

## **CHAPTER 4: ENVIRONMENTAL CONSEQUENCES**

This chapter describes the predicted consequences, or potential effects, on the environment by implementing the proposed Resource Management Plan Amendment (RMPA) alternatives described in Chapter 2. The current conditions of the potentially affected environmental resources at the proposed RMPA Project Area (Project Area), described in Chapter 3, establish the baseline for impact analyses. Using the information in Chapter 3 and a description of the activities that may occur in the reasonably foreseeable future within the Project Area (see Chapter 2), the types of impacts that could result from implementing the alternatives were identified. To the extent possible, the impact analyses provide quantitative impact estimates from the various alternatives, in order to facilitate comparisons among alternatives during the decision-making process.

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 extend beyond 10 years. Short-term impacts are defined as those changes to the environment during or within a few years of ground-disturbing activities that last 10 years or less. Impacts can vary in significance from no change, or only discernible change, to a full modification or elimination of the environmental condition.

Climate change analyses are comprised of several factors, including greenhouse gasses (GHGs), land use management practices, and the albedo effect. The models necessary to relate climate to specific activities associated with those factors are presently unavailable. As a consequence, impact assessment of effects of specific anthropogenic activities cannot be performed. Additionally, specific levels of significance have not yet been established. When further information on the impacts to climate change in southeastern New Mexico is acquired, such information will be incorporated into the U.S. Bureau of Reclamation's (Reclamation's) National Environmental Policy Act (NEPA) documents as appropriate.

### **4.1 RESOURCES OF CONCERN**

The Project Area resources that could be impacted by implementation of the RMPA include: air quality; soils; cave and karst resources; water quality; vegetation; wildlife; fisheries; threatened, endangered, and other special status species (TES); cultural resources; Indian Trust Assets (ITAs); paleontological resources; social and economic values; Environmental Justice; recreation; rangeland and grazing; energy, minerals, and other extractive resources; transportation and access; and visual resources. This section describes the potential impacts to these resources by alternative.

### **4.1.1 Air Quality**

Surface-disturbing activities and exhaust emissions, chemical odors, and dust from motorized equipment can affect air quality. Current air resource management strategies would continue unchanged in the Project Area. Air quality would be temporarily impacted from exhaust emissions, chemical odors, and fugitive dust from motorized equipment used to construct the access roads and well pads, and by the drilling equipment used to drill the wells. Emissions from machinery and leaks or releases from wells or pipelines could result in localized airshed degradation. Blowouts and accidents during drilling and production could result in well fires and release of gases. The winds that frequent the Project Area generally disperse odors and emissions. The generation of dust and the pollution from motorized equipment would greatly decrease upon completion of the construction and drilling phase for each individual project.

The winds that frequent the southeastern part of New Mexico generally disperse odors but they may increase the particulate matter, especially fine particles. When compared to the baseline of criteria pollutants in the area, there could be temporary increases in chemical odors, dust caused by vehicles traveling to and from the Project Area and from motorized equipment used during construction, drilling, and production of the wells. Potential impacts of development could include increased emissions of volatile organic compounds, which could lead to ground-level ozone increases during drilling, testing, and production activities. However, these increases would be considered de minimis levels under 40 CFR 51.165(f) or under the New Mexico State Plan. Because this is a Class II airshed, the predicted increases in criteria pollutants are allowable, would not require a permit, and would not affect human health or the environment. Impacts to air quality will diminish upon completion of the construction and drilling phases of each well project.

Consumption of oil and gas developed from the proposed wells is expected to produce GHGs. Consumption is driven by a variety of complex interacting factors including energy costs, energy efficiency, availability of other energy sources, economics, demography, and weather or climate. Environmental and economic climate change impacts from commodity consumption are not effects of the proposed planning decisions and thus are not required to be analyzed under NEPA. They are not direct effects, as defined by the Council on Environmental Quality (CEQ), because they do not occur at the same time and place as the proposed action. Neither are they indirect effects because the proposed action and resulting greenhouse gas emissions production are not a proximate cause of the emissions or other factors resulting from consumption. The best scientific data available to the agencies today do not provide the degree of precision needed to draw a causal connection between the oil produced at a particular drilling site, the GHG emissions that may eventually result from the consumption of the refined petroleum product, and a particular impact or effect. Effects from consumption are not only speculative, but beyond the scope of agency authority or control. Therefore, this document does not include analysis of the consumption of resources produced as a result of planning decisions.

***Alternative A: 2003 RMP with Old Oil and Gas Leasing Stipulations and Old Maximum Conservation Pool Elevation***

Direct impacts to air quality include exhaust emissions, chemical odors, and dust from motorized equipment used to construct access roads, well pads, and wells during construction and drilling phases. These direct impacts to air quality would be greatly reduced upon completion of the construction and drilling phases. Impacts to air quality would be affected indirectly by existing surface disturbances, which would create sources of fugitive dust, as well as exhaust emissions from heavy equipment and vehicles working in the Project Area. These short-term effects would not be expected to be significantly adverse. The extent of anticipated new surface disturbances, as well as existing surface disturbances that will be reclaimed, under Alternative A are shown in Table 2-8. From 200 to 300 acres (81 to 121 hectares) of disturbance, and from 160 to 210 acres (65 to 85 hectares) of reclamation, are estimated over the 20-year planning period under Alternative A.

***Alternative B: 2003 RMP with New Oil and Gas Leasing Stipulations and Old Maximum Conservation Pool Elevation***

The types of direct and indirect impacts to air quality resulting from implementation of Alternative B would be the same as those described for Alternative A. Impacts to air quality are directly and indirectly related to surface disturbance and construction equipment emissions. From 100 to 200 acres (41 to 81 hectares) of disturbance, and from 110 to 160 acres (45 to 65 hectares) of reclamation, are estimated over the 20-year planning period under Alternative B.

***Alternative C: 2003 RMP with New Oil and Gas Leasing Stipulations and New Maximum Conservation Pool Elevation***

The types of direct and indirect impacts to air quality resulting from implementation of Alternative C would be the same as those described for Alternative A. Impacts to air quality are directly and indirectly related to surface disturbance and construction equipment emissions. From 300 to 400 acres (121 to 162 hectares) of disturbance, and from 210 to 260 acres (85 to 105 hectares) of reclamation, are estimated over the 20-year planning period under Alternative C.

**4.1.2 Soils**

Actions that make soils more susceptible to erosion, or that impair soil productivity include, but are not limited to: soil disturbing activities that result in soil loss from accelerated wind or water erosion; activities that reduce vegetative cover, thus exposing the soil to erosion processes and reducing the amount of soil organic matter and soil productivity; activities that tend to concentrate surface runoff or steepened hydraulic gradients, thus increasing soil erosion by flowing water; activities that result in sediment loading directly to streams; activities that damage soil structure by compaction or other means; and activities that degrade the physical, chemical, or biological properties of the soil, such as high-intensity burns, contamination by toxic substances, or other means.

***Alternative A: 2003 RMP with Old Oil and Gas Leasing Stipulations and Old Maximum Conservation Pool Elevation***

Direct impacts to soils resulting from oil and gas development and surface-use activities in the Project Area include removal of vegetation, exposure of the soil, mixing of soil horizons, soil compaction, loss of top soil productivity, and susceptibility of the soil to wind and water erosion. Wind erosion would be expected to be a minor contributor to soil erosion with the possible exception of dust generated from vehicle traffic. These impacts could result in increased indirect impacts such as runoff, erosion, and off-site sedimentation. Activities that could cause these types of indirect impacts include construction and operation of well sites, access roads, pipelines, and associated facilities.

Contamination of soils from drilling and production wastes mixed into soils or spilled on the soil surfaces could cause a long-term reduction in site soil productivity. Some of these direct impacts can be reduced or avoided through proper design, construction, and maintenance, and through implementation of Best Management Practices (BMPs). Direct impacts to soil resources from new surface disturbances are shown in Table 2-8. From 200 to 300 acres (81 to 121 hectares) of soil disturbance, and from 160 to 210 acres (65 to 85 hectares) of soil reclamation, are estimated over the 20-year planning period under Alternative A.

***Alternative B: 2003 RMP with New Oil and Gas Leasing Stipulations and Old Maximum Conservation Pool Elevation***

The types of direct and indirect impacts to soils resulting from implementation of Alternative B would be the same as those described for Alternative A. Impacts to soil resources are directly and indirectly related to surface disturbance. From 100 to 200 acres (41 to 81 hectares) of soil disturbance, and from 110 to 160 acres (45 to 65 hectares) of soil reclamation, are estimated over the 20-year planning period under Alternative B.

***Alternative C: 2003 RMP with New Oil and Gas Leasing Stipulations and New Maximum Conservation Pool Elevation***

The types of direct and indirect impacts to soils resulting from implementation of Alternative C would be the same as those described for Alternative A. Impacts to soil resources are directly and indirectly related to surface disturbance. From 300 to 400 acres (121 to 162 hectares) of soil disturbance, and from 210 to 260 acres (85 to 105 hectares) of soil reclamation, are estimated over the 20-year planning period under Alternative C.

**4.1.3 Cave and Karst Resources**

Actions that could affect cave and karst resources include surface disturbance and drilling activities that intercept and/or contaminate these subsurface systems. Spills or leaks from pipelines, tank batteries, reserve pits, and/or down-hole casing can introduce contaminants into the groundwater systems through sinkholes and underground conduits that resurge in the springs that feed the Pecos River, causing contamination of the river environment. Cave and karst

features provide direct conduits leading to groundwater. These conduits can quickly transport surface and subsurface contaminants directly into underground water systems and freshwater aquifers without filtration or biodegradation. In addition, contaminants spilled or leaked into or onto cave and karst zone surfaces and subsurfaces may lead directly to the disruption, displacement, or extermination of cave species and critical biological processes. In extreme or rare cases, a buildup of hydrocarbons in cave systems from surface leaks or spills could potentially cause underground ignitions or asphyxiation of wildlife or humans within the cave.

In cave and karst terrains, rainfall and surface runoff is directly channeled into natural underground water systems and aquifers. Changes in geologic formation integrity, runoff quantity and quality, drainage course, rainfall percolation factors, vegetation, surface contour, and other surface factors can negatively impact cave ecosystems and aquifer recharge processes. Blasting, heavy vibrations, and focusing of surface drainages can lead to slow subsidence, sudden collapse of subsurface voids, and/or cave ecosystem damage.

To mitigate or lessen the probability of impacts associated with the drilling and production of oil and gas wells in karst areas, the guidelines listed in Appendix A-3, *Practices for Oil and Gas Drilling and Production in Cave and Karst Areas*, will be followed. The U.S. Bureau of Land Management (BLM) maintains up to date locations and surveys of known cave and karst features. Projects will be located away from these features whenever possible. Drilling pads, roads, utilities, pipelines, and flowlines will be routed around cave and karst features at an adequate distance to mitigate adverse impacts. Wellbore engineering plans will incorporate required cave and aquifer protection protocols. Highly sensitive cave and karst areas with critical freshwater aquifer recharge concerns may have a number of special surface and subsurface planning and construction requirements based upon the risk of adverse impacts created by a specific location or process.

***Alternative A: 2003 RMP with Old Oil and Gas Leasing Stipulations and Old Maximum Conservation Pool Elevation***

The construction of roads, pipelines, well pads, and utilities can impact bedrock integrity and reroute, impede, focus, or erode natural surface drainage systems. Increased silting and sedimentation from construction can plug downstream sinkholes, caves, springs, and other components of aquifer recharge systems and result in adverse impacts to aquifer quality and cave environments. Any contaminants released into the environment during or after construction can impact aquifers and cave systems. A possibility exists for slow subsidence or sudden surface collapse during construction operations from the collapse of underlying cave passages and voids. This would cause associated safety hazards to the operator and the potential for increased environmental impact. Subsidence processes can be triggered by blasting, intense vibrations, rerouting of surface drainages, focusing of surface drainage, and general surface disturbance.

Blasting fractures in bedrock can serve as direct conduits for transfer of contaminants into cave and groundwater systems. Blasting also creates an expanded volume of rock rubble that cannot

be reclaimed to natural contours, soil condition, or native vegetative condition. As such, surface and subsurface disruptions from blasting procedures can lead to permanent changes in vegetation, rainfall percolation, silting/erosion factors, aquifer recharge, and freshwater quality and can increase the risk of contaminant migration from drilling/production facilities built atop the blast area.

During drilling, previously unknown cave and karst features could be encountered. If a void is encountered while drilling and a loss of circulation occurs, lost drilling fluids can directly contaminate groundwater recharge areas, aquifers, and groundwater quality. Drilling operations can also lead to sudden collapse of underground voids. Cementing operations may plug or alter groundwater flow, potentially reducing the water quantity at springs and water wells. Inadequate subsurface cementing, casing, and cave/aquifer protection measures can lead to the migration of oil, gas, drilling fluids, and produced saltwater into cave systems and freshwater aquifers.

