and other mountains in southern Arizona. There have not been any confirmed reports of Cambrian vertebrates in New Mexico. A few heterostracan tesserae were found in a glauconitic sandstone at the Virginia Mine in the northern part of the Sacramento Mountains in Otero County. The sandstone is believed to be part of the Cambro-Ordovician Bliss Formation. No Silurian vertebrates are known in New Mexico. There are several reports of Devonian vertebrates (bone beds with abundant ichthyoliths and conodonts) in the Sacramento Mountains. Fossil fish of the Pennsylvanian occur in the Sacramento Mountains. Vertebrate remains have been found in the Bursum Formation but also found in outcrops in Socorro County (Zidek and Kietzke 1993).

The Mesozoic Era is known as the Age of Reptiles, which included dinosaurs. Outcroppings of Triassic-aged rocks are very limited in the area. Although the Triassic Chinle and Moenkopi formations have yielded many fossils of all types, the localities have been in the northern part of the State (Hunt and Lucas 1993a).

There are no Jurassic-aged rocks in southern New Mexico. Outcroppings are limited to the northern part of the State (Hunt and Lucas 1993b).

During the Cretaceous, New Mexico was at the western margin of an epicontinental seaway. A series of transgressive and regressive sequences moved the western shoreline of the seaway between western Arizona and northeastern New Mexico. The most extensive Cretaceous outcrops occur in northern New Mexico but there are exposures in portions of the Planning Area. In Sierra County, the McRae

Formation has yielded skeletal remains of Tyrannosaurus Rex, Alamosaurus, Ankylosauria, and Ceratopsidae (Hunt and Lucas 1993c).

TABLE 3-8
GEOLOGIC TIME LINE

Era	Period	Epoch	Millions of Years Ago
Cenozoic	Quaternary	Holocene	.01
		Pleistocene	2
	Tertiary	Pliocene	5
		Miocene	24
		Oligocene	38
		Eocene	55
		Paleocene	63
Mesozoic	Cretaceous		140
	Jurassic		205
	Triassic		240
Paleozoic	Permian		290
	Pennyslvanian		330
	Mississippian		360
	Devonian		410
	Silurian		435
	Ordovician		500
	Cambrian		570
Precambrian			4500+

SOURCE: American Geological Institute 1999

Cenozoic vertebrates have been found at several localities in Sierra and Otero Counties. Fossil vertebrates have been documented from the Palm Park Formation (Late Eocene) in the Caballo Mountains of Sierra County. The Miocene-Pliocene Santa Fe Group is exposed along both sides of the Rio Grande from Albuquerque to Las Cruces, and has produced diverse fossil fauna of mammals such as camels, gomphotheres (stegomastodons, mastodons), horses, antelope, and many more. There are several sites in the Palomas Formation near Cuchillo Negro Creek in Sierra County. Fossil mammals have been found in the Rubio Peak Formation in the northern Black Range near Winston in Sierra County.

The above is only a partial indication of the types of fossils that have been found in geologic units that crop out in Sierra or Otero Counties. Many areas have been unexplored and unsurveyed for paleontological resources.

3.16 RECREATION

There is a wide variety of recreation opportunities in the Planning Area including several State parks, White Sands National Monument, and National Forest system lands. State Parks in the Planning Area include Elephant Butte, Percha Dam, Caballo Lake, and Oliver Lee. The BLM also manages portions

of the Tularosa River in Otero County for recreation. Four scenic byways are located within the Planning Area—Geronimo Trail, El Camino Real, Lake Valley Byway in Sierra County, and Sunspot Highway in Otero County. Recreation resources are depicted on Map 3-10.

There are many diverse opportunities for recreation, both dispersed and developed. Dispersed uses include hiking, camping, rockhounding, birdwatching, hunting, and ORV use over large areas encompassing most of the land in the Planning Area, independent of developed facilities. Typically these uses occur near the major population centers of Truth or Consequences and Alamogordo or in the various mountain ranges located in the Planning Area.

3.16.1 Recreation Sites

The only developed BLM recreation site in the Planning Area is the Three Rivers Petroglyph Site and Picnic Area in Otero County. The site contains more than 21,000 petroglyphs as well as a partially excavated and restored prehistoric village. Facilities include two self-guided interpretive trails, handicap-accessible bathrooms, picnic shelters, and a group shelter. The petroglyph trail is partially handicap accessible and includes a spotting scope for individuals unable to go farther along the trail to view the petroglyphs up close. Visitation varies between 25,000 to 28,000 visitors annually. Volunteer camp hosts reside on site. The entire area is now within the Three Rivers ACEC.

Although not a developed recreation site, the historic townsite of Lake Valley in Sierra County is becoming a tourist destination. It is located along the Highway 27 portion of the Lake Valley Backcountry Byway. Volunteer caretakers have resided on site since November 1, 1994. Facilities include a public restroom, water, and a self-guided interpretive trail. The Schoolhouse, which contains much of the original artifacts and furniture, has been restored and is open for visitation daily. Numbers of entries in the Schoolhouse visitor registry were 1,430 between November 1, 1994 and December 16, 1995; 1,936 in 1996; and 1,816 in 1997.

3.16.2 Off-Road Vehicle Use

ORV use occurs throughout the area and can be characterized as either a method of transportation or as a direct recreation use. As a transportation category, ORVs are used to transport recreationists, such as hunters, to recreation sites. A small amount of this use occurs in the Planning Area. The second category, as a recreation use, includes motorcycle races and hill climbing. This type of use occurs near the population centers of Truth or Consequences and Alamogordo. Considerable ORV use occurs in the area know as Red Sands. This is approximately a 10-mile by 10-mile area on the west side of Highway 54, midway between Alamogordo and Orogrande. An annual enduro race, the

Tarantula 100, normally draws between 150 and 200 contestants from several states. The staging area is the blow-sand-depleted section of Community Pit No. 7. The area receives an increasing amount of weekend use.

ORV use is subject to three levels of designations on public land—areas open to ORV use, areas limited to existing roads and trails, and areas closed to all ORV use. The majority of the Decision Area is open to ORV use. Areas classified as closed or limited to using existing or designated roads are described in Continuing Management Guidance in Chapter 2.

3.17 VISUAL RESOURCES

The Planning Area is located within the Colorado Plateau physiographic province (Fenneman 1931) generally in the south-central portion of New Mexico, in Otero County to the east and Sierra County to the west. This province is subdivided further into province sections including the Datil (Sierra County), Mexican Highland (Sierra and Otero Counties), and Sacramento (Otero County) sections (Forest Service 1989). The Planning Area is generally bounded on the southeast by the Guadalupe Mountains, on the west by the Black Range Mountains, and on the north by the Jornada del Muerto Wilderness Study Area (WSA). The Sacramento and San Andres Mountains occur within the central portion of the Planning Area. A more detailed description of the province sections that are within the Planning Area is provided in the MSA.

3.17.1 Landscape Character

Within the Planning Area seven landscape character types were identified—volcanic formations, escarpments, foothills, mesas, riparian areas, alkali flats, and developed areas. These landscape character types were identified through analysis of major landform characteristics, and all occur within the sections mentioned above, Datil, Mexican Highland, and Sacramento. Landscape characteristics within the Planning Area are described in the MSA.

3.17.2 Scenic Quality

Scenic Quality Class A areas are associated with escarpments, volcanic formations, and riparian areas. Areas considered to be of Class A scenic quality within the Planning Area include the Sacramento Escarpment, intrusive formations of the Cornudas Mountains, and riparian areas identified in the Tularosa watershed, Three Rivers, and along the Rio Grande.

Scenic Quality Class B areas are associated with foothills and open mesas. Within the Planning Area foothill areas along major travel routes and Otero Mesa were rated Class B.

Scenic Quality Class C areas are associated with alkali flats and developed areas. Within the Planning Area major population centers were rated Class C.

3.17.3 Sensitive Viewpoints

Highly sensitive viewpoints within the Planning Area were inventoried as a component of either residential communities; parks, recreation areas, ACECs, and WSAs; travel routes; and significant cultural sites.

3.17.4 Distance Zones

Distance zones are established based on perception thresholds. Perception of form, line, color, and texture changes as distance from a viewpoint becomes greater. Landscape elements tend to become less obvious and detailed at greater viewing distances. The elements of form and line become more dominant than color or texture at longer viewing distances. The BLM's Visual Resource Management (VRM) system utilized the following distance zones to evaluate the potential visibility when matrixed with contrast:

- Foreground - the limit of a viewed area in which details are perceived and obvious. Textural and other aesthetic qualities are normally perceived within this zone (0-0.25 mile [0-400 meters] to 0.5 mile [400-800 meters]).

- Middleground - the zone in which details of foliage and fine textures cease to be perceptible. Vegetative patterns begin to appear as outlines or patterns (0.25-0.5 mile [400-800 meters] to 3-5 miles).

- Background - those portions of the landscape where texture and color are weak and the landforms become the most dominant elements (3-5 to 15 miles).

3.17.5 VRM Classes in Context of BLM's Decision Area

The inventory of visual resources in BLM's Decision Area and the development of VRM classes were completed for Sierra County in 1977 and for Otero County in 1980. Each VRM class was determined through a matrix, which combines scenic quality, visual sensitivity, and distance zones. BLM VRM Classes in the Planning Area are shown on Map 3-9.

There are five ACECs that have visual and scenic value. The Sacramento Escarpment ACEC was established for the purposes of protecting and enhancing visual resources. The Escarpment offers

outstanding opportunities for visitor solitude, opportunities for a primitive type of recreation, and the presence of historical and biological amenities add supplemental values. The other ACECs with visual values are Three Rivers Petroglyph Site, Cornudas Mountain, Wind Mountain, and Alamo Mountain.

Within BLM's Decision Area all scenic ACECs are within a VRM Class I designation and include portions of the Sacramento Escarpment ACEC, Cornudas Mountain ACEC, Wind Mountain ACEC, and Alamo Mountain ACEC (BLM 1997b). These ACECs are closed to leasing.

Within the Decision Area the two WSAs are within a VRM Class II designation and include the Jornada del Muerto and Brokeoff Mountains WSAs. Additionally, areas along I-25 and the Rio Grande (T. 13 S. to T. 18 S.), areas within the Tularosa watershed, Nutt Mountain (Sierra County), along the Sacramento Escarpment, in the area of Bent, and along SR 70 are within a VRM Class II designation.

Within the Decision Area the majority of land that occurs along interstates and State highways is within a VRM Class III designation. The Three Rivers ACEC is a VRM Class III designation.

Within the Decision Area the majority of seldom seen areas along travel routes is within a VRM Class IV designation. Also, Alkali Lakes ACEC is within a VRM Class IV designation.

3.18 SPECIAL MANAGEMENT AREAS

The Decision Area contains several BLM special management areas including WSAs, ACECs, and McGregor Range. Since all of these areas have been closed to fluid minerals leasing and development previously (refer to continuing Management Guidance in Chapter 2 for the authority under which each is closed), only brief descriptions are provided below. Also, there are eight areas that have been nominated to become ACECs. All of the special management areas are shown on Map 3-10.

3.18.1 Wilderness Study Areas

The two WSAs located in BLM's Decision Area are Brokeoff Mountains and Jornada del Muerto. BLM manages a third WSA in the Planning Area, Culp Canyon, located within the boundaries of McGregor Range, which is not included in the analysis for this RMPA/EIS. The WSAs are characterized by a high degree of apparent naturalness and landscape diversity. All three are classified as VRM Class II and provide opportunities for hunting, primitive recreation activities, and solitude.

Whether or not the wilderness designation is recommended as suitable by the BLM, all WSAs are under interim wilderness management to protect their wilderness qualities. Congress must act on BLM recommendations to either release the areas from further wilderness consideration or to formally designate them as wilderness.

3.18.2 Areas of Critical Environmental Concern

ACECs are designated by the BLM to recognize, protect, and manage unique or sensitive resources. There are six ACECs in BLM's Decision Area (and one within the boundaries of McGregor Range—McGregor Black Grama Grassland ACEC). These are all located within Otero County, and include Three Rivers Petroglyph Site, Sacramento Escarpment, Cornudas Mountain, Alamo Mountain, Wind Mountain, and Alkali Lakes ACECs. These areas tend to be characterized by the presence of cultural resource sites and/or opportunities for primitive recreation and wildlife observation.

3.18.3 Nominated ACECs

Eight areas in BLM's Decision Area have been nominated to become ACECs (Dunmire 1992, BLM 1999b). These nominations are based primarily on the presence of special status species. The nominated ACECs are listed below and shown on Map 3-8.

- Brokeoff Mountains Nominated ACEC has a full range of habitats occurring. Species include Guadalupe needlegrass (*Stipa curvifolia*), gray sibara (*Sibara grisea*), cliff nama (*Nama xylopodum*), and five-flower rockdaisy (*Perityle quiniqueflora*).

- Caballo Mountains Nominated ACEC is a desert bighorn reintroduction habitat.

- Jarilla Mountains Nominated ACEC has a high-diversity cactus community (possibly the highest known diversity of cactus species in New Mexico). Also, there is a unique hybrid swarm of *Echinocereus X roetteri var. Roetteri*, a past (delisted) Federally listed endangered species.

- Mud Mountain Nominated ACEC has plants and habitat of Duncan's pincushion cactus (*Coryphantha duncanii*), a BLM-sensitive and U.S. Fish and Wildlife Service species of concern; the high plant diversity; and the specialized limestone plant communities in late seral status.

- Percha Creek Nominated ACEC has riparian habitat and a small igneous outcrop containing *Agastache cana* (a rare plant).

- Sacramento Mountains Nominated ACEC is to protect habitat and plants of *Hedeoma todsenii*, a Federally listed endangered plant, and associated plants spoonleaf rabbitbush *(Chrysothamnus spathulatus)* and threadleaf horsebusch *(Tetradymia filifolia)*, and also common button cactus *(Epithelantha micromeris)* and desert rose *(Rosa stellata).*

- Six Shooter Canyon Nominated ACEC is to protect habitat for Guadalupe mescalbean *(Sophora gypsophilia* var. *guadalupensis)*. In addition, five flower rock-daisy *(Perityle quiniqueflora)* and Guadalupe needlegrass *(Stipa curviflora)* occur within the area.

- Pup Canyon Nominated ACEC includes two endemic species—the gypsum ringstem (*Anulocaulis leisolensus* var. *howardii*) and gypsum blazing star (*Mentzelia humilis* var. *Guadalupensis*)—as well as habitat for several endangered/sensitive species and a diverse cactus community.

3.18.4 McGregor Range

McGregor Range encompasses approximately 606,198 acres within Otero County that are owned by the Federal government and jointly managed by the U.S. Army and BLM. The majority of the acreage is public land that has been withdrawn from public use, and the remainder is Army acquired (fee-owned) lands or Forest Service land. McGregor Range is part of the Fort Bliss Training Complex and provides for military use, grazing, wildlife and habitat management, and recreation. McGregor Range is not included as part of this RMPA/EIS analysis. It is addressed in the McGregor Range RMPA (BLM 1990a) and the decisions documented in that RMPA will be carried forward.

3.19 SOCIAL AND ECONOMIC CONDITIONS

Otero and Sierra Counties are rural counties with per capita and household incomes that generally are lower than the State average. Public infrastructure and services are clustered in population centers such as Truth or Consequences and Alamogordo. The military is very significant to Otero County's economy, and retail and other services are important in both counties. Agriculture is not as important a job- or earnings-provider in either county. Tourism also is a factor in Sierra County, which contains several State parks.

3.19.1 Demographics

Selected demographic information is illustrated in Table 3-9. The population of Sierra County is older than that of Otero County and the State as a whole. Table 3-10 indicates that population projections suggest positive but slowing growth over the next 30 years.

TABLE 3-9
SELECTED DEMOGRAPHIC INFORMATION

	Sierra County	Otero County	New Mexico
Population	11,052	56,945	1,729,751
Race			
White	72.8%	60.4%	48.6%
Black	0.6%	5.8%	1.9%
American Indian, Eskimo, or Aleut	0.8%	6.0%	8.5%
Asian and Pacific Islander	0.2%	2.6%	1.1%
Hispanic	25.1%	23.1%	38.3%
Income			
Per capita income	$16,956	$15,479	$18,814
Median household income	$17,020	$26,258	$26,802
Percent of people of all ages in poverty	23.3%	17.4%	20.2%

SOURCES:
For demographic information: Regional Economic Information System 1997
For per capita income: Regional Economic Information System 1996
For median household income: U.S. Bureau of the Census 1993
For poverty information: U.S. Bureau of the Census 1995
NOTE: There may be some double counting of the Hispanic population within the percentages of races other than White.

TABLE 3-10
POPULATION PROJECTIONS

Year	Sierra County		Otero County		New Mexico	
	Population	Percent Change	Population	Percent Change	Population	Percent Change
1990	9,994	-	52,028	-	1,519,889	10.9
1995	10,685	7.5	55,027	5.8	1,686,299	8.0
2000	11,338	6.1	57,537	4.6	1,821,078	7.4
2005	11,926	5.2	59,472	3.4	1,956,725	6.8
2010	12,502	4.8	61,057	2.7	2,090,678	6.8
2015	12,972	3.8	62,700	2.7	2,232,424	6.8
2020	13,380	3.1	64,277	2.5	2,380,802	6.6
2025	13,729	2.6	65,481	1.9	2,534,964	6.5
2030	14,046	2.3	66,238	1.2	2,691,578	6.2

SOURCE: Bureau of Business and Economic Research 1997

Both counties contain a majority of White residents, although the Hispanic population totals approximately a quarter of total residents. In comparison with New Mexico as a whole, Sierra and Otero Counties have disproportionately large White populations and smaller proportions of Hispanic populations. Sierra County has a small percentage of Black and American Indian, Eskimo, or Aleut residents compared to the State, whereas Otero County has a much larger percentage of Black residents than the average throughout the State.

Per capita income in both counties is lower than State median; Sierra County has a substantially lower household income than either Otero County or the State. When compared to the entire State, a greater

percentage of Sierra County residents live in poverty while a smaller percentage of the more populous Otero County live in poverty.

The 1990 Census indicated that the population of rural portions of Otero County totaled 15,826 or 30.5 percent. In Sierra County, the rural population was 3,731 or 37.6 percent. The majority of each county's population is clustered within Alamogordo or Truth or Consequences.

The Mescalero Apache Indian Reservation is located within Otero County. The tribal population is 3,619. There are 868 households on the reservation and an average household size of 4.17. The median family income is $16,536 and unemployment has reached 43 percent, much higher than the county or State unemployment rate (Mescalero Apache Indian Tribal Office 1993).

With regard to environmental justice concerns, demographic information for population centers in each county suggests that many of the larger communities reflect racial and income characteristics of the counties as a whole. A notable exception, however, is the Mescalero Apache Indian Reservation including the towns of Mescalero and Tularosa. These areas constitute disproportionate percentages of minorities (American Indian and Hispanic), lower median incomes, and a higher percentage of the population with incomes below the poverty level.

3.19.2 Housing

Table 3-11 illustrates housing characteristics for both counties. Both counties have experienced an increase in housing units since 1980, although Otero's stock is growing at a rate faster than both Sierra County and the State as a whole. Home ownership rates within the counties are similar to the State rate. However, rental vacancy rates are notably higher than the State average and homeowner vacancy rates are slightly higher in Sierra County. The median value of both owner-occupied and rental units is notably lower in the counties compared to the State average.

TABLE 3-11
HOUSING CHARACTERISTICS

	Sierra County	Otero County	New Mexico
Housing Units			
1980	5,392	17,961	507,513
1990	6,457	23,177	632,058
Percent change 1980-1990	19.8%	29.0%	24.5%
Urban and Rural			
Urban			
Inside urbanized area	0	0	268,612
Outside urbanized area	3,618	14,546	185,952
Rural			
Farm	129	156	5,328
Nonfarm	2,710	8,475	172,166
Age of housing			
Median year structure built	1972	1971	1972
Occupancy/Vacancy			
Home ownership rate	73.3%	62.3%	67.4%
Percent occupied units with over 1 person per room	4.3%	5.5%	7.9%
Homeowner vacancy rate	5.6%	3.0%	2.3%
Rental vacancy rate	21.8%	16.1%	11.4%
Financial Characteristics			
Median value of owner-occupied units	$49,500	$58,000	$70,100
Median value of renter-occupied units	$186	$291	$312

SOURCE: U.S. Bureau of the Census 1990

3.19.3 Economic Activity

Sierra County

Mining activities were important in Sierra County at the turn of the century, after which government, tourism, and agriculture increased in relative importance to the economy. Table 3-12 indicates that retail, health services, construction, and agriculture continue to be important job providers. The largest employers in Sierra County are local, State, and Federal governments.

TABLE 3-12
EMPLOYMENT CHARACTERISTICS

	Sierra County		Otero County		New Mexico	
	Number of Persons Employed	Percent of Total Labor Force	Number of Persons Employed	Percent of Total Labor Force	Number of Persons Employed	Percent of Total Labor Force
Agriculture, forestry, and fisheries	270	8.3	607	2.5	20,485	2.9
Mining	57	1.7	29	0.1	15,559	2.2
Construction	336	10.3	1,473	60.0	46,703	6.6
Manufacturing, nondurable goods	27	0.8	170	0.7	18,111	2.6
Manufacturing, durable goods	88	2.7	1,175	4.8	35,053	5.0
Transportation	108	3.3	821	3.4	23,019	3.3
Communications and other public utilities	70	2.1	613	2.5	18,018	2.5
Wholesale trade	51	1.6	385	1.6	20,902	3.0
Retail trade	640	19.6	3,419	14.0	116,210	16.4
Finance, insurance, and real estate	208	6.4	779	3.2	33,651	4.8
Business and repair services	97	3.0	681	2.8	29,445	4.2
Personal services	134	4.1	1,047	4.3	23,238	3.3
Entertainment and recreation services	54	1.7	276	1.1	9,155	1.3
Public administration	246	7.5	2,368	9.7	49,242	7.0
Professional and Related Services						
Health	337	10.3	1,008	4.1	47,039	6.6
Educational services	193	5.9	1,710	7.0	64,577	9.1
Other professional and related services	101	3.1	1,343	5.5	58,865	8.3
In Armed Forces	7	0.2	4,453	18.2	14,874	2.1
Unemployment	235	7.2	2,097	8.6	54,888	7.8

SOURCE: U.S. Bureau of the Census 1990

Nearby tourist destinations include Elephant Butte Lake, Caballo Lake, and Percha Dam State parks. In addition, the historic El Camino Real crosses Sierra County, a trade and travel route first used by Coronado in 1581. The White Sands Missile Range covers the eastern half of Sierra County.

Otero County

Historically, Otero County served as a source of timber resources. The railroad system and Alamogordo Lumber Company were established in Alamogordo, and were important to the establishment of a timber-based industry at the turn of the century (BLM 1986a). Since the late 1940s, the military has played a large role in Otero County's economy. Holloman Air Force Base develops

research and testing programs, and is by far the largest employer within the County. The presence of military personnel and civilian employees also has permitted the development of healthy retail and service sectors within Otero County's economy. Table 3-14 indicates the importance of the military and retail as job providers within the County.

Economic Activity on Public Land

Table 3-13 provides a recent example of the primary economic activities and revenue generated on public land within Sierra and Otero Counties. Grazing provides the greatest amount of revenue. Some mining has occurred, and sand and gravel have been the most lucrative mining activities to date. The potential exists for copper mining concerns; however, due to low copper prices, mining projects have not been operational. The revenue generated from fluid mineral leasing in Fiscal Year 1997 occurred entirely within Otero County, and represents a very small percentage (0.5 percent) of the total mineral revenue dispersed to the State of New Mexico.

TABLE 3-13
ECONOMIC ACTIVITY ON PUBLIC LAND

Economic Activity	Revenue, FY 1997
Minerals	
Sand and Gravel	$19,687.56
Fluid Minerals Leases	$93,188.60 dispersed to State (half of royalty value) (MMS 1997)
Copper	None
Grazing Leases	$794,176.19 (649,915 AUM) McGregor Contracts: $244,014.10
Wildlife (hunting-related expenditures)	Guides and Outfitters: $6,664.60
Recreation	$14,561.63
Right-of-way Issuance	$69,207.62
Land Disposal	0

SOURCES: U.S. Department of the Interior, Mineral Management Services 1997; T. Hanley, personal communication, 1999

Hunting and other recreational activities including ORV use, camping, and sightseeing also occur on public land. Expenditures on retail and services within the local community constitute the primary economic impact of these activities.

3.19.4 Fiscal

Sierra County

Reflecting its smaller population and economy, the County's government has a much smaller budget than its neighbor Otero County, with $3.91 million in revenues and $4.16 million in expenditures. Local taxes are the primary source of revenues, while general government and public safety account for the majority of expenditures.

The County is permitted by the State Property Tax Code to levy taxes up to $8.85 per $1,000 of assessed valuation for general governmental services other than the payment of principal and interest on long-term debt and in unlimited amounts for the payment of principal and interest on long-term debt.

Otero County

In Fiscal Year 1997-1998, total revenues amounted to $13.34 million while expenditures totaled $16.95 million. For property taxes in Fiscal Year 1997, the County billed 7.772 per $1,000 of net assessed valuation of residential property and 11.320 per $1,000 of net assessed valuation for nonresidential property. Intergovernmental transfers provided the largest share of County government revenues ($5.90 million, or 44 percent) followed by various local taxes ($4.19 million, or 31 percent). The principal cost centers for the County are law enforcement and general government, accounting for three-fifths of total expenses.

3.19.5 Values, Beliefs, and Attitudes

People's values, beliefs, and attitudes were expressed through the scoping process for the RMPA/EIS. The oil and gas industry emphasized the importance of the potential economic benefits to local communities. Some local residents agreed with this position and view fluid minerals leasing and subsequent activities as a potential job provider. Others questioned how close drilling would occur to homes, and expressed concern over potential noise and visual impacts that may lower property values. The Otero Comprehensive Plan also cites public opposition to growth as a possible constraint to economic development.

Ranchers who attended scoping meetings were concerned about potential impacts on grazing leases and groundwater. Environmental groups have raised the issues of potential adverse impacts on nonrenewable resources and habitat.

Previous documents have identified diverse groups within the two counties (BLM 1986a). Recreational users generally agree that public land should be available for a diverse set of uses including hunting, conservation, and ORV use that require access and sometimes solitude. Ranchers may feel that ranching and farming represent a significant sector (custom and culture) of the human environment and also, as pre-existing uses, should have priority on public land.

CHAPTER 4 - ENVIRONMENTAL CONSEQUENCES

4.1 INTRODUCTION

This chapter describes the predicted consequences, or potential effects, on the environment of implementing each of the three alternatives, described in Chapter 2, in association with potential Federal fluid minerals activities (e.g., exploration, development, production, and abandonment). The chapter begins with a summary of the methods used for the impact assessment, describes the impacts that are common to all alternatives, and summarizes the potential impacts that could result from each alternative.

Using the information regarding the existing condition of the environment (Chapter 3), a description of fluid minerals activities (Appendix B), and the reasonable foreseeable development (RFD) projected for the Planning Area (Appendix A-IV), the types of impacts that each alternative could have on the resources were identified and quantified only to the extent practical for this programmatic document. The inherent difficulty of a programmatic EIS is to describe potential impacts from a project action when exact locations of project sites are not known. In addition, frontier areas (new or incompletely investigated) or areas with low-to-medium potential for fluid mineral resources may lack more detailed analyses (e.g., probable locations, resource volumes) that are not feasible due to a lack of geologic data. It should be noted that no ground-disturbing activities will result directly from the alternatives addressed in this document. Although the issuance of a lease grants rights that could result in surface-disturbing activities (unless the leasehold is 100 percent no surface occupancy), further site- and project-specific environmental evaluation is required prior to final approval of the activities (per 36 CFR 228.107).

Impacts are defined as modifications to the environment, as it presently exists, that are brought about by an outside action. Impacts can be beneficial (positive) or adverse (negative), and result from the action directly or indirectly. Impacts can be permanent, long-lasting (long term), or temporary (short term). In the case of this analysis, long-term impacts are defined as those that would substantially remain for the life of a project and beyond (approximately 20 to 30 years). Short-term impacts are defined as those changes to the environment during development or construction activities that generally would revert to preconstruction conditions (except for tree growth) at or within a few years of the end of construction. Short-term impacts may range from one to three years in duration. Impacts can vary in significance from no change, or only discernible change, to a full modification or elimination of the environmental condition. Throughout this analysis, emphasis was placed on lease stipulations that could be applied to areas that are sensitive to potential fluid minerals activities in order to mitigate or eliminate impacts.

4.1.1 Impact Types

The analysis includes three types of effects (see 40 CFR 1508.7 and 1508.8) as described below. *Direct effects* are caused by the action and occur at the same time and place. *Indirect effects* are caused by the proposed actions and are later in time or farther in distance, but are still reasonably foreseeable. *Cumulative effects* result from incremental impacts of action when added to other past, present, and reasonably foreseeable future actions regardless of what person or agency (Federal or non-Federal) undertakes those actions. Reasonably foreseeable future actions consist of projects, actions, or developments that can be projected, with a reasonable degree of confidence, to occur within a defined time frame and that will impact the same, or portions of the same, resource. Because this Resource Management Plan Amendment/Environmental Impact Statement (RMPA/EIS) is programmatic and the size of the Planning Area is large (nearly 7 million acres), it was not practical or economically feasible to describe all projects, actions, and developments within the Planning Area. Therefore, major past, present, and future actions and their relation to potential fluid minerals activities are addressed generally.

The analysis of unavoidable adverse impacts, short-term versus long-term productivity, and irreversible and irretrievable impacts is incorporated into the discussions in sections 4.2 and 4.3. If they are not discussed specifically, there are none.

In order to determine the vulnerability of resources to impacts, resources were evaluated in terms of the following general criteria:

- Resource significance—a measure of formal concern for a resource through legal protection or by designation of special status.

- Resource sensitivity—the probable response of a particular resource to project-related activities.

- Resource quality—a measure of rarity, intrinsic worth, or distinctiveness, including the local value and importance of a resource.

- Resource quantity—a measure of resource abundance and the amount of the resource potentially affected.

4.1.2 Reasonable Foreseeable Development

The reasonable foreseeable development (RFD) is a projection of the fluid mineral actions and activities, including development, that are likely to occur in the Planning Area over the life of the

planning period, which in this case is 20 years. This projection includes the number, density, type of wells likely to be drilled, and the surface use requirements (to project the amount of surface disturbance). The RFD for oil and gas and geothermal resources is explained in Appendix A-IV.

Oil and Gas Resources

A summary of the RFD for oil and gas resources is shown in Table 4-1.

TABLE 4-1
TWENTY-YEAR PROJECTION FOR OIL AND GAS DEVELOPMENT[a]

Type of Action	Number of Actions on Federal Lands	Area Disturbed[b]	Approximate Total Acres Disturbed	
			Short Term	Long Term
Geophysical (miles)	5,000	On existing roads and trails and off-road (1 acre/mile)	5,000	Minimal
Frontier Wildcat Wells	39	Drill pads and access road	351[c]	101.4[d]
Appraisal gas wells (offsetting wildcat wells)	12	Drill pads, access road, pipelines, and power lines	108[e]	60[f]
Gas development wells	30	Drill pads, access road, pipelines, and power lines	228.6[e]	126.6[f]
Oil development wells	60	Drill pads, access road, and power lines	484.8[g]	268.8[h]
Gas production facilities	3	5 acres/site	15	15
Gas transmission pipeline (miles)	100	3.6 acres initial disturbance per mile, 2.6 acres stabilized per mile	360[i]	260[i]
Bulk oil storage facility	3	5 acres/site	15[j]	15[j]
UIC well	3	Drill pads, access road, and power lines	27[k]	15[k]
Total Acres Disturbed			6,589.4	861.8

NOTES:

a Not County-specific

b Acreage estimates for each component from observed average disturbance in the Roswell/Carlsbad area as provided in Bureau of Land Management 1994 Appendix 18 unless otherwise noted.

c Wildcat well - assume 6 acres (400 by 600 feet [122 by 183 meters]) for drill pad (including worker camp) and 3 acres per access road = 9 acres. The source of this assumption is recent drill pad requests from the Bennett Ranch Operators and assumptions based on historical data made in the Roswell/Carlsbad Resource Areas of the BLM (1994).

d 2.4 acres per well not reclaimed immediately for all but three of the rank wildcats. Three of the wildcats are assumed to develop into production wells, which result in 5 acres per well not reclaimed immediately.

e Appraisal and development gas wells - assume 4.4 acres drill pad and access road for all wells, 4.6 acres for associated pipelines and power lines for all producing wells, which are assume to be economic (all appraisal wells and seven development wells per field). If a worker camp is needed, it is assumed that the one set up for the wildcat well can be used.

f Production gas wells - 5 acres per producing well will not be reclaimed immediately. For the three wells per field that are assumed to be drilled but not economic, 2.4 acres per well are assumed not be reclaimed within a three-year period after initial disturbance.

g Development oil wells - assume 4.4 acres drill pad and access road for all wells (20 wells per field), 4.6 acres for associated pipelines and power lines for only producing wells which are assume to be economic (16 producing wells per field). If a worker camp is needed, it is assumed that the one set up for the wildcat well can be used.

h Production oil wells - 5 acres per well not reclaimed immediately. For the three wells per field that are assumed to be drilled but not economic, 2.4 acres per well are assumed not be reclaimed within a three year period after initial disturbance.

I Gas transmission pipeline - 3.6 acres per mile (30 feet [9 meters] wide) and reclaim to approximately 2.6 acres (8 to 9 feet [2.4 to 2.7 meters] wide).

j This facility could occupy the same acreage as the gas production facility or the UIC facility though the acreage for those facilities would increase. Therefore, for the purpose of estimating surface disturbance, all facilities are assumed to be separate.

k UIC wells – assume a similar amount of acreage for drilling the well and constructing the facility as a production well (9 acres per well). Assume each well is reclaimed to 5 acres per well for long-term impacts.

