CHAPTER 4: ENVIRONMENTAL CONSEQUENCES

This "Environmental Consequences" chapter analyzes beneficial and adverse impacts that would result from implementing any of the alternatives considered in this plan/EIS. This chapter also includes a summary of laws and policies relevant to each impact topic, intensity definitions (e.g., negligible, minor, moderate, and major), methods used to analyze impacts, and analysis methods used for determining cumulative impacts. As required by the CEQ regulations implementing the NEPA, a summary of environmental consequences for each alternative is provided in table 5, which can be found at the end of chapter 2. The resource topics presented in this chapter, and the organization of the topics, correspond to the resource discussions contained in "Chapter 3: Affected Environment."

SUMMARY OF LAWS AND POLICIES

Three overarching environmental protection laws and their implementing policies guide NPS actions in managing parks and their resources—the Organic Act of 1916 (16 USC 1), NEPA and its implementing regulations, and the NPOMA (16 USC 5901 et seq.). For a complete discussion of these and other guiding authorities, refer to the section titled "Other Applicable Federal Laws, Policies, Regulations, and Plans" in "Chapter 1: Purpose of and Need for Action." These guiding authorities are briefly described below.

The Organic Act of 1916 (16 USC 1), as amended and supplemented, commits the NPS to making informed decisions that perpetuate the conservation and protection of park resources, leaving them unimpaired for the benefit and enjoyment of future generations.

NEPA is implemented through regulations of the CEQ (40 CFR 1500–1508). The NPS has, in turn, adopted procedures to comply with these requirements, as found in Director's Order 12 (NPS 2011a) and its accompanying handbook (NPS 2001).

NPOMA (16 USC 5901 et seq.) underscores NEPA provisions in that both acts are fundamental to park management decisions. Both acts provide direction for connecting resource management decisions to the analysis of impacts and communicating the impacts of those decisions to the public, using appropriate technical and scientific information. They also recognize that such data may not be readily available and provide options for resource impact analysis in the absence of such data.

Section 4.5 of Director's Order 12 (NPS 2011a) adds to this guidance by stating, "when it is not possible to modify alternatives to eliminate an activity with unknown or uncertain potential impacts, and such information is essential to making a well-reasoned decision, the National Park Service will follow the provisions of the CEQ regulations (40 CFR 1502.22)." In summary, the NPS must state in an environmental assessment or impact statement: (1) whether such information is incomplete or unavailable; (2) the relevance of the incomplete or unavailable information to evaluating reasonably foreseeable significant adverse impacts on the human environment; (3) a summary of existing credible scientific adverse impacts that is relevant to evaluating the reasonably foreseeable significant adverse impacts; and (4) an evaluation of such impacts based on theoretical approaches or research methods generally accepted in the scientific community. Collectively, these guiding regulations provide a framework and process for evaluating the impacts of the alternatives considered in this plan/EIS.

GENERAL METHODOLOGY FOR ESTABLISHING INTENSITY DEFINITIONS AND MEASURING EFFECTS BY RESOURCE

The following elements were used in the general approach for establishing intensity definitions and measuring the effects of the alternatives on each resource category:

- General analysis methods as described in guiding regulations, including the context and duration of environmental effects.
- Basic assumptions used to formulate the specific methods used in this analysis.
- Intensity definitions used to define the level of impact resulting from each alternative.
- Methods used to evaluate the cumulative impacts of each alternative in combination with unrelated factors or actions affecting national recreation area resources.
- Methods and intensity definitions used to determine whether impairment of specific resources would occur under any alternative.

These elements are described in the following sections.

GENERAL ANALYSIS METHODS

The analysis of impacts follows CEQ guidelines and Director's Order 12 procedures (NPS 2011a) and incorporates the best available scientific literature applicable to the region and setting, the resource evaluated, and the actions considered in the alternatives.

This chapter discusses applicable analysis methods for each resource topic, including assumptions and impact intensity definitions.

ASSUMPTIONS

Duration and Type of Impacts

The following assumptions are used for all impact topics (the terms "impact" and "effect" are used interchangeably throughout this document):

- Short-term: Impacts are temporary (i.e., they occur for a matter of hours up to weeks at a time) without lasting effects. Examples include impacts from the ability of a visitor to access a certain area during a resource closure event.
- Long-term: Impacts are continuous throughout the life of the plan, with potentially permanent effects. Examples include ongoing impacts on national recreation area management and operations.
- Direct: Impacts would occur as a direct result of ORV management actions.
- Indirect: Impacts would occur from ORV management actions, but would occur later in time or farther in distance from the action.

- Beneficial: A positive change in the condition or appearance of the resource or a change that moves the resource toward a desired condition.
- Adverse: A change that moves the resource away from a desired condition or detracts from its appearance or condition.

Impacts of Climate Change

Texas is likely to experience a challenging assortment of climate change conditions in the coming years. Scientists postulate that trends showing rising temperatures, increasing frequency of heat waves and severe weather events, less rain west of the Interstate 35 corridor, a reduction in streamflows, and a decline in biodiversity will continue (Schmandt et al. 2009). In combination, these factors would result in increased severity of drought, drier soils, and reduced availability of surface water. These potential changes underscore the need for management of ORV use in the riparian areas and streambeds of the Lake Meredith National Recreation Area. However, given the complex interactions between multiple factors and the uncertainties over human response to climate change, the level of uncertainty about possible effects on specific resources or impact topics over the 10- to 15-year planning period makes analysis for impacts of climate change in this document speculative. Improved management of ORV access and use would support the resiliency of the national recreation area's wildlife and plant resources, and would be beneficial to those resources as they adapt to changed conditions over future decades.

Mileage Assumptions

Table 15 details the assumptions for the area (in miles or acres) that would be marked off under the action alternatives. Under alternative A, routes and areas would not be designated, and the entire area of Blue Creek and Rosita Flats designated in the Superintendent's Compendium would be open to use.

TABLE 15: ORV ROUTES UNDER THE ACTION ALTERNATIVES

Designated Locations for ORV Use	Alternative B / Alternative D	Alternative C
Blue Creek		
Approximate acres on the sandy bottom area that would be marked by cables.	133 acres	133 acres
Approximate miles of routes and access points to the sandy bottom area that would be marked by carsonite posts or other visible markers.	1 mile	1 mile
Rosita Flats		
Approximate acres south of the Canadian River (currently denuded of vegetation) at the western border of the national recreation area where Highway 287 enters the recreation area open to ORV use.	170 acres	170 acres
Approximate acres south of the Canadian River and on the east side of Bull Taco Hill open to ORV use.	65 acres	0 acres
Approximate acres on the sandy riverbed.	119 acres	119 acres
Approximate miles of marked routes and access points to the sandy riverbed that are marked by carsonite posts or other visible markers.	15 miles	15 miles
Approximate acres south of the Canadian River on the northern border of Highway 287. (Beginner zone under alternatives B and D.)	9 acres	0 acres

Intensity Definitions

Determining intensity definitions is a key component in applying NPS *Management Policies 2006* (NPS 2006b) and Director's Order 12 (NPS 2011a). These intensity definitions provide the reader with an idea of the intensity of a given impact on a specific resource. The intensity definition is determined primarily by comparing the effect to a relevant standard based on applicable or relevant/appropriate regulations or guidance, scientific literature and research, or best professional judgment. Because definitions of intensity vary by impact topic, intensity definitions are provided separately for each impact topic analyzed in this document. Intensity definitions are provided throughout the analysis for negligible, minor, moderate, and major impacts. Except for the threatened and endangered species topic, the impact intensity definitions are defined for adverse impacts, and beneficial impacts are addressed qualitatively. For endangered and threatened species, beneficial and adverse impacts are qualified to facilitate Section 7 compliance.

CUMULATIVE IMPACTS

The CEQ regulations to implement NEPA require the assessment of cumulative impacts in the decision-making process for federal projects. Cumulative impacts are defined as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or nonfederal) or person undertakes such other actions" (40 CFR 1508.7). Cumulative impacts are considered for all alternatives, including the no-action alternative.