Production facilities such as tank batteries, pump-jacks, compressors, transfer stations, and pipage may fail and allow contaminants to enter caves and freshwater systems. Downhole casing and cementing failures can allow migration of fluids and/or gas between formations and aquifers. Facilities may also be subject to slow subsidence or sudden collapse of the underlying bedrock.

Under Alternative A, Reclamation's general stipulations for constructing roads and regulating drilling operations in cave and karst areas would continue to be used (see Appendix A). Specific stipulations for mineral exploration and production operations would be adopted to protect cave and karst resources, including a 660-foot (200-meter) No-Surface Occupancy Zone buffer around identified cave entrances. These measures would help protect cave and karst resources, such as groundwater quality, troglobitic species, and wildlife habitat, from adverse impacts related to mineral development activities. Direct impacts from new surface disturbances are shown in Table 2-8. From 200 to 300 acres (81 to 121 hectares) of surface disturbance, and from 160 to 210 acres (65 to 85 hectares) of surface reclamation, are estimated over the 20-year planning period under Alternative A.

***Alternative B: 2003 RMP with New Oil and Gas Leasing Stipulations and Old Maximum Conservation Pool Elevation***

The types of direct and indirect impacts to cave and karst resources resulting from implementation of Alternative B would be the same as those described for Alternative A. From 100 to 200 acres (41 to 81 hectares) of surface disturbance, and from 110 to 160 acres (45 to 65 hectares) of surface reclamation, are estimated over the 20-year planning period under Alternative B.

***Alternative C: 2003 RMP with New Oil and Gas Leasing Stipulations and New Maximum Conservation Pool Elevation***

The types of direct and indirect impacts to cave and karst resources resulting from implementation of Alternative C would be the same as those described for Alternative A. From 300 to 400 acres (121 to 162 hectares) of surface disturbance, and from 210 to 260 acres (85 to 105 hectares) of surface reclamation, are estimated over the 20-year planning period under Alternative C.

**4.1.4 Water Quality**

Surface disturbance in the Project Area may result in degradation of surface water and groundwater quality resulting from non-point source pollution, increased soil losses, increased erosion, and reduced percolation of water into the ground. Development of oil and gas leases in these areas could lead to increased sedimentation and discharge of pollutants into the reservoirs or river.

***Alternative A: 2003 RMP with Old Oil and Gas Leasing Stipulations and Old Maximum Conservation Pool Elevation***

Potential direct impacts that could occur from oil and gas development and surface-use activities include increased surface water runoff and off-site sedimentation brought about by soil disturbance. These impacts include increased salt loading and water quality impairment of surface waters, channel morphology changes from road and pipeline crossings, and contamination of surface waters by produced water. The magnitude of these impacts to water quality would depend on the proximity of the disturbance to the drainage channel, slope aspect and gradient, degree and area of soil disturbance, soil character, duration and time within which construction activities would occur, and the timely implementation and success or failure of mitigation measures.

Direct impacts to water quality would likely be greatest shortly after the start of construction activities and would likely decrease in time from natural stabilization and reclamation efforts. Construction activities would occur over a relatively short period; therefore, the majority of the disturbance would be intense but short lived.

Petroleum products and other chemicals that are accidentally spilled could result in surface and groundwater contamination. Similarly, possible leaks from reserve and evaporation pits could degrade surface and groundwater quality. Authorization of individually proposed projects would require full compliance with Reclamation directives and stipulations that relate to surface and groundwater protection.

Specific impacts to water quality are indirectly related to surface disturbances resulting from oil and gas development activities. New surface disturbances anticipated from implementation of Alternative A are shown in Table 2-8. From 200 to 300 acres (81 to 121 hectares) of surface

disturbance, and from 160 to 210 acres (65 to 85 hectares) of surface reclamation, are anticipated to occur over the 20-year planning period under Alternative A.

***Alternative B: 2003 RMP with New Oil and Gas Leasing Stipulations and Old Maximum Conservation Pool Elevation***

The types of impacts to water quality resulting from implementation of Alternative B would be the same as those described for Alternative A. From 100 to 200 acres (41 to 81 hectares) of surface disturbance, and from 110 to 160 acres (45 to 65 hectares) of surface reclamation, are anticipated to occur over the 20-year planning period under the Alternative B.

***Alternative C: 2003 RMP with New Oil and Gas Leasing Stipulations and New Maximum Conservation Pool Elevation***

The types of impacts to water quality resulting from implementation of Alternative C would be the same as those described for Alternative A. From 300 to 400 acres (121 to 162 hectares) of surface disturbance, and from 210 to 260 acres (85 to 105 hectares) of surface reclamation, are anticipated to occur over the 20-year planning period under Alternative C.

**4.1.5 Vegetation**

Natural forces or land uses that cause surface disturbance can reduce the cover or change the composition of the vegetative resource. As more cover is lost and/or less desirable species increase in composition, the likelihood of negative effects is increased.

***Alternative A: 2003 RMP with Old Oil and Gas Leasing Stipulations and Old Maximum Conservation Pool Elevation***

Direct negative impacts to vegetation include the loss of plant cover from energy exploration and development activities. These impacts can be minimized or negated by proper design of well pads and access roads, and implementation of appropriate reclamation techniques.

Beneficial impacts would generally be accomplished through restoration of existing disturbed areas that is designed to facilitate the growth of desired plant community populations. This would result in an improved water cycle, reduced erosion potential, and better habitat for wildlife and livestock use. Short-term negative impacts to livestock use within the Project Area would include taking a portion of the allotment out of use while oil and gas development activities occur, and until vegetation is allowed to recover in disturbed areas.

As shown in Table 2-8, over the 20-year life of the RMPA, approximately 200 to 300 acres (81 to 121 hectares) of vegetation could be disturbed by oil and gas development construction activities within the Project Area under Alternative A. Of that amount, approximately 160 to 210 acres (65 to 85 hectares) could be reclaimed and stabilized during initial rehabilitation and as plugged and abandoned wells are reclaimed. This leaves a possible 40 to 90 acres (16 to 36 hectares) of net vegetative disturbance with implementation of Alternative A.



***Alternative B: 2003 RMP with New Oil and Gas Leasing Stipulations and Old Maximum Conservation Pool Elevation***

The types of impacts to vegetation resulting from implementation of Alternative B would be the same as those described for Alternative A. As shown in Table 2-8, over the 20-year life of the RMPA, approximately 100 to 200 acres (41 to 81 hectares) of vegetation could be disturbed by oil and gas development construction activities within the Project Area under Alternative B. Of that amount, approximately 110 to 160 acres (45 to 65 hectares) could be reclaimed and stabilized during initial rehabilitation and as plugged and abandoned wells are reclaimed. This leaves a possible 0 to 40 acres (0 to 16 hectares) of net vegetative disturbance with implementation of Alternative B.

***Alternative C: 2003 RMP with New Oil and Gas Leasing Stipulations and New Maximum Conservation Pool Elevation***

The types of impacts to vegetation resulting from implementation of Alternative C would be the same as those described for Alternative A. As shown in Table 2-8, over the 20-year life of the RMPA, approximately 300 to 400 acres (121 to 162 hectares) of vegetation could be disturbed by oil and gas development construction activities within the Project Area under Alternative C. Of that amount, approximately 210 to 260 acres (85 to 105 hectares) could be reclaimed and stabilized during initial rehabilitation and as plugged and abandoned wells are reclaimed. This leaves a possible 90 to 140 acres (36 to 57 hectares) of net vegetative disturbance with implementation of Alternative C.

**4.1.6 Wildlife**

Generally, the quality and condition of wildlife habitat will largely dictate the abundance and distribution of wildlife within the Project Area. It is anticipated that the majority of impacts to wildlife resulting from implementation of each of the alternatives would result from displacement of wildlife through temporary disturbances or permanent destruction of habitat. Other impacts resulting from oil and gas development and operations could lead to reduced reproductive success and increased stress on specific species.

***Alternative A: 2003 RMP with Old Oil and Gas Leasing Stipulations and Old Maximum Conservation Pool Elevation***

Oil and gas development would initially result in the direct loss of wildlife habitat. Based on the 20-year projection, construction of well pads, roads, and pipeline operations could have direct effects on 200 to 300 acres (81 to 121 hectares) within the Project Area. Any new disturbances could incrementally increase the current habitat fragmentation effect within the Project Area resulting from existing roads, livestock management, and past oil and gas development activities.

These activities would cause direct disturbance and/or displacement of ground-dwelling animals, disturbance, and loss of habitat structures such as shrubs with nests, habitat loss through erosion, and changes in food and cover relationships caused by vegetative change and increased erosion.

Animal species composition and densities could change within and adjacent to any mineral development activity. Changes in the animal community and habitat structure change in plant species composition and density would persist until habitat within the development areas is restored to near pre-disturbance conditions. However, re-vegetation of disturbed sites is typically very slow in this arid part of the United States.

The indirect disturbance associated with human activities to wildlife species for non-producing wells (approximately 60 acres or 24 hectares) would be short-term, not extending beyond the 1 to 3 months required to complete the drilling pad/road and would largely disappear after abandonment and reclamation. However, if oil and gas reserves were discovered, the indirect wildlife disturbance would continue long term around the drilling pads, along the roads, and pipelines.

A further effect on wildlife populations could be increased disturbance as a result of access by industry personnel and by the public at large using oil and gas development roads. This access would increase the overall disturbance within the Project Area and potentially create additional effects including shooting, poaching, collisions with vehicles, and accidental release of pollutants. Wildlife abundance and diversity would be expected to decrease.

Impacts from typical geophysical exploration, oil and gas drilling, and fluid minerals operations would continue to displace wildlife from the area of disturbance during active operations. Mobile wildlife species would return once operations were complete and disturbed areas were reclaimed. Creation of new roads from repeated vehicular travel during oil and gas exploration and development, and possible continued use by the public for recreation purposes, may reduce the area of undisturbed wildlife habitat. Increased disturbance and human access could directly impact important habitat features such as nesting areas.

Under Alternative A, existing special lease stipulations would remain in effect and oil and gas leases could continue with the No Surface Occupancy (NSO) stipulation applied to 25,808 acres (10,445 hectares), leaving 13,704 acres (5,546 hectares) of land subject to standard lease stipulations. The abundance and diversity of wildlife known to occur within the Project Area would likely be impacted as additional habitat is developed and reproductive success could decrease as exposure to disturbances including noise and human activity continue.

***Birds***

Under Alternative A, current stipulations would prohibit surface occupancy within 660 horizontal feet (200 horizontal meters) of or below the maximum conservation pool elevation of 3,271 feet (997 meters) and storage facilities would not be permitted below an elevation of 3,286 feet (1,002 meters) at Brantley Reservoir. At Avalon Reservoir surface occupancy would be prohibited within 660 horizontal feet (200 horizontal meters) of or below maximum conservation pool elevation of 3,190 feet (972 meters) and storage facilities would be prohibited below an

elevation of 3,200 feet (975 meters). Alternative A does allow for surface occupancy within the 100 year floodplain above the maximum conservation pool elevation of 3,271 feet (997 meters).

Although current stipulations prohibit surface occupancy below the maximum conservation pool elevation, oil and gas development activities within the 100 year floodplain would further restrict the amount of available riparian-wetland vegetation communities in these areas that currently provide resources such as forage (e.g., fish, macroinvertebrates, emergent vegetation) for large numbers of waterfowl and shorebirds. In addition to forage, these areas also provide loafing sites, cover, nesting material, and secluded nest sites for many of the species known to occur within the Project Area. To avoid direct impact to migratory birds protected by the Migratory Bird Treaty Act (16 USC 703, et seq.), clearing and grubbing of woody vegetation would be scheduled between August 15 and April 15, outside of the normal breeding season for many birds. Should vegetation removal and construction take place between April 15 and August 15, preconstruction nesting bird surveys would be conducted to identify any breeding activity that could be disturbed. This type of precaution would help to minimize nest abandonment or nest predation, which can frequently be attributed to human disturbance.

Although riparian-wetland vegetation communities found along the Pecos River, Brantley and Avalon Reservoirs represent only 20 percent of the total available wildlife habitat, they are responsible for much of the avian diversity found within the Project Area. Additionally, riparian-wetland communities serve to stabilize banks while preventing erosion and excessive sedimentation, and intercept pollutants that may have originated from the watershed (Cooperrider et al. 1986). Development of oil and gas leases in these areas could lead to increased sedimentation and discharge of pollutants into the reservoir, which would result in a decline of available food resources such as aquatic insects and fish.

### ***Herpetofauna***

Under Alternative A, reptiles and amphibians would likely be directly impacted because existing stipulations allow for surface occupancy within the 100-year floodplain (between elevations 3,271 feet [997 meters] and 3,286 feet [1,002 meters]). Impacts would likely result from a direct loss of available habitat and mortality resulting from vehicular traffic and accidental discharge of contaminants. Loss of habitat could also result in the depletion of available food resources. Because amphibians respire through their skin, they are extremely susceptible to the effects of poor air and water quality. In upland communities, reptiles would likely be impacted similarly by this alternative through loss of habitat resulting in displacement and/or direct mortality resulting from vehicular activity during periods when reptiles are most active (e.g., at night, after rain events).