Although location of future development is not assured, there is some information available. The recent gas discovery on Otero Mesa in southern Otero County suggests that location is likely to experience additional development. Maps 3-3 and 3-4 indicate that medium and low potential for oil and gas are distributed throughout the Planning Area.

The timing of development is unlikely to occur evenly over time and multiple wells could be developed in a burst of activity in the same general area, with field development within a period of two to five years.

Geothermal Resources

Development over the next 20 years is expected to be on a small scale. In the RFD, it was assumed that over this period two temperature surveys of 30 wells each would be drilled. These drill sites would be located adjacent to existing roads and each site would disturb an area 25 by 25 feet (7.6 by 7.6 meters). Five other various kinds of geophysical exploration permits would be approved. Most of these activities would be conducted along existing roads and trails and would involve minimal surface

disturbance. Four test wells would be drilled and each would disturb an area of 1 acre and require an access road 1.5 miles long by 16 feet (4.9 meters) wide. Only one of the four test wells would be assumed to become a commercial greenhouse facility. The facility would require an area of 10 acres for development and two production wells (the original test well and another well). A total of approximately 26.6 acres would be disturbed from these activities.

Similar to oil and gas resource projections, the location of future geothermal development is uncertain. However, several areas of "high" potential for geothermal resources have been identified and are mapped (refer to Map 3-4). Within the Decision Area, these locations occur in the vicinity of Truth or Consequences, Hillsboro Arrey, and Derry in Sierra County.

4.1.3 Mitigation Planning

This assessment took into account the rules, regulations, guidelines, and best management practices or techniques (Appendix A-III) that would apply generally to all proposed projects and stipulations that would be attached to leases (Chapter 2, Appendices A-V and A-VI). In addition, as mentioned above, further site- or project-specific environmental evaluation is required at the time of an Application for Permit to Drill (APD). Any measures to mitigate impacts identified at that time would be attached to the APD as conditions of approval. The impacts remaining after considering and incorporating the above are considered residual, unavoidable impacts.

4.2 IMPACTS COMMON TO ALL ALTERNATIVES

The following sections provide descriptions of the issues associated with each resource and the types of impacts from fluid minerals activities that have the potential to affect resources regardless of which alternative is implemented. Potential impacts that could result from each of the three alternatives are described in Section 4.3.

4.2.1 Lands and Access

Issues

In general, issues associated with lands that were identified during scoping focused on potential impacts on private property. Specific issues included the distance of potential fluid minerals development from existing residential and commercial uses, and potential impacts on cattle grazing operations and existing fencelines. In addition, private property in split estate situations was a concern. The development of Federal mineral rights in these situations may lead to land use conflicts if a private landowner is unaware of the severed mineral rights underlying his or her property. Split estate parcels in which the surface is

managed by another Federal or state agency may require coordination in order to comply with existing land use plans and policies.

Access was identified as an issue regarding the siting and number of new roads that would be required by fluid minerals development. According to existing BLM guidelines and public comments from scoping, it is desirable to use existing access roads to the greatest extent possible. Other access-related issues include road construction and traffic associated with fluid minerals development, the potential for an increase in accidents, and trespassing onto private property.

Common Impacts

Types of potential impacts on lands and access were identified for the following situations:

- Those areas where direct impacts are related to physical restrictions and loss of land. Uses with the potential to be impacted directly include grazing and recreation activities that occur on public land. Grazing and recreation impacts are addressed in later sections of this chapter.

- Those areas where indirect impacts would include conflicts between fluid minerals development and residential or community areas related to the presence of truck traffic, dust, and noise.

- Those areas where cumulative impacts related to transportation and access could result from additional traffic volume and associated increase in traffic accidents.

Lands

Each alternative potentially could have short-term and long-term effects on State and private lands. However, the total number of acres disturbed in achieving the RFD is relatively small when compared to the total Federal mineral estate acreage (Table 4-2). Regardless of the alternative, the likelihood of leasing Federal minerals in a split estate situation is greatest within the Rio Grande/Mimbres/Gila River Basin (Map 3-6, Section 4.3.1), where approximately 20 percent of the Federal mineral estate acreage underlies primarily privately owned surface area.

No physical displacement or significant indirect impacts (dust, noise) are expected to occur in larger residential or community areas. Incorporated cities, towns, and villages are nondiscretionarily closed to leasing under all of the alternatives.

TABLE 4-2
SPLIT ESTATE BY HYDROLOGIC BASIN

Split Estate Acres	Basin				
	Salt/Pecos River	Tularosa	Jornada del Muerto	Rio Grande/Mimbres/ Gila River	Total
Private Land	91,910	42,033	5,189	212,314	351,446
State Land	6,342	3,062	568	5,098	15,070
Total	98,252	45,095	5,757	217,412	366,516
Percent of Federal Mineral Estate Acreage	7.9	2.1	1.4	19.4	5.3

SOURCE: Bureau of Land Management database 1998
NOTE: Refer to Map 3-6 and Section 4.3 for a description of hydrologic basins.

Military lands and National Park Service lands (outside of BLM's Decision Area), and public water reserves are nondiscretionarily closed to leasing in all of the alternatives. Other resource concerns include the White Sands Missile Range Safety Evacuation Zone, old Air Force bombing and gunnery range, and Recreation and Public Purpose Act (R&PP) Patents and Leases.

Impacts on utilities or other right-of-way concerns are not expected as a result of the construction and operation of the project alternatives. Pipelines needed for fluid mineral production most likely would be located within existing utility rights-of-way or within road alignments associated with well development, in accordance with BLM guidelines.

Access

Acres of surface disturbance that would result from access road development are estimated in the RFD. This is based on a conservative estimate of 3 acres per well, which may vary based on the ultimate locations of specific activities. The total activity in the RFD relates to an estimate of 432 acres disturbed by access development for oil and gas development over the short term. Over the long term, these impacts may be mitigated through the reclamation of the land and revegetation. However, once access roads are developed it may be desirable to maintain them, should ranchers and others who use public land want to use the new routes.

It is conceivable that existing access roads, which traverse a great deal of the Planning Area, would be used by the fluid mineral development industry, which would reduce the impacts of new surface disturbance. This is more likely in the case of wildcat well drilling. For appraisal and development wells, the need for more permanent access probably would result in the desire to establish more direct routes to well sites rather than co-locating in existing corridors.

Impacts associated with access development may include the increased fragmentation of habitat and removal of vegetation. The increase in traffic along these routes may result in the introduction of noise

and other human activity that may affect wildlife and/or nearby activities such as recreation. A more detailed discussion of these impacts is included in Section 4.2.8.

Trips generated by each stage of fluid minerals activity (i.e., exploration, development, production, and abandonment) have been estimated based on previous oil and gas field development studies. Overall, impacts resulting from trips generated would be short term and largely associated with preproduction activities. As a result of the programmatic nature of this EIS, it is not possible to determine whether any variation would occur among the alternatives based on the specific well locations and roadways.

The closures of parts of US 54, US 70, and US 506 by the military may impact access to fluid minerals development locations for daily or emergency purposes, particularly in the Otero Mesa area. However, the schedule for closures is provided in Otero County and is available to the public for use in alleviating potential delays. The impact of recurrent closures of these major arterials on access to specific project facilities should be considered during APD processing.

Tables 4-3 and 4-4 indicate that the greatest amounts of additional trips are generated by the project alternatives in the short term. The number of trips for well maintenance may be considered a maximum estimate since the number of maintenance trips may decline as a result of efforts to decrease operating costs. When distributed evenly over time (20-year planning time frame), the maximum short-term impact adds a total of 655 trips per year, or an average of less than two trips daily. Given the average daily traffic volumes described in Chapter 3 and even distribution of well sites within the Planning Area, it is anticipated that none of the alternatives would increase traffic volumes significantly. It is possible that the RFD will be realized as a cluster of development rather than an even distribution, which might result in the consolidation of trips in an area or shared use of roadways.

TABLE 4-3
TRIPS GENERATED DURING WELL DEVELOPMENT

Phase	Estimated trips per site
Well drilling	336
Well completion and testing	45
Wellsite facilities installation	31
Pipeline installation	181
Well maintenance	373 annual

SOURCE: BRW 1998

TABLE 4-4
TOTAL TRIPS GENERATED BY RFD

Activity	Number of Actions on Federal Lands	Total Estimated Trips
Frontier wildcat wells	39	13,104
Well completion and testing	39	1,755
Production wells (facilities installation)	16	496
Transmission pipeline	2 sites, 75 miles	150
Well maintenance (production wells)	16	5,968 annually (approximately 16 trips daily)*
NOTE: * This figure does not assume that one truck would be used for maintenance on multiple sites, so the number of vehicles on the road is not necessarily reflected.		

SOURCE: BRW 1998

4.2.2 Minerals

Issues

During scoping, the public expressed concern that the development of fluid minerals might increase the potential for land subsidence. As described below in Common Impacts, removing the fluids from within the rock formations typically would not affect land subsidence like the removal of hard rock minerals. The oil and gas industry is concerned that other resource concerns would limit their ability to explore for and develop oil and/or natural gas. While the geothermal industry has not expressed a similar concern, the same issue of potential limitations is possible.

Common Impacts

The potential for the RFD to affect natural seismic activity in the area during any phase of a project's activities is minimal, as is the potential for natural seismic activity to affect RFD activities. The New Mexico Bureau of Mines and Minerals has reported that some earthquakes in southeastern New Mexico may be related to oil and gas activities; however, normal petroleum activities typically would not affect land stability. Maps of seismic risk for the United States indicate the location of the Planning Area to be at the lowest seismic hazard risk although other areas of the Rio Grande Rift from Soccoro to Albuquerque have the highest seismic hazard risk in New Mexico (USGS 1994).

A discussion of potential impacts common to all of the evaluated alternatives by project phase follows.

Preliminary Exploration Investigations

No exploration-related impacts on geological/mineral resources are expected within BLM's Decision Area.

Construction Phase

No specific construction-related impacts on geologic or mineral resources within the Decision Area were identified. Potential impacts on health and safety such as high formational pressure and hydrogen sulfide can be predicted or evaluated based on knowledge of geological formations that are to be encountered during drilling.

Production Phase

Production of oil and natural gas from one geologic formation would not affect the recovery of oil and/or natural gas from other geologic formations. The production of natural gas and oil under all alternatives is a beneficial irretrievable commitment of the resource as the produced natural gas or oil no longer would be available for future use. The amount of oil, gas, or heat produced would vary depending on the number of wells drilled in the field and the ability to recover the resource.

Geothermal resources are considered a renewable resource, as the heat source is not mined, but rather, groundwater is used to transfer the heat (the resource) to the surface. The removed groundwater can be reinjected or naturally recharged to be used again to retrieve the heat. The amount of geothermal production and the lifetime of the project would be dependent on the end use of the heat rather than the resource.

Oil and gas and geothermal activities could be located in parts of BLM's Decision Area where coal and/or sand and gravel or other construction materials are mined or potentially could be mined. Geothermal activities also could be located in areas favorable for hard rock mining. However, the production of natural gas, oil, or geothermal resources is not expected to be a significant impact on the other minable mineral resources within the Decision Area. The long-term areal extent of the RFDs (e.g., the acreage affected) for petroleum and geothermal activities is small relative to the Decision Area. After abandonment of the facilities and wells, exploitation of the other minerals still can occur.

Although subsidence has occurred as a result of water production in some areas of the country, subsidence in the Decision Area from fluid mineral or groundwater withdrawal associated with either

petroleum or geothermal activities is unlikely because the production zone typically occurs at a significant depth and/or the geologic units are relatively incompressible.

Abandonment Phase

In general, plugging and abandonment of production wells is not predicted to result in any impacts on geological or mineral resources, but in fact would re-establish permanent vertical zonal isolation.

4.2.3 Soils

Issues

Issues associated with soils include concerns regarding damage to land and soil erosion resulting from fluid minerals exploration, development, and production. Another exists where fluid minerals activities affect soils on steeper slopes, typically greater than 30 percent.

Common Impacts

Impacts on soils from fluid minerals activities include both short-term and long-term impacts. Short-term impacts typically occur during the preliminary investigations, construction, and abandonment (reclamation). Impacts continuing beyond construction and into production are long-term and potentially permanent. Potential short-term direct impacts on soil resources include localized compaction, temporary loss of prime farmland, increased soil erosion, mixing of soil horizons, and contamination of soils from various pollutants. Unless mitigated, short-term direct impacts may result in indirect or long-term impacts on soils.

Indirect impacts include accelerated soil erosion, loss of topsoil, and increased sedimentation in streams from runoff following rainfall or snowmelt. Increased sedimentation may affect aquatic habitats, fisheries, and domestic drinking water supplies, clog irrigation systems, and degrade the aesthetic attraction of streams. Increased wind or water erosion of unstabilized, disturbed soils may result in the loss of topsoil and reduced soil productivity, also affecting the revegetation potential of those soils. Areas of prime farmland may be impacted by the conversion of agricultural production acreage to uses associated with project actions.

The following sections briefly describe impacts from fluid minerals activities common to all alternatives that may result in losses of soil resources or soil productivity.

Preliminary Exploration Investigations

Field activities related to exploration have the potential to produce short-term impacts on fragile soil resources. The most common impact expected to occur is localized soil compaction and erosion due to the movement of exploration trucks and equipment across off-road terrain, especially in sloped terrain or fragile soils. Recent geophysical projects on Crow Flats have shown damage on low-angle slopes of 4 to 5 percent. Soils have a higher susceptibility to impact during periods of rain or drought. Soil compaction may lead to decreased short-term productivity and potentially to erosion if vegetation is affected. Potential long-term impact created by accelerated soil erosion due to increased wind and water erosion of disturbed fragile soils include loss of topsoil and increased sedimentation in streams.

Construction Phase

Construction of the drilling site creates the greatest potential for impact on soils. As with the preliminary investigations, soils are more susceptible to impact during periods of rain or drought. Construction activities generally include the installation of a lease access road, well pad grading, and fluid reserve pit excavation. Predicted short-term impacts on fragile soils due to development includes increased or accelerated soil erosion, loss of topsoil, loss of prime farmland, and compaction. The use of petroleum-based drilling products or spillage of petroleum fuels has the potential to contaminate soils immediately around the drill site. Soil erosion may accelerate when vegetation is removed or damaged by compaction in areas disturbed by heavy equipment. Especially in sloped terrain areas, soil erosion also may accelerate in high traffic areas of the well pad, along access roads, or on portions of the well pad that have not been properly graded.

Specific areas of slope instability or failure have not been identified in the Planning Area; however, the potential for instability typically exists where slopes are greater than 30 percent. Steep slopes are present in Sierra County along the Fra Cristobal Range, Caballo Mountains, and San Andres Mountains. In Otero County, the potential for slope instability or failure includes areas along the Sierra Blanca, Sacramento Mountains, Brokeoff Mountains, and Guadalupe Mountains. Because surface disturbance on slopes in excess of 30 percent typically are avoided where possible, project activities would have minimal effect on slope stability. Where such disturbances cannot be avoided, mitigative measures implemented to reduce erosion and protect watershed resources typically are specified for the well/drilling site in the Surface Use Plan of Operation and approved by the BLM through the APD authorization process.

Potential long-term impacts include loss of topsoil, mixing of soil horizons, and impacts on subsurface soils resulting from the introduction of produced formation brine into unlined or leaking reserve pits.

Mixing of soil horizons may occur due to improper soil stockpiling of the soil profile during the development of the drill pad and reserve pits.

Production Phase

Production activities potentially impacting soils include continuous use of the lease access road and areas immediately adjacent to the wellhead. Production phase impacts potentially would be long term as areas of the well pad and access road are maintained for vehicular traffic, resulting in periodic compaction. When the production is dry gas with no associated fluid, potential impacts on soils resulting from well production can include compaction, accelerated erosion, and loss of prime farmland. Associated fluid production or oil production increases the potential for spills/leaks from produced water and/or petroleum fluids (condensate or oil) storage and handling. On-site produced water disposal also could impact soil resources through increased erosion where water is discharged or from leaks and spills from on-site evaporation ponds. Leaks and spills of concentrated brines from evaporation ponds can impact the soil productivity in the short term and potentially in the long term. If flares are used, the area of the flare pit is susceptible to impacts on productivity.

Soils sustaining prime farmland, inclusive of nonirrigated areas, are shown on Map 3-5. Irrigated prime farmland is present in areas where a reliable water resource has been developed. These areas include the Rio Grande Valley of Sierra County and in the Tularosa River Valley and Crow Flats in Otero County. Well pad and access road development could remove some prime farmland from production for the life of the well (10 to 30 years), and potentially permanently. Loss of prime farmland may affect local economic conditions.

Compaction of soils can inhibit natural revegetation and potentially agricultural revegetation of disturbed areas. Loss of topsoil and a decrease in soil productivity from soil layer mixing and compaction impacts the natural vegetation supported in the area, which in turn may affect forage and habitat for wildlife.

Abandonment Phase

Abandonment activities typically are conducted to restore or reclaim the resource that has been impacted during the drilling and/or production of the well. Reclamation activities include regrading and revegetating the previously disturbed site. Short-term impacts described as part of the construction phase are applicable during the abandonment phase of the project. Long-term impacts on soils are highly dependent on the reclamation success.

4.2.4 Water Resources

Groundwater

Issues

The public expressed concern that the exploration and development of fluid minerals potentially may contaminate or deplete the scarce water resources of the Planning Area. As the southern part of Otero County is not a declared groundwater basin, groundwater use is not regulated by the State in this area. Because water is scarce throughout the Planning Area, the perception that a new water user may be competing for the limited supply is of concern to current local water users. Additionally, due to the water scarcity the potential for contamination is of concern both within and outside the declared groundwater basins.

Common Impacts

Water needs of fluid minerals exploration and production are small, but due to the scarce water, impacts may result from the water requirements for drilling and development activities. Potential contamination impacts on groundwater resources may result during well drilling, waste management activities, and re-injection of produced water from fluid minerals development.

Impacts associated with the preliminary, construction, production, and abandonment phases of the project are described below.

Preliminary Exploration Investigations

Preliminary exploration activities typically do not encounter groundwater or require water to perform the activities. Therefore, no impacts on groundwater resources would occur during this phase.

Construction Phase

All alternatives would require water for well drilling and development, construction of roads, well pads, and dust suppression. The potential for impacts on groundwater quality would be limited to drilling, well development, and well testing activities.

Water requirements for a 5,000-foot water-based, mud-rotary-drilled well is approximately 168,000 gallons or 0.51 acre foot (letter from Burlington Resources dated June 21, 1999). In BLM's Decision

Area, all groundwater is appropriated with the exception of the undeclared basin in Otero County. The drilling and completion water needs for an oil and gas well typically would be purchased from already-appropriated water. However, a permit can be issued by State Engineer's Office (SEO) for a water well within the declared basin without new appropriation if the amount of water does not exceed 3 acre-feet for a definite period not to exceed one year, and only if the State Engineer finds that the proposed use would not permanently impair any existing water right (SEO 1995). Therefore, in general, water wells for water used during the construction phase anywhere in the Planning Area can be drilled and pumped without a need for appropriation. In the undeclared basin of Otero County, a permit also is not required. Groundwater aquifers that produce water at rates less than 15 gallons per minute (gpm) would not provide sufficient quantities of water for the construction phase without the use of storage tanks. A water supply well, if drilled to support oil and gas activities, often is turned over to the landowner, as appropriate with the State Engineer's rules and regulations of groundwater use (SEO 1995).

Water quality requirements for the construction phase typically are less than 3,500 parts per million (ppm) total dissolved solids (TDS). Therefore, with the exception of the majority of the Tularosa Basin, the groundwater found in most of the basin deposits in the Planning Area would be of sufficient quality for use in the construction phase (see Management Situation Analysis, Map 12, Distribution of Dissolved Solids in Groundwater).

When drilling through sections of high-permeability rock, losses of drilling fluids may occur in the formation (these are called lost circulation zones). When drilling through shale formations, losses of such drilling fluids typically are minimal. Drilling fluid, which often is referred to as "mud," is a mixture of water, bentonite clay, and polymers. Drilling mud also may contain chemical additives such as caustic soda or barite in amounts to adjust the characteristic of the mud. Additives to drilling mud are controlled and are further diluted by the formation waters. Some minor loss of cement in the formation also may occur during the drilling process as lost circulation zones are plugged or during the cementing of the casings. Impacts on groundwater quality associated with drilling muds or cementing activities are restricted to the immediate vicinity of the well bore (within a few feet) and are not considered to be substantial because of the very small volume of groundwater that could be affected.

A majority of oil and gas wells are stimulated by a process that hydraulically fractures the targeted or producing formation from the well bore. Hydrofracturing is conducted to enhance the permeability of the formation in the vicinity of the well. Water and polymers are pumped into the well at high pressures causing the natural fractures to open and/or creating new fractures. Pressures are monitored to control and ensure that fracturing is maintained within the targeted formation. Sand or other propellant material is pumped into the well with the water and remains in the fractures after the hydraulic injection pressure is reduced, thereby holding the fractures open and increasing the effective permeability of the formation.

Materials used to keep the fractures open are inert; therefore, no detrimental impact on groundwater quality would be caused by the hydrofracturing procedures.

The possibility of degradation of fresh water aquifers could result if leaks or spills occur from pits used for the storage of drilling fluids, or if cathodic protection wells associated with pipelines are installed in a manner that allows for the commingling of shallow surface aquifers. However, since impacts would occur only if the governing regulations fail to protect the resource, the impact is not quantifiable.

Production Phase

Oil and Gas

Production of an oil and gas well typically would not have a direct impact on groundwater resources. All oil and gas wells must have a casing and cement program that is planned and approved through the APD process in order to prevent the migration of oil, gas, or water from one horizon to another that may result in degradation of groundwater (43 CFR 3162.5). The surface casing must be set with sufficient cement to fill the annular space from the casing shoe to the surface and at sufficient depth to protect all usable water aquifers and provide adequate pressure control (Oil and Gas Order No. 2). Well casing programs also require isolation or coverage of oil and gas zones and any usable water sources. This requirement ensures that the interzonal flow of fluids behind the casing is minimized or precluded.

One potential impact of operation of an oil and/or gas well involves the associated gases. Both carbon dioxide and hydrogen disulfide are common associated gases of produced natural gas and oil. Carbon dioxide may cause corrosion by reacting with produced water to form carbonic acid. This condition may be precluded by sodium bicarbonate, which if present in produced water, may have a neutralizing effect on the acid. If corrosion is not monitored and corrected, the carbonic acid could corrode through the steel well casing. Once the acid is in contact with the cement in the annular space between the casing and the well bore wall, the cement would be dissolved and could form potential horizontal and vertical conduits within the annular space. Corrosion could provide a pathway for the natural gas and its associated gases to migrate into a groundwater aquifer. Methane is not a toxic substance, so it would not pose a health risk if ingested. However, methane within the aquifer could alter the aquifer to a reducing environment sufficient to encourage the production of hydrogen sulfide by anaerobic bacteria. Hydrogen sulfide is a toxic gas, and if present in sufficient quantities, it can present human health risks. Additionally, methane within the aquifer could preferentially migrate into the water well. If sufficient quantities of methane are present within a well or pumphouse, the methane could pose an explosive risk.

Mitigation and monitoring measures are used as standard practice in production wells to address this corrosive concern. Many operators treat for corrosion with active and batch chemical treatments, and some monitor for corrosion using coupons (pieces of metal, typically rectangular, of the same alloy as the casing) hung in the well.

As the conditions that would cause an impact are many and quite complex, it is not possible to quantify the impact. If a landowner's well is affected, the impact can be significant to the landowner; however, contamination is often localized. Based strictly on the potential lateral extent of the potential contamination, the regional impact on groundwater resources within the Decision Area would not be significant.

Water requirements in the production phase of oil and gas production is minimal to nonexistent. Instead, water can be a waste product of the production. Typically, natural gas wells make little water and the water produced can be disposed through the use of evaporation ponds. Oil wells tend to make water, especially in the later portion of the well's life as oil production declines. Depending on the quantity of the water, it can be disposed on site or off site. On-site disposal may include release to a surface water feature if water quality is sufficient, or use of evaporation ponds. Off-site disposal can include the use of permitted underground injection control (UIC) wells.

The potential for a disposal (UIC) well to impact groundwater quality is very low due to the casing and cement construction requirements in 40 CFR 146.22, which typically are met by filling all the annular space between the casing and the well bore with cement.

Injection of the produced water into a target zone with poorer quality than the produced water is consistent with BLM policy and the U.S. Environmental Protection Agency (EPA) UIC Permit Program (40 CFR Part 144). The formations used for water disposal must meet the following criteria:

- the aquifer does not currently serve as a source of drinking water

- the aquifer currently cannot, or will not in the future, serve as a source of drinking water because it is:

    - mineral, hydrocarbon, or geothermal-energy producing or can be demonstrated to contain minerals or hydrocarbons that, considering their quantity and location, are expected to be commercially producible

    - situated at a depth or location that makes recovery of water for drinking water purposes economically or technologically impractical

- contaminated to an extent that it would be economically or technologically impractical to render the water fit for human consumption

the TDS content of the groundwater is more than 3,000 milligrams per liter (mg/L) but less than 10,000 mg/L and it is not reasonably expected to supply a public water system

Disposing of produced water by injecting it into a deeper, poorer quality aquifer would result in a loss of the resource within the original aquifer and potential degradation of the resource. Once the produced water has been injected into the disposal reservoir, it could be more expensive to retrieve than it was in a shallower formation. Also, it would be more saline than it was in the original formation due to mixing with the poorer quality of the disposal reservoir. However, the loss of the water from the producing formation does not constitute a significant impact because this produced water is not a water source. If TDS concentrations within the produced water are less than 3,000 ppm, the water typically would be put to a beneficial use or released to a surface water system to naturally recharge the water cycle rather than be disposed.

Disposal of production water by injection would increase formation pressures locally and generally decrease salinity within the formation of injection. Since all disposal wells are designed for "well injection" of wastewater, the wells are subject to the permitting and regulatory control provisions of the Federal Safe Drinking Water Act's UIC Program (40 CFR Part 144). The New Mexico Oil and Gas Commission (NMOGC), with oversight of the EPA, administers and implements the UIC program in the Planning Area. A permit from the NMOGC is required prior to drilling a new well or recompleting an existing well. Injection pressures and volumes are monitored to ensure that potable aquifers are not affected adversely by injection of produced water. Potential cross-contamination of groundwater supply aquifers from disposal wells is unlikely because of the required use of appropriate well construction (e.g., entire well bore cased and cemented), restrictions on injection pressures, completion of mechanical integrity testing, and completion of detailed monitoring of produced and injected water volumes.

Potential accidental spills of produced water or leaks from evaporation ponds could result in an impact on shallow groundwater. However, due to the probable low volumes of spilled or leaked materials and localized geographic extent of such spills or leaks, the impact is not anticipated to be significant.

Geothermal

Using water to convey geothermal heat to the surface requires a State-approved appropriation if the project is located within a declared groundwater basin. As an appropriation hearing would be conducted as part of the geothermal well permitting process, the impact of appropriation would not be

considered significant if the well is permitted by the SEO. Additionally, any fresh water supply wells for the facility also would have to be permitted and the water allotted by the SEO.

Once the heat is removed, typically through the use of heat exchangers, the water is reinjected or released. The SEO encourages the beneficial use of this wastewater. All reinjection wells must comply with the UIC program, as described above. Any chemical treatments to discourage scaling or reduce corrosion within the heat exchangers would need to be neutralized or approved with the UIC program prior to reinjection.

Water production from geothermal production would not affect the supply potential of the shallow domestic and stock use aquifers of the Planning Area. Geothermal water quality is likely to have higher TDS and may have other associated gases such as hydrogen sulfide and carbon dioxide. The same potential impacts of producing and handling petroleum-related produced water, described above, apply to geothermal produced water. Geothermal waters would be expected to be of poorer quality than the first available groundwater; therefore, surface spills and leaks from a production/injection well could degrade water quality. However, the impacts would tend to be limited to the area of the geothermal production facility and, therefore, probably would not be significant to the groundwater system. The geothermal production facility is likely to need fresh water also. Therefore, the facility would have an added incentive to ensure the protection of the groundwater supply.

Abandonment Phase

Little potential exists for fluid migration between formations after injection and production wells have been plugged and abandoned. Present-day methods used for plugging and abandonment of oil and gas wells reduce the potential of leakage and/or migration of fluids after abandonment.

Surface Water

Issues

Issues identified regarding surface water include protection of surface water quality and quantity. Specific areas of concern are riparian and wetland areas, playas, and designated protected watersheds.

Common Impacts

In general, direct impacts on surface water quantity or quality include sedimentation resulting from erosion during drill site, pipeline, and/or road construction or contamination resulting from spills. Indirect impacts may include contaminants migrating into the groundwater system and surfacing in the form of seeps or springs, or reduced flows due to water depletions.

Impacts on surface water resources identified for each phase of activity are expected to be the same but may vary in the degree of impact.

Preliminary Exploration Investigations

Impacts related to field exploration activities are expected to be localized and short term. Decreased infiltration due to soil compaction by vehicle traffic and geophysical vibrosource trucks may lead to increased runoff, but the degree of impact on surface water is dependent on proximity to surface water bodies. Using existing stream crossings for vehicle traffic would minimize impacts on surface water resources.

Construction Phase

The magnitude of potential impacts on surface water quality and quantity is dependent on (1) the extent of surface disturbance, (2) the hydrologic characteristics of disturbed areas, (3) runoff control measures, and (4) the proximity of well pads and rights-of-way to surface water bodies and their drainages. Impacts on perennial streams and rivers also are dependent on the time of year due to seasonal flow considerations and the actual lifespan of the construction phase.

Water Quality

In general, direct impacts on surface water quality are related to the areal extent of surface disturbances associated with road or pipeline construction, and well construction. Well construction could affect surface water within the immediate vicinity of drill pads, whereas road or pipeline construction could affect surface water along the right-of-way corridors. These impacts generally would be localized and short term, and are related to accelerated erosion from storm events that occur when surface soil is exposed, such as during and after construction and earthmoving. Increased runoff and erosion also would have a detrimental impact on stream channels, leading to increased bank erosion, channel scour, and on- and off-site sedimentation.

The magnitude of impacts also is dependent on the time of year due to seasonal changes in rainfall and snowmelt runoff, and length of time the soil is exposed. Runoff events occurring while surface areas are exposed have the potential to increase streamflow and sediment production. Increased flows would have a self-perpetuating effect on the sediment yield by increasing bank erosion and channel scour, and changing the shape and sinuosity of stream channels. Those sites located in well-vegetated areas can expect little or no erosion effects beyond the immediate vicinity of the site. However, many of the impacts from the installation of roads and culverts can be long term.

Potential indirect impacts on surface water quality are primarily dependent on the proximity of the construction site (e.g., drill pad) to receiving bodies of water. Increased sediment production, particularly from storm events or snowmelt runoff, presents the greatest potential risk to surface water quality. The predicted small areas of disturbance associated with individual well development and an enhanced buffer distance of the development site from surface waters would minimize potential impacts. In addition, implementation of best management practices would mitigate erosion and sedimentation impacts.

Potential direct impacts on surface water quality also could occur from accidental contaminant releases associated with machinery fuels, lubricants, and drilling fluids used during the construction phase. Small bermed ponds, which are often lined, are used to contain these fluids in the event of an accidental release, thereby reducing the potential for migration off the site.

Water Quantity and Use

Potential impacts on surface water resources also may occur as a result of depletions from water requirements for well drilling. All alternatives would require water for construction of roads, well pads, well drilling and development, and dust suppression.

The greatest water use would occur during the construction phase. Water is required for drilling, cleaning equipment, cooling engines, and other construction activities. The average amount of water used to drill and complete a 5,000-foot well has been estimated to be approximately 0.51 acre-foot (letter from Burlington Resources dated June 21, 1999). Under the RFD, expected water usage for both drilling and completion is not expected to exceed 12.24 acre feet per year based on the maximum number of wells estimated to be drilled in any one year (24 wells drilled per year [7 wildcats and 17 development wells] at 0.51 acre foot per well).

The primary water source is expected to be purchased from existing water allotments (surface and groundwater) or from a site-specific water supply well and would be trucked or pumped to the site. No significant impact on streamflow in ephemeral or perennial streams in the Planning Area is anticipated.

Production Phase

Potential direct impacts on surface water quality during production could be caused by accidental releases of produced inferior quality water. Although most produced waters are brackish to highly saline, some are fresh enough for surface discharge and/or use. If produced water is to be discharged to surface waters, it must meet water quality standards and have a separate permit from the EPA National Pollution Discharge Elimination System. Produced water, which cannot be directly discharged (e.g., brackish/saline or of poor water quality due to entrained hydrocarbons or other contaminants), is either evaporated from lined pits or transferred into temporary storage tanks prior to transport to off-site disposal (e.g., disposal well). Produced petroleum fluids (condensate or oil) also are commonly stored at the well site prior to transport. Water evaporation pits and water and petroleum storage and transfers present potential for surface water contamination through spills. Evaporation pits can be susceptible to leaks and possible breaching if not maintained or built to accommodate residual stormwater runoff from the site. Spills and leaks can impact surface water directly depending on proximity, or indirectly via stormwater runoff and/or groundwater interactions.

Produced water, if not disposed on site, will be transferred to a centralized disposal facility. The facility may be either a large evaporation pond or UIC well. Impacts on surface water are similar to those associated with the on-site storage and disposal facility, with the exception that the scale of leaks or spills may be larger. These disposal facilities are permitted with the NMOGC and the New Mexico Water Quality Control Commission (NMWQCC).