Cumulative impacts were determined by combining the impacts of the alternative being considered with other past, present, and reasonably foreseeable future actions. Therefore, it was necessary to identify other ongoing or reasonably foreseeable future projects and plans at the national recreation area and, if applicable, the surrounding region. Table 16 summarizes the actions that could affect the various resources at the national recreation area. These actions are described in more detail in the "Other Applicable Federal, Laws, Policies, Regulations, and Plans" section of this document (see "Chapter 1: Purpose of and Need for Action") as well as following table 16. Recreational use—past, present, and future—is considered as an integral part of the action alternatives and is, therefore, not addressed within the cumulative impact scenario.

The analysis of cumulative effects was accomplished using four steps:

Step 1—Resources Affected. Fully identify resources affected by any of the alternatives.

Step 2—Boundaries. Identify an appropriate spatial and temporal boundary for each resource.

Step 3—Cumulative Action Scenario. Determine which actions to include with each resource.

Step 4—Cumulative Impact Analysis. Summarize the cumulative impact of the proposed action plus the other actions affecting the resource in question, defining context, intensity, duration and timing, methodology, etc.

TABLE 16: CUMULATIVE IMPACT SCENARIO

Impact Topic	Study Area	Past Actions	Present Actions	Future Actions (life of plan/EIS)
Soils	National Recreation Area Boundary within Rosita Flats and Blue Creek ORV use areas	Development of the Resources Management Plan Development of the Fire Management Plan ORV Use Prior to the National Recreation Area Development of the Lake Meredith National Recreation Area Master Plan Development of the Oil and Gas Management Plan Invasive Species Removal Ongoing Maintenance Activities Sand Drags event Mesquite Spraying on Adjacent Lands	Implementation of the Resources Management Plan Implementation of the Fire Management Plan Implementation of the Lake Meredith National Recreation Area Master Plan Implementation of the Oil and Gas Management Plan Invasive Species Removal Ongoing Maintenance Activities Sand Drags event Mesquite Spraying on Adjacent Lands Development of the GMP	Implementation of the Resources Management Plan Implementation of the Fire Management Plan Implementation of the Lake Meredith National Recreation Area Master Plan Implementation of the Oil and Gas Management Plan Invasive Species Removal Ongoing Maintenance Activities Sand Drags event Mesquite Spraying on Adjacent Lands Implementation of the GMP
Vegetation	National Recreation Area Boundary, plus Adjacent Land	Development of the Resources Management Plan Development of the Fire Management Plan ORV Use Prior to the National Recreation Area Development of the Lake Meredith National Recreation Area Master Plan Invasive Species Removal Ongoing Maintenance Activities Mesquite Spraying on Adjacent Lands	Implementation of the Resources Management Plan Implementation of the Fire Management Plan Implementation of the Lake Meredith National Recreation Area Master Plan Invasive Species Removal Ongoing Maintenance Activities Mesquite Spraying on Adjacent Lands Development of the GMP Decline of Cottonwoods in the National Recreation Area and Region (related to lack of water)	Implementation of the Resources Management Plan Implementation of the Fire Management Plan Implementation of the Lake Meredith National Recreation Area Master Plan Invasive Species Removal Ongoing Maintenance Activities Mesquite Spraying on Adjacent Lands Decline of Cottonwoods in the National Recreation Area and Region (related to lack of water) Implementation of the GMP

Impact Topic	Study Area	Past Actions	Present Actions	Future Actions (life of plan/EIS)
Water Resources	National Recreation Area Boundary, plus Adjacent Land	Development of the Resources Management Plan Development of the Fire Management Plan ORV Use Prior to the National Recreation Area Development of the Lake Meredith National Recreation Area Master Plan Land and Water Resources Conservation and Recreation Plan Mesquite Spraying on Adjacent Lands Cooperation with the CRMWA Damming of Canadian River Adjacent Agricultural Use Erosion/Siltation into Lake Meredith	Implementation of the Resources Management Plan Implementation of the Fire Management Plan Implementation of the Lake Meredith National Recreation Area Master Plan Mesquite Spraying on Adjacent Lands Cooperation with the Canadian River Water Management Authority Adjacent Agricultural Use Erosion/Siltation into Lake Meredith Development of the GMP Management Actions of CRMWA Lowering of the Lake Level Groundwater pumping increasing and removing resources	Implementation of the Resources Management Plan Implementation of the Fire Management Plan Implementation of the Lake Meredith National Recreation Area Master Plan Mesquite Spraying on Adjacent Lands Cooperation with the Canadian River Water Management Authority Adjacent Agricultural Use Erosion/Siltation into Lake Meredith Management Actions of CRMWA Lowering of the Lake Level Groundwater pumping increasing and removing resources Implementation of the GMP
Soundscapes and the Acoustic Environment	National Recreation Area Boundary, plus Adjacent Land	Development of the Oil and Gas Management Plan Sand Drags event	Implementation of the Oil and Gas Management Plan Sand Drags event Development of the GMP	Implementation of the Oil and Gas Management Plan Sand Drags event Implementation of the GMP

Impact Topic	Study Area	Past Actions	Present Actions	Future Actions (life of plan/EIS)
Wildlife and Wildlife Habitat	National Recreation Area Boundary, plus Adjacent Land	Development of the Resources Management Plan Development of the Fire Management Plan ORV Use Prior to the National Recreation Area Development of the Lake Meredith National Recreation Area Master Plan Texas Wildlife Action Plan Hunting Invasive Species Removal Mesquite Spraying on Adjacent Lands Damming of Canadian River	Implementation of the Resources Management Plan Implementation of the Fire Management Plan Implementation of the Lake Meredith National Recreation Area Master Plan Texas Wildlife Action Plan Hunting Invasive Species Removal Mesquite Spraying on Adjacent Lands Development of the GMP Lower Lake Level Changing Available Natural and Recreation Resources in the Area Decline of Cottonwoods in the National Recreation Area and Region (related to lack of water)	Implementation of the Resources Management Plan Implementation of the Fire Management Plan Implementation of the Lake Meredith National Recreation Area Master Plan Texas Wildlife Action Plan Hunting Invasive Species Removal Mesquite Spraying on Adjacent Lands Lower Lake Level Changing Available Natural and Recreation Resources in the Area Decline of Cottonwoods in the National Recreation Area and Region (related to lack of water) Implementation of the GMP
Threatened and Endangered Species / Species of Concern	National Recreation Area Boundary, plus Adjacent Land	Same as “Wildlife and Wildlife Habitat”	Same as “Wildlife and Wildlife Habitat”	Same as “Wildlife and Wildlife Habitat”
Archeological Resources	National Recreation Area Boundary, plus Adjacent Land	Development of the Resources Management Plan ORV Use Prior to the National Recreation Area Development of the Lake Meredith National Recreation Area Master Plan	Implementation of the Resources Management Plan Implementation of the Lake Meredith National Recreation Area Master Plan Development of the GMP	Implementation of the Resources Management Plan Implementation of the Lake Meredith National Recreation Area Master Plan Implementation of the GMP

Impact Topic	Study Area	Past Actions	Present Actions	Future Actions (life of plan/EIS)
Visitor use and Experience / Health and Safety	National Recreation Area Boundary, plus Adjacent Land	Development of the Resources Management Plan Development of the Fire Management Plan ORV Use Prior to the National Recreation Area Development of the Lake Meredith National Recreation Area Master Plan Development of the Oil and Gas Management Plan Texas Off-Highway Vehicle Program Visitor Study Final Technical Report – Lake Meredith National Recreation Area and Alibates Flint Quarries National Monument Hunting Ongoing Maintenance Activities Sand Drags event Boat Fees for Visitors	Implementation of the Resources Management Plan Implementation of the Fire Management Plan Implementation of the Lake Meredith National Recreation Area Master Plan Implementation of the Oil and Gas Management Plan Texas Off-Highway Vehicle Program Hunting Ongoing Maintenance Activities Sand Drags event Boat Fees for Visitors Development of the GMP Removal of Trash Cans on State Property	Implementation of the Resources Management Plan Implementation of the Fire Management Plan Implementation of the Lake Meredith National Recreation Area Master Plan Implementation of the Oil and Gas Management Plan Texas Off-Highway Vehicle Program Hunting Ongoing Maintenance Activities Sand Drags event Boat Fees for Visitors Removal of Trash Cans on State Property Implementation of the GMP Multi-Use Trail Establishment Implementation of User Fees for Other Areas of Lake Meredith National Recreation Area