### ***Mammals***

Bats and other small mammals would likely be directly impacted because existing stipulations allow for surface occupancy between the elevations of 3,271 feet (997 meters) and 3,286 feet (1,002 meters), which represents the 100-year floodplain at Brantley Reservoir. As such, many

aquatic, riparian, and wetland communities that provide cover, foraging areas, etc., for small mammals could be lost or severely degraded. The potential release of pollutants and increases in sedimentation would likely decrease the abundance and diversity of aquatic insects, which serve as the primary food for bats of the area.

***Alternative B: 2003 RMP with New Oil and Gas Leasing Stipulations and Old Maximum Conservation Pool Elevation***

The amount and severity of direct and indirect impacts to wildlife habitat as a result of oil and gas development activities under Alternative B would be considerably less than those described for Alternative A because Alternative B prohibits surface occupancy below the 100-year floodplain elevations at Brantley Reservoir (i.e., elevation 3,283 feet [1,001 meters]) and Avalon Reservoir (i.e., elevation 3,200 feet [975 meters]), or within a buffer of 660 horizontal feet (200 horizontal meters) above these elevations. Under Alternative B, a total of 40,478 acres (16,382 hectares) would be classified as NSO and 8,057 acres (3,261 hectares) would be classified as open to oil and gas development using standard leasing stipulations.

Implementation of the proposed special lease stipulations found in Section 2.3.2 would provide a flexible platform to minimize direct habitat loss and fragmentation. These stipulations would minimize habitat fragmentation, limit surface disturbance, and expedite habitat restoration. However, these stipulations do not restrict or otherwise regulate other forms of human disturbance within the Project Area. As such, disturbances resulting from such things as recreational activities and agricultural practices would likely continue to limit or further degrade the overall quality of available wildlife habitat within the Project Area.

***Birds***

Avian communities within the Project Area would experience fewer impacts under Alternative B. Total acreage classified as NSO would increase to 40,478 acres (16,382 hectares) and only 8,057 acres (3,261 hectares) would be subject to standard lease stipulations. Under Alternative B, fewer total acres of avian habitat would be lost than would be lost under Alternative A.

Under Alternative B, there would be a NSO designation within 660 horizontal feet (200 horizontal meters) of the 100-year floodplain at Brantley and Avalon Reservoirs. Other stipulations include NSO within 660 horizontal feet (200 horizontal meters) of the normal high-water line of streams, rivers, and arroyos. This would protect existing riparian-wetland communities, which serve to help reduce sedimentation and pollutant discharges into both reservoirs. Additionally, the protection of these communities would help to promote an abundance and diversity of avian species, while providing food resource, nesting areas, etc. This alternative would also protect sand bars and unvegetated shorelines, which are used by the least tern during the breeding season. However, nesting shorebirds would still be subjected to rapid changes in water elevation, which would contribute to the overall lack of nest success.

Although no Critical habitat has been designated for threatened or endangered species within the Project Area, Alternative B does stipulate that there will be NSO in areas designated as Critical or Occupied habitat for threatened or endangered species, which further protects sensitive avian species (e.g., southwestern willow flycatcher [*Empidonax traillii extimus*]) that may eventually be found within the Project Area.

### **Herpetofauna**

Alternative B would have fewer impacts to amphibians than Alternatives A and C because of the special lease stipulations defined under Alternative B. Proposed NSO areas would be designated within the 100-year floodplain or within 660 horizontal feet (200 meters) of this elevation and the normal high-water line of streams, rivers, and arroyos at Brantley and Avalon Reservoirs. Under Alternative B, riparian-wetland communities would be protected and would continue to provide the necessary habitat and resources for amphibians to persist within the Project Area. Additionally, riparian-wetland communities would serve as buffers against sedimentation and pollutant discharges into the reservoirs and the Pecos River, which would also serve to benefit the amphibian populations within the Project Area. Despite these stipulations, reptiles and amphibians would likely still be impacted by such things as recreational activities and agricultural practices. Up-gradient oil and gas developments could result in accidental release of contaminants that could result in the direct mortality of amphibians in particular because they respire through their skin and are extremely sensitive to changes in air and water quality.

### **Mammals**

All mammal species would benefit from implementation of Alternative B, compared to implementation of Alternative A, because Alternative B greatly reduces the amount of surface area that could be disturbed by oil and gas development activities within the Project Area.

### **Alternative C: 2003 RMP with New Oil and Gas Leasing Stipulations and New Maximum Conservation Pool Elevation**

Although Alternative C strives to minimize soil erosion, protect wildlife, special status species, and water quality in a manner similar to Alternative B, the maximum conservation pool elevation of Brantley Reservoir would be revised from 3,271 feet (997 meters) to 3,263 feet (995 meters) and the NSO stipulation would be applied below that elevation. As a result, only 19,155 acres (7,752 hectares) would be designated as NSO and 10,324 acres (4,178 hectares) would be designated as open to oil and gas development using standard leasing stipulations. Based on total acres of land available for oil and gas development (see Table 2-3), Alternative C allows for the greatest potential amount of wildlife habitat degradation.

### **Birds**

Avian communities within the Project Area would benefit to a lesser extent under Alternative C because more total acres of avian habitat would potentially be lost than under Alternatives A or B. Much of the available nesting and brood rearing habitat for shorebirds would be open to oil and gas development if Alternative C were implemented.

***Herpetofauna***

Of the herpetofauna found within the Project Area, amphibians and reptiles would likely be impacted to a greater extent from implementation of Alternative C as compared to Alternatives A or B. Both reptiles and amphibians alike would be impacted by a direct loss of habitat and direct mortality resulting from vehicular traffic. In addition, amphibians would likely suffer direct mortality from decreases in air or water quality because they respire through their skin and are extremely sensitive to environmental changes.

***Mammals***

Bats and other small mammals would likely be directly impacted to a greater extent under Alternative C because it allows for the most acreage of available habitat to be disturbed by oil and gas development activities. As such, many aquatic, riparian, and wetland communities that provide cover, foraging areas, etc. for small mammals could be lost or severely degraded.

**4.1.7 Fisheries**

Actions that have the potential to impact the Project Area fisheries include ground disturbances from oil and gas site development and the associated infrastructure. In general, pollution of freshwaters by oil and gas products in localized areas is known to be harmful and can cause mortality to aquatic organisms including invertebrates and fish. Direct effects of oil and gas development and surface-use activities include the removal of vegetation, soil exposure, and increased soil susceptibility to erosion. In turn, these effects can lead to increased stormwater runoff, soil erosion, off-site sedimentation, increased salt loading, water-quality impairments to surface waters, and ultimately, to the decline in fish habitat quality. In addition, soil disturbances can also lead to changes in stream channel morphology from road and pipeline crossings, as well as to the contamination of surface waters by produced water. Activities that could cause direct or indirect impacts include the use of existing drill pads and access roads, and the construction and operation of new well sites, access roads, gas pipelines, and facilities.

For all alternatives, the extent of potential impacts to water resources, and thus to fish habitat would depend on the proximity of the disturbance to the drainage channel, the slope of the disturbed areas, the size of the disturbed area, the duration and timing of construction activities, and the implementation of lease stipulations and mitigation measures. In addition, oil, oil products, or other chemicals that are accidentally spilled could also contaminate ground and surface waters, and thus impact fish habitat.

One of the greatest concerns of present and future oil and gas exploration activities within the Project Area is the potential for introduction of hazardous materials into adjacent waters and the impact of pollution to aquatic species and their habitat. As noted in Section 2.6, the reasonable foreseeable development (RFD) and associated amount of surface disturbance anticipated for the Project Area for the next 20 years varies by alternative, and the differences among them are based on modifications to existing management prescriptions. The standard lease terms and

conditions include many stipulations designed to contain all drilling fluids and waste byproducts produced in the drilling process on site and to prevent escape of any fluids from the site. However, accidental spills that may enter an adjacent waterway have the potential to affect water quality, fish habitat, and Project Area fisheries. Contaminants associated with oil and gas well drilling and production could potentially lead to reductions in habitat quality, increase the bioaccumulation of heavy metals in fish species, and the direct loss of fish.

In general, while the nature and types of impact to water resources, fish, and fish habitat would be consistent across project alternatives, the extent of such impacts would vary depending on the special lease stipulations associated with each alternative. The potential for detrimental effects on fish habitat is likely to be greater under Alternative A and Alternative C than under Alternative B because of differences in the degree of protection to aquatic resources provided by standard and special lease stipulations. Under Alternative B, beneficial impacts on Project Area fisheries and fish habitat could result from further restrictions on Surface Occupancy along areas adjacent to Brantley and Avalon Reservoirs and along sections of the Pecos River, as well as from other special lease stipulations. The total areas of NSO under Alternative A, Alternative B, and Alternative C, are 25,808 acres (10,445 hectares), 40,478 acres (16,382 hectares), and 19,155 acres (7,752 hectares), respectively. Consequently, the potential for detrimental impacts to water resources and fish habitat is reduced under Alternative B, when compared to Alternative A and Alternative C. Under all alternatives, actual positive effects on fisheries at Brantley and Avalon Reservoirs are not anticipated because of the poor condition of the fishery in both reservoirs.

***Alternative A: 2003 RMP with Old Oil and Gas Leasing Stipulations and Old Maximum Conservation Pool Elevation***

It is anticipated that the extent of potential impacts of oil and gas exploration and development on the quality of fish habitat would be greater under Alternative A than under Alternative B. Potential impacts to fish habitat quality could result from contaminants (e.g., drilling fluids, engine oils, produced natural gas liquids, oil and/or oil products) entering water bodies within the Project Area during flood events, through groundwater, and in the event that an accidental spill is not properly contained and cleaned up. The potential contamination of water resources resulting from oil and gas exploration activities is likely to reduce the quality of fish habitat, which in turn could impact reproduction success and recruitment of fish species. Although standard oil and gas lease stipulations include implementing actions that would contain drilling fluids and waste, the potential exists for accidental spills to enter adjacent water bodies and affect fish habitat.

***Alternative B: 2003 RMP with New Oil and Gas Leasing Stipulations and Old Maximum Conservation Pool Elevation***

Potential impacts on Project Area fisheries under the Alternative B are similar to those described above under Alternative A. However, the inclusion of special lease stipulations under Alternative B that are designed to protect water quality and other resources would offer greater

protection to riparian and shoreline vegetation, water resources, and ultimately fish habitat. Fish habitat in Brantley and Avalon Reservoirs and along sections of the Pecos River within the Project Area would benefit from the inclusion of a 660 horizontal feet (200 horizontal meters) buffer of NSO area from the normal high-water line of all streams, rivers, and arroyos. This stipulation is valuable for the prevention and/or reduction of potential contamination that could influence fish habitat quality. These buffer areas would provide extra measures of protection against high-water runoff that could inundate structures located at or below this elevation and would also provide opportunities for the lessee to recapture or contain escaped materials before they reach the water.

***Alternative C: 2003 RMP with New Oil and Gas Leasing Stipulations and New Maximum Conservation Pool Elevation***

General impacts to fisheries resulting from implementation of Alternative C would be similar to those described for Alternative A and Alternative B. However, this alternative is the least restrictive in terms of surface occupancy area and would allow for the development of a substantially larger surface area (13,527 acres [5,474 hectares]) under surface occupancy on a case-by-case basis stipulation. The NSO special lease stipulation under this alternative would be applied at water surface elevations below 3,263 feet (995 meters) and 3,190 feet (972 meters) at Brantley and Avalon Reservoirs, respectively. Overall, the potential for detrimental effects on fish habitat is likely to be greater under Alternative C given the reduced degree of protection to aquatic resources provided by its special lease stipulations.

**4.1.8 Threatened, Endangered, and Other Special Status Species**

A Biological Assessment (BA) was prepared and submitted to the United States Fish and Wildlife Service (USFWS) as required to provide detailed analyses of all Federally listed (threatened or endangered) species that may be affected. All anticipated environmental effects to threatened or endangered species have been included in the Final BA (Reclamation 2011).

The 20-year projection for RFD includes the drilling of 20 to 80 wells on Reclamation lands within the Project Area, depending upon the alternative that is implemented. Activities associated with oil and gas well exploration and production that may affect these four species include the development and use of access roads, well pads, and pipelines. Under the various alternatives being considered, it is anticipated that between 100 and 400 acres (41 to 162 hectares) of surface area would be directly impacted over a 20-year period (see Table 2-8).

***Alternative A: 2003 RMP with Old Oil and Gas Leasing Stipulations and Old Maximum Conservation Pool Elevation***

Impacts on threatened or endangered species habitat, both existing and future, would continue under Alternative A. Based on the surface use and occupancy requirements currently in place on Reclamation lands, there are no specific requirements for oil and gas development to avoid occupied habitat for these species. Oil and gas development would initially result in the direct



loss of wildlife habitat, including threatened or endangered species habitat. Based on the 20-year projection, construction of well pads, roads, and pipeline operations would have direct effects on 200 to 300 acres (81 to 121 hectares) within the Project Area. Any new disturbances would incrementally add to the current habitat fragmentation effect within the Project Area resulting from existing roads, livestock management, water operations, recreational activities, and past oil and gas development activities. Direct and indirect impacts to threatened or endangered species habitat would be similar to those described in the wildlife section.