Any indirect impacts on surface water flow associated with withdrawal of water during production would require a hydraulic connection between the geologic formation from which water is produced and an ephemeral or perennial stream channel. Due to the anticipated depths of production, water quantity is unlikely to be affected by production from oil and gas or geothermal resources.

Abandonment Phase

Impacts from well abandonment would be similar to construction impacts and would result from grading and recontouring of disturbed areas associated with drill pads and access roads. Impacts would be mitigated using site reclamation. After grading the area to a useful layout, restoring the landform as near as possible to its original contour, and using erosion control devices, the area would be reseeded to minimize erosion.

Site restoration and abandonment would adhere to standards and requirements of BLM and APD conditions of approval. Regulations require that production wells be filled with drilling mud and cement.

Therefore, little potential exists for direct impacts on surface water from the flow of liquids or gases from within the wells.

4.2.5 Air Quality

Issues

Air quality could be affected by activities associated with fluid minerals exploration, development, and production.

Common Impacts

In general, impacts on air quality could result from fugitive dust from ground disturbance, emissions from equipment, release of underground gases, and well fires. Both the construction and use of roads and drill pads could contribute to the amount of atmospheric dust. Emissions from machinery and leaks or releases from wells or pipelines could result in airshed degradation. Blowouts and accidents during drilling and production could result in well fires and release of gases.

Since it is not clear the location and extent of each specific activity that may occur in the Sierra and/or Otero Counties, the emission factors presented in each of the following scenarios are general instead of actual pollutant concentrations. These emission estimates would be applicable for each specific activity throughout the two counties. Exact pollutant concentrations for specific activities at specific locations would not be known until atmospheric dispersion modeling has been performed. This modeling would incorporate dimensions, locations, frequency, and duration of proposed or existing activities. Such information is now available.

The following sections briefly describe impacts from fluid minerals activities common to all alternatives.

Preliminary Exploration Investigations

Most of the activities associated with the preliminary investigation phase do not emit significant amounts of pollutants into the atmosphere. Aerial photograph and map review (topographic, geologic, seismic, etc.) activities generally are conducted prior to on-site visits. Vehicle travel along established roads and off-road is the main source of particulate emissions. In some cases, preliminary investigations require small amounts of drilling and the use of explosives. These activities usually occur off established roads,

incorporate more and larger vehicles, may require creating new roads, and, therefore, may cause greater emissions into the air.

The EPA's *Compilation of Air Pollutant Emissions Factors* (EPA 1999) AP-42 Section 13.2.2 Miscellaneous Sources, Unpaved Roads provides an equation to assess particulate emissions from vehicle travel on unpaved roads like those likely to be present in the study area. The following equation is used to estimate emissions per vehicle miles traveled:

$$E = k(5.9)\ (s/12)\ (S/30)\ (W/3)^{0.7}\ (w/4)^{0.5}\ (365\text{-}p/365)$$

E = emission factor in pounds (lb) per vehicle miles traveled (VMT)
k = particle size multiplier (dimensionless) - 0.36 for PM_{10}
s = silt content of road surface material (percent)—12 percent mean silt content for dirt rural roads
S = mean vehicle speed (miles per hour [mph])—mean speed assumed to be 35 mph
W = mean vehicle weight (ton)—mean weight assumed to be 2 ton (small) and 15 ton (large)
w = mean number of wheels—assumed to be 4 (small) and 10 (large)
p = number of days with at least 0.01 inch of precipitation per year— average of 60 days per year across the Planning Area

$E = (0.36)(5.9)(12/12)(35/30)[(2/3)^{0.7}][(4/4)^{0.5}](365\text{-}60/365)$
E = 1.6 lb/VMT for small vehicles

$E = (0.36)(5.9)(12/12)(35/30)[(15/3)^{0.7}][(10/4)^{0.5}](365\text{-}60/365)$
E = 10.1 lb/VMT for large vehicles

The emission factor for particulates (PM_{10}) from unpaved roads from small vehicles (e.g., pickup trucks) is 1.6 lb/VMT. For drill rigs and significantly larger trucks the emission factor is 10.1 lb/VMT. The emission factor for large vehicles assumes a vehicle weight of 15 tons, vehicle speed of 35 mph, and 10 wheels. These emission factors would be used for vehicle travel over unpaved roads for all activities in the study area.

If the preliminary investigation requires the use of explosives, the following emission factors would be used. Table 11.9-2 in Section 11.9, Western Surface Coal Mining presents a PM_{10} emission factor for blasting of overburden of 0.52 lb/blast. Table 11.9-4 in Section 11.9, Western Surface Coal Mining presents a total suspended particulates (TSP) emission factor for drilling of overburden of 1.3 lb/hole drilled. The conservative assumption that TSP emissions equal the PM_{10} emissions would be used.

Construction Phase

Exploratory Drilling

Exploratory drilling includes upgrading or creating roads capable of supporting heavy drill rigs and associated trucks, clearing a drill pad area, erecting temporary storage tanks and crew housing, and installing power generators and associated equipment, drilling pits, etc. Also, there would be increased vehicular traffic bringing supplies, water, personnel, and equipment.

The AP-42 Section 13.2.3 Miscellaneous Sources, Heavy Construction Operations provides information on emission factors to assess particulate emissions from road construction. The road construction emissions include demolition and debris removal (drilling, bulldozing, truck loading and unloading of debris, truck travel), site preparation (bulldozing, scrapers, truck loading and unloading), and general construction (vehicular traffic). A conservative emission factor for construction activity operations is 1.2 tons of TSP per acre per month. This emission factor is not applicable for PM_{10} emissions, therefore PM_{10} emission estimates, which are assumed to equal TSP emissions, would be conservatively high. This emission factor was derived using soils with moderate silt contents, a medium activity level, and a semi-arid climate. This emission factor is acceptable for use in the study area.

Demolition and Debris Removal

Table 11.9-4 in Section 11.9, Western Surface Coal Mining presents a TSP emission factor for drilling of overburden of 1.3 lb/hole drilled. Table 11.9-2 in Section 11.9, Western Surface Coal Mining presents a PM_{10} emission factor for bulldozing of overburden of 0.75 lb/ton moved. The truck loading and unloading emission factor comes from Section 13.2.4, Aggregate Handling and Storage Piles. The equation for material handling is as follows:

$$E = k(0.0032)\ (U/5)^{1.3}/(M/2)^{1.4}$$

k = 0.35 for PM_{10}
U = mean wind speed (assumed to be 5 mph)
M = moisture content (7.4 for sand)

E = 1.8E-4 pounds of PM_{10} emitted for each ton of material moved

The AP-42 Section 13.2.2, Miscellaneous Sources, Unpaved Roads provides an equation to assess particulate emissions from vehicle travel on unpaved roads. The emission factor for particulates (PM_{10}) from unpaved roads from small vehicles (e.g., pickup trucks) is 1.6 lb/VMT.

Site Preparation

Table 11.9-2 in Section 11.9, Western Surface Coal Mining presents a PM_{10} emission factor for bulldozing of overburden of 0.75 lb per ton moved.

The AP-42 Section 11.9, Western Surface Coal Mining, Table 11.9-4 provides a TSP emission factor of 0.04 lb per ton for scraper unloading of topsoil.

Table 11.9-1 in the AP-42 Section 11.9, Western Surface Coal Mining provides a PM_{10} emission factor of 0.6 lb/VMT for a scraper in travel mode.

Table 13.2.3-1 in the AP-42 Section 13.2.3, Heavy Construction Operation provides a TSP emission factor of 20.2 lb/VMT for scrapers removing topsoil.

The truck loading and unloading emission factor is 1.8E-4 pounds of PM_{10} emitted for each ton of material moved.

General Construction

The AP-42 Section 13.2.2, Miscellaneous Sources, Unpaved Roads provides an equation to assess particulate emissions from vehicle travel on unpaved roads. The emission estimate of PM_{10} from unpaved roads from small vehicles is 1.6 lb/VMT and 10.1 lb/VMT for vehicles 15 tons or heavier.

A typical exploratory well site may have average dimensions of 350 by 300 feet (107 by 91 meters) and may be as large as 600 by 600 feet (183 by 183 meters). The reserve pit can be 200 by 200 feet (61 by 61 meters), depending on drilling depth. An average site size is approximately 600 feet by 600 feet (183 by 183 meters [approximately 8.3 acres]). Using the conservative TSP emission estimate of 1.2 tons per month per acre, clearing and creating a well site would generate approximately 10 tons of TSP per month (30 days) of activity.

Field Development

For each new production well drilled, the emissions presented above for exploratory drilling would be duplicated. The main difference between the wildcat well and the production well is that the drill pad may be smaller. The emissions from demolition and debris removal, site preparation, and general construction generally would be the same.

The AP-42 Section 13.2.2, Miscellaneous Sources, Unpaved Roads emission estimate for PM_{10} from unpaved roads from small vehicles is 1.6 lb/VMT and 10.1 lb/VMT for vehicles 15 tons or heavier. The amount of vehicle traffic is assumed to remain moderate to heavy.

Production Phase

Few heavy construction activities occur during the production phase. The largest particulate-producing activity is vehicle traffic.

At different times during the life of the well, pumping may be necessary to remove the resource from the ground. The pumps and associated power supplies generally are installed during this stage (additional power generators may be required to supply additional electricity for the pumps). If an area needs to be cleared, the bulldozing overburden emission factor for PM_{10} in Table 11.9-2 in Section 11.9, Western Surface Coal Mining of 0.75 lb/ton moved is used.

AP-42 Section 3.4, Large Stationary Diesel and All Stationary Dual-fired Engines covers emission factors for diesel engines with more than 600 horsepower (hp), primarily used in oil and gas exploration and production. Table 3.4-1 presents gaseous emission factors for these engines. These emission factors are averages using data from many manufacturers and duty cycles. The emission factors for diesel fuel generally are greater those used for dual-fired engines so the diesel emission factors are used. The uncontrolled nitrogen oxide (NO_x) (assume 100 percent conversion of nitrogen dioxide [NO_2]) emission factor is 0.024 lb/hp-hr. The carbon monoxide [CO] emission factor is 5.5E-03 lb/hp-hr. The PM_{10} emission factor is 0.0007 lb/hp-hr. The sulfur oxides [SO_x] (assume 100 percent conversion of sulfur dioxide [SO_2]) emission factor is (8.09E-03) x S, where S = percent sulfur in the diesel fuel.

Vehicular traffic would remain relatively constant, but generally at a lower frequency than during other well field stages.

Abandonment Phase

When a well is abandoned, the well hole is filled with concrete and capped. There may be an increase in vehicle traffic due to additional cement truck traffic for a short time until the hole is plugged.

After the well has been plugged and capped, the well site is reclaimed. For surface reclamation, the TSP emission factor for overburden replacement from AP-42 Section 11.9, Table 11.9-4, Western Surface Coal Mine, 0.012 lb/ton would be used.

4.2.6 Noise

Issues

Noise sensitive receptors are land uses associated with indoor and/or outdoor activities that may be subject to stress and/or significant interference from noise. They often include residential dwellings, mobile homes, hotels, motels, hospitals, nursing homes, educational facilities, recreational areas, and noise-sensitive wildlife species. An appropriate noise environment is necessary to prevent activity interference and annoyance.

Common Impacts

Noise impacts associated with fluid minerals development vary according to the activities and processes used in exploration, development, and production phases. Construction phase noise levels would be associated with access roads and well pad construction, drilling, installation of compressor equipment, and construction of pipelines. Production phase noise levels would be associated with well completion and dewatering and compressor engine operation. Other production noise would be associated with well workovers and maintenance operations involving a variety of equipment and vehicles. Produced water not directed to a pipeline gathering system would be trucked to off-site water disposal wells or permitted evaporation ponds resulting in additional vehicle trips and noise.

Preliminary Exploration Investigations

During preliminary geophysical investigations, noise impacts are anticipated to be minimal and short term.

Construction Phase

Impacts from construction would be temporary and result primarily from heavy equipment operation and vehicle traffic. Ambient noise levels would increase as a result of clearing, grading, and construction of pads and access roads. Rigging up, drilling, and rigging down would generate noise at all well sites. Specific noise-generating activities would include hauling equipment and supplies to the well site, constructing rigs, drilling wells to the required depth, and removing drilling equipment. This work would generate noise from diesel-fired drilling rig engines, and noise from operation of drilling rig drawworks, such as braking.

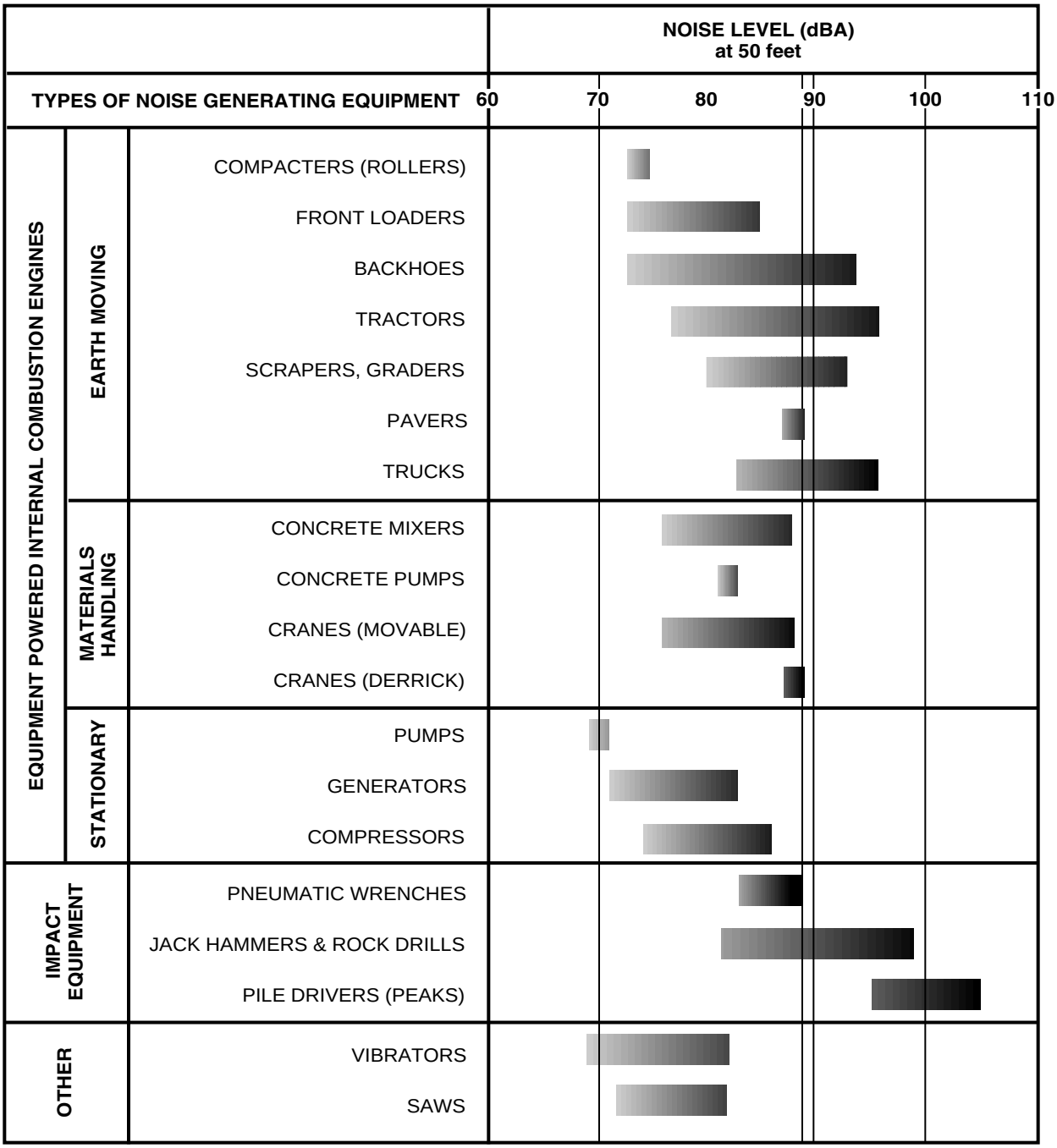
Equipment may include truck-transported drill rigs, cement, pumps, water trucks, miscellaneous hauling and pick-up trucks, cranes, bulldozers, backhoes, and welding equipment. Construction traffic carrying materials and heavy equipment to well sites would cause a temporary increase in vehicular traffic noise on access roads. Well completion and testing also would generate noise. Operation of equipment for cementing well casing, fracturing the well, and flaring of gas at the surface during completion would produce noise as well.

Typical noise levels from construction equipment and oil and gas activity are presented on Figure 4-1 and in Table 4-5. The sound levels shown are at a distance of 50 feet (15 meters). Estimates of noise attenuation can be made by reducing noise levels by a factor of 6 dBA (A-weighted sound levels) for each doubling of distance. This is a logarithmic relationship describing the acoustical spreading of a pure undisturbed spherical wave in air. The actual noise levels experienced by a receptor depend on the distance of the receptor from construction activities, topography, vegetation, and meteorological conditions. Residences located within approximately 2,800 feet (854 meters) and in direct line-of-sight to exploration and development activities could experience noise levels in excess of the EPA's 55 dBA guideline (EPA 1974). Recreational areas located within approximately 500 feet (152 meters) and in direct line-of-sight to could experience noise levels in excess of the EPA's 70 dBA guideline (EPA 1974). However, small percentage of the land area within the Planning Area is occupied by noise sensitive receptors; therefore, the overall potential for noise impacts on sensitive receptors (Figure 4-1 - Typical Construction Equipment Noise Generation Levels) is predicted to be low. Threatened and endangered wildlife species also could be significantly impacted if exploration and development activities occur within 1,600 feet (456 meters) of occupied habitat.

TABLE 4-5
NOSE LEVELS ASSOCIATED WITH OIL AND GAS ACTIVITY

Noise Source	Sound Level and 50 Feet(15 Meters)*
Well Drilling	83 dBA
Pump Jack Operation	82dBA
Produced Water Injection Facilities	71dBA
Gas Compressor Facilities	89 dBA

SOURCE: Woodward Clyde 1988 (raw noise data)
NOTE: * Sound levels are based on highest measured sound levels and are normalized to a distance of 50 feet (15 meters) from the source.



Typical Construction Equipment Noise Generation Levels

Figure 4-1

Production Phase

Typical noise impacts during production would include light vehicle traffic related to well supervision and vehicle traffic and tasks associated with maintenance of surface production equipment. Maintenance tasks could involve pump trucks, welding trucks, backhoes, and wench trucks. These activities would be expected to generate noise levels in the range of 50 to 80 dBA at 50 feet (15 meters). In addition, it is anticipated that each well would be worked over using a truck- mounted rig on an annual basis. Noise levels from this source would be expected to be in the range of 70 to 90 dBA and normally would require one day per workover.

Compressor station operations represent the greatest noise source associated with production. As part of a similar study of oil and gas development, sound levels were measured at existing oil and gas facilities (Woodward Clyde 1988). The average day-night sound levels (Ldn) ranged from 44 to 69 dBA, the highest value being recorded at a distance of 500 feet (152 meters) from a compressor station. A summary of the measured levels is presented in Table 4-5 above. Maximum sound levels were corrected to a reference value of 50 feet (15 meters). Compressors can be designed and operated to reduce noise to acceptable levels. The duration of compressor station operation is anticipated to be the period of project life.

Residences located within approximately 2,800 feet (854 meters) and in direct line-of-sight to production activities could experience noise levels in excess of the EPA's 55 dBA guideline (EPA 1974). Recreational areas located within approximately 500 feet (152 meters) and in direct line-of-sight to could experience noise levels in excess of the EPA's 70 dBA guideline (EPA 1974). However, a small percentage of the land area is occupied by noise sensitive receptors; therefore, the overall potential for noise impacts to sensitive receptors is predicted to be low. Also, incorporated cities, towns, and villages are closed to leasing in all alternatives. Threatened and endangered wildlife species also could be significantly impacted if production activities occur within 1,600 feet (456 meters) of occupied habitat.

Abandonment Phase

Noise associated with abandonment is from construction equipment used for plugging the wellbore and reclamation of the land surface to a stable and productive use. Sound levels would be less than those emitted during exploration and development. The potential for overall noise impacts on sensitive receptors is predicted to be low.

4.2.7 Vegetation

Issues

The primary issue related to vegetation is its protection and management, particularly native plants and habitat types associated with special status species and sensitive species (e.g., grasslands, woodland/forest, and riparian areas).

Common Impacts

Direct impacts on vegetation primarily result from clearing for drill pads, access roads, and pipelines. Also, direct impacts can occur from off-road travel by equipment, such as during seismic activities. Indirect impacts are associated mainly with accelerated wind and water erosion that affect areas adjacent to construction and earth-moving operations, and from contamination by fuels and solvents that are used during operations. The potential also exists for noxious weeds to be spread at the expense of native vegetation as areas are cleared for construction of various facilities. Cumulative impacts result from a combination of land uses that result in surface disturbances (e.g., road building) and in consumptive use of vegetation (e.g., grazing), which reduce the native species composition and promote the spread of non-native species, or reduce the vegetative cover on the ground surface.

Preliminary Exploration Investigations

Impacts on vegetation are attributed primarily to soil disturbance and damage to vegetation structure. The use of vehicles for off-road travel, such as for seismic exploration, would compact soils, increase soil bulk density, change thermal conductivity, and increase soil erosion. Changes in these factors can influence plant growth (Perez et al. 1999, Hausenbiller 1972). Higher compaction rates occur with wet soils and soils with multiple vehicle passes. Churning of soil by vehicle tires reduces soil strength and leads to erosion impacts. Furthermore, off-road vehicle travel can cause compaction and mortality of vegetation. On relatively flat terrain, there would be a small amount of mortality of herbaceous plants and short-term reduction of vegetative cover. Vehicles traveling on steeper slopes can severely churn and remove herbaceous vegetation. Off-road vehicle travel can push over shrubs; while this action is not likely to kill the plant, habitat structure and potentially valuable bird perching, feeding, and nesting substrates would be lost for long periods. Off-road travel generally increases soil erosion rates. Increases in erosion rates reduce soil structure and nutrient cycling, which reduces plant productivity. Such erosion also may affect receiving basins or areas that contain riparian and wetland communities. Reducing vegetation cover often increases the potential for weed species to become more widespread and problematic.

Construction Phase

Impacts on vegetation during construction occur primarily due to clearing activities that are needed for well pads, roads, pipelines, and ancillary facilities. Clearing operations result in a reduction in the amount of vegetation (habitat) in the area and have the potential to increase wind and water erosion, which may affect adjacent areas due to increased soil deposition. Contamination of soil from fuel spills and leaks and drilling mud also may affect vegetation locally (including wetland and riparian vegetation).

Production Phase

No additional impacts on vegetation would be anticipated during production. Accidental leakage of brackish/saline produced water could damage vegetation, which would be a long-term impact.

Abandonment Phase

Revegetation of previously disturbed surfaces would occur during project abandonment. Grasslands generally recuperate relatively quickly, while other vegetation types (e.g., piñon-juniper) grow more slowly. No additional impacts on vegetation are anticipated during abandonment.

4.2.8 Wildlife

Issues

The primary issue related to wildlife is to provide adequate protection and management, particularly for big and small game and raptors, and associated wildlife habitat. During scoping, concern was expressed about potential impacts of increasing human disturbance on wildlife, and fragmenting habitat (e.g., by introducing roads) that may be important for wildlife movement. It was suggested that areas providing high-quality or unique habitat and wildlife habitat management areas should not be leased for fluid minerals activities. Also, protective stipulations were suggested for breeding areas, nest sites, and winter and year-long use areas.

Common Impacts

The magnitude of impacts on wildlife depends on the time of year, location, and amount of surface disturbance, sensitivity and adaptability of the wildlife species present, and duration of human activities

associated with fluid minerals activities. Deviation in normal activity patterns and use of habitat by wildlife may affect the animal's energy budget and, therefore, the welfare and productivity of the animal if left uncovered.

Direct impacts on wildlife could include habitat loss and/or fragmentation, disturbance or displacement of wildlife, mortality of individuals, and hazards due to leaks or spills of or contact with harmful substances. Loss or fragmentation of habitat would result from clearing of vegetation to construct roads, well pads, pipelines, and other ancillary facilities. The magnitude of the impacts may be greater if the habitat affected is rare or used during critical time periods during the animal's life, or if the construction is near a water source used by wildlife. Increased noise and human activity may disturb or displace wildlife. Although wildlife species are likely to avoid areas where increased human activity is occurring, wildlife may be forced into less desirable habitat due to human presence. It also is possible to increase the number of animals into adjacent habitats beyond the carrying capacity of those habitats, potentially increasing the competition for limited resources. The increase in vehicular traffic, particularly during the construction phase, increases the potential for mortality of individuals. High mortalities in an area could result in a decrease of the prey base for larger mammals and raptors due to the loss of small mammals and reptiles. Vehicles and facilities at the well sites present possible hazards if leaks or spills of petroleum products occur. Contaminated evaporation ponds or reserve pits may be harmful to wildlife.

Indirect impacts on wildlife could include an increased potential for recreational traffic if roads are upgraded or new roads are constructed into areas that previously were relatively undisturbed, thereby increasing the disturbance to wildlife. Other indirect impacts include the secondary effects from habitat fragmentation and the potential for soil erosion to affect revegetation and/or to result in increased sedimentation into streams, thereby affecting the aquatic habitat of fish as well as degrading the water sources for wildlife populations.

Habitat Fragmentation Clearing of vegetation to construct roads, well pads, pipelines, and other ancillary facilities would result in fragmenting plant communities and wildlife habitat. This can result in direct, indirect, short-term, long-term, and cumulative effects.

Habitat fragmentation is the division of an extensive habitat into smaller habitat patches. Generally, the effects of habitat fragmentation include: (1) the reduction of the total amount of a habitat type and apportioning the remaining habitat into smaller, more isolated patches (Harris 1984, Wilcove et al. 1986, Saunders et al. 1991), (2) the creation of disturbed land which provides habitat for new, often exotic or weedy species (Harris 1984), and (3) the increase in the amount of edge to remaining communities. This increases predation and modifies plant composition even within the undisturbed area because of micro environmental changes. Such subtle modifications impact on insect and seed

production. Winter and Faaborg (1999) showed bird species in fragmented tall grass prairies were present but at lower densities and had lower nesting success than in unfragmented sites.

Helzer and Jelinski (1999) created a ratio between the amount of edge and the area of a grassland fragment. They then measured populations of six grassland nesting birds. They found, "species richness is maximized when patches are large (greater than 50 hectares) and shaped so that they provide abundant interior areas, free from the impact of edges."

Typically, habitat fragmentation begins with the formation of gaps (e.g., cleared areas such as roads) in the vegetative cover of the landscape. As the gaps become larger or more numerous, the connectivity of the original vegetation cover is broken. Fragmentation creates a mosaic of communities different than species have adapted to over time (Noss and Cooperrider 1994).

Beyond the creation of smaller habitat patches, subtle processes occur when habitats are fragmented or degraded. Some effects of fragmentation may be conspicuous almost immediately following the disturbance of the habitat while other effects may develop over several years. In the long term, fragmentation alters the biodiversity of the landscape. Leach and Givnish (1996) recensused 54 prairie remnants and found that between 8 and 60 percent of the original plant species were lost from individual remnants over a 32-to-54-year period.

Such changes impact the composition of the wildlife community as demonstrated by the birds studied by Herkert (1994). He examined Illinois grassland fragments. He determined that avian species were influenced by habitat area and vegetation structure. Some species required a minimum size of a given plant community while others had to have a specific composition to the plant community no matter what the size. Both these features of grasslands are impacted by fragmentation. Fragmentation can select against some birds by having too small of a contiguous habitat and it can select against other species by causing a shift in plant community composition.

The disturbed areas that divide fragments of the original community are more prone to invasive exotic species that further alter the community makeup. As the plant communities change, the wildlife composition of the area also shifts. Species able to adapt to such disturbances are more successful that those associated with the original habitat.

Harris and Gallagher (1988) identify the following four major consequences of fragmentation for wildlife.

- Loss may occur of area-sensitive species, those animals whose occurrence and successful reproduction are highly dependent on the size of the habitat patch in which they occur.

- Larger species that have wide ranges and occur at low densities, such as large predators, may be lost due to increased harassment and encounters with vehicles.

- There generally is an increase in exotic species or those species that readily adapt to human presence and disturbed habitats.

- Inbreeding may occur if population numbers are low and populations are isolated.

Concern about fragmentation within the Planning Area is not limited to the potential effects of Federal fluid minerals activities being considered in this RMPA/EIS. Historic degradation of habitats in the Planning Area, particularly desert grasslands, is well documented. As mentioned in Chapter 3 (Sections 3.10 and 3.11), encroachment of desert scrub into grasslands has been occurring over the past 80 to 90 years. This shift may be attributed cumulatively to a combination of climatic change, introduction of roads, intensive livestock grazing, and concurrent interruption of naturally occurring fire (Dick-Peddie 1975, Nielson 1986).

Of particular concern are two remnant desert grassland areas that provide important habitat for pronghorn within BLM's Decision Area (these coincide with the Otero Mesa Habitat Management Area and Nutt Antelope Area). The potential effects of Federal fluid minerals activities must be added to past degradation and impact of future activities. This could be a significant adverse impact if these cumulative effects occurred in the remnant desert grasslands. In an effort to protect remaining desert grassland habitat from further degradation in these two areas, BLM is proposing to employ a stipulation of no surface occupancy in remaining habitat patches, which are greater than 320 acres and limit fluid minerals development activities to areas within approximately 492 feet (150 meters) of existing.

Preliminary Exploration Investigations

As mentioned in the vegetation section above, the movement of vehicles hauling equipment over unpaved surfaces results in soil compaction, which reduces soil productivity and damages vegetation. Vegetation changes may result in a loss of herbaceous vegetation (i.e., grasses and shrubs) utilized as forage by wildlife (including pronghorn and mule deer) and changes in the bird prey base until the vegetation recovers. The type of soil and vegetation present determines the recovery time for the area. In addition, there could be a small amount of direct mortality of small mammals, ground-nesting birds, and reptiles due to increased vehicular travel. Small mammals constitute an important prey base for raptors. If crossings through washes or drainages are required, there is an increased potential for increased erosion and sedimentation in aquatic habitats downstream of the crossings, particularly during storm events. Washes and arroyos support more dense vegetation than surrounding areas; therefore, these areas provide habitat for migrating birds and resident species. Loss of vegetation would eliminate these resources, negatively affecting wildlife.

Generally, disturbances associated with geophysical exploration (seismographic activity) during noncritical periods of an animal's life cycle seldom cause significant impacts. These activities are of short duration with minimal habitat disturbance, which results in the temporary displacement of big game species. Studies conducted on the effects of sonic booms on wildlife populations indicate that, in most cases, mule deer and bighorn sheep exhibit minor behavioral reactions (Nevada Department of Wildlife [NDOW] 1989). Although there are some big game birthing areas present within identified herd unit boundaries, no specific birthing areas have been identified. If such areas are identified, effects of blasting and increased traffic during the birthing period could result in increased stress levels and decreased productivity of the animals.

Impacts on birds during the exploration phase could result in nest abandonment, loss of nests or potential nest sites, and elimination of important habitat components. Behavioral responses of birds are often influenced by increased human activity, although the responses vary between species of birds. Some individuals within a species may tolerate or habituate to a higher level of activity than others (Anderson, et al. 1990). Holthuijzen (1989) observed that prairie falcons in construction and blasting zones showed no differences in their overall behavioral repertoire, productivity, or occupancy of traditional nesting areas; however, those in blasting zones showed longer readjustment times and reacted more strongly to activity than those in the construction zone. Bednarz (1984) conducted noise studies on prairie falcons in the Caballo Mountains, and concluded that although the effects of short-term activities have been shown to be negligible, this cannot be assumed for the long-term effects of mining or blasting on occupancy of raptor nest sites.

Other birds, such as shore birds and waterfowl, showed a flight response to blasting and human activities, but appeared to habituate over time (NDOW 1989). Effects to most passerine species are anticipated to be negligible, although there is the potential for loss of nest sites.

Construction Phase

As described above, impacts on wildlife during the construction phase would occur from the removal of vegetation (as forage, habitat, and cover) for well pads, roads, pipelines, and other facilities; and from disturbances from increased human activity. However, the effects of increased human activity are greater than the seismic explosion and equipment noises of preliminary exploration investigations (Barry and Spencer 1976 in Hay 1985). Effects on wildlife would be determined during site-specific studies for individual APDs; however, typical impacts associated with construction are described below.

Impacts could result in loss or degradation of habitat. Habitat loss ranges from the removal of vegetation during construction within a discrete area to the loss of viable wildlife habitat due to human intrusion, noise, and the isolation of habitats. This would result in the disturbance and displacement of

individual animals. The extent of effects on wildlife depends on the animal species, type and quantity of vegetation removed, and period of disturbance. Studies completed on the response of elk to drilling activities show varying degrees of severity. In Wyoming, elk moved 0.5 (800 meters) to 2.5 miles away often placing visual and auditory barriers between the herd and the well site (Hayden-Wing Associates 1990). Elk displacement away from activities has been shown sometimes to be significant (Johnson and Lockman 1980) and in other situations they appear to habituate to such activities (Brekke 1990).

The effect of habitat loss due to human disturbance is difficult to estimate for all species because each species differs in its tolerance to intrusion. Additionally, certain species are less tolerant of disturbance during critical time periods in their lives (i.e., nesting or fawning). If such areas are identified during site-specific studies for an individual APD, it may be necessary to alter the timing of construction to mitigate potential effects.