Impact Topic	Study Area	Past Actions	Present Actions	Future Actions (life of plan/EIS)
Lake Meredith Recreation Area Management and Operations	National Recreation Area Boundary, plus Adjacent Land	Development of the Resources Management Plan Development of the Fire Management Plan ORV Use Prior to the National Recreation Area Development of the Lake Meredith National Recreation Area Master Plan Development of the Oil and Gas Management Plan Texas Off-Highway Vehicle Program Hunting Invasive Species Removal Ongoing Maintenance Activities Sand Drags event Boat Fees for Visitors Demolished and Replaced Comfort Station to Meet ADA Requirements Replaced Fixtures at Three Comfort Stations with Water-Saving Models Replaced Roof on Visitor Contact Station and Maintenance Facility Replaced HVAC System in Ranger Station	Implementation of the Resources Management Plan Implementation of the Fire Management Plan Implementation of the Lake Meredith National Recreation Area Master Plan Implementation of the Oil and Gas Management Plan Texas Off-Highway Vehicle Program Hunting Invasive Species Removal Ongoing Maintenance Activities Sand Drags event Boat Fees for Visitors Development of the GMP Removal of Trash Cans on State Property Emergency Services Partnerships	Implementation of the Resources Management Plan Implementation of the Fire Management Plan Implementation of the Lake Meredith National Recreation Area Master Plan Implementation of the Oil and Gas Management Plan Texas Off-Highway Vehicle Program Hunting Invasive Species Removal Ongoing Maintenance Activities Sand Drags event Boat Fees for Visitors Removal of Trash Cans on State Property Emergency Services Partnerships Implementation of the GMP Multi-Use Trail Implementation of User Fees for other areas of Lake Meredith National Recreation Area

RELATIONSHIP TO OTHER LAKE MEREDITH NATIONAL RECREATION AREA PLANNING DOCUMENTS, POLICIES, AND ACTIONS

Development and Implementation of the 1998 Fire Management Plan—The objectives of the 1998 fire management plan are to protect life, property, and resources from wildfire; use prescribed fire to accomplish resource management objectives; avoid unnecessary effects of fire management operations to prevent adverse impacts from fire management activities; and prevent wildfires. Components of these objectives that would cumulatively contribute to the effects of ORV use in the recreation area include reducing woody species to protect sensitive resources; perpetuating the natural occurrence of native vegetation ecosystems and restoring the landscape to the natural, pre-Anglo settlement prairie setting that existed before livestock grazing; and preventing unplanned human-caused ignitions. Specific actions to be taken under the fire management plan include the reduction of hazardous fuels such as woody vegetation through mechanical removal and prescribed fires, during which times closures and campfire limitations could be imposed. These actions could variously impact ORV user activities occurring at the park unit.

Development and Implementation of the Oil and Gas Management Plan—In September of 2002, an Oil and Gas Management Plan was approved for the Lake Meredith National Recreation Area with the purpose of addressing the issues of how the NPS can recognize the rights of private mineral owners to develop their oil and gas estates while also ensuring the protection of park resources and values, ensuring public safety, and minimizing conflicts with visitors and park management. A central component to the implementation of the Oil and Gas Management Plan has been the designation of all areas of the park as Special Management Areas with specific operating stipulations applied to oil and gas development. ORV use is a contributing factor to vegetation disturbances, which are also brought about by site clearing for oil and gas development. Road clearing from oil and gas development can also contribute to the proliferation of user-created ORV trails in areas of the park unit that were previously undisturbed. Through the effective management of oil and gas development as a result of the Oil and Gas Management Plan, however, the park is able to better protect its resources from the varying uses of lands in the park unit.

Development of a General Management Plan—The draft GMP for Lake Meredith National Recreation Area was published and open for public comment in January 2013, with the final GMP still under development at the time of this writing. A key feature of the plan is to determine ways to expand visitor opportunities at the national recreation area in response to changing conditions at the park, such as the variability of the lake water level in recent years. The park is exploring methods to improve existing recreation and introduce new activities at the national recreation area. The NPS identified alternative 3 as the preferred alternative in the draft GMP. Under alternative 3, management of Lake Meredith National Recreation Area would promote both traditional and nontraditional uses, providing development of facilities and opportunities to address changing lake conditions and visitor uses. It would become a destination for semi-primitive outdoor recreation opportunities for a broad range of skill levels. The national recreation area would strengthen partnership opportunities that employ science-based resource management and compatible land management uses to improve visitor experience and wildlife habitat. This alternative further identifies Rosita Flats and Blue Creek as ORV use areas, with management following this plan/EIS.

Boat Fees for Visitors—Lake Meredith National Recreation Area assesses annual boat launch fees of $40, three-day fees of $10, and a 1-day fee of $4. The boat launch fees fund boating safety improvements at launch ramps and waterways. Any vessel that requires a state registration number is subject to the fee. Many visitors that use the national recreation area take advantage of multiple opportunities. Those visitors would need to pay multiple fees if an alternative was selected that included ORV fees, therefore this item was considered during this plan/EIS.

Implementation of the Multi-use Trail—In 2010, an environmental assessment was completed for a plan to construct a non-motorized, multi-use recreational trail along the eastern portion of Lake Meredith. Along with the construction of the multi-use trail, the plan will install interpretive signs, kiosks, bike racks, and trash receptacles. The multi-use trail will consist of five phases of primitive trails totaling approximately 22 miles in length and will be available for pedestrian and bicycle use. The trail will not enter the Rosita Flats ORV use area. However, portions of the proposed multi-use trail would be located in areas open to hunting, and the use of ORVs has been a popular means of transportation for visitors engaging in hunting in the recreation area. As a result, there may be interactions between pedestrian users of the trail and ORV users.

Invasive Species Removal—Currently, invasive species removal efforts are being concentrated in high visitor use areas including near the Sanford-Yake and Fritch Fortress boat ramps, Cedar Canyon, on the Harbor Bay East Trail, and the Mullinaw Trail. Removal activities include hand application of herbicides and some minor mechanical removal (mowing). Actions that would increase or decrease the amount of invasive species in the recreation area would impact these operations.

Ongoing Maintenance Activities—These activities include maintenance of roads, paths, buildings, campgrounds, boat ramps, ORV use areas, and other facilities in the national recreation area. Typical maintenance activities also include repair of facilities, maintenance of lawns and other vegetation, trash removal, and installation of new amenities. These activities can have impacts on recreation area staff by requiring time and resources, as well as the potential for ground disturbance which can impact vegetation and soils. The level of maintenance also impacts visitor use and experience because the appearance and functionality of facilities improves the visitor experience, providing beneficial impacts to visitors.

Decline of Cottonwoods in the Recreation Area—In recent years, the number of cottonwoods in the recreation area has declined. Mainly, this decline can be attributed to the reduction in the amount of available water. This decline impacts the habitat available to wildlife, including threatened and endangered species, as well as vegetation by altering the available habitat in the area.

Cooperation with the Canadian River Management Authority—The recreation area cooperates with the Canadian River Management Authority to manage resources in the area. Recent examples of this cooperation include the 2009–2010 aerial application of herbicide for tamarisk removal and the Canadian River channel revitalization project. These efforts have beneficial impacts on natural resources in the area, and require recreation area staff time for coordination.

Lowering of Lake Level—Water levels in Lake Meredith have been steadily dropping over the past 10 years. The current depth of the lake is 43.59 feet (as of August 5, 2014). The record high depth was 101.85 feet (April 1973) and the record low was 26.14 feet (August 7, 2013). The lowering of the lake levels have been due to many factors such as lack of rain fall in the watershed and pumping for local use (CRMWA n.d.). One of the main factors in the lake level decline has been the spread of salt cedar. This plant spreads quickly and requires a lot of water, impacting lake levels. Lower lake levels impact visitor use and experience because low lake levels do not allow for many water-dependent activities (such as boating). As these visitor opportunities decrease, visitors look for opportunities in other parts of the recreation area. Lower lake levels also mean a reduced water supply for the surrounding area, impacting water resources as well as reducing the water and habitat available for wildlife, including threatened and endangered species.