Under Alternative A, existing special lease stipulations would remain in effect and oil and gas leases could continue with the NSO stipulation applied to 25,808 acres (10,445 hectares), leaving 13,704 acres (5,546 hectares) of land subject to standard lease stipulations.

***Least Tern***

Direct effects of oil and gas development and surface-use activities including the removal of vegetation, soil exposure, and increased soil susceptibility to erosion all have the potential of having detrimental effects on the least tern's prey base and can potentially lead to indirect impacts that include increased runoff, erosion, off-site sedimentation, increased salt loading and water-quality impairments to surface waters. Actions that have the potential of negatively impacting the least tern include any action that would reduce the abundance of fish in the reservoir because least terns are known as a piscivorous species. In addition, soil disturbances can potentially lead to changes in channel morphology from road and pipeline crossings, as well as to the contamination of surface waters by produced water. Activities that could cause these direct or indirect impacts include the use of existing trails and roads, and the construction and operation of well sites, access roads, gas pipelines, and associated facilities. The extent of these potential impacts to water resources, and thus to habitat used by the least tern's prey base, would depend on the proximity of the disturbance to the drainage channel, the slope of the disturbed areas, the size of the disturbed area, the duration and timing of construction activities, and the implementation of mitigation measures.

One of the greatest concerns of oil and gas exploration activities within the Project Area is the potential for introduction of contaminants into aquatic systems, which would impact aquatic species that serve as the least tern's prey base. Leaks and breaks on lines that cross ravines and the Pecos River would likely have the greatest impacts to aquatic species. The standard lease agreement has many stipulations designed to contain all drilling fluids and waste byproducts produced in the drilling process on site and to prevent escape of any fluids from the site. However, accidental spills that may enter an adjacent waterway have the potential to affect aquatic resources.

Contaminants associated with the oil and gas well drilling and production process have the potential to enter the Pecos River. Drilling fluids, engine oils, produced natural gas liquids, oil and/or oil products could be potentially transported into the Pecos River during a flood event or through the groundwater if any spill events are not properly cleaned up. This type of

contamination could potentially result in a direct loss of fish and increase the chronic bioaccumulation of heavy metals in fish species, which are eaten by piscivorous avian species including the least tern. The accumulation of contaminants including heavy metals and pesticides, etc. is known to have a negative effect on the reproductive success of many avian species (Thompson et al. 1997). However, in addition to stipulations that reduce potential impacts to water resources and aquatic biota, oil and gas wells and storage facilities would include safety measures to ensure operations that minimize the potential for habitat pollution in the form of oil leaks or spills. Such measures would include the replacement of worn or out-of-date materials and equipment, construction of spill-containment structures, removal of contaminated materials, and protection of well sites (see Appendix A).

Existing special lease stipulations would preclude Surface Occupancy within the maximum conservation pool elevation of both reservoirs. These stipulations would prevent the development of oil and gas wells within Project Area least tern habitat. Limits on the spatial area and locales where oil and gas exploration and development can occur, coupled the other constraints placed by special lease stipulations and conditions of approval, would provide adequate protection for the least tern and its habitat.

#### ***Southwestern Willow Flycatcher***

Given the limited amount of suitable flycatcher habitat within the Project Area, negative impacts to flycatchers are not anticipated. However, removal of woody riparian vegetation, including salt cedar, for development of oil and gas leases, recreational access, etc. would further restrict the distribution of the species should they be found within the Project Area. Although one of the greatest concerns of oil and gas exploration within the Project Area is the potential for introduction of contaminants into aquatic systems, such problems are not likely to have a negative impact upon the southwestern willow flycatcher because the amount of potentially suitable habitat within the Project Area is very limited and no flycatchers have been found to date (R. Doster 2008, pers. comm.).

Leaks and breaks on the lines that cross ravines and the Pecos River would have the greatest impacts to aquatic species. The standard lease agreement (see Appendix A) has many stipulations designed to contain all drilling fluids and waste byproducts produced in the drilling process on site and to prevent escape of any fluids from the site. However, accidental spills that may enter an adjacent waterway have the potential to affect riparian and aquatic resources. Potential impacts from oil and gas exploration and development on the flycatcher or its potentially suitable habitat could occur. However, limits on the spatial area and locales where oil and gas exploration and development can occur, coupled with other constraints placed by special lease stipulations, would provide adequate protection for the flycatcher and its habitat.

#### ***Gypsum Wild-Buckwheat***

Direct negative impacts to the gypsum wild-buckwheat would include development of mineral, oil, and gas leases in areas where the species is either known to exist or could potentially be

found. These areas include habitat where the soils consist primarily of gypsum that eroded from nearby outcroppings. Other activities including recreation would also have negative effects on the species by compacting the soils, destroying live plants, etc.

Because gypsum wild-buckwheat can be found only in steep upland areas away from waterways that could be contaminated by discharge from oil and gas exploration, it is unlikely that the species would be negatively impacted by such discharges. Critical habitat for this species was designated on BLM lands adjacent to the Project Area in 1981. However, without a stipulation for NSO within occupied habitat, there is the potential for oil and gas development activities to directly impact existing populations of gypsum wild-buckwheat within the Project Area under Alternative A.

***Pecos Bluntnose Shiner***

Direct effects of oil and gas development and surface-use activities include the removal of vegetation, soil exposure, and increased soil susceptibility to erosion. In turn, these effects can lead to indirect impacts that include increased runoff, erosion, off-site sedimentation, increased salt loading and water-quality impairments to surface waters. Soil disturbances can also lead to changes in channel morphology caused by road and pipeline crossings, as well as to the contamination of surface waters by produced water. Activities that could cause these direct or indirect impacts include the use of existing trails and roads, and the construction and operation of well sites, access roads, gas pipelines, and facilities (BLM 2007). As noted in BLM (2007), the extent of potential impacts to water resources, and consequently to habitat potentially used by displaced bluntnose shiner, would depend on the proximity of the disturbance to the drainage channel, the slope of the disturbed areas, the size of the disturbed area, the duration and timing of construction activities, and the implementation of mitigation measures.

One of the greatest concerns of oil and gas exploration activities within the Project Area is the potential for introduction of contaminants into adjacent waters and the subsequent impact of pollution to aquatic species. Leaks and breaks on lines that cross ravines and the Pecos River would likely have the greatest impacts to aquatic species. The standard lease agreement (see Appendix A) has many stipulations designed to contain all drilling fluids and waste byproducts produced in the drilling process on site and to prevent escape of any fluids from the site. However, accidental spills that may enter an adjacent waterway have the potential to affect aquatic resources.

Oil, oil products, or other chemicals accidentally spilled could contaminate ground and surface waters and could impact habitats where early life stages of bluntnose shiner occur. Road construction can be deleterious to fish and other aquatic life forms as it can potentially alter the hydrology of watersheds. Roads increase surface runoff, sedimentation and debris avalanches, destroy riparian vegetation and often require in-stream structures, such as culverts and bridges, which remove aquatic habitat and/or function as barriers to fish movement (Furniss et al. 1991).

A feature of the landscape capable of buffering and enhancing the protection of water quality and aquatic life is dense vegetation in the riparian zone. Riparian areas act as filters that reduce the concentration of contaminants that enter the watershed and move toward the waterway. However, streambanks along the Pecos River have been highly modified and native riparian vegetation is virtually non-existent. Much of the landscape along the Pecos River and its tributaries is composed of sparse vegetation and groundcover that may slow down the movement of contaminants toward the water is very limited. While riparian vegetation has not been recognized to be critical for the survival of the bluntnose shiner (USFWS 1987), the scarcity or lack of a functional riparian buffer would allow accidental spills to enter waterways and affect the aquatic life in adjacent areas.

Under Alternative A, the area designated as NSO amounts to 25,808 acres (10,445 hectares). Well data provided by the BLM indicated that a total of 330 wells have been drilled within the Project Area. In relation to the area of NSO, 91 wells (of which 30 are active) are located at or below the current maximum conservation pool elevation at Brantley Reservoir (elevation 3,271 feet or 997 meters), and another 21 wells (of which 8 are active) are located within the 100-year floodplain. Only one active well is located in the vicinity of the northern portion of the reservoir near the inflow of the Pecos River. Currently, no active wells occur within 1 mile (1.6 kilometers) of the Pecos River channel 5 miles (8 kilometers) upstream of its inflow into Brantley Reservoir. Further, none of the 48 potential new gas well locations would occur in this area.

Contaminants associated with the oil and gas well drilling and production process have the potential to enter the Pecos River. Drilling fluids, engine oils, produced natural gas liquids, oil and/or oil products could be potentially transported into the Pecos River during a flood event or through the groundwater if any spill events are not properly cleaned up. This type of contamination could result in a direct loss of fish, reduced habitat quality, and/or increased chronic bioaccumulation of heavy metals in fish species. However, in addition to stipulations that reduce potential impacts to water resources and aquatic biota, oil and gas wells and storage facilities would include safety measures to ensure operations that minimize the potential for habitat pollution in the form of oil leaks or spills. Such measures would include the replacement of worn or out-of-date materials and equipment, construction of spill containment structures, removal of contaminated materials, and protection of well sites (see Section 4.1.16). These are standard operation procedures and have no additional impact.

The Project Area is located below the lower Critical habitat boundary for the bluntnose shiner. The limited number of active wells in the vicinity of the northern portion of the reservoir or near its headwaters, coupled with the existing special lease stipulations, would reduce the possibility of contamination of the reservoir and potential negative effects on displaced young bluntnose shiner that may occur seasonally in the headwaters of Brantley Reservoir. Overall, while Alternative A would allow for minerals leasing and development, limits on the spatial area and locales where oil and gas exploration and development can occur would provide adequate

protection for bluntnose shiner that may occur seasonally in the inflow area of Brantley Reservoir.

***Alternative B: 2003 RMP with New Oil and Gas Leasing Stipulations and Old Maximum Conservation Pool Elevation***

Potential impacts to threatened or endangered species under Alternative B would be similar to those described under Alternative A. However, threatened or endangered species within the Project Area would be least affected under Alternative B. Total acreage classified as NSO would increase to 40,478 acres (16,382 hectares) and only 8,057 acres (3,261 hectares) would be subject to standard lease stipulations. Based on the 20-year projection, construction of well pads, roads, and pipeline operations would have direct effects between 100 to 200 acres (41 to 81 hectares) within the Project Area. Any new disturbances would incrementally increase the current habitat fragmentation effect within the Project Area resulting from existing roads, livestock management, and past oil and gas activities. The types of direct and indirect impacts to threatened or endangered species habitat would be similar to those described under Alternative A.

***Least Tern***

The inclusion of a 660 horizontal feet (200 meter) buffer of NSO from the 100-year floodplain of Brantley and Avalon Reservoirs and the normal high-water line of all streams, rivers, and arroyos, is a valuable step in preventing and/or minimizing the potential of contamination of these waterways and any subsequent impacts on aquatic species. These buffer areas provide an extra measure of protection against extremely high-water runoff that could inundate structures that are located at or below this elevation level and also provide an opportunity for the lessee to recapture or contain escaped materials before they reach the water. Consequently, the potential pollution of waterways and impacts to aquatic species that serve as the least tern's prey base are unlikely.

Under Alternative B, efforts to prevent or minimize impacts to resources (e.g., soil erosion, water quality, and special status species) within the Project Area include oil and gas special lease stipulations that restrict Surface Occupancy. The total area of NSO under Alternative B amounts to 40,478 acres (16,382 hectares). Well data provided by the BLM indicated that a total of 330 wells have been drilled within the Project Area. In relation to the area of NSO, 112 wells (of which 38 are active) are located within the current maximum conservation pool elevation at Brantley Reservoir (elevation 3,271 feet or 997 meters) and the 100-year floodplain (elevation 3,283 feet or 1,001 meters).

Special lease stipulations under Alternative B would preclude Surface Occupancy within both the maximum conservation pool elevation and the 100-year flood plain of the reservoir. These stipulations would prevent the development of oil and gas wells within Project Area least tern habitat, and would greatly reduce human disturbance during the least tern breeding season, which is thought to greatly reduce reproductive success (Mayer and Dryer 1988, Smith and

Renken 1990). Other special lease stipulations that would minimize potential negative effects of well drilling and production on the least tern include NSO within 660 horizontal feet (200 meters) of the normal high-water line of streams, rivers, and arroyos, and NSO within Critical or Occupied habitat for threatened and endangered species. Further, access may be restricted seasonally in other important wildlife areas as needed.

Overall, while Alternative B would allow for minerals leasing and development, limits on the spatial area and locales where oil and gas exploration and development can occur under this alternative coupled with other constraints placed by special lease stipulations, would provide adequate protection for least terns that may occur seasonally in the Project Area. The NSO stipulations set under Alternative B would minimize future potential impacts of oil and gas exploration and development on the least tern and its occupied habitat.