New road construction into previously unroaded or isolated areas could impact big game species significantly. Increased public access to these areas could result in increased legal take by hunters and higher levels of harassment, intentional (i.e., poaching) and accidental, to animals. This would be more critical if birthing areas are identified on a site-specific basis. The potential for deaths of big game species individuals would increase above existing levels due to increased traffic along existing roads. Also, direct mortality of some other wildlife individuals could be expected as a result of encounters with construction vehicles.

Activities adjacent to permanent water sources where waterfowl nesting areas may occur could cause nest abandonment and decreased hatching success, although this has not been well-documented. It is not anticipated that small birds, such as passerines, would be affected directly by activities associated with fluid minerals development.

During construction, aquatic and semi-aquatic populations (i.e., fish, frogs) in and downstream of the Planning Area potentially could be affected by any reductions in the quantity and quality of the surface waters. Well drilling requires the use of water, although water requirements should be met by purchase of already-appropriated groundwater or from a new water well approved by the State Engineer for drilling (refer to Section 4.2.4). Therefore, water usage would not impact fisheries through stream depletions. Fisheries resources are limited to a few sites in the Planning Area, including Caballo Reservoir, Elephant Butte Reservoir, portions of the Rio Grande, Three Rivers, and Tularosa Creek. Effects on fisheries could result from the removal of vegetation near or adjacent to the stream that could increase the potential for erosion and increased sedimentation especially following storm events. Fish populations could be affected adversely by contamination of surface waters from accidental spills or leakage of petroleum products from vehicles.

Production Phase

Impacts on wildlife associated with surface disturbance generally are anticipated to be low to nonexistent during the production phase. Grassland areas that have been reclaimed following disturbance during construction would provide forage for larger mammals and burrow sites for small mammals and reptiles.

Activities associated with the operation and maintenance of the field vary, but some activities are continual, which could have adverse effects on wildlife although other studies indicate that impacts are minimal during this phase (Hayden-Wing Associates 1990). There is an increased potential for disturbance resulting from activities associated with operation and maintenance. It has been estimated that the expected zone of disturbance for elk and deer can extend for up to a 0.25-mile radius from a well site, road, or compressor station after construction activities have been completed. Disturbances caused by human activity and the presence of vehicular traffic associated with production and maintenance activities at well sites and compressor stations are anticipated to be low for antelope, deer, and elk. Bighorn sheep tend to be more sensitive to human disturbance; therefore, increased levels of activity could result in potentially higher effects.

The number of visits to compressor stations vary from visits per week to as much as two to five vehicle visits per day at larger stations. Servicing activities at well sites are generally intense for a short period of time, with an increase in human and motorized activity. Wildlife is likely to avoid these areas during servicing, if possible.

For oil and/or gas, construction of a large transportation pipeline is generally required to move the product from the well field to the market or refineries. Effects from pipeline construction vary greatly depending on the type of vegetation, terrain, and length of the pipeline.

Saline levels in produced water can be high and the water cannot be released into surface waters. Other disposal methods include subsurface injection, lined or unlined pits, and other BLM-approved methods. State and/or EPA permits also are required. Evaporation ponds and skimmer pits present a hazard to waterfowl and other wildlife that may be attracted to the water, which may contain residual materials such as oil or other chemicals.

Abandonment Phase

Areas that were disturbed would be revegetated to a stable and productive state. Abandonment activities occurring near the sites could result in a short-term effect on nearby wildlife. Impacts associated with the increased noise and human activity during abandonment would be similar to those described for the construction phase. Closure of roads that are no longer needed would constitute a

beneficial effect on wildlife by decreasing the accessibility of the area to other traffic. Reclamation efforts of surface disturbances in the arid Southwest are not always successful due to variable climate and the presence of non-native species that are able to colonize a disturbed area. Revegetation of an area with native species may take on the order of 10s to 100s of years. Fragmentation effects that result in changes in community composition are long term.

Activities associated with abandonment should have no effect on fisheries populations except in areas where highly erodible soils occur in areas near streams or lakes. Measures to mitigate the effects of erosion would be effective in reducing potential harm to aquatic habitats.

4.2.9 Special Status Species

Issues

The primary issue related to special status plant and wildlife species (i.e., Federally listed, State-listed, and other sensitive species) and their habitats is to provide adequate protection and management. During scoping, concern was expressed about potential fragmentation of threatened and endangered species habitats, and it was suggested that fluid minerals leasing should not be allowed in habitats of threatened and endangered species.

Common Impacts

Effects on special status species are generally associated with ground disturbance and increased human access. Impacts that could affect special status plant and animal species are similar to those described for vegetation and wildlife in the previous two sections. Therefore, this section provides a summary of impacts specific to the different groups of special status species known or likely to occur within the Decision Area as a result of the RFD. The RFD projects the development of three gas fields and associated facilities. It is estimated that all phases of oil and gas development over 20 years could result in the short-term disturbance of approximately 6,589 acres. The type of habitat disturbed and the effects on species associated with those habitats would be determined on a site-specific basis when an APD is submitted and processed.

The following provides a general discussion about potential adverse effects on groups of special status plant and wildlife species. Descriptions of the mitigation measures that are required under the various lease stipulations and the special status species that have the potential to occur within each of the hydrologic basins are discussed under each alternative description. Detailed information about the natural history and status of each species is provided in Appendix D. Effects on Federally listed species are presented in detail in the Biological Assessment.

Wildlife

Mammals Habitat suitable for one special status big game species, the desert bighorn sheep, occurs in the area. Areas suitable for the reintroduction of bighorn are located in the Caballo, Sacramento, Guadalupe, Brokeoff, and Cornudas Mountains. The Caballo Mountains provide a potential movement corridor for bighorn inhabiting the Fra Cristobal Mountains. Desert bighorn sheep are sensitive to human disturbance, especially during the breeding season. Increased access and human activity in bighorn sheep habitat could adversely affect the reproductive success of these animals. New roads and facilities could hinder the movement of animals and fragment suitable habitat. Placement of a field development in or near an area suitable for bighorn would likely eliminate that area from consideration for reintroduction of bighorn.

Small mammals include Arizona black-tailed prairie dog, gray-footed chipmunk, Guadalupe southern pocket gopher, desert pocket gopher, White Sands woodrat, and New Mexico jumping mouse. There is likely to be increased mortality of small mammals due to the loss of local habitat. They ate generally not able to move away from construction areas as readily as more mobile animals and are more vulnerable to disturbance and loss of habitat. Adjacent habitat may be marginal or populations of other animals may already inhabit those areas making it unlikely for displaced animals to reestablish a viable population. Increased traffic in the area could result in increased mortality due to collisions with construction vehicles. Loss of burrows and vegetation for shelter also could make these small mammals more vulnerable to predation by larger mammals and raptors. The level of impact would be determined by the size of the existing populations of mammals and the availability of unoccupied suitability habitat adjacent to the development, as well as the mobility and sensitivity of the species.

The 10 species of bats present within the area are big free-tailed bat, occult little brown bat, pale Townsend's big-eared bat, small-footed myotis, cave myotis, fringed myotis, long-legged myotis, long-eared myotis, Yuma myotis, and spotted bat. A majority of these bat species occupy a variety of habitats within the area and would likely avoid areas during construction. They would be most vulnerable if construction occurs near roost sites or results in the loss of foraging areas. Water sources at the construction sites may attract insectivorous bats if the water is uncontaminated and supports increased insect populations.

Birds Special status raptor species in the area are northern aplomado falcon, peregrine falcon, ferruginous hawk, northern goshawk, and bald eagle. Owls in the area include western burrowing owl and Mexican spotted owl. Effects on raptors include loss or degradation of habitat, including nest sites, roosting sites, and foraging areas; lack of reproductive success due to nest abandonment in response to noise and increased activity; and a reduced prey base due to habitat loss in foraging areas. Different raptors species display varying tolerance levels for disturbances within their habitats. Additional effects of the proposed project on raptors during the different phases of exploration and development are provided under Section 4.2.8 - Common Impacts. Existing management guidance for raptors requires a

0.25-mile (400-meter) buffer around most active raptor nests. The buffer around an eagle's nest is 0.5 mile (800 meters) and is from 0.5 mile (800 meters) to over 2 miles (900 - 3,400 meters) for peregrine falcons, depending on the surrounding terrain. Site-specific surveys would be conducted when an APD is submitted and processed for to identify the presence of active nests.

Bird species, other than raptors, include mountain plover, Baird's sparrow, loggerhead shrike, southwestern willow flycatcher, and yellow-billed cuckoo. Increased noise and activity levels during construction and development could result in nest abandonment and decreased reproductive success if such activity occurs during the breeding season. The southwestern willow flycatcher and yellow-billed cuckoo are riparian species and any loss or degradation of such habitat would constitute a loss of potential breeding habitat for these species. Mitigation requires the avoidance of riparian and aquatic habitats; therefore, such effects are not likely to occur. Construction occurring in proximity to these areas during breeding may cause a disturbance to nesting birds and could reduce reproductive success. In the case where a proposed well site is in an area adjacent to riparian woodlands, surveys for active nests would reduce the likelihood of disturbing a nest site. Loss of grasslands would reduce nesting and foraging opportunities for mountain plover, Baird's sparrow, and loggerhead shrike. Loggerhead shrikes and Baird's sparrow occupy other habitats as well and could be affected by loss of resources in desertscrub and montane habitats, as well.

Shorebirds that may breed in the area are white-faced ibis, interior least tern and neotropic cormorant. Breeding areas are generally located along shoreline and marsh habitats near open water. The black tern is an uncommon summer migrant that forages in vegetated marshes. Construction and development would not affect these habitat types in accordance with proposed lease stipulations.

Amphibians and Reptiles Amphibians and reptiles in the area include the Texas horned lizard, gray banded kingsnake, mottled rock rattlesnake, Chiricahua leopard frog, and southwestern toad. Chiricahua leopard frog and southwestern toad inhabit riparian and wetland areas, which would be avoided by development. Road development and increased traffic that cross washes or arroyos would increase the potential for mortality of animals residing in those areas. The Texas horned lizard is associated with grasslands and deserts, as well as riparian and arroyo habitats. Both the gray banded rattlesnake and mottled rock rattlesnake occur in rocky areas within desert scrub, montane scrub, woodland/forest, and arroyo habitats. There would likely be some loss of suitable habitat for the horned lizard, kingsnake, and rattlesnake where development occurs. Increased traffic and human activity could result in direct mortality of individuals of these species inhabiting the area. The presence of new or upgraded roads and placement of facilities could cause the fragmentation of habitat or make it more difficult for these animals to move between areas of suitable habitat.

Invertebrates Mineral Creek mountain snail and Cornudas Mountains land snail are two special status invertebrate species that occur in the area. The Mineral Creek Mountain snail inhabits a very small area along Mineral Creek. Its habitat will not be affected by development because lease stipulations prohibit development along waterways. The Cornudas Mountains land snail is found within the Cornudas Mountains ACEC, although its range extends beyond the ACEC boundaries.

Fish Longfin dace is the only special status fish species likely to occur in the area. It is present in streams and drainages, which are protected by lease stipulations.

Plants

Seventeen species of special status plants have been identified as occurring or potentially occurring within the Decision Area. Plants are susceptible to activities resulting in ground disturbance, as well as those that increase human access into an area. Increased human access into an area may result in the loss of plants that are collected for landscaping. Ground disturbance results in the direct loss of individual plants and may alter the habitat so that plants would not be reestablished. In many cases, non-native species are able to out-compete native species and successfully colonize a disturbed area. Construction vehicles may spread non-native species farther as they travel to and from the construction site. Increased human and vehicular activity would result in trampling and soil compaction. Trampling increases direct damage to plants. Soil compaction causes water to run-off rather than infiltrating the soil where it would become available for use by plants. Long-term effects of the loss of vegetation include erosion that can result in the loss and continued degradation of habitat.

The sensitivity of the habitat type and the extent of ground disturbance would determine impact levels. Some plants are more susceptible to disturbance, while others can withstand or even thrive in disturbed environments. When an APD is submitted, site-specific surveys will be required to determine which plants are or could be present. Effects could be long-term where plants are associated with habitats that are difficult to re-establish. Appendix C provides information on each species including known occurrences and associated habitat type(s). This information can be used to determine what surveys should be conducted prior to construction and development in a specific area.

4.2.10 Rangeland

Issues

Issues associated with rangeland and livestock grazing identified during alternatives development and through the public scoping process are related to potential effects on forage and short- and long-term carrying capacity, and maintaining grazing improvements and management facilities.

Common Impacts

Direct impacts on rangeland and livestock grazing are much the same as those described for vegetation and wildlife in Sections 4.2.7 and 4.2.8 above. Impacts on rangeland result primarily from removal of vegetation (forage) during clearing to construct roads, drill pads, pipelines, and other ancillary facilities. Off-road travel also causes vegetation damage, soil compaction, and associated decreases in soil productivity.

Indirect impacts include the potential for increased erosion rates in conjunction with vegetation removal and loss of topsoil in an area and sedimentation at a downgradient location, and the potential for water sources to be affected. Clearing existing vegetation often provides a pathway for the spread of noxious weeds, which can be harmful to the health of livestock. Other indirect impacts include disruption of existing grazing use, and the management of facilities such as fencing, water access, and livestock movement patterns. Cumulative impacts result from a combination of land uses that result in surface disturbances or interrupt existing grazing patterns and access.

In summary, surface disturbances reduce grazing capacity, and may change vegetation composition to include fewer forage species. Conversely, forage improvement can be implemented through revegetation.

Preliminary Exploration Investigations

Impacts on rangeland and livestock grazing during exploration consist primarily of vegetation and soil disturbance by off-road travel equipment. Off-road travel generally increases soil erosion rates, and causes compaction and rutting during wet conditions. These impacts reduce soil and vegetation productivity. If surfaces are disturbed and are not revegetated, they may provide an avenue for invasion by weedy species. Equipment operation also may disturb livestock or interrupt normal livestock movement patterns. Range improvements (fences, reservoirs, etc.) or land treatment projects (contour furrowing, seeding, or range monitoring sites) on public land should be avoided wherever possible.

Construction Phase

Impacts on rangeland during construction result primarily from the direct loss of vegetation during clearing operations. Clearing and earthmoving also increase the potential for increased erosion and sedimentation that may affect water sources, such as stock ponds. Construction equipment may disturb livestock from traditional use or movement patterns. Contamination from fuel spills and drilling mud also may affect forage species locally.

Production Phase

No additional direct impacts would be anticipated during production. Leakage of brackish/saline produced water could reduce the forage production and would constitute a long-term impact, as salt is difficult to remove once it becomes part of the soil.

Abandonment Phase

Revegetation of previously disturbed areas with species that provide forage would occur during abandonment. Thus, impacts that originally occur in the exploration and production phases would be reduced.

4.2.11 Cultural Resources

Issues

The impact analysis addressed the issue of whether BLM's leasing program for Federal fluid minerals would directly or indirectly affect any significant cultural resources.

Common Impacts

Impacts were assessed using criteria defined by regulations for *Protection of Historic Properties* (36 CFR Part 800). An effect is a direct or indirect alteration of the characteristics of a historic property that qualify it for inclusion in the National Register of Historic Places. Effects are adverse when the alterations diminish the integrity of a property's location, design, setting, materials, workmanship, feeling, or association. Examples of adverse effects include the following:

- physically destroying a property

- inappropriately altering a property by not following the Secretary of the Interior's Standards for Treatment of Historic Properties (36 CFR Part 68) and applicable guidelines

- moving a property from its historic location

- changing the physical features within the property's setting that contribute to its historical significance

- introducing visual, atmospheric, or audible elements that diminish the integrity of the property's significant historic features

- transferring, selling, or leasing a property out of Federal ownership or control without adequate restrictions to ensure preservation

Review of inventory data indicated that archaeological sites are the type of cultural resources most likely to be affected by fluid minerals leasing. Ground disturbance directly associated with fluid minerals leasing is anticipated to have the most potential for adversely affecting archaeological sites. The introduction of visual, atmospheric, or audible elements into the setting of such sites is not expected to affect the scientific information of archaeological sites, but possibly could degrade the integrity of such sites if they have other historic values such as for public interpretation or for traditional cultural associations.

Other impacts may be indirect. Ground disturbance could result from overland travel that might increase as a result of fluid minerals activities enhancing vehicular access into an area. The simple increase of human presence in previously undeveloped areas also could result in inadvertent damage or intentional vandalism to archaeological sites.

It is anticipated that subsequent Section 106 (National Historic Preservation Act) reviews of individual projects undertaken as part of the BLM Federal fluid minerals leasing program would result in avoidance, minimization, or mitigation of any identified adverse effects. Any adverse effects on significant cultural resources that would not be avoided or mitigated through Section 106 consultations among the project proponents, BLM, State Historic Preservation Office (SHPO), and other consulting parties would be considered to be significant.

The aggregate extent of disturbance forecasted by the RFD over the next 20 years accumulates to about 10 square miles. Current inventory data indicate that 10 to 20 archaeological sites typically are present within each square mile of Sierra and Otero Counties. This suggests that under the worst scenario approximately 100 to 200 archaeological sites might be affected. The average density of archaeological sites varies across the landscape and the number of sites potentially affected could be greater or less depending on where activities are pursued. The potential to avoid impacts on most sites

is quite high, but as site density increases this potential is diminished. There is a high potential for satisfactorily mitigating impacts by conducting studies to recover important archaeological information before any unavoidable sites are disturbed, but such studies can be costly.

Preliminary Exploration Investigations

Although the extent of ground disturbance resulting from geophysical exploration generally is characterized as relatively minimal and short term, many cultural resources, especially the type of archaeological sites found within the Planning Area, are quite fragile and even overland travel can damage such resources, especially if heavy equipment trucks are used.

Applicants for a permit to conduct geophysical exploration would be required to arrange for and fund an inventory of cultural resources that might be affected. Usually such exploration strategies are flexible and can be modified to avoid direct impacts on archaeological sites that may be present within the proposed exploration area. However, time and efforts are required on the part of BLM staff and the applicants to make such adjustments.

Although direct impacts usually are avoided by modifying geophysical exploration plans, individuals on field crews have been known to vandalize archaeological sites. In addition, geophysical exploration can result in informal two-track roads that can increase general public accessibility. Such enhanced access has resulted in inadvertent or intentional damage to archaeological sites in other areas managed by the BLM. The extent of such indirect effects is difficult to characterize, but they seldom are mitigated. However, BLM will take steps to minimize such indirect impacts by considering potential indirect effects in scoping resource surveys, working to control overland travel, limiting creation of informal roads, and educating work crews about penalties for unauthorized collection of artifacts.

The cultural resource inventories conducted for geophysical explorations would provide valuable information about the cultural resources present on public lands. However, the tendency is to conduct surveys only along the narrow transects of seismic lines and the resulting information often is less useful than the results of block surveys. The extent of survey (assumed to be 1 acre per linear mile of seismic line) would expand the average extent of annual inventory within the Decision Area by approximately 20 percent over the average rate of survey during the past one to two decades. However, exploration activities are likely to be sporadic and more intense during parts of the next 20 years. Therefore, staff review efforts are likely to be increased considerably more than 20 percent during some years.

Construction Phase

During the construction phase, the ground-disturbing impacts described above could result from clearing, grading, and slope cutting activities required for upgrading and new roads, well pads, pipelines, and other ancillary facilities. Applicants for permits to drill would be required to arrange for and fund cultural resource surveys of areas potentially affected by these activities. Review of individual projects, modification of projects to avoid or minimize adverse effects, potential to avoid direct impacts, and potential for indirect impacts are all similar to those for geophysical exploration.

Production Phase

During production, it is anticipated the amount of ground disturbance would be less than during construction. However, any new ground-disturbing activities (if needed) that were not permitted previously would require review and permitting. The potential to avoid direct impacts and the potential for indirect impacts are similar to those described above.

Abandonment Phase

Activities associated with abandonment must take place within the area permitted for and disturbed by previous activities to avoid impacts on cultural resources.

4.2.12 Paleontological Resources

Issues

The primary issue related to paleontological resources is protection and management of potentially valuable paleontological resources.

Common Impacts

Surface disturbance associated with geophysical exploration, construction of roads, well pads, pipelines, and other ancillary facilities may damage or destroy vertebrate or invertebrate paleontological resources that may be of scientific importance. The loss of the resource because of destruction or damage would be an adverse impact.

Indirect impacts may result from upgrading or constructing new roads that would increase the potential for access into areas relatively undisturbed previously. Improved access into areas could result in off-road travel, which may damage or destroy fossil resources. An increase in human visitations may result in vandalism of paleontological resources.

As previously described, ground disturbance associated with development of fluid minerals would occur in during preliminary exploration investigations and construction. Limited disturbance is expected to occur during the production and abandonment phases.

Many portions of Sierra and Otero Counties have not been explored or surveyed for paleontological resources; therefore, effects on paleontological resources would be determined during site-specific reviews for geophysical exploration and for individual APDs. With adherence to the BLM requirements for surveying and evaluating paleontological resources, no adverse impacts on these resources are anticipated.

4.2.13 Recreation

Issues

The primary concern related to recreation is the potential for the displacement or significant alteration of existing recreation opportunities due to land requirements associated with fluid minerals development. Through scoping, issues raised included providing for the availability of recreation and preserving or enhancing the public's access to recreation. Most of the BLM-administered land in the Planning Area includes recreation among the multiple uses.

The BLM has identified specific recreation resources of concern. These include some sections of the Tularosa River and the Red Sands Off-road Vehicle (ORV) Area. Areas of Critical Environmental Concern (ACECs), the Cornudas and Cuchillo Mountains areas, and Lake Valley Backcountry Byway also have been identified for consideration of impacts on recreation opportunities as well as visual resources.

Common Impacts

Two major impacts on recreation resources could result from fluid minerals activities. First, the displacement of recreation areas may occur in order to locate well or production facilities. Second, a change in the character of outdoor recreation opportunities may occur as a result of proximity to facilities and the associated dust, noise, and human activity.

Under the RFD, the total acreage disturbed for oil and gas development is estimated to be 6,589 acres in the short term and 862 over the long term. Geothermal development is anticipated to disturb a total of 26 acres. All fluid minerals development is associated with the introduction of motorized activities. However, it is unlikely that fluid minerals development would significantly displace the opportunity for primitive recreation due to its informal and dispersed nature and the small amount of acreage that is required to achieve the RFD relative to public land available.

The areas that are primitive in character and are closed to ORV use often correspond with Wilderness Study Areas (WSAs) or ACECs, which are designated as such due to notable natural or scenic qualities. These areas are already closed to leasing (see Section 4.2.15).

4.2.14 Visual Resources

Issues

The primary visual resource issues surrounding fluid minerals leasing in Sierra and Otero Counties are the degree of visible changes to the characteristic landscapes within local and regional viewsheds, preservation of scenic quality of the landscape, and compliance with Visual Resource Management (VRM) classifications. Specific issues identified in scoping include the protection of visually sensitive locations such as the Otero Mesa, Sacramento Escarpment, and mountain foothills.

Common Impacts

With implementation of any of the alternatives, direct impacts on visual resources could include adverse effects on the character of sensitive settings and on residential, recreation, and roadway views. Types of impacts on visual resources as direct or indirect result of the project could include short-term and long-term adverse effects on the visual character of the setting.

Long-term, direct impacts include the removal of vegetation, changes to existing landform through site grading, and the addition of structural elements into an undeveloped setting visible from sensitive viewsheds. Short-term, direct impacts primarily would include actions associated with construction, such as increased dust, and the presence of temporary drilling equipment and associated lighting that would allow for work to occur 24 hours a day. Indirect impacts on visual resources include the potential for increased recreational traffic on access roads.

Potential impacts from project activities relate to project visibility and the introduction of elements of different form, line, color, and texture into the landscape. The extent of noticeable change to the form,

line, color and texture of the landscape as a result of project exploration, construction, production, and abandonment can be measured in levels of visual contrast. The contrast levels (strong, moderate, and weak) and types of visual contrast that could result from the project components are defined as follows:

- Strong—strong contrast occurs where project activities would attract attention and dominate the landscape setting.

- Moderate—moderate contrast occurs where project activities are noticeable and start to dominate the setting.

- Weak—weak contrast occurs where project activities would be noticeable but would not attract attention, and would be subordinate to the setting.

Components of the project with the highest potential to adversely affect visual resources include the visual character of the well pad and pipeline right-of-way clearing, as well as large solid components associated with oil and gas separation, treating, and storage facilities.

Preliminary Exploration Investigations

Activities associated with preliminary investigations could vary widely depending on the type of survey conducted. Gravity, geomagnetic, and seismic reflection surveys result in little or no surface disturbance or other visually evident impacts. Vibrosource surveys, however, require the use of several ORVs that compact soils and vegetation. The compacted, disturbed areas created from this type of survey can take many years to revert to pre-existing conditions depending on the type of soils and vegetation impacted. Drilling and explosive surveys, whether surface or subsurface, do not result in any long-term visual impact. Subsurface charges are installed with small-diameter drills to depths of 100 to 200 feet (31 to 61 meters), and result in little or no surface disturbance other than the drill hole itself.

Construction Phase

While impacts from exploratory drilling are usually short term, they typically would result in some of the most noticeable visual contrast. The greatest amount of human, vehicular, and equipment activity occurs during construction and drilling activities. Thirty to forty truckloads carrying equipment and/or water typically are necessary for the drilling of each well site. Drilling operations continue 24 hours a day and 7 days a week, and are accompanied by considerable noise and highly visible activity. Drilling activities, equipment, dust, traffic, and road construction likely would attract the greatest amount of attention during this phase. Similar to the preliminary exploration investigations phase described

previously, visual impacts created during the exploratory drilling phase would vary depending upon the methods used. For example, wildcat wells require larger drilling rigs (plus or minus 160 feet [49 meters]) with support facilities and may disturb a larger surface area than the area required for development wells.

Impacts on visual resources during field development primarily would occur from the removal of vegetation for well pads, roads, and other facilities; the addition of structural elements into a relatively undeveloped landscape; and potentially unnatural grading transitions within rolling or steep terrain. Major components of the analysis include the addition of structural elements into the landscape and vegetation modifications. Vegetation contrast results from clearing trees, shrubs, and grasses, and primarily is related to the density and type of vegetation cleared. Structure contrast results from the introduction of alternative facilities and primarily is related to the distance from which the well components are viewed. The typical structures associated with development such as well heads, condensate pits, meter houses, and chain link fencing are most dominant in the immediate foreground (0 to 300 feet [0 to 92 meters]) and less dominant in foreground views (300 feet [92 meters] to 0.25 mile [400 meters]). Well-related facilities become subordinate to the characteristic landscape in middleground views (0.25 mile [400 meters] to 1 mile), and noticeable to the casual observer in background views (1 to 5 miles). Other less common facilities (i.e., only one of these facilities would be required per development area) include larger facilities associated with resource processing treating and storage, and are more visually obtrusive.

Production Phase

The occurrence of adverse impacts identified under construction for the potential well sites would continue to occur during production.

Abandonment Phase

At this phase, reclamation would be required for any surface disturbed that is not needed for continued well operation. Long-term positive effects on visual resources would result from abandonment and reclamation including recontouring and revegetation of well pads, and pipeline and flowline paths. No additional impacts on visual resources in form, line, color, or texture are anticipated during abandonment.

4.2.15 Special Management Areas

Issues

During scoping, it was expressed that special management areas such as WSAs and ACECs should be protected from impacts associated with fluid minerals development. The WSAs in the Planning Area are managed according to BLM Manual H-8550-01, the Interim Management Policy and Guidelines for Lands Under Wilderness Review, commonly known as the IMP. The IMP directs nondiscretionary closure to leasing. The ACECs within the Planning Area were designated by the Otero County ACEC RMPA (BLM 1997) and were discretionarily closed to leasing. Also, management of the eight nominated ACECs in BLM's Decision Area included those reasonable measures necessary to protect significant resource values until the area is fully evaluated through the resource management planning process.

Management for fluid minerals development in McGregor Range also is previously determined, in the McGregor Range RMPA (BLM 1990). The decisions described in that document will be carried forward unchanged.

Common Impacts

Because the WSAs, ACECs, and the majority of McGregor Range are closed to leasing, there would be no direct impacts on those areas. There may be indirect impacts on biological or visual resources within special management areas as a result of project activities occurring on adjacent leaseholds. The potential for such impacts is discussed in the respective resource sections.

4.2.16 Social and Economic Conditions

Issues

The principal socioeconomic issues associated with the alternatives arise from potential changes in land use, employment of labor and capital in exploration and development activities, and generation of revenues in the form of royalties and taxes. If economic development is anticipated to be significant, related impacts of growth and the ability to provide required community services may become concerns.

The issue of environmental justice is included in this section. Title VI of the Civil Rights Act of 1964 and related statutes ensure that individuals are not excluded from participation in, denied the benefit of, or subjected to discrimination on the basis of race, color, national origin, age, sex, and disability. Executive

Order 12898 on Environmental Justice directs that programs, policies, and activities not have a disproportionately high adverse impact on affected minority or low-income populations.

Common Impacts

Socioeconomic impacts generally result from disturbances to customary living patterns of the inhabitants of an area where some activity is proposed that will involve significantly altering conditions and uses of the local environment. In this analysis, impacts could occur in areas where leasing of Federal lands for exploration and development of fluid minerals would lead to clearing patches of land and temporary or permanent placement of facilities for finding and extracting oil, natural gas, or geothermal fluids. Current uses of such lands would be displaced, including livestock grazing, hunting, and recreational uses. Loss of such uses, often temporary, would involve depriving individuals of the economic or cultural benefits of customary uses. Mitigating measures may be necessary to compensate such persons with established property rights on the affected lands.

Besides these displacement impacts, there would be positive economic impacts from the employment and wages generated directly by the exploration and, particularly, development activities as well as the secondary (i.e., indirect and induced) effects on local businesses from spending by workers and contractors in communities in the vicinity. State and county governments would benefit from royalties on any production, while local governments would continue to accrue revenues from Federal government payments in lieu of property taxes on the leaseholds and other Federal lands in the counties. Cumulative impacts would occur in the event that fluid mineral development is anticipated to produce a boom-bust effect on local economies, potentially in conjunction with other proposed projects.

An important concern for socioeconomic impacts is the frequency and dispersion of exploration and development activities. The more concentrated they are in time and space, the more likely that local communities would experience a mix of beneficial and adverse effects. It is true, however, that any adverse disturbances would be of relatively brief duration, while the fiscal benefits would be long term.

Impacts on specific communities cannot be determined at this time due to the programmatic nature of this EIS; however, clusters of population that may be affected can be identified. If adverse impacts are anticipated, the potential for environmental justice concerns can be assessed by identifying clusters of the population that are characterized by a disproportionate number of minority or low-income residents.

Environmental Justice

Environmental justice concerns are based on the location of well facilities, which could produce positive economic benefits or adverse impacts if the sites disproportionately impact minority or low-income communities (refer to Table 4-5). Demographic information for population centers in each county suggests that many of the larger communities reflect racial and income characteristics of the counties as a whole. A notable exception, however, is the Mescalero Apache Indian Reservation including the town of Mescalero, and the town of Tularosa. These areas comprise disproportionate percentages of minorities (American Indian and Hispanic), lower median incomes, and a higher percentage of the population with incomes below the poverty level. Significant adverse socioeconomic impacts are not anticipated; however, any specific environmental justice concerns may be addressed on a site-specific basis in the APDs.

Oil and Gas

Impacts of oil and gas activities common to all alternatives include the land and labor needs, costs, revenue, and royalty rates associated with achieving the RFD. This section illustrates a likely scenario to accompany the RFD.

Preliminary Exploration Investigations

Exploratory investigations are associated with certain financial risks and are not anticipated to generate returns every time. No significant socioeconomic impacts are anticipated during this phase.

Construction Phase

One oil or gas well and its associated pad and infrastructure occupies 9 acres of land (based on well sites on the Bennett Ranch Unit), and can cost anywhere from $600,000 to upwards of $2 million to equip, drill, and complete (dry hole or successful). In 1997, the average cost for a completed onshore exploration well in the continental United States was $1.685 million, drilled to a depth of 8,900 feet (EIA 1998). The average cost for a dry hole was $2.042 million (average depth 10,400 feet). Development wells were less expensive–completed wells averaging $870,000, drilled to 7,400 feet; dry holes averaging $668,000, drilled to 6,400 feet (EIA 1998). An onshore well typically could be completed in less than a month's time, employing two crews of a dozen or more workers splitting 12-hour shifts around the clock (and oftentimes living in a remote work camp, to maximize worker productivity).

For purposes of this programmatic impact assessment, it was assumed that a maximum ("worst-case") development scenario would consist of two drilling rigs drilling simultaneously over a period of approximately four years.[1] This scenario presumes that if a promising strike were to occur, the operator would quickly drill additional wells near the strike to define the field. In such an instance, it is possible that as many as a dozen wells could be drilled in a wellfield area within a few months' time.

Specifically, the RFD scenario envisions 39 wildcat wells (three of which are successful), and four appraisal wells for each successful wildcat (see Table A-5). Subsequently, 30 gas development wells and 60 oil development wells would be drilled. The total number of new wells that would be drilled in Sierra or Otero County (or both) would be 141. Geographical concentration of activity would, of course, increase the scale of impacts on a local area. Using a nominal cost of $1.3 million per well (the unweighted average of the cost figures cited earlier), the maximum development scenario would yield a total outlay of $183.3 million over a period of approximately four years. Assuming 12 producing wells per field, the 141 wells to be drilled would equate to developing 12 fields. The value of $183.3 million represents the value of labor, materials, equipment, and other supplies that would be consumed to sustain a program of wildcat and production well drilling in Sierra and Otero Counties. In addition, per the RFD, 100 miles of gas transmission pipelines would be constructed, the cost of which is estimated at $15 million.[2]

For purposes of assessing the regional socioeconomic impacts of the RFD, the IMPLAN input-output modeling system was used (Minnesota IMPLAN Group, Inc. 1999). IMPLAN estimated the secondary (indirect and induced) economic effects of well field development on the basis of projected direct expenses to be incurred in the Planning Area (i.e., Sierra and Otero Counties), and the resulting values were used to project any demographic and other social impacts of oil and gas exploration and development activities. Table 4-6 presents the results of the modeling, displaying the changes in regional total output, value added components, and employment, disaggregated by 1-digit SIC industry sector.