Hunting Activities—Hunting occurs at various times throughout the year within the recreation area including in Blue Creek and Rosita Flats. Game species within the recreation area include dove, turkey, quail, duck, goose, and whitetail and mule deer. Each species has a specific season for which hunting can occur, ranging from late September to December, with turkey season extending into March. Hunting is one of the many visitor activities at the recreation area that contribute to and could impact the visitor experience. Management of the hunting program has the potential to impact park operations and management, because staff time and resources are needed for administration.

Demolish and Replace Comfort Station to meet ADA Requirements, Replace Fixtures at the Three Comfort Stations with Water Saving Models, Replace Room on the Visitor Centers Contact Station and Maintenance Facility, and Replace HAVC System in Ranger Station—Multiple visitor improvement projects have been conducted at the recreation area. These projects had a short-term impact on park operations (due to resource requirements) and long-term impacts on upkeep, with long-term beneficial impacts to the visitor experience from improved facilities.

Emergency Services Partnership—The recreation area has partnerships with Hutchinson County, Potter County, Moore County, and Fritch Emergency Management Service. These partnerships can put additional requirements on recreation area staff, but the partners can assist the recreation area when needed.

Implementation of User Fees for the Recreation Area—The ongoing GMP process discusses the potential for user fees related to ORV and campground utility hookups. Additional user fees may be implemented at a later date, but would require a feasibility study before implementation.

RELATIONSHIP TO OTHER STATE AND LOCAL PLANNING DOCUMENTS, POLICIES, ACTIONS, LAWS, AND REGULATIONS

ORV Use Prior to the National Recreation Area—Prior to the establishment of the Sanford River Project in 1965, the Canadian River and Blue Creek riparian area were utilized by the local community for recreational use. Lake Meredith was created by the construction of Sanford Dam in the early 1960s for the purpose of impoundment and diversion of water for 11 municipalities located in the Texas panhandle. Over the next decade, two ORV areas were designated under special regulation 36 CFR 7.57. Since that time, the use of the two ORV areas has caused extensive erosion and vegetation damage to the hillsides of Rosita and erosion of trail at the Bull Taco Hill area. The Blue Creek off-road use area has incurred comparatively less damage.

Amarillo Sand Drags—Amarillo sand drags is a competitive ORV drag racing event that began in the 1980s and is hosted by local ORV organizations. Held every February, the event attracts thousands of spectators and hundreds of motorcycles, four wheelers, sand rails, and river buggies on state lands adjacent to Rosita Flats. Drivers of these vehicles compete against one another in ORV races. Although the event itself is held on state-owned lands, the event's increasing popularity has resulted in spill-over effects on parklands outside the main event grounds. There is a substantial increase in visitor use at Lake Meredith associated with this annual event, and this dramatic increase in visitation necessitates greater law enforcement and park management services, while the increased intensity of ORV use has the potential to negatively affect soils and other natural resources from the spill over use.

Land and Water Resources Conservation and Recreation Plan—In 2005, the TPWD developed the Land and Water Resources Conservation and Recreation Plan, which identifies priorities for recreation on land, cites growing urban population and limited public land access as a threat to public outdoor recreation, and establishes the following goals and objectives that are particularly relevant to how ORV use is managed on public lands: promote and expand outdoor recreational activities; promote awareness and support of safe and responsible use of the outdoors; and identify opportunities to expand outdoor recreation, water access, hunting, and fishing on both public and private lands and waters. The plan also identifies the Canadian River Basin as a target for needed in-streamflow studies to evaluate river and stream systems in order to determine the appropriate flow regimes necessary to conserve fish, wildlife, and recreational resources. The results of these studies may lead to modifications to the management of the watershed and implications for recreational uses in the park unit.

Damming of the Canadian River Project—The construction of the Canadian River Project began under the authority of the BOR with the award of the construction contract for Sanford Dam in February 1962. Lake Meredith, the artificial reservoir created by Sanford Dam, has a total capacity of 1,382,500 acre-feet. The reservoir currently provides flood control, fish and wildlife, recreation, and municipal and industrial water supply. The damming of the Canadian River, while providing for the benefits of municipal and industrial water supply, recreation, and flood control, incurs the cost of all water impoundment projects in the form of direct effects on the natural riverine systems and aquatic life existing prior to dam construction. Continued ORV use can contribute incrementally to the further deterioration of riparian habitat, which has already been impacted by changes from the predisturbance flow regime.

Management Actions of the Canadian River Water Management Authority—Upon the completion of Sanford Dam, the Texas Legislature created the CRMWA for the purpose of providing a source of municipal and industrial water for the following 11 member cities that it serves: Amarillo, Brownfield,

Borger, Lamesa, Levelland, Lubbock, O'Donnell, Pampa, Plainview, Slaton, and Tahoka. The CRMWA Board of Directors is made up of 17 members appointed to two-year terms by the member cities. The Board meets once every quarter to set policy, review progress on major activities and issues, and authorize large expenditures and projects. Ongoing projects of the CRMWA include the Salt Cedar Management Program, which aims to increase flow in the Canadian River and its tributaries within the Lake Meredith watershed, increase water quality in the Canadian River, and create better habitat for the federally listed Arkansas River shiner. Continued ORV use at Lake Meredith, combined with management actions such as the Salt Cedar Management Program that remove woody vegetation, can contribute to further bank destabilization and erosion.

Mesquite Spraying on Adjacent Lands—Past land uses practices on adjacent lands have included spraying of mesquite. To park staffs knowledge, spraying is not a current practices, rather plants are pulled and removed. How mesquite is addressed depends on the land owners' preference. Activities on adjacent lands that use spraying could impact water quality in the recreation area. The presence of mesquite on adjacent lands could also impact the recreation area by spreading from those areas into Lake Meredith National Recreation Area.

Damming of the Canadian River—Damming of the Canadian River limits water availability in other areas. This can create impacts to threatened and endangered species, such as the Arkansas River shiner, in other areas such as New Mexico.

Adjacent Agriculture—Agricultural practices on adjacent lands mainly include grazing and calf/cow operations. Waste produced from these operations could impact water resource in the recreation area through runoff into nearby water bodies.

Erosion/Siltation into Lake Meredith—In general, erosion and siltation from surrounding land uses has contributed to lower lake levels in the recreation area. This impacts water resources, wildlife, vegetation, and visitor use and experience.

Groundwater Pumping—Although not currently occurring, historical pumping of groundwater in the region has contributed to lower lake levels, impacting natural resources, as well as visitor use and experience.

Removal of Trash Cans from State Property—The removal of trash cans from the state property adjacent to Rosita Flats has resulted in an increased demand for trash receptacles in the recreation area. This impacts park operations but increasing duties related to trash management and removal at this site.

SOILS

Section 4.8.2.4 of the NPS *Management Policies 2006*, "Soil Resource Management," states that the NPS will "actively seek to understand and preserve the soil resources of park units, and to prevent, to the extent possible, the unnatural erosion, physical removal, or contamination of the soil or its contamination of other resources" (NPS 2006b). NPS *Management Policies 2006* further states that management actions will be taken to prevent or minimize potentially irreversible adverse impacts on soils.

METHODOLOGY, ASSUMPTIONS, AND INTENSITY DEFINITIONS

Impacts on soils were assessed by determining the types and current conditions of the soils in ORV use areas and evaluating the extent to which motorized vehicle access would cause potential impacts in the ORV use areas. This included an assessment of the potential beneficial effects of closing certain routes/areas to motorized vehicle access, as well as the potential adverse effects of allowing ORV use on

designated routes and areas. The study area for this analysis is composed of the two areas located within the boundaries of Blue Creek and Rosita Flats. Because 8 of the 13 soil associations identified within the two ORV use areas of Lake Meredith National Recreation Area exhibit moderate to severe erosion hazard on roads and routes, erosion is the primary issue analyzed. Other effects from disturbance, such as soil compaction and removal, are also addressed. The definitions for the intensity of an impact are as follows:

Negligible: The management and operation of ORVs would not cause discernible alteration (physical disturbance/removal, compaction, or unnatural erosion of soils) to the soils in the national recreation area. The alteration of soil resources would be so slight that their ability to sustain biota and water quality would not be affected.