***Southwestern Willow Flycatcher***

Under Alternative B, efforts to prevent or minimize impacts to resources (e.g., soil erosion, water quality, and special status species) within the Project Area include oil and gas special lease stipulations that restrict Surface Occupancy. The total area of NSO under Alternative B amounts to 40,478 acres (16,382 hectares). Well data provided by the BLM indicated that a total of 330 wells have been drilled within the Project Area. In relation to the area of NSO, 112 wells (of which 38 are active) are located within the maximum conservation pool elevation at Brantley Reservoir (elevation 3,271 feet or 997 meters) and the 100-year floodplain (elevation 3,283 feet or 1,001 meters).

Special lease stipulations under Alternative B would preclude Surface Occupancy within both the maximum conservation pool elevation and the 100-year flood plain of the reservoir. These stipulations would prevent the development of oil and gas wells within potential Project Area southwestern willow flycatcher habitat. Other special lease stipulations that would minimize potential negative effects of well drilling and production on the southwestern willow flycatcher include NSO within 660 horizontal feet (200 meters) of the normal high-water line of streams, rivers, and arroyos, and NSO within Critical or Occupied habitat for threatened and endangered species. Further, access may be restricted seasonally in other important wildlife areas as needed.

Overall, while Alternative B would allow for minerals leasing and development, limits on the spatial area and locales where oil and gas exploration and development can occur under this alternative, coupled with other constraints placed by special lease stipulations, would provide adequate protection for southwestern willow flycatchers that may eventually occur within the Project Area. The NSO stipulations set under Alternative B would minimize future potential impacts of oil and gas exploration and development on the southwestern willow flycatcher and its potentially suitable habitat.

***Gypsum Wild-Buckwheat***

Under Alternative B, efforts to prevent or minimize impacts to resources (e.g., soil erosion, water quality, and special status species) within the Project Area include oil and gas special lease stipulations that restrict Surface Occupancy. The total area of NSO under Alternative B amounts to 40,478 acres (16,382 hectares). Special lease stipulations under Alternative B would preclude Surface Occupancy within Critical or Occupied habitat for threatened and endangered species. This stipulation would prevent the development of oil and gas wells within Project Area gypsum wild-buckwheat habitat. Additionally, known buckwheat populations occur within a BLM designated Special Management Area adjacent to the Project Area, which provides the species additional protection.

Overall, while Alternative B would allow for minerals leasing and development, limits on the spatial area and locales where oil and gas exploration and development can occur under this alternative coupled with other constraints placed by special lease stipulations, would provide adequate protection for gypsum wild-buckwheat populations known to occur within the Project Area.

***Pecos Bluntnose Shiner***

As previously noted, one of the greatest potential concerns of oil and gas exploration activities within the Project Area is the potential for introduction of materials into the adjacent waters and the subsequent impact of pollution to aquatic species. Leaks and breaks on lines that cross ravines and the Pecos River would likely have the greatest potential for impacts to aquatic species. The standard lease agreement has many stipulations designed to contain all drilling fluids and waste byproducts produced in the drilling process on site and to prevent escape of any fluids from the site. However, as noted above, accidental spills that may enter an adjacent waterway have the potential to affect aquatic resources. To minimize the potential for habitat pollution from leaks and spills, wells and storage facilities would include safety measures to ensure operations that minimize the potential for habitat pollution in the form of oil leaks or spills.

Under Alternative B, efforts to prevent or minimize impacts to resources (e.g., soil erosion, water quality, and special status species) within the Project Area include oil and gas special lease stipulations that increase restrictions on surface occupancy. The total area of NSO under the Alternative B amounts to 40,478 acres (16,382 hectares), the largest NSO among all alternatives. In addition, the inclusion of a 660 horizontal feet (200 meter) buffer of NSO from the 100-year floodplain of Brantley and Avalon Reservoirs and the normal high-water line of all streams, rivers, and arroyos, is a valuable step in preventing or minimizing the potential of contamination of these waterways and any subsequent impacts on bluntnose shiner or habitats where they may occur. These buffer areas provide an extra measure of protection against extremely high-water runoff that could inundate structures that are located at or below this elevation level and also provide an opportunity for the lessee to recapture or contain escaped materials before they reach the water.

Although the Project Area is located below the lower critical habitat boundary for the bluntnose shiner, the limited number of active wells in the vicinity of the northern portion of the reservoir or near its headwaters coupled with the proposed special lease stipulations would reduce the possibility of contamination of the reservoir and potential negative effects on displaced young bluntnose shiner that may occur seasonally in the inflow area of Brantley Reservoir. Other special lease stipulations that would minimize potential negative effects of well drilling and production on the bluntnose shiner include NSO within Critical or Occupied habitat for Federally listed threatened or endangered species and seasonal access restrictions in other important wildlife areas as needed. Further, among all alternatives, Alternative B accounts for the lowest number of potential new gas well developments (i.e., 20 to 40 potential wells total) within the Project Area.

Overall, while Alternative B would allow for minerals leasing and development, limits on the spatial area and locales where oil and gas exploration and development can occur under this alternative coupled with other constraints placed by special lease stipulations, would provide adequate protection for bluntnose shiner that may occur seasonally in the Project Area.

***Alternative C: 2003 RMP with New Oil and Gas Leasing Stipulations and New Maximum Conservation Pool Elevation***

Under Alternative C, the total acreage classified as NSO would decrease to 19,155 acres (7,752 hectares) compared to Alternative A, and only 10,324 acres (4,178 hectares) would be subject to standard lease stipulations. Up to 60 to 80 potential new gas wells could be developed in the Project Area under this alternative and based on the 20-year RFD projection, construction of well pads, roads, and pipeline operations would have direct effects between 300 to 400 acres (121 to 162 hectares) within the Project Area. Any new disturbances would incrementally add to the current habitat fragmentation effect within the Project Area resulting from existing roads, livestock management, and past oil and gas activities. Direct and indirect impacts to threatened or endangered species or their habitat under Alternative C would be similar to those described for Alternative B. However, the total amount of area available for oil and gas development activities is much greater under Alternative C than under Alternative B. Therefore, the likelihood of either disturbing or eliminating habitat for protected species is greatest under Alternative C.

***Least Tern***

Although Alternative C is similar to Alternative B because both address concerns regarding the minimization of soil erosion, protection of wildlife and special status species, and protection of water quality, Alternative C allows for a revision to the maximum conservation pool elevation at Brantley Reservoir from 3,271 feet (997 meters) to 3,263 feet (995 meters) and a NSO stipulation would be applied below that elevation. The total area of NSO under Alternative C amounts to 19,155 acres (7,752 hectares). Well data provided by the BLM indicated that a total of 330 wells have been drilled within the Project Area. In relation to the area of NSO, 112 wells (of which 38 are active) are located within the current maximum conservation pool elevation at



Brantley Reservoir (elevation 3,271 feet or 997 meters) and the 100-year floodplain (elevation 3,283 feet or 1,001 meters). Any additional well development below the existing maximum conservation pool elevation would further reduce the amount of breeding habitat for least terns.

Overall, while Alternative C would allow for minerals leasing and development, limits on the spatial area and locales where oil and gas exploration and development can occur under this alternative coupled with other constraints placed by special lease stipulations, would provide adequate protection for least terns that may occur seasonally in the Project Area. The NSO stipulations set under Alternative C would minimize future potential impacts of oil and gas exploration and development on the least tern and its occupied habitat.

***Southwestern Willow Flycatcher***

Under Alternative C, efforts to prevent or minimize impacts to resources within the Project Area are similar to those identified in Alternative B. However, Alternative C would allow for a revision to the maximum conservation pool elevation at Brantley Reservoir from 3,271 feet (997 meters) to 3,263 feet (995 meters) and a NSO stipulation would be applied below that elevation. The total area of NSO under Alternative C amounts to 19,155 acres (7,752 hectares). Well data provided by the BLM indicated that a total of 330 wells have been drilled within the Project Area. In relation to the area of NSO, 112 wells (of which 38 are active) are located within the current maximum conservation pool elevation at Brantley Reservoir (elevation 3,271 feet or 997 meters) and the 100-year floodplain (elevation 3,283 feet or 1,001 meters).

Although special lease stipulations under Alternative C would be applied at elevations below the revised maximum conservation pool elevation, oil and gas development would be permitted in portions of the Project Area that may serve as potential flycatcher habitat. Other special lease stipulations that would minimize potential negative effects of well drilling and production on the flycatcher include NSO within Critical or Occupied habitat for threatened and endangered species. Further, access would be restricted seasonally in other important wildlife areas as needed.

Overall, while Alternative C would allow for minerals leasing and development, limits on the spatial area and locales where oil and gas exploration and development can occur, coupled with other constraints placed by special lease stipulations, would provide adequate protection for southwestern willow flycatchers that may eventually occur within the Project Area. Other special lease stipulations that would minimize potential negative effects of well drilling and production on the southwestern willow flycatcher include NSO within 660 horizontal feet (200 meters) of the normal high-water line of streams, rivers, and arroyos, and NSO within Critical or Occupied habitat for threatened and endangered species. The NSO stipulations set under Alternative C would minimize future potential impacts of oil and gas exploration and development on the southwestern willow flycatcher and its potentially suitable habitat.

***Gypsum Wild-Buckwheat***

Under Alternative C, efforts to prevent or minimize impacts to resources within the Project Area are similar to those identified in Alternative B. However, Alternative C would allow for a revision to the maximum conservation pool elevation at Brantley Reservoir from 3,271 feet (997 meters) to 3,263 feet (995 meters) and a NSO stipulation would be applied below that elevation. The total area of NSO under Alternative C amounts to 19,155 acres (7,752 hectares). Well data provided by the BLM indicated that a total of 330 wells have been drilled within the Project Area. In relation to the area of NSO, 112 wells (of which 38 are active) are located within the current maximum conservation pool elevation at Brantley Reservoir (elevation 3,271 feet or 997 meters) and the 100-year floodplain (elevation 3,283 feet or 1,001 meters). Special lease stipulations under Alternative C would preclude Surface Occupancy within Critical or Occupied habitat for threatened and endangered species. This stipulation would prevent the development of oil and gas wells within the Project Area gypsum wild-buckwheat habitat. Additionally, known buckwheat populations occur within a BLM designated Special Management Area adjacent to the Project Area, which provides the species additional protection.

Overall, while Alternative C would allow for additional minerals leasing and development when compared to Alternatives A and B, limits on the spatial area and locales where oil and gas exploration and development can occur under this alternative, coupled with other constraints placed by special lease stipulations, would provide adequate protection for gypsum wild-buckwheat populations known to occur within the Project Area.

***Pecos Bluntnose Shiner***

Under Alternative C, it is anticipated that general impacts on aquatic resources and bluntnose shiner that may occur seasonally in the Project Area, specifically in the inflow area of Brantley Reservoir, would be similar to those described for Alternative A and Alternative B. However, this alternative is the least restrictive in terms of surface occupancy area and would allow for the development of a substantially larger surface area (13,527 acres [5,474 hectares]) under surface occupancy on a case-by-case basis stipulation. The NSO special lease stipulation under this alternative would be applied at water surface elevations below 3,263 feet (995 meters) and 3,190 feet (972 meters) at Brantley and Avalon Reservoirs, respectively. Further, this alternative would allow for the surface occupancy on a case-by-case basis within 660 feet (200 horizontal meters) of the normal high-water of water bodies in the Project Area for construction of roads and pipelines.

While there is a limited number of active wells in the vicinity of the northern portion of the reservoir or near its inflow area, Alternative C could allow for the development of a larger area in the vicinity of water bodies in the Project Area, thus increasing the potential of contamination of aquatic resources and impact bluntnose shiner that may occur seasonally in the inflow area of Brantley Reservoir. In general, given the differences in restrictions and the overall reduced degree of protection to aquatic resources provided by special lease stipulations, the potential for

detrimental effects on bluntnose shiner that may occur seasonally in the Project Area would be greater under this alternative.

#### **4.1.9 Cultural Resources**

Land uses requiring surface disturbance can impact cultural resources. Oil and gas development, and the associated well pad construction, drilling operations, pipeline installations, and road construction, is a common cause of surface disturbance within the Project Area that could affect cultural resources. The more surface disturbance that occurs, the greater likelihood there is for direct negative effects to cultural resources. The movement and loss of artifacts because of soil erosion is an indirect negative impact associated with surface-disturbing activities. It is also likely that accidental damage from construction activities destroys buried cultural resources, even though nothing is visible during surface inventories.

Cultural resource inventories would continue to be required for all proposed surface-disturbing activities, including oil and gas development activities, within the Project Area. Any lands identified for development will need to follow Section 106 National Historic Preservation Act and the New Mexico State Cultural Properties Act processes before work begins. This includes all Federal mineral estates within the Project Area and future leases on lands conveyed to the Carlsbad Irrigation District in 2001. Regulations for the Protection of Historic Properties (36 CFR Part 800) defines the process for demonstrating such consideration through consultation with the State Historic Preservation Office, the Federal Advisory Council on Historic Preservation, and other interested parties.