In terms of relative magnitude of impact on the regional economy, the RFD would be less than significant. The direct annual output associated with exploration and development would be

[1] A "worst-case" scenario is postulated in order to define the maximum extent of socioeconomic impacts that might occur. If only one drilling rig were used, socioeconomic impacts would be spread over approximately six to seven years, as opposed to four years under the two-drilling-rig scenario. This parameter is based on the fact that a typical well takes approximately 21 days to drill, thus limiting the annual output of one drilling rig (under optimal conditions) to 17. (Kerri Sitler, Newfields, Inc., Denver. Personal communication with Robert Mott, November 29, 1999). This analysis assumes that with a total of 141 wells to be drilled, two drilling rigs together drilling a total of 34 wells per year would require about four years to complete the RFD scenario.

[2] Based on a nominal cost of $15,000 per inch per mile (Personal communication between Eileen Day, Burlington Industries, and Cindy Smith, November 29, 1999) for 10-inch gas transmission pipelines over a total of 100 miles (Personal communication between Kerri Sitler, New Fields, and Robert Mott, April 27, 2000).

approximately $23.9 million. The additional indirect and induced output resulting from the direct output stimulus would be approximately $ 6.6 million (a multiplier effect of 1.28). Total output attributable to the exploration and development phase of this project would be over $30.5 million annually, which represents approximately 1.6 percent of total industry output in the study area.[3]

The number of jobs associated directly with exploration and development would be 275, which would result in an additional 105 indirect and induced jobs. In total, annual average employment would be 381 employees over four years, representing approximately 1.2 percent of total 1997 employment in the Planning Area. The increase in value added in the Planning Area (equivalent to change in gross regional product) would be $9.4 million (a direct result of exploration and development), resulting in indirect and induced value added of approximately $3.7 million, for a total of $13.2 million in value added annually. This would represent less than 1 percent of the Planning Area's total value added/gross regional product. As noted above, Table 4-6 presents an industry sector breakdown of impacts on the Planning Area economy. Note that the indirect and induced impacts are a result of the multiplier effect. The indirect impact component represents the effects of the exploration and development contractors' purchases of goods and services from local vendors. The induced impact component (which is the larger portion of the secondary impacts), is largely manifested in the trade and services sectors, arising from increases in the consumption spending of Planning Area residents who earn income from the project.

In addition to these economic impacts, any removals of grazing land would impact ranchers holding grazing leases. Based on average carrying capacity of lands (in Animal Units [AUs], which vary with the quality of soils and precipitation), estimates of well field leases on ranchers can be developed on a site-specific basis.

Fluid minerals development would cause spillover into local communities in the form of jobs, supply contracts for construction materials and services, sales of retail goods and services to workers, taxes, and any associated requirements for police, fire, health, and welfare services and facilities. Of concern is the capacity of the community to accommodate an influx of non-local workers and business. If it has the capacity, then the area prospers; if not, then some residents may suffer inconveniences or even losses from project-induced pressure on local resources. The construction phase offers the main opportunity for socioeconomic problems to develop, because it contains the bulk of labor force, logistical, and capital spending effects.

[3] Estimated impacts exclude those impacts that would occur outside Sierra and Otero counties, and expresses dollar amounts in 2000 dollars. The total output was converted to 1997 dollars to estimate the percentage of total study area output.

TABLE 4-6
OIL AND GAS EXPLORATION AND PRODUCTION IMPACT ANALYSIS
EXPLORATION AND DEVELOPMENT PHASE

TOTAL INDUSTRY OUTPUT	**Impact in Millions of Year 2000 Dollars**			
Sector	**Direct**	**Indirect**	**Induced**	**Total**
Agriculture	0	3,130	15,067	18,197
Mining	0	4,621	2,126	6,747
Construction	23,864,096	54,464	56,072	23,974,632
Manufacturing	0	240,350	45,495	285,845
Transportation and Utilities	0	1,360,962	211,288	1,572,250
Wholesale and Retail Trade	0	454,944	609,016	1,063,960
Finance, Insurance, and Real Estate	0	613,389	523,613	1,137,001
Services	0	1,577,554	689,741	2,267,295
Government	0	57,087	99,955	157,042
Total Impact	**23,864,096**	**4,366,502**	**2,252,371**	**30,482,970**
TOTAL VALUE ADDED	**Impact in Millions of Year 2000 Dollars**			
Sector	**Direct**	**Indirect**	**Induced**	**Total**
Agriculture	0	2,426	11,211	13,637
Mining	0	2,997	1,333	4,330
Construction	9,416,122	27,954	26,904	9,470,980
Manufacturing	0	75,491	12,544	88,035
Transportation and Utilities	0	540,513	124,291	664,804
Wholesale and Retail Trade	0	299,139	423,739	722,878
Finance, Insurance, and Real Estate	0	438,516	388,216	826,732
Services	0	939,641	346,223	1,285,864
Government	0	28,249	48,905	77,154
Total Impact	**9,416,122**	**2,354,926**	**1,383,366**	**13,154,414**

TABLE 4-6
OIL AND GAS EXPLORATION AND PRODUCTION IMPACT ANALYSIS
EXPLORATION AND DEVELOPMENT PHASE

TOTAL LABOR INCOME	**Impact in Millions of Year 2000 Dollars**			
Sector	**Direct**	**Indirect**	**Induced**	**Total**
Agriculture	0	1,542	6,853	8,395
Mining	0	1,197	426	1,623
Construction	5,108,695	26,341	25,331	5,160,367
Manufacturing	0	59,295	8,701	67,996
Transportation and Utilities	0	338,583	54,324	392,907
Wholesale and Retail Trade	0	180,621	271,704	452,325
Fire, Insurance, and Real Estate	0	120,358	64,225	184,583
Services	0	800,011	295,263	1,095,274
Government	0	19,645	29,673	49,318
Total Impact	**5,108,695**	**1,547,593**	**756,500**	**7,412,788**
OTHER PROPERTY INCOME	**Impact in Millions of Year 2000 Dollars**			
Sector	**Direct**	**Indirect**	**Induced**	**Total**
Agriculture	0	797	3,956	4,753
Mining	0	1,595	803	2,398
Construction	3,735,548	1,387	1,346	3,738,281
Manufacturing	0	14,491	3,556	18,047
Transportation and Utilities	0	164,227	55,660	219,887
Wholesale and Retail Trade	0	57,615	71,284	128,899
Finance, Insuranand Real Estate	0	274,798	271,883	546,681
Services	0	110,687	40,947	151,634
Government	0	8,604	19,231	27,835
Total Impact	**3,735,548**	**634,201**	**468,666**	**4,838,415**

TABLE 4-6
OIL AND GAS EXPLORATION AND PRODUCTION IMPACT ANALYSIS
EXPLORATION AND DEVELOPMENT PHASE

INDIRECT BUSINESS TAXES	**Impact in Millions of Year 2000 Dollars**			
Sector	**Direct**	**Indirect**	**Induced**	**Total**
Agriculture	0	86	402	488
Mining	0	205	104	309
Construction	571,880	226	227	572,333
Manufacturing	0	1,705	287	1,992
Transportation and Utilities	0	37,703	14,307	52,010
Wholesale and Retail Trade	0	60,903	80,751	141,654
Finance, Insurance, and Real Estate	0	43,360	52,108	95,468
Services	0	28,944	10,012	38,956
Government	0	0	0	0
Total Impact	**571,880**	**173,132**	**158,198**	**903,210**
EMPLOYMENT	**Impact in Number of New Jobs**			
Sector	**Direct**	**Indirect**	**Induced**	**Total**
Agriculture	0	0	0	1
Mining	0	0	0	0
Construction	275	1	1	277
Manufacturing	0	2	0	3
Transportation and Utilities	0	14	2	16
Wholesale and Retail Trade	0	10	18	28
Finance, Insurance, and Real Estate	0	5	3	8
Services	0	32	15	47
Government	0	1	1	2
Total Impact	**275**	**65**	**40**	**381**

NOTE: Model - Sierra-Otero.iap

The foregoing analysis indicates that the RFD scenario would not likely stress local community resources. This is due in part because the exploration and development activities would be carried on largely by non-local contractors (none are located in either Sierra or Otero Counties), who would bring

in their workers from centers of oilfield activity in the Permian Basin; also, the well sites mostly would be in remote areas, where the contractors would have to provide transient living accommodations for workers, thus isolating the activities. Another factor reducing the local economic stimulus of the exploration and development activities would be the leakage of income due the high proportion of imported (i.e., non-local) exploration and development-related goods and services that would be employed in the wellfield activities.

Production Phase

Once drilling is completed and production facilities are in place, well field activities are largely low-level. The principal economic benefits of the projects are generated during the operating phase, in the form of fiscal flows to local governments from royalties and taxes on production. In 1997, oil and gas wells on Federal lands in New Mexico generated $287.9 million in royalties for disbursement to the state and counties. (MMS 1999) This sum was based on production of 14.4 million barrels of oil and 531.4 billion cubic feet of gas, which was about one-half of total gas production on Federal lands that year upon which one-half of the royalties went to the Federal government and one-half to the state and local governments.[1] The average royalty statewide amounted to $1.534 per barrel (Bbl) of crude oil and $0.229 per thousand cubic feet (MCF) of natural gas, yielding a total of $144 million to New Mexico jurisdictions, with the rate accruing to the individual counties ranging upwards of $0.2 to $0.25 per MCF.

In order to estimate the economic impacts of these wells with the IMPLAN model, it is necessary first to estimate average levels of production per year and their associated values. The RFD postulates drilling of 30 gas production wells and 60 oil production wells. Assuming in addition that 3 of the wildcat wells and all 12 of the definition wells become successful producers, the RFD would yield a total of 105 producing wells. An analysis of oil and gas production data for the southeastern area of New Mexico indicates that the average producing gas well produces 75,530 MCF dry gas and 595 Bbl of condensates per year (NMBMMR 2000). The average oil well produces 3,107 Bbl of crude per year plus 10,597 MCF of natural gas.[4] (NMBMMR 2000) The IMPLAN model database is as of 1997, so wellhead prices for oil and gas in that year were applied to the production averages to obtain an estimate of the value of new output, value added, and employment that would be associated with the new wells (the results were converted to their year 2000 equivalents for presentation later). According to the New Mexico Bureau of Mines and Mineral Resources, spot wellhead prices for southeast New Mexico crude averaged about $21 per barrel in 1997, while gas fetched $1.76 per MCF. Applying these values to the above outputs yields a value of $83,897 per well per year in crude oil and associated casinghead gas for oil wells. For gas wells, the corresponding value for dry gas and natural

[4] New Mexico Bureau of Mines and Mineral Resources. Well counts and production data as of 1993 (latest available consolidated statisitics). Personal communication with Ron Broadhead by Robert Mott, 27 April 2000.

gas liquids (i.e., conden-sates) is $145,421 million per well per year. Multiplying these values by the corresponding numbers of new producing wells (70 oil, 35 gas, respectively)[5], yields values of annual produc-tion for the overall RFD of $5,872,787 for the oil wells and $5,089,728 for the gas wells, for a grand total of $10,962,514 per year. This is the "direct effect" of the RFD upon which the IMPLAN analysis is based.

Using IMPLAN, the indirect and induced annual output that would result from direct output of $10.96 million (actually $11.04 million in year 2000 prices) would be approximately $2.93 million, for a total annual output of approximately $13.97 million (a multiplier effect of 1.27). Direct annual employment associated with production would be 63 employees. Combined with indirect and induced employment of 36, a total of 99 new jobs would develop as a result of production. In terms of annual value added, direct value added due to the project would be $6.91 million. Total value added would be $8.68 million per year, including $1.77 in indirect and induced impacts to value added. These impacts would represent less than 1.0 percent of total annual economic activity in the study area. Table 4-7 presents the detailed IMPLAN impact analysis results. Again, the multiplier would largely affect the trade and services industry, because the stimulus would originate from increased consumer spending.

TABLE 4-7
OIL AND GAS EXPLORATION AND PRODUCTION IMPACT ANALYSIS
PRODUCTION PHASE

TOTAL INDUSTRY OUTPUT	**Impact in Millions of Year 2000 Dollars**			
Sector	**Direct**	**Indirect**	**Induced**	**Total**
Agriculture	0	1,574	6,285	7,859
Mining	11,036,740	470,245	887	11,507,872
Construction	0	715,019	23,389	738,408
Manufacturing	0	12,966	18,977	31,943
Transportation and Utilities	0	113,217	88,137	201,354
Wholesale and Retail Trade	0	35,566	254,045	289,611
Finance, Insurance, and Real Estate	0	442,073	218,416	660,490
Services	0	170,148	287,712	457,859
Government	0	33,362	41,695	75,058
Total Impact	**11,036,740**	**1,994,171**	**939,544**	**13,970,455**

[5] It was assumed that the 3 successful wildcat wells and the 12 definition wells would be divided between oil and gas production in the same proportion as the development wells (i.e., 10 would be for oil and 5 for gas).

TABLE 4-7
OIL AND GAS EXPLORATION AND PRODUCTION IMPACT ANALYSIS
PRODUCTION PHASE

TOTAL VALUE ADDED	**Impact in Millions of Year 2000 Dollars**			
Sector	**Direct**	**Indirect**	**Induced**	**Total**
Agriculture	0	1,189	4,677	5,866
Mining	6,911,231	294,472	556	7,206,259
Construction	0	287,981	11,222	299,203
Manufacturing	0	4,585	5,233	9,817
Transportation and Utilities	0	56,963	51,848	108,810
Wholesale and Retail Trade	0	23,526	176,760	200,286
Finance, Insurance, and Real Estate	0	312,543	161,937	474,479
Services	0	93,755	144,423	238,178
Government	0	15,027	20,400	35,427
Total Impact	**6,911,231**	**1,090,040**	**577,055**	**8,578,325**
TOTAL LABOR INCOME	**Impact in Millions of Year 2000 Dollars**			
Sector	**Direct**	**Indirect**	**Induced**	**Total**
Agriculture	0	883	2,859	3,742
Mining	2,195,367	93,547	178	2,289,092
Construction	0	167,431	10,566	177,997
Manufacturing	0	3,531	3,630	7,160
Transportation and Utilities	0	26,034	22,661	48,695
Wholesale and Retail Trade	0	14,451	113,339	127,790
Finance, Insurance, and Real Estate	0	51,584	26,792	78,376
Services	0	78,426	123,166	201,593
Government	0	8,875	12,378	21,253
Total Impact	**2,195,367**	**444,762**	**315,568**	**2,955,698**

TABLE 4-7
OIL AND GAS EXPLORATION AND PRODUCTION IMPACT ANALYSIS
PRODUCTION PHASE

OTHER PROPERTY INCOME	**Impact in Millions of Year 2000 Dollars**			
Sector	**Direct**	**Indirect**	**Induced**	**Total**
Agriculture	0	262	1,650	1,912
Mining	4,176,547	177,947	335	4,354,828
Construction	0	104,531	562	105,092
Manufacturing	0	959	1,483	2,442
Transportation and Utilities	0	24,351	23,219	47,569
Wholesale and Retail Trade	0	4,384	29,736	34,119
Finance, Insurance, and Real Estate	0	210,336	113,409	323,745
Services	0	12,175	17,080	29,255
Government	0	6,152	8,022	14,174
Total Impact	**4,176,547**	**541,095**	**195,496**	**4,913,13**
INDIRECT BUSINESS TAXES	**Impact in Millions of Year 2000 Dollars**			
Sector	**Direct**	**Indirect**	**Induced**	**Total**
Agriculture	0	43	168	211
Mining	539,318	22,978	43	562,339
Construction	0	16,020	95	16,114
Manufacturing	0	95	120	215
Transportation and Utilities	0	6,578	5,968	12,546
Wholesale and Retail Trade	0	4,691	33,685	38,376
Finance, Insurance, and Real Estate	0	50,623	21,735	72,358
Services	0	3,154	4,176	7,330
Government	0	0	0	0
Total Impact	**539,318**	**104,182**	**65,990**	**709,490**

TABLE 4-7
OIL AND GAS EXPLORATION AND PRODUCTION IMPACT ANALYSIS
PRODUCTION PHASE

EMPLOYMENT	Impact in Number of New Jobs			
Sector	**Direct**	**Indirect**	**Induced**	**Total**
Agriculture	0	0	0	0
Mining	63	3	0	65
Construction	0	8	0	9
Manufacturing	0	0	0	0
Transportation and Utilities	0	1	1	2
Wholesale and Retail Trade	0	1	8	8
Finance, Insurance, and Real Estate	0	3	1	5
Services	0	3	6	9
Government	0	0	0	1
Total Impact	**63**	**20**	**17**	**99**

NOTE: Model - Sierra-Otero.iap

Assuming average royalty rates of $1.534 per Bbl of crude oil and $0.25 per MCF on gas production from leases in Sierra and Otero Counties and the nominal production rates cited above, the royalties that would accrue to the State would amount to approximately $1.21 million per year.[2] These royalties would be in addition to the Federal government's ongoing payments in-lieu of taxes (PILT) that have been paid to local governments as compensation for the exemption of Federal lands from local property taxes (costs of which as well as other administrative and management expenses the Federal government recovers from bonuses, rents, and royalties on leases of mineral and grazing rights).

Abandonment Phase

When it comes time to abandon production facilities, impacts are also relatively benign, because the manpower and equipment required for capping and plugging wells and removing other facilities is small.

4.3 ALTERNATIVES

The following sections provide descriptions of the potential impacts that could result from fluid minerals activities as a result of continuing existing management (No-action Alternative) or implementing the alternatives to existing management (Alternatives A or B).

The discussion of each alternative begins with a table summarizing the constraints that would be imposed under each alternative. The discussions for each alternative focus on specific resource concerns.

Potential impacts on the various resources from oil and gas activities are addressed in Section 4.3.1. To facilitate the discussion and narrow the focus geographically, the Planning Area was divided into four geographic areas. These areas generally correspond to the hydrologic basins shown on Map 3-6 including the Salt/Pecos River Basins, Tularosa Basin, Jornada del Muerto Basin, and Rio Grande/Mimbres/Gila River Basins. It was assumed for the purpose of this programmatic analysis that the RFD could occur generally anywhere on Decision Area lands that are open to leasing within each basin. For other resources, it was not appropriate or necessary to discuss the resource by basin but, rather, a general discussion for the alternative was deemed sufficient.

Potential impacts on the various resources from geothermal activities are addressed in Sections 4.3.2. The discussion of geothermal resources focuses geographically on the area where the potential for developing geothermal resources is high and open for leasing; that is, the Rio Grande/Mimbres/Gila River Basins.

4.3.1 Oil and Gas Resources

No-action Alternative (Existing Management)

As explained previously (Chapter 2), under the No-action Alternative, fluid minerals leasing and development would continue under existing management direction. Overall, a substantial amount of land open to leasing could be leased with standard lease terms and conditions. However, potential impacts would have to be identified on a case-by-case basis at the time of an APD and measures to mitigate impacts would have to be determined and applied as conditions of approval.

Table 4-8 summarizes the approximate acres by basin area of surface lands that are closed to leasing or open to leasing with stipulations or standard lease terms and conditions. Also, the table summarizes the total acres within each basin area and acres overlying Federal fluid minerals.

Lands and Access

Salt/Pecos River Basin Under existing management direction, a total of approximately 50,581 acres (about 7 percent) of BLM's Decision Area within this basin area is currently closed to leasing. Approximately 38,372 acres (5 percent) are nondiscretionarily closed to leasing to protect resources in the Brokeoff Mountains WSA and prohibit activities in the impact area of a former Air Force bombing and gunnery range. Approximately 12,209 acres (2 percent) are discretionarily closed to leasing to protect resources in the Alkali Flats, Cornudas Mountain, Wind Mountain, and Alamo Mountain ACECs. The majority of BLM's Decision Area (695,339 acres, or 93 percent) is open to leasing with standard lease terms and conditions, and 662 acres (less than 1 percent) is open to leasing with controlled surface use (Butterfield Trail). Also, there are areas associated with the WSAs, ACECs, and three watershed activity areas where travel is limited to existing roads and trails year-round.

TABLE 4-8
NO-ACTION ALTERNATIVE
CONSTRAINTS IN DECISION AREA BY BASIN
(approximate acres)

Constraint	Basins			
	Salt/Pecos River	Tularosa	Jornada del Muerto	Rio Grande/ Mimbres/Gila River
Closed to Leasing				
Nondiscretionary closure	38,372	1,412	4,333	1,931
Discretionary closure	12,209	5,465	0	0
Open to Leasing				
No surface occupancy	0	1,181	40	3,060
Controlled surface use and timing limitation	0	0	0	0
Controlled surface use	662	0	1,561	691
Timing limitation	0	0	231,288	5,300
Standard lease terms and conditions	695,339	302,074	40,693	703,395
Total acres	746,582	310,132	277,915	718,377
Total acres overlying Federal minerals	745,272	309,135	277,691	714,190

Considering the small percentage of Decision Area lands closed to leasing (7 percent) or constrained with stipulations for controlled surface use (less than 1 percent) and the area of surface disturbance projected for the RFD is less than 1 percent (6,589 acres short term, 862 acres long term), overall impacts on Decisions Area lands or on the ability to explore for or exploit fluid minerals are expected to be minimal.

Tularosa Basin A total of approximately 6,877 acres (about 2 percent) of BLM's Decision Area within this basin area is closed to leasing to protect the resources in the Sacramento Escarpment ACEC. The majority of the Decision Area (302,074 acres, or 97 percent) is open to leasing with

standard lease terms and conditions, and 1,181 acres (less than 1 percent) is open to leasing with no surface occupancy to protect resources of the Rattlesnake Hill Archaeological District, Danley Ecological Study Plot, and along portions of the Tularosa River. Also, there are areas associated with the ACEC and two watershed activity areas where travel is limited to existing roads and trails year-round.

Considering the small percentage of BLM's Decision Area that is closed to leasing (7 percent) and constrained with a stipulation for no surface occupancy (less than 1 percent) and the area of surface disturbance projected for the RFD would be 2 percent, overall impacts on the Decision Area lands or on the ability to explore for or exploit fluid minerals are expected to be minimal.

Jornada del Muerto Basin A total of 4,333 acres (1.5 percent) of BLM's Decision Area within this basin area is nondiscretionarily closed to leasing to protect resources of the Jornada del Muerto WSA. Forty acres are open to leasing with no surface occupancy to protect the Caballo Mountain Communication Site. The majority of the Decision Area (231,288 acres, or 83 percent) is open to leasing with a stipulation for a timing limitation required by the military in the area of the White Sands Missile Range Safety Evacuation Zone. Approximately 1,561 acres (less than 1 percent) is open to leasing with controlled surface use (portion of the Jornada del Muerto Trail), and 40,693 (15 percent) is open to leasing with standards terms and conditions.

Considering the small percentage of BLM's Decision Area that is closed to leasing and is constrained with no surface occupancy (1.2 percent) and the surface disturbance from the RFD would be 2 percent, overall impacts on the Decision Area from fluid mineral activities are expected to be minimal. However, the timing limitation associated with the White Sands Missile Range Safety Evacuation Zone (83 percent of the Decision Area), which is within an area with a medium potential for oil and gas resources, may have an effect on industry's decisions regarding leasing and development.

Rio Grande/Mimbres/Gila River Basins A total of 1,931 acres (less than 1 percent) of BLM's Decision Area within this basin is closed to leasing. Approximately 3, 060 acres (less than 1 percent) are open to leasing with a stipulation for no surface occupancy to protect the Caballo Mountain Communication Site, and Trujillo, Cuchillo, and Nordstrom Ecological Study Plots. The majority of the Decision Area (707,395 acres, or about 99 percent) is open to leasing with standard lease terms and conditions. Approximately 691 acres (less than 1 percent) are open to leasing with controlled surface use and 5,300 acres, or less than 1 percent, with a stipulations for timing limitations.

Considering that the majority of the Decision Area is open with standard lease terms and conditions (98 percent) and a small percentage of BLM's Decision Area constrained with stipulations (less than 1 percent) and the area of surface disturbance projected for the RFD would be less than 1 percent,

overall impacts on Decision Area land or on the ability to explore for or exploit oil and gas resources are expected to be minimal.

Minerals

In general, under existing management, surface and subsurface management within the Planning Area has the potential to affect the ability to explore for or exploit oil and gas resources.

Salt/Pecos River Basins This geographic area is highly prospective for oil and gas resources. Approximately 35 percent of the entire basin area is estimated to have a medium potential for oil and gas resources and there was a highly favorable gas show in 1997 (Bennett Ranch Unit discovery well). Approximately 99 percent of the basin area overlies Federal fluid minerals. Much of BLM's Decision Area has a medium potential for oil and gas resources (refer to Map 3-3). Since only a small percentage of the Decision Area is closed to leasing or constrained with restrictions, there would be little effect on the ability to explore for or exploit oil and gas resources.

Tularosa Basin This area also is prospective for oil and gas with 74 percent of the entire basin estimated to have a medium potential for oil and gas resources. Good gas shows were seen in two wells in 1976 and 1990 in the northern portion of the basin. More than 99 percent of the basin overlies Federal fluid minerals. However, 85 percent of the Federal fluid minerals for which BLM has some and/or all surface jurisdiction is closed to leasing and is not part of the Decision Area. Since the majority of land within BLM's Decision Area could be leased and managed with standard lease terms and conditions, there would be little effect on the ability to explore for or exploit oil and gas resources.

Jornada del Muerto Basin This area also is prospective for oil and gas with 79 percent of the entire basin estimated to have a medium potential for oil and gas resources. Ninety-nine percent of the basin overlies Federal fluid minerals. A small percentage of BLM's Decision Area is closed to leasing or open to leasing with stipulations for controlled surface use, and 15 percent is open to leasing with standards terms and conditions. However, 83 percent of BLM's Decision Area is open to leasing with a timing limitation, required by the military, to evacuate the White Sands Safety Evacuation Zone on days when missiles are fired. Although this area is open to leasing, this stipulation may effect decisions to lease and develop in this area.

Rio Grande/Mimbres/Gila River Basins This area also is prospective for oil and gas with 36 percent of the entire area estimated to have a medium potential for oil and gas resources, almost exclusively in the Rio Grande Basin. An excellent gas show was seen in one well in 1953 in the northern portion of the basin (subsurface Engle Basin). More than 99 percent of the entire basin area overlies Federal

minerals. Less than 1 percent of the public lands in the basins is closed to leasing. Of the public lands open to leasing, most (about 99 percent) are managed with standard lease terms and conditions. There would be little effect on the ability to explore for or exploit oil and gas resources.

Soils

Salt/Pecos River Basin Within this basin area, highly erosive and fragile soils are found west of the Brokeoff Mountains in an area that is open to leasing with standard lease terms and conditions; however, the area is estimated to have a low potential for oil and gas resources. Three watershed activity areas are located in this basin area: Moccasin and Otto Draw, Wind and Chess Draw, and a watershed east of Crow Flats. These areas are open with standard lease terms and conditions; however, travel within these watershed areas is limited to existing roads and trails. Known and potential prime farmlands are located in the Decision Area; however, if the entire RFD were to occur in an area of prime farmland, less than 1 percent of the prime farmland would be affected and would be reclaimed as wells are abandoned. Impacts on highly erosive and fragile soils and prime farmland are not anticipated to be significant.

Tularosa Basin Although the majority of the highly erosive soils and known and potential prime farmland occurs within areas closed to leasing and outside of BLM's Decision Area, there are highly erosive and fragile soils located within BLM's Decision Area, mostly north of Alamogordo and known and potential prime farmland located south of Alamogordo. Two watershed activity areas occur in this basin: Three Rivers Watershed and a watershed east of Tularosa and south of Tularosa River. Under existing management, these watershed areas are open to leasing; however, travel within them is limited to existing roads and trails. Assuming that best management practices would be implemented and reclamation were successful, impacts on soils and prime farmlands would be minimal.

Jornada del Muerto Basin No highly erosive and fragile soils were identified in BLM's Decision Area within this basin. Known and potential prime farmlands are located in the southern portion of the basin in an area estimated to have a medium potential for oil and gas resources. The area of known and potential prime farmlands is open to leasing with standard lease terms and conditions; however, the majority of these known and potential prime farmlands overlap with the White Sands Safety Evacuation Zone, which has a timing limitation restriction on use of the area. Assuming that best management practices and (if needed) site-specific mitigation measures would be implemented and reclamation were successful, impacts on known and potential prime farmland would be minimal.

Rio Grande/Mimbres/Gila River Basins Highly erosive and fragile soils are located primarily along the Rio Grande and the drainages emanating from the west and into the Rio Grande. Known and potential prime farmlands occur in association with these soils. Other smaller areas of concern occur to the east

of the Rio Grande. The area west of the river is estimated to have a medium potential for oil and gas resources. The majority of BLM's Decision Area in this basin area is managed as open to leasing with standard terms and conditions. Assuming that site-specific mitigation measures would be implemented and reclamation were successful, impacts on soils and known and potential prime farmlands would be minimal.

Water Resources

Groundwater

Salt/Pecos River Basins This area is underlain by an undeclared groundwater basin. Groundwater is found mostly in consolidated rock with total dissolved solids (TDS) typically between 1,000 and 3,000 parts per million (ppm). While in all parts of the Planning Area a water supply well typically can be drilled without requiring an operator to receive a water allotment, in an undeclared basin the operator does not have to apply for a permit. The permit application allows the State Engineer's office (SEO) to review the water requirements to ensure that no existing water right is permanently impaired. Without this review, the water supply may be impacted. Depressed water levels were reported as early as the 1950s with the concern that increased depletion of the water reserves would decrease water quality (BLM 1999). The annual recharge of the basin is estimated to be less than 100,000 acre-feet, which is still much greater than the 12.24 acre-feet/year estimated for the period of greatest development under the RFD (24 wells drilled/year at 0.51 acre-feet per well). Therefore, the impact on groundwater resources are expected to be minimal.

Tularosa Basin The area is underlain by high TDS groundwater (typically greater than 3,000 ppm) found in basin fill deposits. Fresher waters (less than 3,000 ppm), which can be used for stock or potentially domestic uses, can be found in the deep consolidated aquifers of the Otero Platform, Sacramento, and San Andres Mountains and typically are not underlain by Federal minerals. Most of the basin with Federal fluid mineral rights is closed to leasing due primarily to military lands (White Sands Missile Range and McGregor Range) and on lands open for leasing the groundwater TDS concentrations are high. Estimated annual recharge for the basin is only 5,000 acre-feet/year. While high TDS water may indicate that the water likely would not be degraded by project activities, the water probably would not be of sufficient quality to be used for drilling makeup water. Impacts on groundwater resources are expected to be minimal.

Jornada del Muerto Basin Groundwater in this basin typically is shallow (less than 500 feet) with TDS concentrations between 1,000 to 3,000 ppm. This basin is considered a "closed basin;" what flows in does not flow out. Therefore, water quality could be highly susceptible to contamination. Annual recharge of the basin has not been estimated but occurs mainly by infiltration from flash floods in the

arroyos. As the largest annual water need is only 12.24 acre-feet, the impact on the water supply is not expected to be significant. The closed nature of the basin with its relatively fresh water could be impacted by contamination, the extent of which would not be expected to be great; therefore, impacts on groundwater resources are expected to be minimal.

Rio Grande/Mimbres/Gila River Basins Groundwater in this portion of Sierra County typically is shallow and of good quality (less than 3,000 ppm TDS). Water quality is slightly better in the Palamos Basin (typically less than 1,000 ppm TDS) than in the Engle Basin (typically less than 3,000 ppm TDS). Recharge is from flash floods in the mountain arroyos as well as infiltration from the Rio Grande and its associated reservoirs. The impacts on groundwater resources are expected to be minimal.

Surface Water

Salt/Pecos River Basins Although the area of disturbance projected during development in the RFD (for development) is relatively minor compared to the total area of the Salt/Pecos River Basin, those areas where perennial flow occurs are subject to the greatest potential impacts. The upper Sacramento River and the headwaters of the Rio Penasco represent the only perennial flow of consequence within this basin area. Piñon Creek drains the northern Salt Basin and terminates in Crow Flats. Scott Able Creek is a short stretch of perennial flow that joins the Sacramento River near its headwaters (BLM 1985).

In general, to minimize impacts on wetlands associated with perennial streamflow and on playas, the operator would comply with Section 404 of the Clean Water Act and adhere to BLM guidelines. Additionally, the Wind and Chess Draw watershed area, Moccasin and Otto Draw watershed area, and the watershed east of Crow Flats already are protected partially through the limitation on travel to use of existing roads and trails. Based on protection of surface waters as provided by existing management direction, it is expected that impacts within the Salt/Pecos River Basins are expected to be minimal.

Tularosa Basin Areas of specific concern within the Tularosa Basin include all areas where perennial flow occurs. Within the Tularosa Basin perennial streamflow occurs in the upper reaches of Three Rivers although the most important stream is Tularosa Creek. Springs in the head canyons and tributaries in the northern Sacramento Mountains contribute to the flow of Tularosa Creek. Perennial flow occurs in the upper Three Rivers Canyon and in Indian Creek. La Luz Creek also is perennial, fed by springs along La Luz and Fresnal Canyons and tributaries north of Alamogordo. Alamo Creek flows to the Tularosa Basin from the Sacramento Mountains and Salt Creek drains the Malpais and the San Andres Mountains. The basin is intermontane and also contains many playas such as Lake Lucero.