Minor: The management and operation of ORVs would cause localized or limited alteration (physical disturbance/removal, compaction, or unnatural erosion of soils) to soils in the national recreation area. The alteration of soils would affect their ability to sustain biota and water quality, such that mitigation may be needed to offset adverse effects and would be relatively simple to implement and would likely be successful.

Moderate: The management and operation of ORVs would cause alteration (physical disturbance/removal, compaction, or unnatural erosion of soils) to soils in the national recreation area. The alteration of soil resources would affect their ability to sustain biota and water quality, such that mitigation measures would be necessary to offset adverse effects and they would likely be successful.

Major: The management and operation of ORVs would cause substantial alteration (physical disturbance/removal, compaction, or unnatural erosion of soils) to soils in the national recreation area. The alteration of soil resources would have a lasting effect on the ability of soils to sustain biota and water quality, such that mitigation measures to offset adverse effects would be needed, they would be extensive, and their success could not be guaranteed.

Duration: Short-term—Impacts would last less than three years.

Long-term—Impacts would last more than three years.

Study Area

The study area for this topic is defined as the lands contained within the boundaries of Rosita Flats and Blue Creek ORV use areas for the analysis of the impacts of the alternatives and defined as Lake Meredith National Recreation Area and adjacent land for the analysis of cumulative impacts. ORV use could occur throughout Blue Creek along the creek bottom from cutbank to cutbank and throughout Rosita Flats below the 3,000-foot elevation line. Together, these ORV use areas constitute less than 20 percent or one-fifth of the total national recreation area.

IMPACTS OF ALTERNATIVE A: NO ACTION – CONTINUATION OF CURRENT MANAGEMENT

Under alternative A, the management of ORV use and access at the national recreation area would be a continuation of management based on the 2007 *Interim OHV Use Plan* (NPS 2007a), the regulations in 36 CFR 7.57, and the Superintendent's Compendium (NPS 2008d).

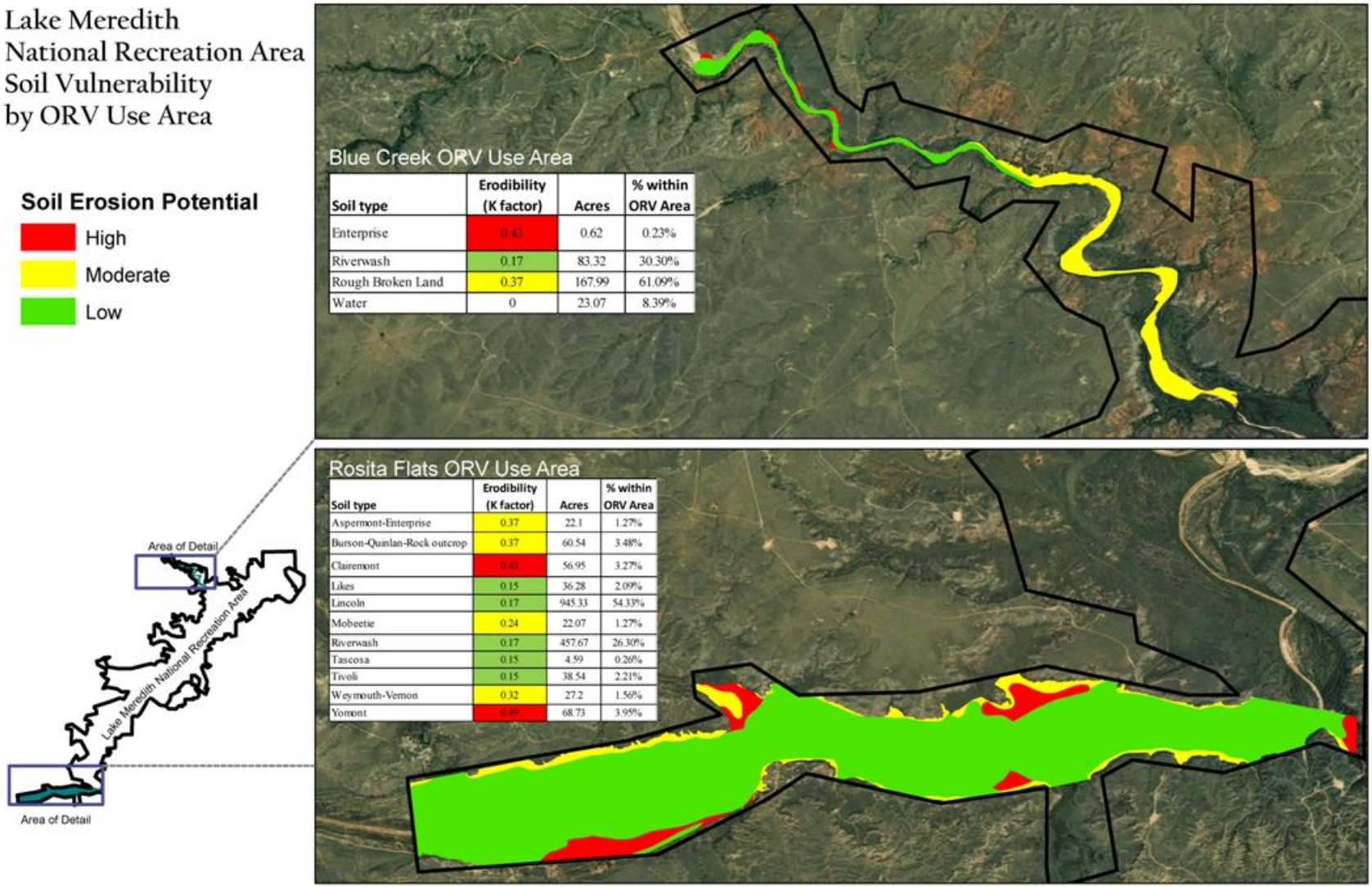
Blue Creek ORV Use Area

Under alternative A, soils in the ORV use area would continue to be affected through ongoing erosion and compaction from vehicles operating directly on the soil substrate, with no routes or areas designated for use. Soil compaction decreases soil permeability, which contributes to more highly channelized runoff during storm events and corresponding erosion of adjacent areas. Moreover, in the absence of designated ORV routes, direct impacts from ORVs could result in the loss of vegetation, which would also result in higher erosion potential. Other recreational activities, such as camping in vegetated areas, would similarly continue to result in disturbance and damage to soils through compaction and erosion. The primary soil type in the northwestern portion of the ORV use area is riverwash, which is a deep, sandy material that occupies the bottom of dry stream channels. Riverwash constitutes approximately 30 percent of the total ORV use area and has a low erosion potential, with a K factor of 0.17 (see figure 25). Common ORV use resulting in physical changes to the streambed, such as tire ruts and gouges, would not result in permanent physical alterations of this sandy bottom, which can return to predisturbance conditions over a short period of time. Because riverwash constitutes the most prevalent soil type in the area between cutbanks in the northwestern portion of the use area, surface disturbances would be contained to the extreme edges of the cutbanks, where very minute portions of highly erodible (K factor of 0.43) Enterprise soils are found, and the southeastern portion of the ORV use area, which is characterized by rough broken land having a moderate erosion potential, with a K factor of 0.37. ORV use in the southeastern portion of the ORV use area, which constitutes approximately 60 percent of the total ORV use area, would be particularly prone to impacting this more sensitive soil substrate.

No routes or areas would be established, the allowable ORV use area (cutbank to cutbank) would not be marked, and posts or other physical markers would not be installed to contain ORV use to specific areas. This would result in continuing impacts throughout Blue Creek, because operators would be able to easily traverse the entire area with no restrictions. Additionally, this would result in a larger “footprint” of impacts on soils when compared to alternatives that designate routes and areas. These impacts would be more severe as a result of higher vehicle speeds due to the lack of speed limits. By contrast, ongoing ORV use among national recreation area personnel for law enforcement and other purposes would continue to result in less-than-substantial impacts on soils because such use is subject to strict regulation of speeds and constrained whenever possible to designated routes. Notable surface disturbances from the use of ORVs at high speeds over a large area and not constrained to designated routes would be readily apparent in these marginal portions of the use area and would result in additional compaction and erosion, causing substantial alteration of soils without the employment of extensive mitigation. As a result, adverse impacts on soils in the Blue Creek ORV use area would be localized, long term, and major.