The BLM and Reclamation will continue to work with the National Park Service in regard to any proposed mineral leasing and development within the Carlsbad Irrigation District National Historic Landmark (NHL). Reclamation, SHPO and the Archaeological Council will develop a programmatic agreement for the McMillian Dam and Reservoir area in the NHL. This area of the NHL includes approximately 1500 acres of Reclamation lands with special lease stipulations of surface occupancy on a case by case basis and no storage facilities. The Avalon Dam and Reservoir area would remain in a no surface occupancy zone. All historic properties included in the CID NHL will continue to be subject to Federal statute under the National Historic Preservation Act and the New Mexico State Cultural Properties Act, as appropriate.

Reclamation has received no indications of traditional cultural properties or sacred sites from the Native American tribes and pueblos consulted. Therefore, the assumption is the Project Area contains none of these properties. Cultural resource inventory surveys would continue to be required for Federal actions involving surface-disturbing activities, such as oil and gas development activities, within the Project Area. Eligible and potentially eligible sites would continue to be protected from damage or archaeologically treated to mitigate damage. Buffer areas of 100 feet (31 meters) or more would be established from the edges of sites to protect

cultural resources unless Reclamation determines that circumstances justify a reduced buffer area.

***Alternative A: 2003 RMP with Old Oil and Gas Leasing Stipulations and Old Maximum Conservation Pool Elevation***

Federal laws, statutes, regulations, and policies would remain in effect for identifying and protecting cultural resources. The amount of potential impacts to cultural resources would be determined by the actual amount of oil and gas development activities and associated surface disturbance. The chance of impacting cultural resources would increase as surface disturbance increases. The amount of surface disturbance anticipated during the 20-year planning horizon is shown in Table 2-8. From 200 to 300 acres (81 to 121 hectares) of surface disturbance, and from 160 to 210 acres (65 to 85 hectares) of surface reclamation, are anticipated to occur over the 20-year planning period under Alternative A.

***Alternative B: 2003 RMP with New Oil and Gas Leasing Stipulations and Old Maximum Conservation Pool Elevation***

The types of direct and indirect impacts to cultural resources resulting from implementation of Alternative B would be the same as those described for Alternative A. From 100 to 200 acres (41 to 81 hectares) of surface disturbance, and from 110 to 160 acres (45 to 65 hectares) of surface reclamation, are anticipated to occur over the 20-year planning period under Alternative B.

***Alternative C: 2003 RMP with New Oil and Gas Leasing Stipulations and New Maximum Conservation Pool Elevation***

The types of direct and indirect impacts to cultural resources resulting from implementation of Alternative C would be the same as those described for Alternative A. From 300 to 400 acres (121 to 162 hectares) of surface disturbance, and from 210 to 260 acres (85 to 105 hectares) of surface reclamation, are anticipated to occur over the 20-year planning period under Alternative C.

**4.1.10 Indian Trust Assets (ITAs)**

***Alternative A: 2003 RMP with Old Oil and Gas Leasing Stipulations and Old Maximum Conservation Pool Elevation***

Because there are no known ITAs within the Project Area, there would be no effects to ITAs under Alternative A.

***Alternative B: 2003 RMP with New Oil and Gas Leasing Stipulations and Old Maximum Conservation Pool Elevation***

Because there are no known ITAs within the Project Area, there would be no effects to ITAs under Alternative B.

***Alternative C: 2003 RMP with New Oil and Gas Leasing Stipulations and New Maximum Conservation Pool Elevation***

Because there are no known ITAs within the Project Area, there would be no effects to ITAs under Alternative C.

**4.1.11 Paleontological Resources**

Land uses requiring surface disturbance can impact paleontological resources. The more disturbance that occurs, the greater the likelihood there is for negative effects.

***Alternative A: 2003 RMP with Old Oil and Gas Leasing Stipulations and Old Maximum Conservation Pool Elevation***

Federal law would continue to be in effect for protecting paleontological resources within the Project Area. No paleontological sites have been documented in the Project Area and no exposed, fossil-bearing geologic strata are known to occur in the Project Area. Therefore, Alternative A would have no impact on known paleontological sites, fossil localities, or fossil-bearing geologic strata. However, the chance of impacting unknown paleontological resources would increase as surface disturbance increases. The amount of surface disturbance anticipated during the 20-year planning horizon is shown in Table 2-8. From 200 to 300 acres (81 to 121 hectares) of surface disturbance, and from 160 to 210 acres (65 to 85 hectares) of surface reclamation, are anticipated to occur over the 20-year planning period under Alternative A.

***Alternative B: 2003 RMP with New Oil and Gas Leasing Stipulations and Old Maximum Conservation Pool Elevation***

The potential for impacts to unknown paleontological resources resulting from implementation of Alternative B would be the same as those described for Alternative A. From 100 to 200 acres (41 to 81 hectares) of surface disturbance, and from 110 to 160 acres (45 to 65 hectares) of surface reclamation, are anticipated to occur over the 20-year planning period under Alternative B.

***Alternative C: 2003 RMP with New Oil and Gas Leasing Stipulations and New Maximum Conservation Pool Elevation***

The potential for impacts to unknown paleontological resources resulting from implementation of Alternative C would be the same as those described for Alternative A. From 300 to 400 acres (121 to 162 hectares) of surface disturbance, and from 210 to 260 acres (85 to 105 hectares) of surface reclamation, are anticipated to occur over the 20-year planning period under Alternative C.

**4.1.12 Social and Economic Values**

For the analysis of impacts to social and economic values, it is assumed that development of existing oil and gas leases would continue in the Project Area.

***Alternative A: 2003 RMP with Old Oil and Gas Leasing Stipulations and Old Maximum Conservation Pool Elevation***

Social and economic trends identified in Chapter 3 would continue for the foreseeable future. Because the development of existing oil and gas leases would continue, revenues, employment, and income generated by this activity would continue at or close to current levels for the foreseeable future. Costs associated with the development requirements (e.g., plans of development, designing road networks, reclamation activities) would be borne by the lease holder under these alternatives. More intensive development planning, however, could lead to reduced development costs. Larger factors such as market prices would have more impact on the economic viability of leases and wells than the existing or proposed development stipulations.

Offering new oil and gas leases by the BLM within the Project Area has no direct connection to employment or income levels in the local economy because new leases do not guarantee well development. Changes in employment and personal income in the oil and gas industry is more directly connected to market prices and not the availability of Federal minerals for lease. Increasing new oil and gas leasing by the BLM in the Project Area would not produce much economic benefit. Unleased tracts within the Project Area are more likely the result of a lack of interest and no evidence of payable petroleum zones. Additionally, some existing oil and gas leases within the Project Area remain undeveloped.

While still an important component of the local economy, employment in the petroleum industry has decreased in relation to total employment over the past 30 years, although personal income from jobs in the oil and gas industry has increased. The per capita income for all jobs in the vicinity of the Project Area in general trails the New Mexico average. However, the average weekly wages for those employed in the local oil and gas industry is nearly double the statewide average for all jobs (see Chapter 3).

It is estimated that between 40 and 60 wells would be drilled on Project Area lands during the next 20-year planning period under Alternative A. This is somewhat less than the average of 80 wells over a 20 year period estimated in the RFD section of Chapter 2. The difference, however, is likely more reflective of the long history of oil and gas development in the Project Area, and the lack of area remaining to develop because of well-spacing requirements, than existing or proposed stipulations.

Changes in local economic conditions such as employment and personal income tend to be reflected in society as a whole. Large-scale changes in these conditions would be more easily documented in an economic impact analysis than the small-scale changes analyzed in this alternative. Because the Project Area represents such a minor proportion of the overall regional oil and gas development industry in this part of New Mexico, it is not possible to accurately estimate specific economic impacts. Moreover, proposed oil and gas well developments that cannot locate within the Project Area because of the lack of area remaining for leasing and development are likely to find sufficient opportunities on surrounding Federal lands.

It is more difficult to quantitatively measure social impacts. In the social context of communities in the vicinity of the Project Area, changes would likely be minor and relatively unnoticed under Alternative A. However, individuals and families with interests in oil and gas development would be affected in particular localities. For these individuals and families, the most noticeable impact would likely be reduced personal income, reduced operations flexibility, and an increase in personal stress through increased operational restrictions.

***Alternative B: 2003 RMP with New Oil and Gas Leasing Stipulations and Old Maximum Conservation Pool Elevation***

The types of impacts to social and economic values resulting from implementation of Alternative B would be the same as those described for Alternative A. It is estimated that between 20 and 40 wells would be drilled on Project Area lands during the next 20-year planning period under Alternative B. This is less than half of the average of 80 wells over a 20-year period estimated in the RFD section of Chapter 2. Although the number of potential wells would be substantially less with implementation of Alternative B compared with Alternative A, changes in the local social and economic values are not likely to be noticed because operators would relocate to nearby Federal lands.

***Alternative C: 2003 RMP with New Oil and Gas Leasing Stipulations and New Maximum Conservation Pool Elevation***

The types of impacts to social and economic values resulting from implementation of Alternative C would be the same as those described for Alternative A. It is estimated that between 60 and 80 wells would be drilled on Project Area lands during the next 20-year planning period under Alternative C. This level of development is similar to the average of 80 wells over a 20 year period estimated in the RFD section of Chapter 2.

**4.1.13 Environmental Justice**

***Alternative A: 2003 RMP with Old Oil and Gas Leasing Stipulations and Old Maximum Conservation Pool Elevation***

There are no areas within the Project Area that meet the definitions of low-income areas or that contain minority populations. Therefore, none of the alternatives analyzed in this document would place a disproportionate share of negative environmental consequences on low-income or minority populations in or around the Project Area.

***Alternative B: 2003 RMP with New Oil and Gas Leasing Stipulations and Old Maximum Conservation Pool Elevation***

Impacts to minority and low-income populations resulting from implementation of Alternative B would be similar to those described for Alternative A.

***Alternative C: 2003 RMP with New Oil and Gas Leasing Stipulations and New Maximum Conservation Pool Elevation***

Impacts to minority and low-income populations resulting from implementation of Alternative C would be similar to those described for Alternative A.

**4.1.14 Recreation Resources**

The demand for recreation opportunities on Project Area lands is expected to continue.

***Alternative A: 2003 RMP with Old Oil and Gas Leasing Stipulations and Old Maximum Conservation Pool Elevation***

Recreation would continue within the Project Area much as it does today. Recreational users would continue to engage in wildlife viewing, boating, swimming, hunting, fishing, hiking, and camping. Oil and gas development activities would continue throughout the Project Area and are not expected to have any measurable impacts on recreational activities. However, affects such as those from noise, wildlife displacement, and visual resource impacts are likely to result in reduced satisfaction on the part of recreationists using the Project Area lands that are subject to energy development. Existing and future oil and gas development restrictions would remain in place to protect developed recreational areas and facilities.

To the extent that active oil and gas well construction requires a temporary closure in site-specific areas, some dispersed recreational users may be forced to relocate to other portions of the Project Area during these development activities. It is estimated that between 40 and 60 wells would be drilled on Project Area lands during the next 20-year planning period under Alternative A. Depending upon the final location of these wells and their associated infrastructure, it is possible that some dispersed recreational users would be temporarily or permanently displaced from specific undeveloped recreational areas within the Project Area.

***Alternative B: 2003 RMP with New Oil and Gas Leasing Stipulations and Old Maximum Conservation Pool Elevation***

Impacts to recreation resources resulting from implementation of Alternative B would be similar to those described for Alternative A. To the extent that active oil and gas well construction requires a temporary closure in site-specific areas, some recreational users may be forced to relocate to other portions of the Project Area during these development activities. It is estimated that between 20 and 40 wells would be drilled on Project Area lands during the next 20-year planning period under Alternative B. Depending upon the final location of these wells and their associated infrastructure, it is possible that some recreational users would be temporarily or permanently displaced from specific undeveloped recreational areas within the Project Area.

***Alternative C: 2003 RMP with New Oil and Gas Leasing Stipulations and New Maximum Conservation Pool Elevation***

Impacts to recreation resources resulting from implementation of Alternative C would be similar to those described for Alternative A. To the extent that active oil and gas well construction



requires a temporary closure in site-specific areas, some recreational users may be forced to relocate to other portions of the Project Area during these development activities. It is estimated that between 60 and 80 wells would be drilled on Project Area lands during the next 20-year planning period under Alternative C. Depending upon the final location of these wells and their associated infrastructure, it is possible that some recreational users would be temporarily or permanently displaced from specific undeveloped recreational areas within the Project Area.

#### **4.1.15 Rangeland and Grazing**

Under current conditions, Reclamation has the authority to make the necessary adjustments in grazing management to allow for oil and gas development on Project Area allotments. Oil and gas development may have an impact on animal unit months (AUMs), depending on the amount of area disturbed. Fluctuations in annual livestock use are also expected because of unrelated factors such as weather conditions and the price of livestock.