Areas sensitive to additional degradation in water quality include perennial portions of Three Rivers from U.S. Highway 54 to the White Mountain Wilderness boundary, designated as "not supported" due to high conductivity and temperature probably from agriculture, and the Tularosa Creek from the town of Tularosa to the headwaters, designated as "partially supported" although the specific pollutant or threat is unknown.

In general, to minimize impacts on wetlands associated with perennial streamflow and on playas, the operator would comply with Section 404 of the Clean Water Act and adhere to BLM guidelines. Additionally, the Three Rivers watershed and the watershed east of Tularosa and south of the Tularosa River already are protected partially by limiting travel to existing roads and trails. Based on protection of surface waters as provided by existing management direction, impacts within the Tularosa River Basin are expected to be minimal.

Jornada del Muerto Basin The Jornada del Muerto Basin contains all surface water flows within its boundaries. Although there are no perennial streams in the basin, it does contain many playas fed by stormwater runoff during the rainy season. Springs occur in the surrounding mountains but most yield only small quantities of unpotable water (Weir 1965).

Activities more likely to occur during the rainy season have the greatest potential to impact surface water quality or quantity within the Jornada del Muerto Basin. Potential direct impacts on surface waters include soil erosion and resulting runoff and sedimentation into receiving surface waters, as well as accidental releases of contaminants.

Based on protection of surface waters as provided by existing management direction and the lack of perennial flows, impacts on surface waters within the Jornada del Muerto Basin are expected to be minimal.

Rio Grande/Mimbres/Gila River Basins Those areas of specific concern within the Rio Grande/Mimbres/Gila River Basins include all areas where perennial flow occurs. In addition to the Rio Grande, a few perennial streams occur in the mountains, but in general the area is drained by ephemeral channels. The primary drainages to the Rio Grande emanate from the west and include Alamosa Creek, Cuchillo Negro Creek, Las Palomas Creek, Las Animas Creek, Seco Creek, and Percha Creek. Elephant Butte and Caballo Reservoirs (not in BLM's Decision Area) are maintained primarily to store irrigation water although the Elephant Butte Reservoir has a secondary function as a hydroelectric power producer.

In general, to minimize impacts on wetlands associated with perennial streamflow and on playas, operators would comply with Section 404 of the Clean Water Act and adhere to BLM guidelines. Based on protection of surface waters as provided by existing management direction, impacts within the Rio Grande/Mimbres/Gila River basins are expected to be minimal.

Vegetation

Salt/Pecos Basin Vegetation types that are considered to be more sensitive because of forage production or revegetation include grasslands, woodland/forest, montane scrub, playas, and arroyos. Within BLM's Decision Area, grasslands constitute about 33 percent (249,530 acres) and within that are the remnant desert grasslan ds in the Otero Mesa area. Woodland/forest vegetation constitutes 9 percent (69,987 acres). Montane scrub, a minor component, occurs on 2 percent of the Decision Area. Playas occur on 3,152 acres and arroyos were identified on 45 acres, which combined to total less than 1 percent. No riparian or wetland areas were delineated within the Decision Area in this basin; however, if such areas were identified at the time of an APD, they would be protected under Section 404 of the Clean Water Act.

Tularosa Basin Grassland vegetation constitutes 32 percent (100,412 acres) of the Decision Area within this basin. Woodland/forest occurs on 4 percent of the area. Montane scrub occurs on 2.5 percent of the area (7,780 acres). Twenty-seven acres of playas are mapped. Riparian vegetation and wetlands occur for short stretches along Tularosa Creek, along the drainage systems north of Tularosa and again north of La Luz. These areas are managed as open to leasing, but no surface occupancy is allowed, which restricts development within 0.25 mile (400 meters) of these areas. This basin contains a number of noxious weed species. Areas cleared of vegetation often facilitate the spread of these plants, and measures should be taken to avoid their spreading.

Jornada del Muerto Basin The majority of BLM's Decision Area within this basin is desert scrub vegetation. Grasslands constitute 13 percent of the area, woodland/forest constitues 1 percent, and arroyos comprise less than 1 percent. Playas are delineated on only 57 acres.

Rio Grande/Mimbres/Gila River Basins The Decision Area within this basin is characterized by desert scrub vegetation, but also contains large areas of grasslands (198,702 acres, or 28 percent). Woodland/forest vegetation occurs on approximately 5 percent (33,393 acres). Arroyos and playas are relatively abundant, occurring on 18,988 acres (3 percent), and 115 acres, respectively. Arroyos and playas should be avoided by ground-disturbing activities.

Wildlife

Generally, under existing management, BLM's Decision Area is managed as open to leasing with standard lease terms and conditions. If impacts on important wildlife resources (e.g., riparian and arroyo habitats, birthing and nesting areas) are identified during site-specific investigations at the time of an APD, standard lease terms and conditions allow for relocating the site of a proposed facility within a reasonable distance (e.g., as much as or more than 200 meters). This may not be adequate for the avoidance of such resources in all cases. Standard lease terms and conditions also allow for delaying

activities within a reasonable time period (e.g., as much as or more than 60 days). This would be useful if nest sites or birthing areas are identified, although birthing and nesting periods are often longer than 60 days for big game and raptor species, respectively.

Standard lease terms and conditions would not necessarily allow the BLM to mitigate all impacts on fish and wildlife habitat. Detrimental effects that could occur under existing management include (1) disturbance of birthing areas that may be identified, (2) new road construction into isolated or unroaded areas, (3) disturbance to nesting raptors and waterfowl, and (4) impacts on aquatic/riparian/arroyo habitats.

Standard lease terms and conditions do not require the use of existing roads; however, use of the existing road system is encouraged to the extent practical. The worst-case scenario would be that all roads be upgraded or constructed new resulting in greater disturbance. Fragmentation resulting from those roads would depend on the location of the roads. Mitigation measures are not required and, therefore, impacts of the proposed development would not be reduced.

Salt/Pecos River Basins An important big game habitat that exists in this area is the Otero Mesa Habitat Management Area, which coincides with an area of remnant desert grasslands—one of the largest contiguous grasslands left in the region. This area is important habitat for pronghorn. Loss of grasslands due to clearing for pads and roads would lead to fragmentation of habitat. Fragmentation and increased road access in this area could have detrimental effects on pronghorn populations. Also, the terrain of Otero Mesa is relatively level. Therefore, placement of wells and roads would be visible for long distances and there would be little opportunity for visual and auditory barriers between the herd and any field development. Small mammals and birds associated with grasslands would either avoid the areas during fluid minerals activities or be displaced or killed. Existing management direction would not allow for these potential impacts to be mitigated completely. If a substantial amount of development were to occur in this area, impacts could be significant. A worst-case scenario would exist if the three field developments, described as part of the RFD, occurred in the desert grassland habitat area.

Only about 45 acres of arroyo habitat are mapped within this basin area (a larger amount of unmapped arroyo habitat is present). Loss of these habitats would have adverse effects on small birds, reptiles, amphibians, and mammals that inhabit the denser vegetation found along these drainages. Riparian/wetlands/playas occur within the Alkalai Flats ACEC, which is closed to leasing. Any other riparian (or wetland) habitats identified in this area would be avoided in compliance with Section 404 of the Clean Water Act and BLM guidelines. Springs or other water sources should be identified and avoided.

Tularosa Basin Mule deer and elk are present throughout the Sacramento Mountains and pronghorn inhabit the valley west of the Sacramento Mountains and north of the Jarilla Mountains. The pronghorn habitat is more isolated, and exploration and development activities in this area could displace the

animals into less desirable habitat. Standard lease terms and conditions would not be effective in mitigating disturbance in this area. Elk inhabit the higher elevations of the Sacramento Mountains. Most of this basin area has been estimated as having a medium potential for oil and gas resources; however, elk in this area could move to adjacent habitat during periods of disturbance associated with oil and gas activities.

Portions of lands along the Tularosa River are managed as open to leasing, but no surface occupancy is allowed. Although the justification for this is to protect recreational opportunities, fish and wildlife benefit as well. Sensitive riparian or wetland areas are expected to be small and could be avoided by ground-disturbing activities in compliance with Section 404 of the Clean Water Act.

Jornada del Muerto Basin Woodland/forest habitat type is located in the San Andres Mountains. The environment of this basin supports pronghorn, and mule deer inhabit the San Andres Mountains. If fluid mineral exploration and development occur within the grassland or woodland habitat types, a short-term loss of habitat for big game would result. Road construction in this area could fragment currently contiguous patches of woodland, which would affect big game, raptors, and other bird species residing there. Nest sites could be lost and active nests near development could be abandoned. Much of this area is managed for other resources as open to leasing with controlled surface use, which may benefit wildlife depending on the location of facilities. The arroyo habitat type is located along drainages on the eastern slope of the Caballo Mountains and should be avoided. Sensitive riparian or wetland areas that may be in the basin are expected to be small and could be avoided.

Rio Grande/Mimbres/Gila River Basins Wildlife habitat within this area supports elk, deer, and pronghorn. Deer and elk inhabit the eastern slope of the Black Range and Mimbres Mountains, with deer habitat extending eastward into the valley. The Caballo Mountains deer habitat area has the specific objective of providing adequate habitat for mule deer. The southeastern corner of this area includes a small portion of antelope habitat located within the Jornada del Muerto. Areas within the Caballo Mountains have been identified as potential reintroduction sites for bighorn sheep.

A worst-case scenario would exist if the three field developments, described as part of the RFD, occurred within habitat identified for a given herd in the Caballo Mountains. If the field developments were to be placed in the area of individual herds or habitat areas, this could result in disturbance to big game during construction. The presence of wells and roads could result in habitat fragmentation especially if travel routes are blocked. New road construction could result in the loss of escape cover and result in the increased loss of animals through legal and illegal hunting. The use of existing roads where possible would reduce the need for new roads. Increased traffic along these roads would increase the potential for direct and indirect effects on wildlife. Loss of woodland habitat would

displace many species of birds and other wildlife. Loss of grasslands would reduce populations of small mammals, which provide a prey base for raptors.

Arroyo habitats in this basin area are important movement corridors for wildlife and support many other animal species, including birds and small mammals. There are numerous arroyos covering approximately 18,988 acres, within this basin area, located primarily west of the Caballo Mountains and draining into the Rio Grande and associated reservoirs. The siting of the field developments along adjacent arroyos could disrupt wildlife movement and result in the loss of habitat for birds and small mammals.

Special Status Species

Under existing management, the majority of BLM's Decision Area is managed as open to leasing with standard lease terms and conditions, which allow for relocating the site of a proposed facility within a distance of 200 meters and/or for a period of up to 60 days if needed to avoid a sensitive resource. This would offer limited protection to active nest sites and birthing areas. However, standard lease terms and conditions offer no specific protective measures for special status species. Potential impacts on special status species would be identified through a case-by-case analysis at the time of an APD for each site and prudent operation measures would have to be developed as conditions of approval and attached to the APD.

The following sections list special status species likely to occur within each of the basins. The discussion of potential effects is provided in the section titled "Impacts Common to All Alternatives."

Salt/Pecos River Basins Special status species potentially occurring within BLM's Decision Area of this area include Guadalupe rabbitbrush, Guadalupe Mountains mescal bean, fish hook barrel cactus, gray sibara, grama grass cactus, Kuenzler hedgehog cactus, Todsen's pennyroyal, Glass Mountain coral root, gypsum blazing star, gypsum ringstem, aplomado falcon, peregrine falcon, Arizona black-tailed prairie dog, mountain plover, Baird's sparrow, loggerhead shrike, ferruginous hawk, western burrowing owl, gray-footed chipmunk, Mexican spotted owl, northern goshawk, Sacramento prickly poppy, southwestern willow flycatcher, bald eagle, ferruginous hawk, yellow-billed cuckoo, desert bighorn sheep, Guadalupe southern pocket gopher, Cornudas Mountain land snail, Texas horned lizard, and numerous bat species.

Tularosa Basin Special status species potentially occurring within BLM's Decision Area in this basin include Sacramento prickly poppy, grama grass cactus, Todsen's pennyroyal, Wright's marsh thistle, Alamo beardtongue, aplomado falcon, peregrine falcon, ferruginous hawk, Mexican spotted owl, Baird's sparrow, loggerhead shrike, white faced ibis, black tern, least tern, Arizona black-tailed prairie dog, desert bighorn sheep, southwestern willow flycatcher, yellow-billed cuckoo, White Sands woodrat, desert pocket gopher, Texas horned lizard, and numerous bat species.

Jornada del Muerto Basin Special status species potentially occurring within BLM's Decision Area of this basin include grama grass cactus, aplomado falcon, loggerhead shrike, bighorn sheep, Texas horned lizard, and numerous bat species.

Rio Grande/Mimbres/Gila River Basins Special status species potentially occurring within BLM's Decision Area of this basin include Sheer's cory cactus, Duncan's cory cactus, Roetter's hedgehog cactus, bald eagle, southwestern willow flycatcher, yellow-billed cuckoo, loggerhead shrike, Neotropic cormorant, New Mexican jumping mouse, Chiricahua leopard frog, Arizona southwestern toad, longfin dace, Mineral Creek mountain snail, Texas horned lizard, and numerous bat species.

Rangeland

Under existing management, grazing areas are managed generally as open to leasing with standard lease terms and conditions and the number of livestock that are allowed within a particular allotment has been established by the BLM. Under standard lease terms and conditions, for geophysical exploration, range improvements would not be disturbed or altered without prior authorization. Road and pipeline construction generally cause the most losses to grazing from surface clearing of vegetation. Overall, impacts on grazing are expected to be minimal throughout the Decision Area. Local or site-specific concerns or potential concentration of impacts in one area may require additional consideration as part of the APD approval process.

Cultural Resources

In general, regardless of the alternative, potential impacts on cultural resources would be reviewed and considered in accordance with Section 106 of the National Historic Preservation Act using the procedures outlined in the previous discussion of impacts common to all alternatives. Implementation of such procedures would be expected to result in avoidance of any identified adverse effects or satisfactory mitigation those effects. Cultural resources of particular concern are addressed by basin below.

Salt/Pecos Basins Existing management provides specific protection for two ACECs defined specifically to protect cultural resources (Cornudas Mountain, and Alamo Mountain) and a fourth (Wind Mountain) also protects some archaeological sites. The ACECs are closed to leasing. In additions, surface use is controlled within 0.25 mile (400 meters) of the well-preserved segment of the Butterfield Trail to protect physical remnants of this historic route.

Tularosa Basin The Three Rivers ACEC, defined to specifically protect the Three Rivers Petroglyph Site, is closed to leasing. Rattlesnake Hill Archaeological District is managed as open to leasing with a restriction of no surface occupancy. Two other areas important for cultural resources, Lone Butte and Jarilla Mountains, are managed as open to leasing with standard lease terms and conditions. However, ORV use is limited to existing roads and trails in the Lone Butte area and the Jarilla Mountains areas is closed to ORV use.

Jornado del Muerto Basin Surface use is controlled within 0.25 mile (400 meters) of the well-preserved segments of the Jornada del Muerto Trail to protect physical remnants of this historic route.

Rio Grande/Mimbres/Gila River Basins A portion of the Jornada del Muerto Trail is located in this basin area as well. As explained above, surface use in controlled within 0.25 mile (400 meters) of the well-preserved segments of the trail to protect physical remnants of this historic route. Another important cultural resource is the Lake Valley historic townsite, which under existing management is managed as open to leasing with standard lease terms and conditions. However, protection of this site is through existing cultural resource regulations.

Recreation

Under existing management, recreation resources generally are managed as open to leasing with standard lease terms and conditions, with the exception of sections of the Tularosa River where no surface occupancy is permitted. Areas that are closed to or limit ORV use are under standard lease terms and conditions, with the exceptions of ACECs and WSAs that have been closed to leasing. There is some potential conflict between development activities and the primitive recreation opportunities provided in areas where ORV use is prohibited or limited.

Salt/Pecos River Basins Brokeoff Mountains WSA and four ACECs are closed to leasing. No area within this basin is currently closed to ORV use, but vehicles are limited to existing roads and trails on approximately 65,583 acres. These areas are located near the Cornudas Mountains, Brokeoff Mountains, and Moccasin and Otto Draw Watershed Area. The Cornudas and Brokeoff Mountains are in an area estimated as having a medium potential for oil and gas resources.

Tularosa Basin Areas along Tularosa River (approximately 119 acres) are managed as open to leasing but no surface occupancy is allowed in order to protect recreational opportunities. The Red Sands ORV Area, an important recreation resource, is currently managed as open to leasing with standard lease terms and conditions. Approximately 885 acres including and in proximity to the Rattlesnake Hill Archaeological District are closed to ORV use to protect cultural resources. On an additional 35,304 acres, ORV use is limited to existing roads and trails. These sensitive areas are estimated to have a medium potential for oil and gas resources.

Jornada del Muerto Basin No area has been designated as closed or limited to ORV use in this basin. The majority of this area has a medium potential for oil and gas resources.

Rio Grande/Mimbres/Gila River Basins No area within this basin is currently closed to ORV use, but vehicles are limited to existing roads and trails on 6,222 acres. The area of limited ORV use is identified as having low potential for oil and gas resources.

Visual Resources

Areas designated as VRM Class I, are closed to leasing under the No-action Alternative; therefore, no visual impacts from fluid minerals activities would occur in these locations. Under existing management, VRM Classes II through IV are managed with standard lease terms and conditions, under which development of the RFD has the potential to result in significant visual impacts in other locations within BLM's Decision Area. Oil and gas development likely would result in contrast of line, form, color, and texture to the characteristic landscape and would attract attention depending upon the location and proximity to sensitive viewers.

Salt/Pecos River Basins Within this basin area, approximately 5,850 acres are designated as VRM Class I, all of which is closed to leasing. These VRM Class I areas include the Cornudas Mountains, Wind Mountain, and Alamo Mountain ACECs.

VRM Class II areas within BLM's Decision Area portion of this basin constitute 103,001 acres including portions of the Brokeoff Mountains, Brokeoff Mountains WSA, and land surrounding the town of Piñon. The RFD could be widely distributed throughout BLM's Decision Area or it could be concentrated within designated VRM Class II areas open to leasing within the basin area. According to BLM Visual Resource Management Guidelines, development within areas designated as VRM Class II should follow the basic elements in the characteristic landscape, and contrast resulting from this development must not attract attention. Under existing management, oil and gas development projected for the RFD likely would not meet the BLM VRM objectives and, therefore, could result in a significant impact.

VRM Class III areas within BLM's Decision Area portion of this basin area constitute 26,806 acres. These lands primarily occur along the interstate and State highways within the Decision Area. The majority of Decision Area lands within this basin are designated as VRM Class IV, totaling 591,883 acres. According to BLM Visual Resource Management Guidelines, development within areas designated as VRM Class III should remain subordinate to the existing landscape.

Tularosa Basin Within the Tularosa Basin 4,277 acres are designated as VRM Class I, all of which is closed to leasing. These VRM Class I areas include the Sacramento ACEC and Three Rivers Petroglyph Site ACEC.

VRM Class II areas open to leasing within the Tulorosa Basin portion of BLM's Decision Area constitutes 12,492 acres, primarily skirting the foothills of the Sacramento Mountains. However unlikely, the RFD could be concentrated within areas designated as VRM Class II within the Tulorosa Basin. Development in VRM Class II areas should not be visually evident.

VRM Class III areas within BLM's Decision Area constitute 75,615 acres. These lands primarily occur along the interstate and State highways within BLM's Decision Area. The majority of Decision Area lands within the Tularosa Basin are designated as VRM Class IV, 210,225 acres. According to BLM Visual Resource Management Guidelines, development within areas designated as VRM Class III should remain subordinate to the existing landscape.

Jornada del Muerto Basin No VRM Class I areas exist within this basin. VRM Class II areas within the basin portion of BLM's Decision Area constitute 777 acres, including the Jornada del Muerto WSA. The RFD could be concentrated within areas designated as VRM Class II open to leasing within the basin; however, impacts should not be visually evident.

VRM Class III areas within BLM's Decision Area constitute 3,035 acres. These lands primarily occur along the interstate and State highways within BLM's Decision Area. The majority of Decision Area lands within this basin are designated as VRM Class IV, 273,512 acres, where impacts may begin to dominate the landscape. According to BLM Visual Resource Management Guidelines, development within areas designated as VRM Class III should remain subordinate to the existing landscape.

Rio Grand/Mimbres/Gila River Basins No VRM Class I areas exist within this basin area. VRM Class II areas open to leasing within BLM's Decision Area portion of this basin area constitutes 59,467 acres, primarily skirting the foothills of the Caballo Mountains and Reservoir. The RFD could be concentrated within areas designated as VRM Class II within the basin area, although visual impacts should not be evident.

VRM Class III areas within BLM's Decision Area constitute 204,340 acres. These lands primarily occur along the interstate and State highways within BLM's Decision Area. The majority of Decision Area lands within this basin area are designated as VRM Class IV, 447,352 acres. According to BLM Visual Resource Management Guidelines, development within areas designated as VRM Class III should remain subordinate to the existing landscape.

Alternative A

As explained in Chapter 2, Alternative A represents a modification of (alternative to) existing management direction (No-action Alternative). Alternative A incorporates legislative and regulatory requirements and/or management objectives that likely would be specified on a case-by-case basis under existing management.

Table 4-9 summarizes the approximate acres by basin of surface lands that are closed or open to leasing with stipulations or standard lease terms and conditions. Also, the table summarizes the total acres of Decision Area lands within each basin area and acres overlying Federal fluid minerals.

TABLE 4-9
ALTERNATIVE A
CONSTRAINTS IN DECISION AREA BY BASIN
(approximate acres)

Constraint	Basins			
	Salt/Pecos River	Tularosa	Jornada del Muerto	Rio Grande/ Mimbres/Gila River
Closed to Leasing				
Nondiscretionary closure	38,372	1,412	4,333	1,931
Discretionary closure	12,209	6,349	0	0
Open to Leasing				
No surface occupancy	90,039	41,291	1,928	27,178
Controlled surface use and timing limitation	58,470	993	12,713	90,321
Controlled surface use	199,283	139,791	257,541	259,547
Timing limitation	0	29,632	581	0
Standard lease terms and conditions	348,207	90,665	819	339,402
Total acres	746,580	310,133	277,915	718,379
Total acres overlying Federal minerals	745,272	309,135	277,691	714,190

Lands and Access

Salt/Pecos River Basins Under Alternative A, a total of approximately 50,581 acres (about 7 percent) of BLM's Decision Area within this basin area would remain the same as the No-action Alternative;

i.e., closed to leasing. Approximately 90,039 acres (12 percent) would be open to leasing with a stipulation for no surface occupancy. Approximately 257,753 acres (34 percent) of BLM's Decision Area would be managed as open to leasing with stipulations for controlled surface use, timing limitation, or both. Approximately 348,207 acres (47 percent) would continue to be managed as open to leasing with standard lease terms and conditions.

Considering the small percentage of Decision Area land that is closed to leasing (7 percent) and constrained with a stipulation for no surface occupancy (12 percent) and the area surface disturbance projected for the RFD is less than 1 percent, overall impacts on Decision Area lands within this basin area or on the ability to explore for or exploit fluid minerals are expected to be minimal.

Tularosa Basin As is the case under the No-action Alternative, a total of approximately 7,761 acres (3 percent) would be closed to leasing. Approximately 41,291 acres (13 percent) would be open to leasing with a stipulation of no surface occupancy. The majority of BLM's Decision Area would be managed as open to leasing with stipulations of controlled surface use, timing limitation, or both. The remaining 90,665 acres (29 percent) would be open to leasing with standard lease terms and conditions.

Considering the small percentage of Decision Area land that is closed to leasing (2 percent) and constrained with a stipulation of no surface occupancy (13 percent) and the area of surface disturbance projected for the RFD is less that 1 percent, overall impacts on Decision Area lands or on the ability to explore for or exploit fluid minerals are expected to be minimal.

Jornada del Muerto Basin As is the case under the No-action Alternative, a total of approximately 4,333 acres (2 percent) would be nondiscretionarily closed to leasing. Approximately 1,928 acres (less than 1 percent) would be open to leasing, but with a stipulation for no surface occupancy. The majority of the Decision Area (270,835 acres, or 97 percent) would be managed as open to leasing with stipulations for controlled surface use, timing limitation, or both. The remaining 819 acres (less than 1 percent) would be open to leasing with standard lease terms and conditions.

Considering the small percentage of Decision Area land that is closed to leasing (2 percent) and constrained with a stipulation for no surface occupancy (less than 1 percent) and the area of surface disturbance projected for the RFD is less than 1 percent, overall impacts on Decision Area lands are not anticipated to be significant. However, as under the No-action Alternative, the timing limitation associated with the White Sands Missile Range Safety Evacuation Zone, which is within a area estimated to have a medium potential for oil and gas resources, may have an effect on industry's decision regarding leasing and development.

Rio Grande/Mimbres/Gila River Basins A total of approximately 1,931 acres (less than 1 percent) within this basin area would be closed to leasing. Approximately 27,178 acres (4 percent) would be open to leasing but with a stipulation for no surface occupancy. Approximately 349,868 acres (49 percent) would be managed as open to leasing with stipulations for timing limitation and controlled surface use. The remaining 339,402 acres (47 percent) would be open to leasing with standard lease terms and conditions.

Considering the small percentage (less than 1 percent) of Decision Area lands are closed to leasing in this basin area and 4 percent would be constrained with no surface occupancy and the area of surface disturbance projected for the RFD is less than 1 percent, overall impacts on Decision Area lands or on the ability to explore for or exploit fluid minerals are expected to be minimal.

Minerals

Overall, the surface management constraints as well as required mitigation procedures and best management practices (refer to Appendices A-3 and A-5) imposed by Alternative A are not anticipated to significantly impact the ability to explore for or exploit oil and gas resources. Surface management requirements potentially may burden the project economics such that the project activities may be delayed. Some surface managements are more financially burdensome to the operators, such as closed pit systems or avoidance management that may require the use of directional drilling. The cost of the management requirements versus the anticipated revenue of the project may make the project infeasible. However, since BLM projects that the stipulations imposed under Alternative A most likely would be conditions of approval attached to APDs under existing management, the overall additional burden is not anticipated to be significant.

The areas of no surface occupancy (NSO) have increased under Alternative A versus the No-action alternative in all basin areas. Many of the NSO areas are small and the resource availability is not anticipated to be greatly affected; however, NSO is imposed in the Otero Mesa area to protect several patches of remnant desert grassland habitat. The feasibility and cost to reach the fluid minerals beneath these NSO areas would be impacted. Depending on the depth to the resource and other stratigraphic and structural aspects influencing the drilling program of the well, directional drilling to reach the underlying fluid minerals may not be feasible due to technical issues or cost. The resulting impact of the NSO areas is project specific and cannot be fully evaluated in a programmatic EIS. However, if NSO areas coalesce and become large enough that directional drilling is highly unlikely, then the majority of the NSO area is essentially closed to leasing. It is this aspect of the NSO areas that a programmatic EIS can evaluate and is assessed below by area.

Salt/Pecos River Basins No additional land would be closed to leasing under Alternative A. Leasing stipulations would increase under Alternative A by incorporating more controlled surface use (approximately 47 percent of the public lands would be leased under standard terms and conditions in Alternative A versus almost 100 percent under existing management). Overall, the constraints imposed under Alternative A and most surface use requirements would not preclude the ability to explore for or exploit the oil and gas resources; however, NSO imposed in the Otero Mesa area to protect several patches of remnant desrt grassland habitat allows use of the surface within 492 feet (150 meters) of existing roads and allows no surface use within the patches of grassland habitat. Generally, the patches proposed for protection are greater than 350 acres. Also, an area in T. 26 S., R. 18 E. does the stipulation for no surface occupancy of the buffer zones around playa lakes and riparian area coalesce into an area where the ability to exploit potential oil and gas resources would be impacted, as the area is effectively closed. As not all playa or riparian areas were mapped for this assessment, other areas also may potentially be closed by coalescing areas with a stipulation for no surface occupancy after a site inspection. However, it is not anticipated that the overall ability of the industry to explore for or exploit oil and gas resources would be significantly impacted by the controlled surface use requirements under this alternative.

Tularosa Basin Only minor additional lands from those closed under existing management would be closed to leasing under Alternative A (approximately less than 1 percent) and are not anticipated to impact the exploration and exploitation of oil and gas resources. Leasing stipulations would increase under Alternative A by incorporating more controlled surface use (approximately 29 percent of the public lands would be leased under standard terms and conditions in Alternative A versus almost 100 percent under existing management). The constraints imposed by Alternative A as well as the surface use requirements are not anticipated to restrict the industries ability to explore for or exploit oil and gas resources. Coalescing additional riparian/wetland/playa buffer zones with a stipulation for no surface occupancy is possible in this basin due to the incomplete inventory of the areas, but is not anticipated to impact the exploration or exploitation of oil and gas resources.

Jornada del Muerto Basin No lands additional to those closed under existing management would be closed to leasing under Alternative A. Leasing stipulations would increase under Alternative A by incorporating more controlled surface use (less than 1 percent of the public lands would be leased under standard terms and conditions in Alternative A versus almost 15 percent under existing management). The constraints imposed by Alternative A as well as the surface use requirements are not anticipated to restrict the ability to explore for or exploit oil and gas resources. Coalescing additional riparian/wetland/playa buffer zones with a stipulation for no surface occupancy is probable in this basin due to the incomplete inventory of the areas, but is not anticipated to impact the exploration or exploitation of oil and gas resources. As stated above, the timing limitation associated with the White Sands Missile Range Safety Evacuation Zone, which is within the area estimated to have a

medium potential for oil and gas resources, may have an effect on industry's decision regarding leasing and development.

Rio Grande/Mimbres/Gila River Basins No lands additional to those closed under existing management would be closed to leasing under Alternative A. Leasing stipulations would increase under Alternative A by incorporating more controlled surface use (approximately 47 percent of the public lands would be leased under standard terms and conditions in Alternative A versus almost 99 percent under existing management). These additional surface use requirements are not anticipated to restrict the ability to explore for or exploit the oil and gas resources. These surface use requirements likely would have been specified as conditions of approval on APDs under existing management.

Soils

This alternative is similar to the No-action Alternative in that it reflects the existing management decisions that normally would be required to meet resource condition objectives to manage the soil resource. Soils management under Alternative A includes stipulations for controlled surface use in areas where highly erosive or fragile soils and slopes are present. Occupancy or use of highly erosive or fragile soils would be considered and controlled on a case-by-case basis. On those soils that are on slopes greater than 5 percent, mitigation measures may be applied (e.g., waterbars, reseeding, pad design changes, etc.) Impacts on fragile soils are anticipated to be less under Alternative A than under existing management due to mitigation associated with the controlled surface use stipulations. Impacts on known and potential prime farmland are anticipated to be similar to those of the No-action Alternative. Impacts on soil resources are expected to be minimal under Alternative A.

Water Resources

Groundwater

Most of the leasing stipulations under this alternative are controlled surface use. Therefore, impacts on groundwater resources are anticipated to be similar to those identified under the No-action Alternative throughout BLM's Decision Area.

Surface Water

Areas identified as sensitive in the No-action Alternative also are sensitive under this alternative. Under Alternative A, the BLM has identified surface use and management limitations for fluid minerals

activities in many sensitive use areas. Impacts on surface waters may be reduced by limiting surface disturbances by minimizing road construction. Leases within designated watersheds (see No-action Alternative for location by basin area) also would have controlled surface uses stipulated. Impacts on highly sensitive surface water bodies also would be reduced by providing a 0.25-mile (400-meter) buffer zone with a stipulation for no surface occupancy around riparian areas, wetlands, and playas. These controlled surface uses have the potential to decrease impacts that may occur during primarily the construction and abandonment activities, but also during the production phase.

Therefore, impacts on surface water resources are anticipated to be less than under the No-action Alternative. However, since greater residual impacts would occur only where best management practices do not fully mitigate an impact, the reduction in impacts under this alternative relative to No-action Alternative is not quantifiable. Based on protection of surface waters as provided by existing management and additional limitations as described under Alternative A, it is expected that impacts on surface water resources would be minimal.

Vegetation

Stipulations for vegetation under this alternative vary from standard lease terms and conditions for desert scrub, arroyos, malpais and various unclassified types to controlled surface use for grassland, montane scrub, and woodland/forest vegetation. Patches of remnant desert grasslands in the Otero Mesa and Nutt areas would be protected by a stipulation of NSO. Also, areas within 0.25 mile (400 meters) of riparian and wetland/playa vegetation would be managed with a stipulation of no surface occupancy. Playas have been grouped with wetlands because they are jurisdictional to Section 404 of the Clean Water Act as Waters of the United States. Within BLM's Decision Area, stipulations would apply to approximately 347,792 acres (47 percent) of the Rio Grande/Mimbres/Gila River Basins; 211,700 acres (69 percent) of the Salt/Pecos River Basin; 272,763 acres (98 percent) of the Tularosa Basin; and 377,046 acres (52 percent) of the Jornada del Muerto Basin. Due to the stipulations and use of other mitigating measures, impacts on vegetation are expected to be minimal.

Wildlife

Fluid mineral activities generally are allowed throughout the lease areas (unless specific areas are protected by other stipulations), but because of resource concerns, lease activities must be controlled. For big game, the stipulation of controlled surface use is designed to ensure that adequate habitat is maintained in a given area. Only herds for which specific goals were identified in the RMPA would be managed under stipulations of controlled surface use. Under this stipulation, development of an area

requires the maximum use of existing road and/or other utility corridors to minimize the potential for increased habitat fragmentation. Riparian/wetland habitats and playas are protected further by this stipulation. This stipulation also is imposed in areas where active raptor nests are present.