Rosita Flats ORV Use Area

Under alternative A, soils in the Rosita Flats ORV use area would continue to be affected by ongoing disturbances similar to those at the Blue Creek ORV use area. Other recreational uses, such as camping in vegetated areas, would continue to result in disturbance and damage to soils through compaction and erosion. Approximately 15 percent of the soils in the Rosita Flats ORV use area are classified as having moderate or high erosion potential, and these soils are located along the edges of the ORV use area (figure 25). Because the 3,000-foot elevation line would remain unmarked, there would be ongoing uncertainty about where ORV use would be allowed, resulting in continued impacts on these more sensitive soils. In the absence of extensive mitigation measures, these adverse effects would continue to be readily apparent in these portions of the use area, which would affect the ability of soils to sustain biota and water quality. The implementation of alternative A would result in localized long-term major adverse impacts on soils in the Rosita Flats ORV use area.



Soil type	Erodibility (K factor)	Acres	% within ORV Area
Enterprise	0.43	0.62	0.23%
Riverwash	0.17	83.32	30.30%
Rough Broken Land	0.37	167.99	61.09%
Water	0	23.07	8.39%

Soil type	Erodibility (K factor)	Acres	% within ORV Area
Aspermont-Enterprise	0.37	22.1	1.27%
Burson-Quinlan-Rock outcrop	0.37	60.54	3.48%
Clairemont	0.43	56.95	3.27%
Likes	0.15	36.28	2.09%
Lincoln	0.17	945.33	54.33%
Mobeetie	0.24	22.07	1.27%
Riverwash	0.17	457.67	26.30%
Tascosa	0.15	4.59	0.26%
Tivoli	0.15	38.54	2.21%
Weymouth-Vernon	0.32	27.2	1.56%
Yomont	0.49	68.73	3.95%

FIGURE 25: LAKE MEREDITH NATIONAL RECREATION AREA SOIL VULNERABILITY BY OFF-ROAD VEHICLE USE AREA

Cumulative Impacts

Other past, present, and future planning actions at the national recreation area have the potential to adversely and beneficially affect soils at both ORV use areas. ORV use occurring prior to the establishment of the national recreation area has resulted in major impacts on soils in the ORV use area and periphery. Under alternative A, soils would be adversely affected by ongoing maintenance activities throughout the national recreation area, such as roadway maintenance and invasive species management, which may involve the removal of vegetation, cause soil compaction and rutting, reduce permeability, and increase erosion. Thus, impacts on soils from maintenance activities would be expected to continue under alternative A. These actions have the potential to result in localized long-term minor adverse impacts on soils.

In addition to actions with negative effects on soils, some actions would have beneficial effects. Plans specifically related to ORV use that could contribute to soil impacts include the Resources Management Plan (NPS 1996), which provides goals for the national recreation area that address preserving national recreation area resources. The national recreation area is currently developing a GMP that will articulate the long-term vision that will guide management of the national recreation area for the next 15 to 20 years. The decision to develop a GMP is, in part, a response to changes in the recreation opportunities at Lake Meredith because of changes in the lake level. During the planning process, the NPS will explore different approaches to preserve the important recreational opportunities, natural resources, and cultural histories of the national recreation area (NPS 2009k). Upon implementation of the plan, the national recreation area would manage natural resources, including soils, in a manner consistent with laws, NPS policy, and standards. The development and implementation of these plans would, over time, result in improving resource protection aspects through regulatory mechanisms. These changes could have long-term beneficial impacts on soils due to improving resource protection practices.

Overall, the impacts of these past, present, and future actions would be long term, minor, and adverse. When combined with the localized long-term major adverse impacts of alternative A, these actions would result in long-term moderate adverse cumulative impacts on soil resources.

Conclusion

Under alternative A, continued ORV use at Blue Creek and Rosita Flats would result in long-term localized major adverse impacts on soils. Incremental contributions to soil erosion would be most notable at the extreme edges of the cutbanks and the eastern extent of the Blue Creek ORV use area and at the edges of the Rosita Flats ORV use area. The long-term minor adverse effects of past, present, and reasonably foreseeable future actions, when combined with the long-term major adverse impacts of alternative A, would result in long-term moderate adverse cumulative impacts on soil resources.

Impacts of Alternative B: Zone System – Separation of Visitor Uses, with a Permit for Educational Purposes

Alternative B would institute a zoning system, in addition to designated routes and areas, that would further manage ORV use. Established zones could include camping-only zones, hunting zones, resource protection zones, low-speed zones, and beginner zones. A no-charge ORV permit system would also be implemented where the permits could be revoked if riders are found off designated routes.

Blue Creek ORV Use Area

Under alternative B, the establishment of a zone system and separation of visitor uses would promote resource protection at Blue Creek by limiting impacts to discrete portions of the use area. Although

intensification of disturbances would occur in designated camping zones, these impacts would potentially be mitigated by prohibiting camping outside these areas. Speed limits of 15 mph in camping zones and a low-speed zone near the highway bridge would further reduce impacts from vehicle-caused soil erosion and compaction. Surface disturbances would be contained to already-disturbed portions of the ORV use area. As a result of this protection, vegetation throughout Blue Creek would be less vulnerable to damage and removal and would provide an erosion control function through root structure and the effect of wind diffusion. Educational measures would provide long-term beneficial impacts on soils from increased awareness and behavior modification among ORV users. Ongoing ORV use among national recreation area personnel for law enforcement and other purposes would continue to result in less-than-substantial impacts on soils because such use is subject to strict regulation of speeds and constrained whenever possible to designated routes. The implementation of a permit system in which riders found off route would have their permits revoked would create an incentive to comply, thereby reducing impacts on soils. As a result, adverse impacts on soils in the Blue Creek ORV use area would be localized, long term, and moderate.

Rosita Flats ORV Use Area

Under alternative B, the establishment of a zone system and separation of visitor uses would promote resource protection at Rosita Flats. Intensification of uses at certain areas would impact soils at those locations. For instance, the proposed beginner zone and designated camping zones would together overlie 14 acres of highly erodible Yomont- and Clairemont-type soils. However, long-term beneficial impacts would potentially result from the establishment of a resource protection zone that would prohibit vehicles with a wheel width greater than 64 inches from driving on approximately 1,040 acres of soils, 172 acres (17 percent) of which are classified specifically within the resource protection zone as highly erodible. Moreover, post -and -cable fencing would be installed to define specific zones under this alternative. During the installation of the post and cable materials, there would be limited disturbances to soils, resulting in localized short-term moderate adverse impacts on soils. These impacts would need to be mitigated by using least damaging methods during installation, such as digging post holes rather than trenches and tamping to ensure that soils are compacted to control runoff. Once established, this boundary would create a containment area, reducing impacts on soils outside the established zone. Consequently, long-term beneficial impacts would result from the establishment of the zone system because areas outside various use zones or outside designated routes and areas would receive less disturbance. Educational measures would provide beneficial impacts on soils from increased awareness and behavior modification among ORV users. Ongoing ORV use among national recreation area personnel for law enforcement and other purposes would continue to result in less-than-substantial impacts on soils because such use is subject to strict regulation of speeds and constrained whenever possible to designated routes. In combination with educational outreach, the implementation of a permit system in which riders found off route would have their permits revoked would create an incentive to comply. Speed limits of 15 mph in camping zones would further reduce impacts from vehicle-caused soil erosion and compaction. Overall, adverse impacts on soils in the Rosita Flats ORV use area would be localized, long term, and moderate.

Cumulative Impacts

Past, present, and reasonably foreseeable future actions with the potential for impacts on soils under alternative B would be identical to those under alternative A: impacts would be localized, long term, minor, and adverse. In combination with the localized long-term moderate adverse impacts of alternative B, cumulative impacts on soils would be localized, long term, moderate, and adverse.