##### ***Alternative A: 2003 RMP with Old Oil and Gas Leasing Stipulations and Old Maximum Conservation Pool Elevation***

In general, livestock use levels within the Project Area are expected to continue into the future at current levels under Alternative A. Under Alternative A, there would be no change to current livestock grazing management practices. All Project Area grazing allotments are on lands that have been leased for Federal minerals exploration and development. Modifications to existing grazing permits/leases would be made based on proposed oil and gas development activities that may remove forage on specific allotments because of surface disturbance activities. If determined necessary, allotment specific AUMs would be reduced to reflect the revised forage base.

As shown in Table 2-8, over the 20-year life of the RMPA, approximately 200 to 300 acres (81 to 121 hectares) of vegetation could be disturbed by oil and gas development construction activities within the Project Area under Alternative A. Of that amount, approximately 160 to 210 acres (65 to 85 hectares) could be reclaimed and stabilized during initial rehabilitation and as plugged and abandoned wells are reclaimed. This leaves a possible 40 to 90 acres (16 to 36 hectares) of net vegetative disturbance with implementation of Alternative A. To the extent that these disturbances may occur on existing grazing allotments within the Project Area, existing grazing operations would be negatively affected by implementation of Alternative A accordingly. Short-term negative economic impacts to individual grazing operations would include fewer livestock being grazed, increased costs associated with moving cattle to other pastures, and/or finding additional pastures. Smaller ranch operations would be affected more than larger operations because they generally have fewer resources and less flexibility. Long-term negative impacts to grazing operations are not anticipated.

***Alternative B: 2003 RMP with New Oil and Gas Leasing Stipulations and Old Maximum Conservation Pool Elevation***

The types of impacts to rangeland and grazing resources resulting from implementation of Alternative B would be the same as those described for Alternative A. As shown in Table 2-8, over the 20-year life of the RMPA, approximately 100 to 200 acres (41 to 81 hectares) of vegetation could be disturbed by oil and gas development construction activities within the Project Area under Alternative B. Of that amount, approximately 110 to 160 acres (45 to 65 hectares) could be reclaimed and stabilized during initial rehabilitation and as plugged and abandoned wells are reclaimed. This leaves a possible 0 to 40 acres (0 to 16 hectares) of net vegetative disturbance with implementation of Alternative B. To the extent that these disturbances may occur on existing grazing allotments within the Project Area, existing grazing operations would be negatively affected by implementation of Alternative B, though to a lesser extent than under Alternatives A or C.

***Alternative C: 2003 RMP with New Oil and Gas Leasing Stipulations and New Maximum Conservation Pool Elevation***

The types of impacts to rangeland and grazing resources resulting from implementation of Alternative C would be the same as those described for Alternative A. As shown in Table 2-8, over the 20-year life of the RMPA, approximately 300 to 400 acres (121 to 162 hectares) of vegetation could be disturbed by oil and gas development construction activities within the Project Area under Alternative C. Of that amount, approximately 210 to 260 acres (85 to 105 hectares) could be reclaimed and stabilized during initial rehabilitation and as plugged and abandoned wells are reclaimed. This leaves a possible 90 to 140 acres (36 to 57 hectares) of net vegetative disturbance with implementation of Alternative C. To the extent that these disturbances may occur on existing grazing allotments within the Project Area, existing grazing operations would be negatively affected by implementation of Alternative C to a greater extent than under Alternatives A or B.

**4.1.16 Energy, Minerals, and Other Extractive Resources**

The basic assumption for mineral resources development within the Project Area is that there would be demand for the resource regardless of the action taken and that some level of exploration and development of resources would be allowed. Reclamation and BLM planning guidance for oil and gas leasing directs these agencies to make land use plan decisions (such as this RMPA) at the following four levels:

- Lands open for leasing subject to existing laws, regulations, formal orders, and the conditions of the standard lease form;
- Lands open to leasing subject to moderate constraints such as seasonal and controlled surface use restrictions;

- Lands open to leasing subject to major constraints such as NSO stipulations; and
- Lands closed to leasing.

Decisions to open lands to leasing represents Reclamation's determination, based on the information available at the time, that it is appropriate to allow development consistent with the terms of the lease, laws, regulations, and orders, and subject to reasonable conditions of approval. The assumptions for surface disturbance from access roads, drill pads, pipelines, power lines, and seismic activity are detailed in Section 2.6 of this RMPA. Some of the estimates used reflect values for exploration and development in newly leased areas. Much of the Project Area is within or near well-developed fields. Exploration and development of resources in well-developed areas reduces the distance required for roads, pipelines, and power lines. Therefore, the actual amount of ground disturbance within the Project Area of the 20-year planning horizon may be less.

Reclamation and BLM have the authority to control the density and location of surface-disturbing activities affecting public land and those activities associated with Federal mineral exploration and development. Reclamation and BLM have the authority to designate areas as closed or open to oil and gas leasing, attach a NSO stipulation to leases, and attach other conditions of approval (COA) that are included in approved applications for permit to drill (APDs). Reclamation and BLM can also attach other conditions of surface use (CSU) stipulations such as requirements for wildlife surveys or plans of development (PODs). Use of these designations, stipulations, or COAs provides effective tools for development of mineral resources and management of the accompanying surface disturbance.

Restrictions to leasing of Federal minerals and Surface Occupancy may result in an increase in development of private and State minerals adjacent to leased and unleased Federal lands. Reclamation COAs are common to all alternatives. Conditions of Approval are tools to be used in the effort to return areas that have had surface disturbance (such as drill pads and roads) to natural conditions. For a description of the COAs, see Appendix A. Implementation of COAs would reduce initial surface disturbance (direct impacts) and increase opportunities for reclamation success.

***Alternative A: 2003 RMP with Old Oil and Gas Leasing Stipulations and Old Maximum Conservation Pool Elevation***

The RFD projections for oil and gas activities developed for this EA are based on drilling statistics for the Project Area during the past 83 years from 1926 to 2009 (see Section 2.6). The RFD does not imply any drilling restrictions or limitations but is simply a forecast of anticipated activity. The actual number of wells drilled per year varies from year to year.

The RFD indicates that approximately 2 to 3 wells per year would be drilled and up to two wells per year would be plugged and abandoned in the Project Area under Alternative A. Direct

impacts include surface disturbances of approximately 10 to 15 acres (4 to 6 hectares), of which approximately 5 to 8 acres (2 to 3 hectares) would be reclaimed and stabilized by the end of 3 years. Successful reclamation of the plugged and abandoned wells would total approximately 3 acres (1 hectare) per year.

Over the next 20 years, a total of 40 to 60 wells would be drilled in the Project Area and approximately 40 wells would be plugged and abandoned under Alternative A. During that period, approximately 200 to 300 acres (81 to 121 hectares) of surface would be disturbed and approximately 160 to 210 acres (65 to 85 hectares) would be reclaimed and stabilized within 3 years of initial disturbance. Approximately 60 acres (24 hectares) would be reclaimed and stabilized from plugged and abandoned wells over the 20-year planning period.

***Alternative B: 2003 RMP with New Oil and Gas Leasing Stipulations and Old Maximum Conservation Pool Elevation***

Under Alternative B, no areas would be closed to new oil and gas leasing. However, areas available for leasing with a NSO stipulation would increase from 25,808 acres (10,445 hectares) under Alternative A to 40,478 acres (16,382 hectares) under Alternative B. Leasing with a NSO stipulation could dissuade bidders from purchasing lease parcels. When applied to permits for drilling, proponents may have to relocate drilling projects, thereby increasing construction costs on the project. Some lands may have to be developed through directional well drilling. Of the proposed lands open to oil and gas leasing with the NSO stipulation, all are in areas of high or moderate hydrocarbon potential. Some lease on these lands with the NSO stipulation could also be subject to drainage of hydrocarbons by non-Federal wells. In this situation, the lessee would not be responsible for payment of lost royalties unless an economic directional well can be drilled.

When the notice of a competitive sale of oil and gas leases clearly provides that a lease would be subject to a NSO stipulation, by making a bid for the indicated parcel the bidder is bound to accept the stipulation. Lessees would be advised that issuance of a lease in the Project Area with the NSO stipulation does not guarantee that a suitable surface location would be available for drilling or that the lease would be developed. Prospective lessees should take this into consideration prior to obtaining a lease with the NSO stipulation. If a lessee acquires a lease with an NSO stipulation attached, then it would be the responsibility of the lessee to locate a suitable surface location that meets existing requirements. The immediate and long-term effects of NSO restrictions could include lost production opportunities, increased drilling and production costs, and loss of royalties.

There are existing oil and gas leases in areas where NSO stipulations would be applied to newly issued leases. Development of resources covered by these leases would continue under the terms of the lease and appropriate conditions of approval in these areas. Plans of Development (PODs) and COAs would be used to guide orderly development on existing Federal leases in the Project

Area. Abandoned well pads and the caliche roads that serve them would be cleaned of caliche, raked, contoured, and reclaimed.

Oil and gas wells and storage facilities would include safety measures to ensure operations that minimize the potential for habitat pollution in the form of oil leaks or spills. Such measures would include, but not be limited to, replacement of worn or out-of-date materials and equipment, construction of spill-containment structures, removal of contaminated materials, and protection of well sites. These are standard operating procedures and have no additional impact. The RFD indicates that approximately 1 to 2 wells per year would be drilled and up to two wells per year would be plugged and abandoned in the Project Area under Alternative B. Direct impacts include surface disturbances of approximately 5 to 10 acres (2 to 4 hectares), of which approximately 2 to 5 acres (1 to 2 hectares) would be reclaimed and stabilized by the end of 3 years. Successful reclamation of the plugged and abandoned wells would total approximately 3 acres (1 hectare) per year.

Over the next 20 years, a total of 20 to 40 wells would be drilled in the Project Area and approximately 40 wells would be plugged and abandoned under Alternative B. During that period, approximately 100 to 200 acres (41 to 81 hectares) of surface would be disturbed and approximately 110 to 160 acres (45 to 65 hectares) would be reclaimed and stabilized within three years of initial disturbance. Approximately 60 acres (24 hectares) would be reclaimed and stabilized from plugged and abandoned wells over the 20-year planning period.

***Alternative C: 2003 RMP with New Oil and Gas Leasing Stipulations and New Maximum Conservation Pool Elevation***

The types of direct and indirect impacts to energy, minerals, and other extractive resources resulting from implementation of Alternative C would be the same as those described in the introduction of this section (Section 4.1.16) and Alternative B. The areas available for leasing with a NSO stipulation would decrease from 25,808 acres (10,445 hectares) under Alternative A to 19,155 acres (7,752 hectares) under Alternative C. The RFD indicates that approximately 3 to 4 wells per year would be drilled and up to two wells per year would be plugged and abandoned in the Project Area under Alternative C. Direct impacts include surface disturbances of approximately 15 to 20 acres (6 to 8 hectares), of which approximately 8 to 10 acres (3 to 4 hectares) would be reclaimed and stabilized by the end of 3 years. Successful reclamation of the plugged and abandoned wells would total approximately 3 acres (1 hectare) per year.

Over the next 20 years, a total of 60 to 80 wells would be drilled in the Project Area and approximately 40 wells would be plugged and abandoned under Alternative C. During that period, approximately 300 to 400 acres (121 to 162 hectares) of surface would be disturbed and approximately 210 to 260 acres (85 to 105 hectares) would be reclaimed and stabilized within three years of initial disturbance. Approximately 60 acres (24 hectares) would be reclaimed and stabilized from plugged and abandoned wells over the 20-year planning period.

#### **4.1.17 Transportation and Access**

##### ***Alternative A: 2003 RMP with Old Oil and Gas Leasing Stipulations and Old Maximum Conservation Pool Elevation***

Implementation of Alternative A would have no affect on transportation and access within the Project Area. Existing designated roads would continue to be managed and maintained by the appropriate responsible entity (see Chapter 3). Designated roads, as well as unmanaged and unmaintained roads, would continue to be used for oil and gas development activities, as well as other appropriate uses allowed within the Project Area. Unmanaged and unmaintained roads would continue to be closed and reclaimed according to provisions described in the existing RMP (Reclamation 2003). As appropriate, proposed oil and gas development activities in the vicinity of proposed road closures would include reclamation of those unmanaged and unmaintained roads identified in the existing RMP.

##### ***Alternative B: 2003 RMP with New Oil and Gas Leasing Stipulations and Old Maximum Conservation Pool Elevation***

Affects to transportation and access resulting from implementation of Alternative B would be similar to those described for Alternative A.

##### ***Alternative C: 2003 RMP with New Oil and Gas Leasing Stipulations and New Maximum Conservation Pool Elevation***

Affects to transportation and access resulting from implementation of Alternative C would be similar to those described for Alternative A.

#### **4.1.18 Visual Resources**

##### ***Alternative A: 2003 RMP with Old Oil and Gas Leasing Stipulations and Old Maximum Conservation Pool Elevation***

This project will cause some short term and long term visual impacts to the natural landscape. Short term impacts occur during construction operations and prior to interim reclamation. These include the presence of construction equipment and vehicle traffic. Interim reclamation will be conducted where possible within 6 months after construction by recontouring and revegetating.