Leases within habitat occupied by bighorn sheep would be subject to stipulations of controlled surface use and timing limitations to minimize adverse impacts primarily during lambing seasons. Several areas within BLM's Decision Area have been identified as potential reintroduction sites for bighorn sheep. Bighorn sheep are sensitive to human activities; therefore, timing limitation would reduce the potential for adverse effects to the animal's productivity.

Stipulations of controlled surface use would be applied within raptor habitat, which is consistent with BLM management objectives. Specific raptor habitat and nests sites would be determined during site-specific investigations for individual APDs.

Salt/Pecos River Basins The Otero Mesa Habitat Area would be protected with the stipulation of controlled surface use. This area contains one of the largest contiguous remnant grassland areas in the State. Under Alternative A, patches of this remnant desert grassland habitat within the Otero Mesa Habitat Management Area would be protected from further habitat fragmentation by a stipulation of no surface occupancy, which allows for surface use within 150 meters of existing roads and no surface use within the patches of grassland habitat. The patches proposed for protection are greater than 320 acres. This protection would be consistent with BLM's management goal of providing adequate habitat for pronghorn. The stipulations would be more effective than standard lease terms and conditions in reducing potential effects because it limits road construction in unroaded areas. This is especially important in areas adjacent to water sources and in areas where cover vegetation is present. Pronghorn utilize vegetation for cover as protection from predators or birthing. Controlling access into these areas would help reduce possible adverse effects on the productivity of the herd. The stipulations would help reduce adverse effects resulting from new road construction where roads are already in existence. The effectiveness of this stipulation is dependent on the location of the prospective wells relative to existing roads. Impacts associated with increased noise and activity levels would not be reduced. Mule deer habitat on Crow Flats would remain managed with standard terms and conditions.

Tularosa Basin The westernmost portion of the Otero Mesa Habitat Area is within the Tularosa Basin area (refer to maps 3-6 and 3-7). Refer to the relevant discussion in the paragraph above. The stipulation of controlled surface use also would be imposed on leases within the boundaries of the Sacramento Escarpment Deer Habitat Area. This is consistent with the BLM's management goal of providing adequate habitat for mule deer. Maximizing the use of existing roads would help reduce possible adverse effects of increased access and habitat fragmentation resulting from new road construction.

The Sacramento Mountains have been identified as an area suitable for reintroduction of bighorn sheep. Under Alternative A, stipulations of controlled surface use and timing limitation would be imposed on leases that are within habitat suitable for bighorn sheep. The lambing period for bighorn has been identified in some areas as January through June.

Jornada del Muerto Basin Under Alternative A, leases within the White Sands Antelope Area (Jornada Plain) would be subject to the stipulation of controlled surface use to protect the habitat. The purpose of delineating this habitat area in the 1986 RMP was to conduct studies to determine the biological factors limiting the distribution and numbers of pronghorn in this area. General management guidance states that forage will be provided for big game species in such delineated (herd unit) areas. Consistent with the management goal in the 1986 RMP, BLM's best management practice (Appendix A-III) encourages the use of existing roads to the maximum extent practical and minimizing new roads in unroaded areas and controlled surface use (Appendix VI, big game habitat areas) stipulates protection of habitat through avoidance of known habitat.

Rio Grande/Mimbres/Gila River Basins The Nutt Antelope Area and Caballo Mountains Deer Habitat Area are located within this basin. Leases within these two areas would be subject to stipulations of controlled surface use. However, the Nutt Antelop Area contains large patches of remnant desert grassland habitat. A stipulation of NSO would be imposed which would allow use of the surface within 492 feet (150 meters) of existing roads and no surface use within the habitat patches. The purpose is to protect against further habitat fragmentation. BLM management guidelines within the Nutt Antelope Area are the same as those for the White Sands pronghorn herd. That is, the area is to be used to conduct studies to determine the biological factors limiting the distribution and numbers of animals in this habitat. BLM guidance states that forage will be provided for big game species in this area. BLM's management objective for the Caballo Mountains Deer Habitat Area is to provide adequate habitat for mule deer. Limiting new road construction under the stipulation of controlled surface use would reduce effects of fragmentation and increased access.

The Caballo Mountains have been identified as a potential reintroduction area for bighorn sheep. The stipulations of controlled surface use and timing limitation would be attached to any lease within habitat suitable for bighorn sheep. This would reduce potential adverse effects to the productivity of a herd.

Special Status Species

A summary of the protection provided by stipulations under Alternative A follows.

General direction imposed by this alternative would manage the majority of special status species and their habitats under stipulations of controlled surface use. For many of these species, a stipulation of timing limitation may be imposed. One special status species, the desert bighorn sheep, would be managed under stipulations of controlled surface use and timing limitation as described in the previous section on wildlife. Although this direction is provided by Alternative A, potential site-specific impacts would have to be identified through analysis at the time of an APD and prudent operation measures would be developed as conditions of approval attached to the APD.

Special status species likely to occur in each of the basins are listed under the No-action Alternative (Existing Management) and potential impacts are discussed under the section titled "Common Impacts."

Areas where these Federally listed or BLM-sensitive species are known to occur would be managed with a lease stipulation of controlled surface use, whereby operations would be designed to avoid disturbance of individuals of listed plant populations. Each project would be scrutinized for potential effects on listed wildlife species and their suitable and potential habitat. There would be a high potential for timing limitations and other conditions of approval resulting from BLM analysis and consultation with the U.S. Fish and Wildlife Service (FWS). Similarly, areas where these State-listed species are known to occur would be managed with a stipulation for controlled surface use, whereby operations would be designed to avoid delineated populations.

As mentioned previously, riparian areas, wetlands, and playas would be managed with a stipulation of no surface occupancy within 0.25 mile (400 meters) of these areas to avoid direct impacts on special status species that utilize these areas. Potential water contamination of these resources would be minimized in accordance with other BLM guidelines.

Crucial habitat would be managed with a stipulation of controlled surface use, whereby new disturbances would be minimized to reduce loss of habitat area and habitat fragmentation. In the Otero Mesa and Nutt areas, portions of the remnant desert grasslands would be protected by a stipulation of NSO, which would allow use of the surface within 492 feet (150 meters) of existing roads and no surface use in adjacent grassland habitat. Areas of designated southwestern willow flycatcher habitat, which is riparian, would be managed with a stipulation of no surface occupancy within 0.25 mile (400) meters of riparian/wetland/playa areas.

Grassland habitats for the aplomado falcon would be managed under a stipulation of controlled surface use, whereby new disturbances would be minimized to reduce loss of habitat and habitat fragmentation and to avoid disturbance and/or displacement of individuals. A timing limitation may be required to avoid impacts on nesting falcons between January 1 and July 31. If needed, site-specific plans to avoid impacts on the aplomado falcon would be coordinated with the FWS.

Areas where black-tailed prairie dogs are known to occur would be managed with a stipulation of controlled surface use, whereby operations would be relocated to avoid prairie dog towns.

Occupied habitat for bighorn sheep would be managed with stipulations for controlled surface use and timing limitation, whereby new disturbances would be minimized to reduce loss of habitat and habitat fragmentation. The stipulation of timing limitation provides that no exploration or construction can occur in habitat occupied by bighorn sheep during lambing seasons.

The eight nominated ACECs would be managed with stipulations of controlled surface use designed to protect resource values. These are listed in Section 3.18.3.

Special status species that may occur within the Decision Area are listed by basin in the special status species section under the No-action Alternative. Assuming that operators comply with the lease stipulations, conditions of approval, and other guidelines, impacts on special status species are expected to be minimal.

Rangeland

Under Alternative A, no specific lease stipulations have been developed for rangeland and livestock grazing. However, the stipulation of controlled surface use that would be implemented for grassland, montane scrub, and woodland/forest vegetation also would serve to reduce impacts on grazing resources as well. Accordingly, riparian vegetation and wetlands, including playas would be managed under the stipulation of NSO within 0.25 mile (400 meters) of these areas, which would similarly reduce impacts on livestock grazing in these areas.

Cultural Resources

As mentioned previously, regardless of the alternative, potential impacts on other resources would be reviewed and considered in accordance with Section 106 of the National Historic Preservation Act using the procedures outlined in the previous discussion of common impacts. Implementation of such procedures is expected to result in avoidance of any identified adverse effects or satisfactory mitigation those effects.

Salt/Pecos River Basin The ACECs would remain discretionarily closed to leasing. Surface use would be controlled within 0.25 mile (400 meters) of the entire Butterfield Trail to protect this historic route.

Tularosa Basin The Three Rivers ACEC would remain discretionarily closed to leasing. The stipulation for the Rattlesnake Hill Archaeological District would be changed from no surface occupancy to a discretionary closure, and an adjacent 245 acres currently closed to ORV use would be managed with a stipulation of no surface use. Also, a larger adjacent area would be managed with a stipulation of NSO. The Lone Butte Archaeological District and Jarilla Mountains Archaeological District, currently closed to ORV use, would be managed with stipulations of controlled surface use.

Jornada del Muerto Basin Surface use would be controlled within 0.25 mile (400 meters) of the entire Jornado del Muerto Trail to protect this historic route.

Rio Grande/Mimbres/Gila River Basins The Lake Valley Historic Townsite would be managed with a stipulation of no surface occupancy. In addition, surface use would be controlled within 0.25 mile (400 meters) of the Mormon Battalion Trail to protect this historic route.

Recreation

Under Alternative A, some recreation resources are provided additional protection. The Red Sands ORV Area would be managed with a stipulation of timing limitations in order to accommodate periods of heavier ORV activity and an annual race. In addition, the Cornudas Mountains, Cuchillo Mountains, and Lake Valley Back-country Byway would be managed with the stipulation of controlled surface use. These stipulations, designed mainly to protect visual resources, increase the protection for more passive recreation opportunities as well.

Visual Resources

The differences between the No-action Alternative and Alternative A are the same for each hydrological basin, as described in this section. Under Alternative A, VRM Class I areas would be closed to leasing, VRM Class II areas would be managed with the stipulation of controlled surface use, and VRM Classes III and IV areas would be managed with standard lease terms and conditions.

Because areas designated as VRM Class I are closed to leasing under Alternative A, no visual resource impacts would occur in these locations as a result of field development.

In VRM Class II areas, the stipulation of controlled surface use would allow for short-term impacts as long as long-term impacts are consistent with the VRM Class II objectives. BLM guidance for areas of VRM Class II requires that changes in any of the basic elements in the characteristic landscape, caused

by management activity should not be evident in the characteristic landscape, and that contrast may be seen but must not attract attention. Under Alternative A, within an area of VRM Class II, requirements of controlled surface use may include painting facilities to blend with the surrounding vegetation and landscape and maximizing use of existing roads and utility corridors. Sensitive siting and mitigation planning of each site should reduce impacts on visual resources to be in compliance with BLM VRM classifications, and to less than significant levels.

In areas designated as VRM Class III and IV, where standard lease terms and conditions apply, field development within areas designated as VRM Class III potentially could result in significant visual impacts and noncompliance with BLM VRM objectives. Field development within areas designated as VRM Class IV is unlikely to result in noncompliance with BLM VRM objectives; however, significant impacts on sensitive viewers could occur within these locations.

Alternative B

As explained in Chapter 2, Alternative B also represents a modification of (alternative to) existing management direction (No-action Alternative). While Alternative B incorporates legislative and regulatory requirements and/or management objectives, it provides for greater protection of resource concerns. Areas identified as fragile, of significant value, or in need of protection are closed to leasing or are open to leasing but protected by stipulations including no surface occupancy.

Table 4-10 summarizes the approximate acres by basin of Decision Area surface lands that are closed or open to leasing with stipulations or standard lease terms and conditions. Also, the table summarizes the total acres of Decision Area lands within each basin area and acres overlying Federal fluid minerals.

Lands and Access

Salt/Pecos River Basins Under Alternative B, a total of 157,290 acres (21 percent) of BLM's Decision Area within this basin area would be closed to leasing. Approximately 100,297 acres (13 percent) would be open to leasing but with a stipulation of no surface occupancy. Approximately 168,553 acre (23 percent) of BLM's Decision Area would be open to leasing with stipulations of controlled surface use and/or timing limitations, and 320,442 acres (43 percent) would be open to leasing with standard lease terms and conditions.

TABLE 4-10
ALTERNATIVE B
CONSTRAINTS IN DECISION AREA BY BASIN
(approximate acres)

Constraint	Basins			
	Salt/Pecos River	Tularosa	Jornada del Muerto	Rio Grande/ Mimbres/Gila River
Closed to Leasing				
Nondiscretionary closure	38,372	1,412	4,333	1,931
Discretionary closure	118,918	80,052	2	80,136
Open to Leasing				
No surface occupancy	100,297	41,781	8,973	50,759
Controlled surface use and timing limitation	8,771	605	12,713	58,160
Controlled surface use	159,782	131,876	251,144	270,182
Timing limitation	0	0	581	0
Standard lease terms and conditions	320,442	54,405	169	257,227
Total acres	746,582	310,131	277,915	718,377
Total acres overlying Federal minerals	746,272	309,135	277,691	714,190

Considering that 65 percent of Decision Area lands within this basin area would be open to leasing with stipulations (other than no surface occupancy) or standard lease terms and conditions and the area of surface disturbance projected for the RFD is less than 1 percent of Decision Area lands, overall impacts on Decision Area lands are not anticipated to be significant.

Tularosa Basin A total of 81,464 acres (26 percent) of BLM's Decision Area would be closed to leasing and 41,781 acres (13 percent) would be open to leasing but with a stipulation of NSO. Approximately 132,481 acres (43 percent) of BLM's Decision Area would be open to leasing with stipulations of controlled surface use and/or timing limitations. The remaining lands would be open with standard lease terms and conditions (54,405 acres, or 18 percent).

Considering that 60 percent of Decision Area lands within this basin would be open to leasing with stipulations (other than no surface occupancy) or standard terms and conditions and the area of surface disturbance projected for the RFD is less than 1 percent, overall impacts on Decision Area lands are expected to be minimal.

Jornada del Muerto Basin A total of 4,333 acres (1.5 percent) of BLM's Decision Area would be closed to leasing and 8,973 acres (3 percent) would be open to leasing but with a stipulation of no surface occupancy. The majority of Decision Area lands (264,438 acres, or 95 percent) would be open to leasing with stipulations of controlled surface use, timing limitations, or both. The remaining lands would be open to leasing with standard lease terms and conditions (169 acres, or less than 1 percent).

Considering the small percentage of Decision Area lands closed to leasing (1.5 percent) or constrained with stipulations for no surface occupancy (3 percent), the 95 percent of lands open to leasing with stipulations (other than no surface occupancy) or standard lease terms and conditions, and the area of surface disturbance projected from the RFD (less than 1 percent), overall impacts on Decision Area lands in this basin are expected to be minimal. However, the timing limitation associated with the White Sands Missile Range Safety Evacuation Zone (83 percent of the Decision Area), which is within an area with a medium potential for oil and gas resources, may have an effect on industry's decisions regarding leasing and development.

Rio Grande/Mimbres/Gila River Basin A total of 82,067 acres (11 percent) of BLM's Decision Area would be closed to leasing and 50,759 acres (7 percent) would be open to leasing but with a stipulation of no surface occupancy. The majority of Decision Area lands (328,342 acres, or 46 percent) would be open to leasing with stipulation of controlled surface use and/or timing limitations, and 257,227 acres (36 percent) would be open with standard lease terms and conditions.

Considering that 82 percent of Decision Area lands within this basin area would be open to leasing with stipulations (other than no surface occupancy) or with standard lease terms and conditions and the area of surface disturbance projected for the RFD (less than 1 percent), overall impacts on Decision Area lands are expected to be minimal.

Minerals

Under Alternative B, the protection of other resources takes precedence over the ability to explore for or exploit oil and gas resources. If a significant portion of additional land is closed to leasing, the ability to explore for oil and gas resources would be impacted and could be significantly impacted locally. Additionally, limiting geophysical exploration on discretionarily closed areas also may limit the ability to fully explore and evaluate open adjacent lands. In general, the ability to explore for and exploit the oil and gas resources is anticipated to be impacted, and possibly significantly impacted in the Rio Grande/Gila River/Mimbres, Salt/Pecos River, and Tularosa Basins.

As described in Alternative A, other surface management requirements also can impact the feasibility of a project due to cost of implementation. Areas of NSO have increased in Alternative B both in number and in size, but as the contiguous NSO areas are small the resource availability is not anticipated to be greatly affected. However, the feasibility and cost to reach the underlying fluid minerals beneath these areas will be impacted. The resulting impact of the NSO areas is project specific and cannot be evaluated fully in a programmatic EIS. However, if NSO areas coalesce and become large enough that

directional drilling is highly unlikely, then the majority of the NSO area is essentially closed to leasing. It is this aspect of the NSO areas that a programmatic EIS can evaluate and is assessed below by area.

Salt/Pecos River Basins Fifteen percent of lands open to leasing under existing management would be closed to leasing under Alternative B (additional 12 percent of the total Federal minerals would be closed). Constraints also would increase under Alternative B by incorporating the stipulation of controlled surface use. However, most surface use requirements would not directly restrict the industry's ability to explore for or exploit the oil and gas resources, but may indirectly impact the ability to explore and exploit reducing the feasibility of the project. These controlled surface uses are generally the same as Alternative A with the exception that buffer zones managed with a stipulation of no surface occupancy are increased from almost a 0.25 mile
(400 meters) to 0.5 mile (800 meters) around riparian/other wetlands/playas. Two areas (in T. 26 S., R. 18 E. and T. 26 S., Rs. 16 and 17 E.) have buffer zones managed with the stipulation of no surface occupancy around playa lakes and riparian areas, which coalesce into an area where the ability to exploit potential oil and gas resources would be restricted just as if that the area is effectively closed. As not all playa or riparian areas were mapped for this assessment, other areas potentially could be effectively closed if identified as sensitive. The areas of NSO associated with the desert grassland habitat in the Otero Mesa Habitat Management Area would remain the same as Alternative A. It is anticipated that the overall ability of the industry to explore for or exploit the oil and gas resources would be impacted by the closures and areas of no surface occupancy, and could be significantly impacted locally.

Tularosa Basin Twenty-four percent of lands open to leasing under existing management would be closed to leasing under Alternative B (additional 4 percent of the total Federal minerals would be closed to leasing). These additional closures are anticipated to impact the exploration and exploitation of oil and gas resources in combination with the closures of military land and incorporated cities, towns, and villages. Leasing stipulations also would increase under Alternative B by incorporating the stipulation of controlled surface use. However, most surface use requirements would not directly restrict the industry's ability to explore for or exploit oil and gas resources, but may indirectly impact that ability by decreasing the feasibility of the project. These stipulations of controlled surface use generally are the same as Alternative A with the exception that buffer zones managed with the stipulation of no surface occupancy are increased from almost a 0.25 to 0.5 mile (400 to 800 meters) around riparian/otehr wetlands/playas. As not all playa or riparian areas were mapped for this assessment, areas potentially could be effectively closed by coalescing additional buffers managed with stipulations of NSO. The western portion of the Otero Mesa desert grassland habitat area, portions of which would have a stipulation of NSO, are within this basin area. It is anticipated that the overall ability of the industry to explore for or exploit oil and gas resources would be impacted by the closures and areas of no surface occupancy, and could be significantly impacted locally.

Jornada del Muerto Basin Only very minor amounts of additional lands would be closed discretionarily to leasing under Alternative B (approximately 2 acres). Leasing stipulations would increase under Alternative B by incorporating more stipulations of controlled surface use. These additional surface use requirements are not anticipated to directly restrict the industry's ability to explore for or exploit oil and gas resources unless areas managed with the stipulation of no surface occupancy are identified due to the lack of a complete inventory of playas. As buffer zones managed with the stipulation of no surface occupancy are increased in Alternative B from almost a 0.25 mile (400 meters) in Alternative A to 0.5 mile (800 meters) around riparian/wetlands/playas, the potential for coalescing riparian/other wetland/playa buffer zones managed with a stipulation of no surface occupancy are probable in this basin. The impact on the ability to explore for and exploit oil and gas resources in the Jornada del Muerto Basin is not anticipated to be significant; however, the presence of noninventoried playas potentially may provide areas of coalescing buffer managed with the stipulation of no surface occupancy. Leasing stipulations of surface management may indirectly impact the industry's ability to explore for and exploit oil and gas resources by requiring significant changes to the drilling plan to make the project infeasible either technically or costly.

Rio Grande/Mimbres/Gila River Basins Eleven percent of lands open to leasing under existing management would be closed to leasing under Alternative B (11 percent of the total Federal minerals would be closed as opposed to less than 1 percent under the No-action Alternative). These additional closures are anticipated to impact the exploration and exploitation of oil and gas resources but not as greatly as in other portions of the Decision Area as 89 percent of the Federal minerals would still be open to leasing in the basin. Leasing stipulations also would increase under Alternative B by incorporating more stipulations of NSO and controlled surface use. However, most surface use requirements would not directly restrict the industries ability to explore for or exploit the oil and gas resources but may indirectly impact that ability by decreasing the feasibility of the project. The stipulation of controlled surface use generally is the same as Alternative A with the exception that buffer zones managed with the stipulation of no surface occupancy is increased from almost 0.25 to 0.5 mile (400 to 800 meters) around riparian/other wetlands/playas. It is anticipated that the overall ability of the industry to explore for or exploit the oil and gas resources would be impacted by the closures under this alternative. However, given the proportion of non-Federal minerals and the overall percentage of Federal minerals still open to leasing, the impact is expected to be minimal overall but could be significantly impacted locally.

Soils

Anticipated impacts on soil resources under Alternative B are similar to Alternative A. Impacts on soils on slopes and the indirect impacts on water resources are anticipated to be less due to guidance provided by best management practices (Appendix A-III).

Water Resources

In general most lease stipulations under this alternative control surface uses. Therefore, impacts on groundwater resources are anticipated to be similar to those identified under the No-action Alternative. Areas of exception would include lands that are closed to leasing or associated with the stipulation of no surface occupancy, which may limit the development of the minerals and further limit the potential for impact on the groundwater resources. The impacts on groundwater resources are expected to be minimal.

Areas identified as sensitive in the No Action Alternative and Alternative A also are sensitive in this alternative and have been given additional protection. Under Alternative B, the BLM has identified surface management limitations for fluid minerals activities that control surface use as described in Alternative A. Additionally, impacts in the designated watersheds (see No Action Alternative for location by analysis area) would be nonexistent due to discretionary closure of these areas. These areas would obtain further protection as geophysical exploration would not be allowed. Impacts on highly sensitive surface water bodies would be reduced further from Alternative A by providing a 0.5-mile (800-meter) buffer zone of no surface occupancy around riparian areas, other wetlands, and playas. These controlled surface uses have the potential to decrease or eliminate impacts that occur during primarily the construction and abandonment activities, but also during the production phase.

Vegetation

The areas specified for the various stipulations are similar to Alternative A in that standard lease terms and conditions are applied to desert scrub, arroyos, malpais, and various unclassified types, and grassland, montane scrub, and woodland/forest vegetation would be managed with stipulations of controlled surface use. Riparian and wetland/playa vegetation are associated with the more restrictive stipulation of no surface occupancy. The stipulation of no surface occupancy would apply to a total of 201,810 acres within BLM's Decision Area, ranging from less than 1 percent to 13 percent of the surface area within the basins. Because of protective stipulations and other mitigating measures, it is unlikely that impacts on vegetation would be significant.

Wildlife

Under Alternative B, generally, protection through discretionary closures and NSO would increase.

Salt/Pecos River Basins Management would be the same as that described for Alternative A. That is, the Otero Mesa Habitat Area would be protected with the stipulation of controlled surface use and the remnant patches of desert grassland within the Otero Mesa Habitat Area would be protected with the stipulation of no surface occupancy (which allows for surface use within 150 meters of existing roads and no surface use within the patches of grassland habitat).

Tularosa Basin Management would be the same as that described for Alternative A. That is, the westernmost portion of the Otero Mesa Habitat Area would be protected with the stipulation of controlled surface use and the remnant patches of desert grassland within the Otero Mesa Habitat Area would be protected with the stipulation of no surface occupancy (as described in the paragraph above). The stipulation of controlled surface use also would be imposed on leases within the boundaries of the Sacramento Escarpment Deer Habitat Area except in areas where the Habitat Area coincides with the Sacramento Escarpment ACEC, which is closed to leasing. Stipulations of controlled surface use and timing limitation would be imposed on leases that are within habitat suitable for bighorn sheep.

Jornada del Muerto Basin The stipulations of controlled surface use would be applied to leases within the Jornada del Muerto Habitat Area. The addition of a timing limitation would mitigate potential effects of activities occurring during the birthing season. Such areas would be identified on a site-specific basis at the time of an APD.

Rio Grande/Mimbres/Gila River Basins The stipulation of controlled surface use would be applied to leases within the Nutt Antelope Area and habitat suitable for bighorn sheep in the Caballo Mountains. Leases within the Caballo Mountains Deer Habitat would be subject to the stipulation of controlled surface use, as under Alternative A.

Special Status Species

Generally, Alternative B affords greater protection for special status species. Areas where Federally listed or BLM sensitive species are known to occur would be discretionarily closed to leasing. Areas where State-listed species are known to occur would be managed with stipulations for controlled surface use, whereby operations would be designed to avoid delineated populations and there would be a high potential for timing limitations and other conditions of approval following BLM analysis.

Areas of riparian/other wetland/playa habitat, including a 0.5-mile (800-meter) buffer, would be managed with the stipulation of no surface occupancy to reduce impacts on special status species that utilize these areas. Potential water contamination of riparian/other wetland/playa areas from offsite sources could result in indirect impacts to special status species, but would be minimized in accordance with other BLM guidelines.

Crucial habitats would be managed with standard lease terms and conditions as under the No-action Alternative and Alternative A. Areas of designated southwestern willow flycatcher habitat, which is riparian, would be discretionarily closed to leasing and protected further by the stipulation of no surface occupancy within 0.5 mile (800 meters) of these areas. Grassland habitats for the aplomado falcon would managed with the stipulation of controlled surface use as under Alternative A. Areas where the Arizona black-tailed prairie dog is known to occur would be managed with the stipulation of no surface occupancy on known towns and controlled surface use in habitat suitable for the prairie dog. Habitat suitable for bighorn sheep would be managed with stipulation of controlled surface use combined with a timing limitation as under Alternative A.

The eight nominated ACECs would be discretionarily closed to leasing to protect resource values.

Special status species that may occur within BLM's Decision Area are listed by basin in the special status species section under the No-action Alternative. Assuming that operators comply with the lease stipulations, conditions of approval, and other guidelines, impacts on special status species are not anticipated to be significant.

Rangeland

No specific lease stipulations have been developed for rangeland and livestock grazing. Riparian vegetation and wetlands would be afforded additional protection in that no surface occupancy would be allowed within 0.5 mile (800 meters) of these areas.

Cultural Resources

In general, potential impacts on cultural resources would be reviewed and considered in accordance with Section 106 of the National Historic Preservation Act using the procedures outlined in the previous discussion of impacts common to all alternatives. Implementation of such procedures is expected to result in avoidance of any identified adverse effects or satisfactory mitigation those effects.

Salt/Pecos River Basin the ACECs would remain discretionarily closed to leasing. Protection of the Butterfield Trail would be enhanced with a stipulation of no surface occupancy within 0.25 mile (400 meters) of the entire trail.

Tularosa Basin The Three Rivers ACEC would remain discretionarily closed to leasing. Alternative B enhances protection of the Rattlesnake Hill Archaeological District, which would remain discretionarily

closed to leasing and surrounding areas also would be discretionarily closed to leasing. The Lone Butte Archaeological District would be managed with a stipulation of no surface occupancy as under Alternative A and protection of the Jarilla Mountains Archaeological District would be enhanced by closing it to leasing.

Jornada del Muerto Basin Protection of the Jornada del Muerto Trail would be enhanced with a stipulation of no surface occupancy within 0.25 mile (400 meters) of the entire trail.

Rio Grande/Mimbres/Gila River Basins The Lake Valley Historic Townsite would be discretionarily closed to leasing. Protection of the Mormon Battalion Trail also would be enhanced with a stipulation of no surface occupancy within 0.25 mile (400 meters) of the entire trail.

Recreation

Under this alternative, nearly all recreation resources of concern would be discretionarily closed to leasing. Impacts on recreation are expected to be minimal.

Visual Resources

Under Alternative B, VRM Classes I and II areas are discretionarily closed to leasing, VRM Class III would be open to leasing and managed with a stipulation of controlled surface use, and VRM Class IV would be open to leasing with standard lease terms and conditions.

Because areas designated as VRM Classes II and I, are closed to leasing, no visual resource impacts would occur in these locations as a result of development of the RFD.

In areas designated as VRM Class III, stipulations of controlled surface would allow for short- term impacts as long as long-term impacts are consistent with the VRM Class III objectives. BLM guidance for areas of VRM Class III requires that changes to the basic elements in the characteristic landscape, caused by management activity may be evident, but should remain subordinate to the existing landscape. Under alternative B, within areas of VRM Class III, controlled surface use may include painting facilities to blend with the surrounding vegetation and landscape, minimizing pad size, and maximizing use of existing roads and utility corridors. Sensitive siting and mitigation planning for each site should reduce impacts on visual resources to be in compliance with BLM VRM classifications, and to less than significant levels.

In areas designated as VRM Class IV, where standard lease terms and conditions apply, field development is likely to comply with BLM VRM objectives; however, significant impacts on sensitive viewers could occur within these locations.

4.3.2 Geothermal Resources

Only areas exhibiting a "high" potential for geothermal resources in BLM's Decision Area (see Map 3-4) are evaluated and, therefore, only potential impacts within the Rio Grande/Mimbres/Gila River Basins are presented below. Generally, impacts would be the same regardless of the alternative due to the overall low level of surface disturbance necessary to achieve the RFD.

Lands and Access

As projected by the RFD, a total of approximately 26.6 acres would be disturbed for development of geothermal resources. Due to the small area of surface disturbance and closure to leasing of incorporated cities, towns, and villages, impacts on land use are expected to be minimal. For geothermal development, needed access is expected to total approximately 12 acres. In general, geothermal resources are used on-site and drilling activities can be conducted along existing access routes. Geothermal resources likely would be applied to a direct use; specific land use or traffic impacts that may be associated with that use may be addressed in the APD.

Minerals

The production of geothermal resources (heat) is a renewable resource; therefore, no impact on the resource has been identified. Surface and subsurface management within the Planning Area has the potential to impact the ability to explore for or exploit the geothermal resources.

Three areas of high geothermal potential were identified in this basin area. Two of these areas are along the Rio Grande and its associated reservoirs, and one is located in the vicinity of the town of Truth or Consequences. Therefore, only limited portions of these two high potential areas overlie Federal fluid minerals. Under the No-action Alternative or Alternative A, these lands are open to leasing with standard lease terms and conditions and no impact on the ability to explore for and exploit geothermal resources is anticipated. Under Alternative B, most of the Decision Area lands in the high potential geothermal areas around Truth or Consequences and the Derry area would be closed to leasing. Therefore, only one of the three areas of high geothermal potential could be explored and exploited.

This could result in an impact on the ability to explore for and exploit lands in areas of high geothermal potential.

Soils

Nickel-bluepoint soils are located in the areas of high potential for geothermal resources in the vicinity of Derry and Truth or Consequences. These soils are identified as fragile and as known or potential prime farmland. No fragile soils or known or potential prime farmland are identified in the Hillsboro area, also an area of high potential for geothermal resources; however, the area contains slopes with high grades.

Predictable short-term impacts include loss of topsoil and increased erosion, which are likely to be limited to new development. Long-term impacts on soil resources in the form of increased roadway construction and construction of production facilities, are similar to the oil and gas activities. Since the development of hydroponic crop production or aquiculture is a likely end use of the geothermal resource, if known or potential prime farmland is taken out of production, the resulting land use may increase the productivity of the land though not the soils themselves.

Subsidence may occur as a result of geothermal development. However, it is expected to be minor and could be mitigated through the use of injection wells.

Overall, the impacts on soil resources from geothermal activities are anticipated to be similar to those anticipated under oil and gas activities. Variation between alternatives also are similar.

Water Resources

Groundwater

Impacts on groundwater resources are identified in Impacts Common to All Alternatives and as described for the Rio Grande/Mimbres/Gila River Basins in the oil and gas section above. An important issue related to water quality is the method of disposal of spent goethermal fluids. As geothermal facilities pump and manage water entirely at the facility and do not require any trucking of wastewaters, the anticipated impacts from spills would be less. However, the amount of wastewater generated is likely to be much greater for the geothermal facility and therefore the likelihood of impact on-site becomes greater. Overall potential impacts on groundwater resources are not anticipated to vary by alternative other than in Alternative B, in which the impacts on groundwater resources may be less due to some areas not being available for leasing. In particular most of the high potential geothermal areas around Truth or Consequences and the

Derry area would be closed to leasing. Impacts on groundwater resources are expected to be minimal under any alternative.

Surface Water

Impacts on surface water resources are anticipated to be the same as those Impacts Common to All Alternatives. Spills of produced water, which could be highly mineralized, likely would be of most concern. Activities more likely to occur near surface water features have the greatest potential to impact surface water quality. Potential direct impacts on surface waters include detention pond leaks or breaches resulting in discharge of highly saline or highly mineralized water into receiving surface waters, as well as accidental releases of contaminants.

Air Quality

Impacts on air quality would be the same as those for oil and gas operations. The airborne effluents associated with construction are the primary concern, and can be mitigated.

Noise

Impacts from noise would be similar to noise impacts described for oil and gas operations.

Vegetation

Some direct loss of vegetation would result from the construction of roads, wells, and other facilities. Due to the small amount of surface disturbance and assuming the use of mitigation and reclamation measures, impacts to vegetation are expected to be minimal.