Conclusion

Under alternative B, continued ORV use at Blue Creek and Rosita Flats would result in localized short- and long-term moderate adverse impacts on soils. There would also be long-term beneficial impacts on soils accruing from educational measures provide increased awareness and behavior modification among ORV users. Incremental contributions to soil erosion would result from the intensification of uses in certain areas, such as the proposed beginner zone and designated camping areas, and would impact soils at those locations. However, this impact would potentially be mitigated by the establishment of zoning restrictions. The long-term minor adverse effects of past, present, and reasonably foreseeable future actions, when combined with the long-term moderate adverse impacts of alternative B, would result in long-term moderate adverse cumulative impacts on soils.

IMPACTS OF ALTERNATIVE C: MANAGEMENT THROUGH USE OF A PERMIT SYSTEM AT CURRENT ORV USE AREAS

Under alternative C, the national recreation area would manage ORV use through a permit system as well as through the establishment of an ORV user capacity. Permits would include a fee and initially there would be no limit on the number of permits issued. Fees from the permits would be used to add amenities to the ORV use areas, including pit toilets, fire rings, and picnic tables. ORV routes and areas would be the same as those established under alternative B, except there would be no designated ORV use area east of Bull Taco Hill.

Blue Creek ORV Use Area

Under alternative C, the establishment of an ORV route system for the Blue Creek ORV use area would discourage further disturbance in areas where a high probability of impacts on soils through erosion exists. These routes would be established on already-disturbed user-created ORV trails. As a component in determining the precise location of ORV use routes and areas, resource characteristics such as soil erodibility will be taken into consideration, and areas with highly erodible soils will be avoided to the extent possible as part of the revised management scenario under alternative C. Other user -created trails would not be designated as routes and would be allowed to recover naturally. Restrictions would also be placed on camping, which would be permitted only on designated camping sites located in already-disturbed areas, thereby eliminating impacts on soils from camping outside these areas. Impacts on soils, which would be of high intensity and occur over the long-term life of the management plan, would be contained within camping areas.

Under alternative C, the establishment of a user-fee permit system, while placing no strict limit on entry, would potentially reduce the amount of visitation and place a lesser burden on the landscape, thereby reducing impacts on soils. Contingent valuation studies (Turpie 2003) have found that a willingness to pay for conservation measures is positively correlated with an active interest in nature-related activities, suggesting that national recreation area users who pay entry may be more keenly interested in the maintenance of national recreation area resources for those purposes.

Moreover, alternative C would retain the option of limited entry if a study of use limits determined that such an option was warranted. The prospect of limited visitation would promote resource protection at the Blue Creek ORV use area. Further, added benefits to soils would accrue from the establishment of a permit system in which ORV use permits would be revoked in the case of users driving off route, as well as from the establishment of speed limits (35 mph on routes and 55 mph on the sandy river bottom). Educational measures such as “tread lightly” pamphlets would provide beneficial impacts on soils from increased awareness and behavior modification among ORV users. Overall, these expanded resource protection measures would result in long-term beneficial impacts on soils under alternative C by reducing

and containing the extent of soil erosion. Soils would continue to be impacted in portions of the ORV use area where travel is still permitted. However, due to the sandy nature of soils in the riverwash portion of the ORV use area, these impacts would not be detectable throughout most of the ORV use area and would cause very little or no physical disturbance when compared with current conditions. Thus, the implementation of expanded resource protection measures under alternative C would result in localized long-term moderate adverse impacts on soils in the Blue Creek ORV use area.

Rosita Flats ORV Use Area

Under alternative C, the establishment of a user-fee permit system, while placing no strict limit on entry, would potentially reduce the amount of visitation, which would place a lesser burden on the landscape, thereby reducing impacts on soils. Moreover, alternative C would retain the option of limited entry if a study of use limits determined that such an option was warranted. The prospect of limited visitation would promote resource protection at the Rosita Flats ORV use area. Impacts on soils would potentially be mitigated by the establishment of use restrictions such as hike-in-only camping. Further, added benefits to soils would accrue from the establishment of a permit system in which ORV use permits would be revoked in the case of users driving off route. Educational measures such as “tread lightly” pamphlets would provide beneficial impacts on soils from increased awareness and behavior modification among ORV users. Hardening of the route surface for improved access to the ORV use area at Rosita Flats would result in impacts from compaction of soils. Similarly, intensification of uses at discrete locations within the ORV use area would impact soils at those locations. For instance, the proposed ORV use area and designated camping sites in Rosita Flats under alternative C would together overlie 14 acres of highly erodible Yomont- and Clairemont-type soils. However, some impacts on soils would likely be mitigated by restrictions on vehicle entry to camping locations because, with the exception of one drive-in campground, access to campsites would be available on foot only. According to Wilson and Seney (1994), foot traffic generally creates less disturbance in terms of erosion on dry soils than motorized vehicles[1]. Thus, impacts on soils would potentially be mitigated by the establishment of use restrictions such as hike-in-only camping. Overall, adverse impacts on soils in the Rosita Flats ORV use area would be localized, long term, and moderate.

Cumulative Impacts

Past, present, and reasonably foreseeable future actions with the potential for impacts on soils under alternative C would be identical to those under alternative A: impacts would be localized, long term, minor, and adverse. In combination with the localized long-term moderate adverse impacts of alternative C, cumulative impacts on soils would be localized, long term, moderate, and adverse.

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[1] Horses produced significantly larger quantities of sediment compared to hikers, off-road bicycles, and motorcycles; the greatest sediment yields occurred on wet trails. Different trail uses result in different erosion rates, presumably because different users exert different forces. Weaver and Dale (1978) also compared motorcycle erosion with horse and foot erosion. Motorcycles moving uphill established a narrow rut which increased the velocity and sediment transport capacity of trail runoff. The development of this linear channel was the direct result of the imprint of the tire and the torque applied by the motorcycle which then led to increased erosion. However, motorcycles moving downhill, when torque is not needed, caused less erosion than hikers and horses which tend to loosen soil when descending a steep trail because greater forces are applied when decelerating and moving down a steep trail.

Conclusion

Under alternative C, continued ORV use at Blue Creek and Rosita Flats would result in localized long-term moderate adverse impacts on soils. There would also be long-term beneficial impacts on soils accruing from enhanced resource protection measures. Incremental contributions to soil erosion would result from intensification of uses at certain areas and would impact soils at those locations. However, this impact would potentially be mitigated by the establishment of use restrictions such as hike-in-only camping. The long-term minor adverse effects of past, present, and reasonably foreseeable future actions, when combined with the long-term moderate adverse impacts of alternative C, would result in long-term moderate adverse cumulative impacts on soils.

IMPACTS OF ALTERNATIVE D: MANAGEMENT THROUGH USE OF A ZONING AND PERMITTING SYSTEM AT CURRENT ORV USE AREAS

Alternative D would establish a fee-based permit system as well as instituting a zoning system to manage ORV use. The permit system would include a fee and there would be no limit on the number of permits issued. Fees from the permits would be used to add amenities to the ORV use areas, including pit toilets, fire rings, and picnic tables. ORV use zones established under this alternative could include camping-only zones, hunting zones, resource protection zones, low-speed zones, and beginner zones.

Blue Creek ORV Use Area

Under alternative D, the establishment of a zone system and separation of visitor uses would promote resource protection at Blue Creek ORV use area by limiting impacts to discrete portions of the use area. Any intensification of disturbances occurring as a result of designated camping areas in Blue Creek would potentially be mitigated by the establishment of no-camping zones around vegetated areas. Speed limits in camping zones and a low-speed zone near the highway bridge, although primarily intended to improve visitor safety, would have the secondary effect of further reducing impacts from vehicle-caused soil erosion and compaction by containing the area of disturbance and reducing the occurrence of rutting from vehicles travelling at higher speeds. Surface disturbances would be contained to previously-disturbed portions of the ORV use area. As a result of this protection, vegetation throughout the use area would be less vulnerable to damage and removal and would provide an erosion control function through root structure and the effect of wind diffusion.

Ongoing ORV use by national recreation area personnel for law enforcement and other purposes would continue to result in less-than-substantial impacts on soils because such use is subject to strict regulation of speeds and constrained to designated routes whenever possible.

Use limits would not be established under alternative D. However, the implementation of a permit system in which riders found off route would have their permits revoked would create an incentive to comply, thereby reducing impacts on soils in protected areas.