Long term impacts are visible to the casual observer through the life of the well. These include the visual evidence of storage tanks, piping, pump jacks, well pads, and roads which cause visible contrast to form, line, color, and texture within the characteristic landscape. Removal of vegetation by road and drill pad construction exposes bare soil lighter in color and smoother in texture than the surrounding vegetation. The surfacing of these areas with caliche materials causes further contrasts to the characteristic landscape. These contrasts will be visible to visitors in the vicinity of the facilities.

After final abandonment and reclamation, the pad, road, and associated infrastructure will be removed, reclaimed, recontoured, and revegetated to eliminate visual impacts. Short and long term impacts are minimized by best management practices such as color selection, reducing cut and fill, screening facilities with natural features and vegetation, interim reclamation, and contouring roads along natural changes in elevation. Implementation of the General Conditions of Approval (Appendix A, Section A-2) will further minimize impacts to visual resources.

***Alternative B: 2003 RMP with New Oil and Gas Leasing Stipulations and Old Maximum Conservation Pool Elevation***

Affects to visual resources resulting from implementation of Alternative B would be similar to those described for Alternative A, though to a lesser extent because of fewer wells being constructed.

***Alternative C: 2003 RMP with New Oil and Gas Leasing Stipulations and New Maximum Conservation Pool Elevation***

Affects to visual resources resulting from implementation of Alternative C would be similar to those described for Alternative A, though to a greater extent because of more wells being constructed.

## **4.2 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES**

A commitment of resources is irreversible when its primary or secondary impacts limit the future option for a resource. An irretrievable commitment refers to the use or consumption of resources neither renewable nor recoverable for later use by future generations. Implementation of any of the alternatives would require a commitment of natural, physical, human, and fiscal resources to construct and operate wells, well pads, access roads, pipelines, and associated utilities. Any construction would require the use of fossil fuels for construction vehicles, equipment, and construction-worker vehicles. Electricity would also be used at construction sites.

Construction and operation of oil and gas facilities within the Project Area would require the use of various types of raw materials, including soil, aggregate, steel, electrical supplies, piping, and other building materials such as metal, stone, sand, and fill material. Additionally, the fabrication and preparation of these construction materials would require labor and natural resources. Utilization of these resources would be irretrievable. However, these resources are readily available at this time and adverse effects on their continued availability are not expected.

Construction and operation of oil and gas facilities would require labor, which would otherwise be unavailable for other projects. The commitment of labor is considered irretrievable. Furthermore, fiscal resources would be irretrievably committed to construction and operation of these facilities. These funds would then not be available for other projects and activities.

In addition to the resources utilized in construction and operation of proposed oil and gas facilities, there would be irreversible and irretrievable loss of existing resources in the areas of impact. These resources would include the loss of biological habitat as discussed throughout Section 4.1. Most negative long-term effects have been minimized to the extent possible, but some effects remain.

### **4.3 CUMULATIVE IMPACTS**

The Project Area is part of the Permian Basin which overlaps western Texas and eastern New Mexico. The first oil well drilled in the New Mexico portion of the Permian Basin dates from the 1920s and the area continues to produce oil and natural gas. That production includes lands within the Project Area where the first well was drilled in 1926. The boundary of the Carlsbad Field Office of the BLM encompasses both Lea and Eddy Counties, as well as the southern portion of Chaves County, an area consisting of approximately 6,381,000 acres (2,582,391 hectares). Within this boundary are approximately 2,197,000 acres (889,126 hectares) of BLM land where the Federal government owns both the surface and subsurface mineral estate, as well as an additional 1,898,000 acres (768,121 hectares) of Federal mineral estate where the surface is not administered by the BLM (e.g., lands administered by Reclamation, National Park Service, Forest Service, Department of Energy). The 43,745 acres (17,703 hectares) of Federal mineral lands and lands subject to Federal mineral leasing stipulations within the Project Area fall within this latter category and represent approximately 1 percent of the Federal mineral estate within the Carlsbad Field Office area.

In the Carlsbad Field Office, some 15,400 wells were drilled as new well completions during the 30-year period between 1975 and 2004 (BLM 2007). This represents an average of 513 well completions per year. The 1997 Carlsbad RMPA (BLM 1997) analyzed surface disturbance as nine acres (4 hectares) of initial surface disturbance for each well, which included well pads, access roads, and pipeline right-of-ways. The analysis also included reclamation in the amount of 5 acres (2 hectares) per well within two years. Using this analysis, the amount of surface disturbance from existing Federal wells within the Carlsbad Field Office ranges from 61,600 to 138,600 acres (24,930 to 56,091 hectares). There are also active wells on State and private lands adjacent to the Project Area and throughout the Carlsbad Field Office area.

During the same 30-year period between 1975 and 2004, there were 154 well completions within the Project Area. This represents an average of 5 well completions per year. Using the BLM analysis above, the amount of surface disturbance from existing wells within the Project Area ranges from 770 to 1,386 acres (312 to 561 hectares). Over the next 20 years, between 20 and 80 wells could be drilled within the Project Area depending upon which alternative is implemented. During this period, approximately 100 to 400 acres (41 to 162 hectares) of surface could be disturbed and approximately 50 to 200 acres (20 to 81 hectares) of surface could be reclaimed and stabilized within three years of initial disturbance. Approximately 60 acres (24 hectares) of



surface could be reclaimed and stabilized from plugged and abandoned wells over the next 20 years.

Alternative B is more restrictive than Alternatives A or C for oil and gas development within the Project Area. Because of the revised conservation pool elevation at Brantley Reservoir under Alternative C, it is less restrictive than Alternative A or Alternative B for oil and gas development within the Project Area. Approximately 20 to 40 more wells could be drilled under Alternative C than under Alternatives A or B over the 20-year planning period. Complying with existing or proposed mineral leasing stipulations may in effect mean that some areas previously open to exploration and development with limited restrictions would be closed to protect sensitive resources. Over time this may result in increased costs associated with exploration and development, a decrease in oil and gas production, and reduced profits and associated economic benefits for entities extracting such Project Area resources. To the degree that NSO restrictions remove property from future oil and gas drilling, or make drilling significantly more difficult, some mineral resources may be unavailable for future extraction.

The New Mexico Greenhouse Gas Inventory and Reference Case Projection 1990–2020 estimates that approximately 17.3 million metric tons of natural gas and 2.3 million metric tons of natural gas emissions are projected by 2010 as a result of oil and natural gas production, processing, transmission, and distribution. The lack of scientific tools designed to predict climate change on local scales limits the ability to quantify or even identify potential future impacts. However, potential impacts to natural resources and plant and animal species from climate change are likely to be varied, including those in the southwestern United States. For example, if global climate change results in a warmer and drier climate, increased particulate matter impacts could occur because of increased windblown dust from drier and less stable soils. Cool season plant species' spatial ranges are predicted to move north and to higher elevations and extinction of endemic threatened or endangered plants may be accelerated. Due to loss of habitat or competition from other species whose ranges may shift northward or to higher altitudes, the population of some animal species may also be reduced or increased. Less snow at lower elevations would likely impact the timing and quantity of snowmelt, which, in turn, could impact water resources and species dependant on historic water conditions. Forests at higher elevations in New Mexico, for example, have been exposed to warmer and drier conditions.

Soils and vegetation are directly impacted by these past and future surface disturbances. As a result of oil and gas development activities under any of the alternatives, soils would be removed from vegetation production. These anticipated direct impacts are listed earlier in this chapter under their respective sections. Cumulative impacts would include this loss of productive soil to support vegetation, combined with the loss of soils and vegetation from surface-disturbing activities in the past. Cumulative impacts to soils and vegetation would be greater under Alternative C than under Alternatives A or B.

Any industrial activities that take place upon or within karst terrains or freshwater aquifer recharge zones have the potential to create both short-term and long-term negative impacts to freshwater aquifers and cave systems. While a number of mitigation measure can be implemented to mitigate many impacts (see Appendix A-3), it is still possible for impacts to occur from containment failures, well blowouts, accidents, spills, and structural collapses. To the extent that increased oil and gas development activities increases this potential, Alternative C has the greatest potential to negatively affect cave and karst resources when compared to Alternatives A or B.

Water quality and air quality are indirectly impacted by past and future surface disturbances. These anticipated indirect impacts are listed earlier in this chapter under their respective sections. Additional surface disturbance as a result of oil and gas development activities has the potential to further degrade overall water quality within the Project Area. Cumulative impacts to water and air quality would be greater under Alternative C than under Alternatives A or B.

Changes in vegetation and wildlife habitat, not directly caused by construction activities, would be most prone to the amount and timing of precipitation. A prolonged drought could lead to a decrease in desirable grasses, shrubs, and forbs and an increase in less desirable “invasive” type species. Conversely, several years of above normal precipitation could result in an increase in desirable grasses, shrubs, and forbs and a decrease in less desirable invasive type species. Localized areas could see improvement in cover/composition because of livestock management prescriptions, closure of unmanaged/unmaintained roads, and vegetation treatment (e.g., invasive species control) type projects. Additional vegetative cover would improve watershed function, increase infiltration, reduce runoff, and allow more precipitation to be available for vegetative growth.

Under any of the alternatives, surface disturbance and habitat fragmentation would continue as would other activities on Project Area lands authorized by Reclamation. Fragmentation is one of the affects that create habitat connectivity issues. Roads, powerlines, and infrastructure associated with oil and gas field development are all fragmentary in nature. With the reclamation of plugged and abandoned wells and associated infrastructure, connectivity of habitat can occur between habitat patches, thus expanding the available habitat for wildlife and sensitive species. By removing roads, powerlines, well pads, and any other infrastructure down to native soils, coupled with proper seeding of native species, available habitat could be increased over time. Impacts to wildlife resources and sensitive species would be considered greater under Alternative C than under Alternatives A or B.

Cumulative impacts to Project Area fisheries may result from continued reservoir water level fluctuations, occasional reduced Pecos River flows, increased oil and gas development activities, and increased recreational activities. Spring irrigation draw downs have historically occurred during the spawning period for littoral fish species in Brantley Reservoir. Such dewatering can have a significant negative impact on reproductive success of littoral spawning fishes and reduce

the aquatic invertebrate food base available to young-of-year and juvenile fishes. Channelization, surface erosion, and damage to riparian areas along the Pecos River would continue to degrade habitat for native fish species in the Project Area.

Reductions in livestock numbers or changes in season of use as a result of oil and gas development activities would negatively impact grazing operators within the Project Area. This would impact local businesses as grazing operators would have less disposable income to spend at businesses in and around the Project Area. This is not expected to be significant because the amount of rangeland being grazed within the Project Area is minimal. This cumulative impact is expected to be localized to certain allotments or pastures, not the entire Project Area. The potential for impacts to grazing operators would be considered greater under Alternative C than under Alternatives A or B.

Implementation of any of the alternatives would affect some portion of employment and personal income derived from oil and gas development within the Project Area. Because the amount of oil and gas development varies between alternatives, the resulting affects to social and economic conditions, positive or negative, would also vary. However, because the Project Area represents less than 1 percent of all oil and gas development activity within the Carlsbad Field Office area, the affects are expected to be localized and minimal. Given the relative economic diversity of the counties surrounding the Project Area, economic affects would be readily absorbed by the local economy and would not be noticeable to the general population. However, some individuals and companies would be directly affected.

Numerous past and present activities have resulted in adverse impacts on cultural resources within the Project Area. These activities include: the development of the Pecos River with its associated dams, canals, and ditches; increasing oil and gas development activities; grazing; and recreational use of the Project Area. It is anticipated that future impacts on cultural resources would occur because: the population of the Carlsbad, New Mexico, area would continue to increase; demand for additional recreational opportunities would increase; oil and gas exploration would continue, at least at present levels; vandalism in the Project Area would continue to degrade and destroy known and currently unknown historical and archaeological sites; continuing erosion along the Pecos River channel and reservoir beaches would adversely impact archaeological sites located within the inundation zone; and the impacts associated with unregulated camping, vehicle use, and recreation would continue. Such impacts, because they are cumulative in nature, result in the bit-by-bit destruction of the total archaeological and record. In addition, natural erosional processes, vandalism, recreational activities, and unauthorized land uses would continue to negatively affect the condition of cultural and archaeological resources no matter which alternative is implemented. The potential for impacts to cultural resources would be considered greatest under Alternative C compared to Alternatives A or B.

Opportunities for uncontrolled access and use of public lands are expected to decrease over time. This appears to be a regional and national trend, resulting from protecting resources from

damage and from protecting recreational experiences from overcrowding and conflicts. Additionally, oil and gas development activities within the Project Area can result in the permanent displacement of dispersed recreational activities in those areas. From a recreational opportunity perspective, the long-term cumulative effects are a net loss.

Currently, there are no alternative energy generating sites, ITAs, paleontological resources, waste water, solid waste, or hazardous waste resources that would be affected by implementation of any of the alternatives. Similarly, low income or minority populations, water rights, water operations, and fire management would not be affected by any of the alternatives.