Wildlife

Increased human activity, traffic, and noise could impact wildlife and use of habitat adjacent to project facilities. Alternatives A and B provide greater protection for habitats of concern through the use of the controlled surface use stipulation in some areas that overlap with high potential areas for geothermal resources.

Special Status Species

The types of impacts on special status species from geothermal operations are anticipated to be similar to those described for each of the alternatives discussed in the oil and gas development section. Potential impacts on special status species would be identified through site-specific investigation at the time of an APD and prudent mitigating measures would be prescribed as conditions of approval as part of the APD.

Rangeland

Impacts on rangeland and grazing from geothermal operations are expected to be minimal for any alternative.

Cultural Resources

No cultural resources of particular concerns have been specially designated within BLM's Decision Area in the areas of high potential for geothermal resources. In general, potential impacts on cultural resources would be reviewed at the time of an APD and considered in accordance with Section 106 of the National Historic Preservation Act using the procedures outlined in the previous discussion of impacts common to all alternatives. Implementation of such procedures is expected to result in avoidance of any identified adverse effects or satisfactory mitigation of those effects.

Paleontological Resources

Potential impacts on paleontological resources would be reviewed at the time of an APD, and if needed, measures would be developed as conditions of approval to mitigate the impacts.

Recreation

Impacts on recreation resources from geothermal development would be similar to those described for oil and gas, although the acreage disturbed would be much less.

Visual Resources

Potential impacts on visual resources from geothermal development are anticipated to be more localized than those resulting from oil and gas development. In geothermal development all of the facilities would be located at the source of the resource in a single location. Best management practices for reducing impacts on visual resources are summarized in Appendix A-III.

Social and Economic Conditions

Fluid mineral development could potentially cause spillover into local communities in the form of jobs, supply contracts for construction materials and services, sales of retail goods and services to workers, taxes, and any associated requirements for police, fire, health and welfare services and facilities. Of concern is the capacity of the community to accommodate an influx of non-local workers and business. If it has the capacity, then the area prospers; if not, then some residents may suffer inconveniences or even losses from project-induced pressure on local resources. The construction phase offers the main opportunity for socioeconomic problems to develop, because it contains the bulk of labor force, logistical, and capital spending effects.

The geothermal resources most likely to be developed in the RFD study area are located in Sierra County in the vicinity of towns and communities such as Truth or Consequences, Arrey, and Derry. The resources are relatively low in temperature, i.e., less than 100 degrees Celsius, and relatively shallow (less than 500 feet [153 meters]) (Geo-Heat 1998). As such, they could be exploited with conventional water well drilling technology. The capital costs to explore for, develop, and produce such a resource (including pumps, piping, and reinjection wells) run in the neighborhood of $500,000 to $750,000. Annual operating costs are on the order of $40,000 to $45,000 per year (excluding capital recovery). The manpower and material resources represented by these values are relatively insignificant, and as such would have very little impact on the local socioeconomic milieu. Local contractors could probably supply most of the inputs (including workers), so most of the economic benefit would accrue to the local communities. But the magnitude of the worker income and local procurements would be negligible in terms of economic stimulus.

The economic variables associated with the RFD will remain consistent through all the alternatives. However, some of the area that has been identified as high potential for geothermal is closed discretionarily in Alternative B.

4.4 CUMULATIVE EFFECTS

Regulations prepared by the Council on Environmental Quality (CEQ) for implementing NEPA require Federal agencies to analyze and disclose effects that result from incremental impact of an action "when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time" (40 CFR 1508.7).

Cumulative effects could result from fluid minerals activities occurring in the same or adjacent areas simultaneously. However, this RMPA/EIS is broad in scope and analyzes the fluid minerals program of the Las Cruces Field Office of BLM. The RMPA and Record of Decision will disclose the lands that are available for leasing and how those lands and resources will be managed for fluid minerals activities. At this programmatic level of analysis and the uncertainty of the location(s) of the potential fluid minerals activities, it is difficult to define the functional, temporal, and spatial relationships between potential fluid minerals activities and other past, present, and reasonably foreseeable future actions. Therefore, past, present, and potential reasonably foreseeable future actions are addressed generally here and will be considered on a case-by-case basis for each lease application and APD.

By comparing the direct and indirect impacts of the RFD with the potential effects of other actions, the relative contribution of the RFD to the cumulative impact or the effect that other actions may have on the ability for industry to achieve the RFD may be estimated. Because the RFD is the same for all alternatives, no variation in the level of cumulative impacts is anticipated among the alternatives.

Major past, present, and potential reasonably foreseeable future actions in BLM's Decision Area are briefly described below.

Past Actions

- Within the Planning Area, a total of approximately 2,042,200 acres of lands are nondiscretionarily closed to leasing for military, recreation and preservation, and protective purposes.

- Within BLM's Decision Area, approximately 46,047 acres of land are nondiscretionarily closed to leasing and approximately 17,673 acres of land currently are discretionarily closed to leasing.

- *Livestock grazing and rangeland improvements* Ranching and livestock grazing has been a predominant use of the land dating back to the 1880s when railroads arrived in the territory. Historically, grazing on public land has been authorized and numerous rangeland improvements such as fencing and watering sources have been developed.

- *Habitat fragmentation* Encroachment of desert scrub into grasslands has been occurring over the past 80 to 90 years. This shift may be attributed to a combination of climatic change, introduction of roads, intensive livestock grazing, and concurrent interruption of naturally occurring fire (Dick-Peddie 1975, Nielson 1986).

- *Copper Flat Mine* Copper has been pursued in the Copper Flats area northwest of Hillsboro since the mid 1950s, beginning with a small copper leaching operation and exploration. Exploration continued into the 1970s when sufficient reserves were defined to begin development. In 1982, an open pit copper mine was developed and operated. Operation continued intermittently until 1986.

- *Navajo Pipeline* The Navajo Pipeline is a 12.75-inch-diameter pipeline that delivers petroleum products from the Navajo Refinery in Artesia, New Mexico to El Paso, Texas. The pipeline crosses through Otero County (across Otero Mesa).

- *Diamond Shamrock Pipeline* The Diamond Shamrock Pipeline is a 10-inch-diameter petroleum products pipeline that parallels the Navajo Pipeline through Otero County.

Present Actions

- *Livestock grazing and rangeland improvements* Existing authorizations for livestock grazing and rangeland improvements occur on public land throughout the Planning Area.

- *Habitat fragmentation* Authorizations resulting in removal of vegetation (habitat) and possible ongoing impacts from past habitat fragmentation continue to affect habitat.

- *Bennett Ranch Gas Exploration* Existing lands have been leased in this area and exploration activities have begun.

- *Otero Platform Geophysical Exploration* Notices of intent to explore for fluid mineral resources have been approved in this area.

Reasonably Foreseeable Future Actions

- *BLM Actions Per Year* As summarized in Table 4-11 below, BLM estimates that there are approximately 356 acres disturbed each year due to miscellaneous actions.

- *Proposed RMPA/FEIS for New Mexico Standards for Public Land Health and Guidelines for Livestock Grazing Management* This Proposed RMPA/FEIS was released in January 2000. The Proposed Statewide RMPA/FEIS documents the effects of adopting standards for public land health and guidelines for livestock grazing management on BLM-administered public land in the State. The standards describe conditions needed for healthy sustainable public rangelands and provide the measure of resource quality, condition, and function upon which the health of public land will be assessed. Changes to existing grazing practices may result to attain the new standards for public land health, based on the need to retain the integrity of the soil and the continued sustainability of ecological processes. The Record of Decision for this project was signed on April 5, 2000. Following the signing of the Record of Decision, the standards and guidelines were sent to the Secretary of the Interior for review and approval.

- *Copper Flat Mine Project* Alta Gold Company proposes to rebuild and reestablish the operation, expected to produce 16,500 tons per day of copper and molybdenum concentrate. Construction is scheduled to begin in 1999, with mining and milling operations beginning 15 to 18 months later. Operations are expected to continue for 10 years, and reclamation would occur for two to three years later.

- *Highway 54 Widening* The highway will be widened to four lanes between Alamogordo and Orogrande. This five-year project is currently in the survey and design stages.

- *Spaceport Initiative* Private industry currently is evaluating the opportunity to site a spaceport or assembly site for a next-generation space shuttle. Two sites of 176,000 acres each are proposed in New Mexico for the project (for which 14 other states also are competing). The New Mexico sites are located near Upham on the border of Sierra and Dona Ana Counties, and about 40 miles southwest of Alamogordo near Orogrande. A Draft EIS was completed for the Southwest Regional Spaceport in July 1997 as required as part of the process for licensing by the U.S. Department of Transportation and Federal Aviation Administration. It is anticipated that a site will be selected in 2001.

Overall, the cumulative impacts for leasing activities are anticipated to be minimal for most resources over the 20-year planning time frame, due to the limited nature of expected surface disturbance unless a substantial amount of development were to occur in one area that has sensitive resource concerns. However, there is potential for cumulative impacts to result in substantive effects on visual resources, wildlife habitat, and water resources. Potential cumulative impacts may be anticipated to occur on

visual resources, wildlife habitat, groundwater levels, surface water quality, and socioeconomic resources, as described below.

Because of the open and undeveloped landscape within BLM's Decision Area, the potential exists for cumulative visual impacts if fluid mineral development occurs in visual proximity to other past, present, or reasonably foreseeable future actions. The greatest concern is if the combination of visual effects of the proposed action and other development were to result in a moderate to strong visual contrast to the setting. The potential for significant effects would be greater if this occurred on BLM VRM Class II or III lands. These types of cumulative impacts may be mitigated through siting and other proposed mitigation measures.

TABLE 4-11
ESTIMATED SURFACE-DISTURBING ACTIONS PER YEAR

Type of Action	Average Number of Actions Per Year	Acres of Disturbance Per Action	Average Acres of Disturbance Per Year
Mining notices	7	1.5	10.5
Mining plans of operation	0.5	5.8	2.9
Mineral material sales	45	0.5	22.5
Fences	7	0.6	4.2
Pipelines	5	5.0	25.0
Troughs	10	0.1	1.0
Wells	1	1.0	1.0
Storage tanks	1	0.1	0.1
Prescribed burns	1	2.0	2.0
Wildfires	4	25.0	100.0
Leases 2920	1	20.0	20.0
Permits 2920	2	5.0	10.0
Recreation and Public Purpose Patents and Leases	1	20.0	20.0
Linear Right-of-way	8	15.0	120.0
Site Right-of-way	3	5.0	15.0
Vegetative products removal	0.1	0.0001	0.00001
Erosion control	1	1.0	1.0
Spring development	1	0.1	0.1
Umbrella catchments	1	0.1	0.1
Exclosures	2	0.25	0.5
Total		108.1	355.9

SOURCE: Bureau of Land Management, Las Cruces Field Office, July 23, 1999

The volume of road development is not large relative to the existing road network; however, the density or location of new access may have a cumulative effect on a previously undisturbed area. Well spacing in gas and oil fields can suggest the density of road development that may be anticipated. According to the RFD, the three gas fields are expected to have 320-acre spacing, with the total field covering

approximately 6 square miles. Each gas field will contain an oil field developed on 40-acre spacing. Although the associated road networks would not be
particularly dense, especially given the existing access in the Planning Area and possibilities for co-location, the cumulative direct and inderect effects may be notable in terms of habitat fragmentation for larger wildlife regardless of which alternative is selected.

Although the water requirements for fluid minerals development are not anticipated to cause significant impacts, the other water demands such as irrigation and domestic needs due to population growth potentially could make even a small water demand a burden to the water system. Water table declines are monitored by the SEO, and the water right allotment and well permit system are in place to ensure that all interested parties have access to their allotted water. However, in the portion of Otero County where an underground water basin has not been declared, this check and balance system may not be present. Declining water levels are of concern to residents of the area. However, fluid minerals development on non-Federal land is not expected to greatly increase the water supply demands in the Planning Area by more than twofold. None of the other potential projects are believed to impact the supply of groundwater resources.

Indirect impacts on surface water quality also can be cumulative in nature because the impact source could include one or more areas. For example, the Rio Grande flows through the western portion of the Planning Area and then flows to Dona Ana County, through New Mexico and into Texas. Incremental impacts of the actions taken within the Planning Area when added to other past, present, and future actions could adversely affect downstream receiving waters.

Development of hydrocarbons or geothermal fluids could produce positive primary and secondary effects on local economies (through employment and purchases of goods and services) as well as generate royalties and tax revenue for state and local governments. The magnitudes, however, would be small; thus, the total positive benefits are not anticipated to produce a significant impact as defined by this study (10 percent increase or recession) based on the level of potential for fluid mineral resources. As a result the adverse impacts associated with stress on communities due to rapid growth is not anticipated as a long-term significant impact. There is no distinction among the alternatives for socioeconomic resources. No mitigating measures are called for, due to the low levels of economic and social impacts likely to be associated with the RFD scenarios.

CHAPTER 5-CONSULTATION AND COORDINATION

5.1 INTRODUCTION

During the planning process for this Draft Resource Management Plan Amendment (RMPA)/ Environmental Impact Statement (EIS), formal and informal efforts were made by the Bureau of Land Management (BLM) to involve other Federal agencies, State and local governments, and the public. BLM initiated the planning process in October 1998 by requesting comments to determine the scope of issues and concerns that needed to be addressed during the studies and in the document. As part of the resource inventory, members of the interdisciplinary team formally and informally contacted various relevant agencies to request data to supplement BLM's existing resource database. The Draft RMPA/EIS has been distributed to relevant agencies and the interested public for review and comments, which will be addressed in the Proposed RMPA/Final EIS.

The sections of this chapter describe these efforts including the formal consultation required, how this RMPA/EIS is consistent with other finalized plans, public participation activities throughout the process, and public review of the Draft RMPA/EIS. In addition, a list is provided of the individuals involved in the preparation and review of this document.

5.2 AGENCY CONSULTATION

BLM is required to prepare draft EISs in coordination with any studies or analyses required by the Fish and Wildlife Coordination Act (16 USC Sec. 661 et seq.), Endangered Species Act of 1973 (16 USC Sec 1531 et seq.), National Historic Preservation Act of 1966 (16 USC Sec. 470 et seq.), and other environmental review laws and executive orders. A description of the formal consultation relevant to this RMPA/EIS follows.

Consultation with the U.S. Fish and Wildlife Service (FWS) is required prior to initiation of any project by BLM that may affect any Federally listed special status species or its habitat in accordance with Section 7 of the Endangered Species Act of 1973. This RMPA/EIS is considered a major planning effort, and consultation has been initiated. On January 5, 1999, the FWS provided a list of Federally listed species that may occur in Sierra and Otero Counties. This letter is on file in the Las Cruces Field Office of BLM. An informal consultation meeting was held between the BLM and FWS on February 17, 1999 to discuss the scope of the RMPA/EIS and efforts to address Federally listed, proposed, and candidate species. A Biological Assessment is being prepared concurrently with the RMPA/EIS to address these potential effects.

The New Mexico Department of Game and Fish and the New Mexico Natural Resources Department also have been contacted in regard to State-listed threatened and endangered plant and animal species.

This is consistent with legislation protecting State-listed species. Coordination and consultation with the State will continue throughout the planning process and during implementation of the RMPA.

In addition, the BLM cultural resource management program operates in accordance with 36 CFR, Part 800, which provides specific procedures for consultation between the BLM and State Historic Preservation Office (SHPO). The SHPO has been consulted during the development of the RMPA concerning cultural resources. A copy of the Draft RMPA/EIS has been sent to the SHPO for review and comment. However, formal consultation with the SHPO is not required since no ground-disturbing activities will result from this RMPA/EIS for Federal fluid minerals leasing.

In accordance with the National Historic Preservation Act, efforts were made to identify and consider traditional cultural places. Letters were sent to five American Indian tribes to initiate discussions. The five tribes include the following:

- Fort Sill Apache Tribe
- Mescalero Apache Tribe
- San Carlos Tribe
- White Mountain Apache Tribe
- Ysleta del Sur Pueblo

To date, written responses have been received from the San Carlos Tribal Council and Mescalero Apache Tribe.

5.3 CONSISTENCY WITH OTHER PLANS

The BLM planning regulations require that Resource Management Plans (RMPs) be "consistent with officially approved or adopted resource-related plans, and the policies and procedures contained therein, of other Federal agencies, State and local governments, and Indian tribes, so long as the guidance and RMPs also are consistent with the purposes, policies and programs of Federal laws and regulations applicable to public lands…" (43 CFR 1610.3-2). In order to ensure such consistency, finalized plans were solicited from Federal, State, and local agencies as well as tribal governments listed in Table 5-2 (at the end of this chapter). These same agencies will receive copies of this Draft RMPA/EIS and will be asked to comment.

Section 202 of the Federal Land Policy and Management Act (FLPMA) of 1976 requires the BLM to coordinate land use planning activities with other Federal agencies, State and local governments and Indian tribes. FLPMA also requires BLM to ensure that consideration is given to non-Bureau plans that are pertinent to the development of the RMPA, assist in resolving inconsistencies between Federal and

non-Federal government plans, and to provide for meaningful public involvement of other Federal agencies, State and local government officials, and Indian tribes in the development of the RMPA.

At this time, there are no known inconsistencies between any of the alternatives and officially approved and adopted resource-related plans of other Federal agencies, State and local governments, and Indian tribes. Continuing coordination and consultation will take place during the public comment period on the Draft RMPA/EIS, Proposed RMPA/Final EIS, and the Record of Decision.

5.4 PUBLIC PARTICIPATION

The public participation process for the RMPA/EIS has been ongoing throughout the development of the Draft RMPA/EIS and will continue to the Record of Decision. In addition to formal public participation activities, informal contacts occur frequently with public land users, industry, and interested persons through meetings, field trips, telephone calls, or letters. All public participation applicable to the RMPA/EIS has been documented and analyzed as part of the planning process and kept on file in the Las Cruces Field Office.

5.4.1 Identification of Issues

The RMPA/EIS and scoping process officially began on October 15, 1998, with the publication in the *Federal Register* of BLM's Notice of Intent to amend the RMP, prepare an EIS, and conduct public scoping meetings. This notice invited the general public as well as Federal, State, and local government agencies to identify issues and submit comments regarding the proposed RMPA/EIS.

In addition to the Notice of Intent, the BLM prepared a scoping notice to send to interested parties. The scoping notice included a brief letter from the Las Cruces Field Office Manager, a newsletter, and a comment form. The notice provided background information and descriptions of fluid minerals leases and RMPs, announced the preparation of the RMPA and EIS, explained the planning process, project schedule, agency responsibilities, and announced the public scoping meetings and other public participation opportunities. The scoping notice was distributed to approximately 700 agencies, and interested organizations and individuals in early October 1998. The mailing list will continue to be reviewed and updated throughout the RMPA/EIS process.

Also, a media release introducing the project and announcing the scoping meetings was prepared and issued on October 21, 1998 by the BLM to local and regional newspapers, television, and radio.

Three public scoping meetings were held in early November 1998 to obtain input on issues and planning criteria, and determine the scope of the RMPA/EIS. Several displays illustrating or explaining components of the RMPA/EIS were stationed around the meeting room for those in attendance to review. Each meeting began with a presentation by BLM representatives after which comments and questions were received from the public. Table 5-1 summarizes the public meeting attendance and number of oral comments.

TABLE 5-1
PUBLIC SCOPING MEETING ATTENDANCE AND COMMENTS

Meeting Date	Meeting Location	Number in Attendance	Number of Oral Comments Received
Meeting, November 2, 1998	Roswell, New Mexico	18	65
Wednesday, November 4, 1998	Alamogordo, New Mexico	8	15
Thursday, November 5, 1998	Truth or Consequences, New Mexico	9	22
Total		35	102

In addition to the comments received during the meetings, a total of 36 comment forms and letters were submitted to BLM. Scoping ended on November 16, 1998; however, additional comments were accepted after that date.

A Summary Scoping Report was issued in January 1999 that described the scoping process and summarized the public comments and issues obtained.

5.4.2 Other Public Participation

Informal coordination with relevant agencies and interested public has taken place throughout the planning process through personal contacts, small group meetings, and letters, and will continue throughout the remainder of the planning process.

5.4.3 Public Review of the Draft RMPA/EIS

The next official opportunity for public participation in the planning process will occur during the agency and public review and comment period on this Draft RMPA/EIS. Concurrent with the distribution of this Draft RMPA/EIS, a BLM Notice of Availability was published in the *Federal Register* announcing the availability of the Draft RMPA/EIS for public review and comment. The EPA Notice in the *Federal Register* marks the beginning of the 90-day review and comment period.

Comments, including names and street addresses of respondents, will be available for public review at the BLM Las Cruces Field Office, 1800 Marquess, Las Cruces, New Mexico, 88005, during regular business hours (7:45 a.m. to 4:30 p.m.), Monday through Friday, except holidays, and may be published as part of the RMPA/EIS. Individual respondents may request confidentiality. If you wish to withhold your name or street address from public review or from disclosure under the Freedom of Information Act, you must state this prominently at the beginning of your written comment. Such requests will be honored to the extent allowed by law. All submissions from organizations or businesses, and from individuals identifying themselves as representatives or officials of organizations or businesses, will be made available for public inspection in their entirety.

5.4.4 Public Hearing

About midway through the 90-day review period, BLM will conduct public hearings to listen to and understand the public's comments on the Draft RMPA/EIS. An open house will precede the hearing to provide opportunity for people to view maps and other information displays and to ask questions about the planning process and its results. A hearing officer will conduct the hearing allowing individuals to formally provide comments on the Draft RMPA/EIS. The dates and locations of the hearings also were announced in the Notice of Availability and the "Dear Reader Letter" at the beginning of this document.

5.4.5 Proposed RMPA/Final EIS

All written and oral comments received during the 90-day period will be compiled, analyzed, and summarized. A Proposed RMPA/Final EIS will be prepared that addresses the comments and provides responses to each comment received on the Draft RMPA/EIS. The Proposed RMPA/Final EIS will contain additional information as needed to support the responses to the comments. Following publication of an Notice of Availability in the *Federal Register*, distribution of the Proposed RMPA/Final EIS, a 60-day Governor's Consistency Review, and a 30-day public protest period, the BLM will issue a Record of Decision summarizing the findings and decisions regarding the preferred alternative and its determination regarding compliance with NEPA and other regulations. Also, the RMPA will be prepared to document the resource management decisions and complete the BLM's resource management planning process for Federal fluid minerals in Sierra and Otero Counties, New Mexico.

5.5 DISTRIBUTION OF THE DRAFT RMPA/EIS

Table 5-2 is a partial list of various Federal, State and local agencies, organizations, Indian tribes, and individuals to whom this Draft RMPA/EIS has been sent for review and comment.

TABLE 5-2
LIST OF DOCUMENT RECIPIENTS

Federal

Department of Agriculture
- Agriculture Research Service
- Jornada Experimental Range
- Agricultural Stabilization and Conservation Service
- Animal Damage Control
- Rural Development
- Forest Service
- Natural Resources Conservation Service

Department of Commerce

Department of Defense
- Department of the Air Force
  - Holloman Air Force Base
- Department of Army
  - Corps of Engineers
  - Fort Bliss
  - McGregor Range
  - White Sands Missile Range

Department of Energy
- Western Area Power Administration

Department of Justice
- Immigration and Naturalization Service Border Patrol

Department of the Interior
- Bureau of Indian Affairs
- Bureau of Reclamation
- Fish and Wildlife Service
- Geological Survey
- National Park Service
  - White Sands National Monument
- Natural Resources Library
- Office of Environmental Policy and Compliance

Department of Transportation

Department of Treasury
- Customs Service

Environmental Protection Agency

Federal Highway Administration

International Boundary and Water Commission

TABLE 5-2
LIST OF DOCUMENT RECIPIENTS

New Mexico State Agencies

Agriculture Department
- Agricultural Programs and Resources Division Livestock Board

Bureau of Mines and Mineral Resources
Commerce and Industry Department
Department of Finance and Administration
- Office of Cultural Affairs
  - Museum of New Mexico
  - Historic Preservation Division

Department of Game and Fish
Department of Public Safety
- State Police Division

Energy and Minerals Department
- Forestry and Resources Conservation Division
- Energy Conservation and Management Division
- Mining and Minerals Division
- Oil, Gas, and Minerals Division
- Parks and Recreation Division

Governor's Office
Environment Department
- Environmental Protection Division
- Waste and Water Management Division
- Surface Water Quality

Highway and Transportation Department
Human Services Department
- Office of Indian Affairs

Land Office
- Commissioner's Office

New Mexico State University
New Mexico National Guard
- General Services Department
- Radio Communications Bureau

State Engineer/Interstate Stream Commission
Taxation and Revenue Department
University of New Mexico

Congressional Delegation and New Mexico State Legislators

U.S. Senator Jeff Bingaman
U.S. Senator Pete V. Domenici
U.S. Congressman Joe Skeen
State Senator, District 35
State Senator, District 39
State Senator, District 40
State Representative, District 51
State Representative, District 52
State Representative, District 53

TABLE 5-2
LIST OF DOCUMENT RECIPIENTS

Congressional Delegation and New Mexico State Legislators, continued

State Representative, District 53

Local and Regional Governments, Agencies, and Indian Tribes

Chambers of Commerce (Alamogordo, El Paso, and Truth or Consequences)
Caballo Soil and Water Conservation District
Cities of Alamogordo, El Paso, and Truth or Consequences
El Paso County Commissioners
Elephant Butte Irrigation District
Fort Sill Apache
Jornada Resource Conservation and Development Council
Mescalero Apache Tribe
Otero County Commissioners
Otero County Electric Cooperative, Inc.
Otero County Public Land Use Advisory Council
Otero Soil and Water Conservation District
San Carlos Apache Tribe
Sierra County Commissioners
Sierra County Livestock Committee
Sierra Soil and Water Conservation District
Southeastern New Mexico Economic Development District
Village of Tularosa
Village of Williamsburg
White Mountain Apache
Ysleta del Sur

Other Groups/Individuals

Addwest Minerals Company
AMOCO Production Company
Bartoo Sand & Gravel, Inc.
Brighton Corporation
Burlington Resources
Cibola Energy Corporation
Exxon Coal and Minerals Company
Gas Company of New Mexico
Grazing Permittees in Sierra and Otero Counties (160)
Greystone
Harvey E. Yates Company
Horne Engineering Services
Independent Petroleum Association of Mountain States
Marathon Oil
Mobil Oil
New Mexico Cattle Growers Association

TABLE 5-2
LIST OF DOCUMENT RECIPIENTS

Other Groups/Individuals (continued)
New Mexico Farm & Livestock Bureau
New Mexico Oil & Gas Association
PermitsWest, Inc.
People for Preservation of the Caballo Mountains
Prairie Dawgs Motorcycle Club
PRESCO, Inc.
Public Service Company of New Mexico
Sierra Club - Southern New Mexico Group, Rio Grande Chapter
Sierra County Farm & Livestock Bureau
Southwest Center for Biological Diversity
Southwest Minerals Exploration Association
Southwest New Mexico Grazing Association
Southwest Research & Information Center
Sun Valley Corporation
T&E, Inc.
Texaco, Inc.
The Black Range Lodge
The Rudman Partnership
White Sands Cycling Club
Wildlife Management Institute

5.6 LIST OF PREPARERS AND REVIEWERS

An interdisciplinary team of resource specialists prepared the RMPA/EIS. Table 5-3 lists the team members, job titles, and responsibility associated with the RMPA.

TABLE 5-3
LIST OF PREPARERS AND REVIEWERS

Name/Title	RMPA/EIS Responsibility	Education	Experience
Bureau of Land Management			
Theresa Hanley Archaeologist, Land Use Planner	Team Leader (October 1998 - October 1999)	BA, Anthropology MA Anthropology	13 years, cultural resource management, land use planning
Tom Phillips Rangeland Specialist Land Use Planner	Team Leader (October 1999 - Present)	BS, Range Science	16 years, rangeland management, land use planning
Russ Jentgen Geologist	Minerals	BS, Geology	30 years, minerals resource management

TABLE 5-3
LIST OF PREPARERS AND REVIEWERS

Name/Title	RMPA/EIS Responsibility	Education	Experience
Joe Sanchez Natural Resource Specialist	Recreation, Visual Resources, Wilderness	BS, Range Science	25 years, natural resource management
Mark Hakkila Outdoor Recreation Specialist	Off-highway vehicles, wilderness	BS, Wildlife Science MS, Range Science	17 years, natural resource management
Bruce Call Soil Scientist	Soil, Water Resources	BS, Range/Soil Science	23 years, natural resource management
Scott Archer Environmental Scientist	Air Quality, Noise	BS, Chemistry, Environmental Science	20 years, environmental analysis
Ray Aguilar Rangeland Management Specialist	Vegetation, Livestock Grazing	BS, Range Science	20 years, range management
Mike Howard Wildlife Management Biologist	Wildlife, Special Status Species	MS, Wildlife Management	21 years, wildlife management
Bill Merhege Wildlife Management Biologist	Special Status Species (Aplomado Falcon)	BS, Wildlife Science	21 years, wildlife management
Juan Padilla Realty Specialist	Land, Access	Business	20 years, lands and realty
Pam Smith Archaeologist	Cultural Resources	BA, anthropology	25 years, cultural resource management
Mike O'Neill Physical Anthropologist	Paleontological Resources	BA, Physical Anthropology MA, Physical Anthropology	BLM, 23 years, Paleontology
Tom Custer Physical Scientist-Hazmat	Hazardous Materials	BS, Geology	10 years, hazardous materials
Butch Wilson Fuel Management Team Leader	Fire Management	BS, Range Science	25 years, fire management
Jeanette Pranzo Social Economist	Social and Economic Conditions	MA, Economics	29 years, socio-economic analysis
Rusty Stovall Geographer	GIS Coordinator	MS, Geography	6 years, geographic information systems (GIS) management
Rena Gutierrez Writer/Editor	Writer/Editor	BA, Journalism/Mass Communications	21 years, technical writing and editing
Bill Gilbert Natural Resource Specialist	Planning and Environmental Coordination	BS, Biology	24 years, NEPA compliance and land use planning
Tim Sanders Lands & Minerals Staff Supervisor	Management Oversight	MS, Agricultural Economics	22 years, resource management, budget analyst

TABLE 5-3
LIST OF PREPARERS AND REVIEWERS

Name/Title	RMPA/EIS Responsibility	Education	Experience
David Sinclair Budget Officer	Contracting Officer's Representative	BS, Chemistry MS, Geology	28 years, resource management, budget analyst
Gary Stephens Geologist	New Mexico State Office Coordinator	BS, Geology	25 years, minerals resource management, policy, land use planning
J.W. Whitney Program Analyst/Planning	New Mexico State Office Planning and Environmental Coordinator	BS, Botany	32 years, NEPA compliance, policy, land use planning
Dames & Moore			
Cindy Smith Associate	Project Manager	BS, Liberal Arts and Sciences Graduate Studies, Anthropology	23 years, environmental consulting
Leslie Ellwood Biologist	Project Coordinator Special Status Species	MS, Ecology Mammology BA, Biology	12 years, environmental consulting
Jennifer Donahue Environmental Planner	Project Coordinator Lands, Access, Recreation, Special Management Areas, Social and Economic Conditions, Fire Management	MEP, Environmental Planning (pending) BA, Politics	4 years, land use planning, public involvement
Mike Doyle Environmental Planner	Lands, Access, Recreation, Special Management Areas, Fire Management	BS, Environmental Design	7 years, environmental consulting
Kerri Sitler Senior Hydrogeologist	Geology, Minerals, Groundwater	MS, Geology BS, Geology	11 years, environmental consulting
Doreen Hoskins Project Hydrologist	Groundwater	BS, Geology	4 years, environmental consulting
Mike Crouse Senior Hydrologist	Surface Water	BS, Watershed Sciences	15 years, environmental consulting
Pete Pendrak Project Hydrologist	Surface Water	BS, Geology	6 years, hydrology
Bill Polivka Project Hydrogeologist	Soils	BS, Geology	20 years, environmental consulting
A.E. Rogge, Director, Southwest Cultural Resources Services	Cultural Resources	PhD, Anthropology, MA, Anthropology BA, Anthropology	27 years, archaeology
Tom Carr Project Meteorologist	Air Quality	BS, Atmospheric Sciences	10 years, meteorology

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LIST OF PREPARERS AND REVIEWERS

Name/Title	RMPA/EIS Responsibility	Education	Experience
Jeff Fuller Senior Acoustician	Noise	BS, Environmental Health	15 years, noise and acoustics
Loren Hettinger Senior Ecologist	Vegetation, Habitat, Livestock Grazing	PhD, Ecology MS, Biology BS, Biology	27 years, environmental consulting
E. Linwood Smith Director, Biological Resources Study Group	Biological Resources Oversight	PhD, Zoology MS, Zoology BA, Zoology	26 years, environmental consulting
Kim Smith Otero Project Biologist	Wildlife	MEM, Environmental Management BA, Biology	16 years, environmental consulting
Teresa Suter-O'Neil Landscape Architect/Planner	Visual Resources	BSLA, Landscape Architecture	6 years, environmental consulting
David Luhan GIS Manager	GIS Coordinator	MA, Applied Geography, BA, Geography	9 years, GIS
John Wieber GIS Manager	GIS Coordinator	BA, International Affairs and Environmental Studies	3 years, GIS
Jennifer Wennerlund GIS Coordinator	GIS	BS, Geography	11 years, GIS, remote sensing
Peter Martinez GIS Analyst		BS, Geography MA, Geography	8 years, GIS
Shirley Wiley Technical Writer/Editor	Writer/Editor	Business Management Course Work	30 years, editing and document coordination
Keryn Darr Technical Writer/Editor	Writer/Editor	BA, English	4 years, environmental consulting
Jennifer Wallach Graphic Designer	Graphics	BA, Economics	2 years, graphic design