Educational measures such as “tread lightly” pamphlets would provide beneficial impacts to soils from increased awareness and behavior modification among ORV users. As documented by Bogner (1998), environmental education programs can effectively provoke favorable shifts in individual behavior toward more pro-environmental orientations. Thus, increased environmental protection can be achieved through educational outreach. Measures such as increased awareness and behavior modification among ORV users would result in beneficial impacts to soils.

As a result of these improvements to ORV use management under alternative D, adverse impacts on soils in the Blue Creek ORV use area would be localized, long term, and minor to moderate.

Rosita Flats ORV Use Area

Under alternative D, the establishment of a zone system and separation of visitor uses would promote resource protection at the Rosita Flats ORV use area by limiting impacts to discrete portions of the use area. Although intensification of disturbances would occur as a result of designated camping areas, these impacts would potentially be mitigated by the establishment of no-camping zones around vegetated areas. Speed limits of 15 mph in camping zones, although primarily intended to improve visitor safety, would have the secondary effect of further reducing impacts from vehicle-caused soil erosion and compaction by containing the area of disturbance and reducing the occurrence of rutting from vehicles travelling at higher speeds. Surface disturbances would be contained to previously disturbed portions of the ORV use area. As a result of this protection, vegetation throughout the use area would be less vulnerable to damage and removal and would provide an erosion control function through root structure and the effect of wind diffusion.

Ongoing ORV use by national recreation area personnel for law enforcement and other purposes would continue to result in less-than-substantial impacts to soils because such use is subject to strict regulation of speeds and constrained to designated routes whenever possible.

Use limits would not be established under alternative D. However, the implementation of a permit system in which riders found off route would have their permits revoked would create an incentive to comply, thereby reducing impacts to soils in protected areas.

Educational measures such as “tread lightly” pamphlets would provide beneficial impacts to soils from increased awareness and behavior modification among ORV users. As documented by Bogner (1998), environmental education programs can effectively provoke favorable shifts in individual behavior toward more pro-environmental orientations. Thus, increased environmental protection can be achieved through educational outreach. Measures such as increased awareness and behavior modification among ORV users would result in beneficial impacts to soils.

As a result of these improvements to ORV use management under alternative D, adverse impacts on soils in the Rosita Flats ORV use area would be localized, long term, and minor to moderate.

Cumulative Impacts

Past, present, and reasonably foreseeable future actions with the potential for impacts on soils under alternative D would be identical to those under alternative A: impacts would be localized, long term, minor, and adverse. In combination with the localized long-term minor to moderate adverse impacts of alternative D, cumulative impacts on soils would be localized, long term, minor to moderate, and adverse.

Conclusion

Under alternative D, continued ORV use and management at Blue Creek and Rosita Flats would result in localized long-term minor to moderate impacts. There would also be long-term beneficial impacts on soils accruing from enhanced resource protection measures. Incremental contributions to soil erosion would result from intensification of uses in certain areas and would impact soils at those locations. However, this impact would potentially be mitigated by the establishment of no-camping zones around vegetated areas. The long-term minor adverse effects of past, present, and reasonably foreseeable future actions, when combined with the long-term minor to moderate adverse impacts of alternative D, would result in long-term minor to moderate adverse cumulative impacts on soils.

VEGETATION

GUIDING REGULATIONS AND POLICIES

The Organic Act of 1916 (16 USC 1) and NPS *Management Policies 2006* (NPS 2006b) direct parks to provide for the protection of park resources. NPS *Management Policies 2006* (NPS 2006b) states that the NPS will minimize human impacts on native plants (and animals); their populations, communities, and ecosystems; and the processes that sustain them (Section 4.4.1). In addition, NPS *Management Policies 2006* prohibits the displacement of native species by nonnative species if displacement can be prevented (Section 4.4.4). Recognizing the influence of external factors on natural resources in the park, Section 4 of NPS *Management Policies 2006* (NPS 2006b) also calls for the NPS to protect natural resources by working cooperatively with federal, state, and local agencies; tribal authorities; user groups; adjacent landowners; and others to identify and achieve broad natural resource goals.

METHODOLOGY, ASSUMPTIONS, AND INTENSITY DEFINITIONS

Past vegetation classification data and maps showing vegetation cover in Lake Meredith National Recreation Area were used to identify baseline conditions in the study area. Based on discussions with Lake Meredith and other NPS staff, vegetation types were grouped into 11 map units as described in the "Vegetation" section of "Chapter 3: Affected Environment." Digital maps of the alternatives and vegetation were analyzed using geographical information system (GIS) software to evaluate which vegetation types could be affected by open ORV routes and ORV use areas. Comparisons were then made between alternative A (no action) and alternatives B, C, and D (the action alternatives) to determine whether there was a difference in vegetation communities with open ORV routes / use areas. In addition, potential indirect impacts were assessed, such as the potential for ORV use to introduce seeds of nonnative vegetation, or create other conditions suitable for the establishment of nonnative species.

Because NPS *Management Policies 2006* (NPS 2006b) requires the NPS to minimize not only impacts on individual native plants, but also on their populations, communities, ecosystems, and the processes that sustain them, the definitions for impact intensity for vegetation consider all such effects, as follows:

Negligible: No native vegetation would be affected or some individual native plants could be affected in localized areas. The abundance or distribution of vegetation would not be affected or would be slightly affected. Ecological processes and biological productivity would not be affected.

Minor: The alternative would affect the abundance or distribution of individual native plants in a localized area, but would not affect the viability of local or regional populations or associated communities. Mitigation, such as revegetation and weed control, to offset adverse effects would be necessary and would be effective.

Moderate: The alternative would affect some individual native plant communities and the loss or disturbance of vegetation would be readily noticeable and measurable. Ecological and biological productivity would be disrupted in the disturbed area. Mitigation, such as revegetation and weed control, to offset adverse effects would be necessary and would likely be successful.

Major: The alternative would have a considerable effect on native plant populations and would affect a relatively large area. Mitigation measures to offset the adverse effects would be required and would be extensive, and the success of the mitigation measures would not be guaranteed.

Duration: Short-term—Impacts would last less than one year.

Long-term—Impacts would last more than one year.

Study Area

The area of analysis for direct and indirect effects on vegetation, including cumulative impacts, is the Blue Creek and Rosita Flats ORV use areas.

IMPACTS OF ALTERNATIVE A: NO ACTION – CONTINUATION OF CURRENT MANAGEMENT

Alternative A would continue managing ORVs as currently managed under the 2007 *Interim OHV Use Plan* (NPS 2007a) and regulations contained in the Superintendent's Compendium. ORV use would continue to be permitted throughout Rosita Flats below the 3,000-foot elevation line and at Blue Creek along the creek bottom from cutbank to cutbank.

Blue Creek ORV Use Area

Under alternative A, impacts on vegetation would occur within the 275 acres authorized for ORV use in and along the creek bottom (cutbank to cutbank) at Blue Creek. Motorized travel on vegetation, whether inadvertent or intentional, creates damage to the resource. As a result, allowing open ORV use under alternative A without designating specific routes or areas has resulted in the area generally being devoid of vegetation due to ORV use over the years.

Impacts identified in a study of ORV travel in western states (Wilshire, Shipley, and Nakata 1978) included the crushing of foliage, stems, root systems, and seedlings; uprooting of small plant cover; and disruption of root systems of larger plans. This study also noted that ORV travel has even destroyed juniper trees more than 10 feet (3 meters) tall. These impacts have been documented to occur not only where vehicles directly contact vegetation, but also beyond the vehicle track width (Wilshire, Shipley, and Nakata 1978; Lathrop 1983). Although some studies in arid environments have documented loss of vegetation with a small number of passes by ORVs (Wilshire 1983; Webb 1983), others have shown that the more pronounced effects occur in localized areas as a result of concentrated use (such as heavy weekend use) (Lathrop 1983).

Other vegetation impacts would result from erosion and physical changes to soils that occur from ORV travel in Blue Creek and Rosita Flats (see "Soils" analysis in this chapter). Erosion creating gullies can undercut and cause the loss of vegetation, including plants lost when soil from surrounding high spots erodes and deposits into low spots. Additional runoff resulting from the loss of vegetation (either directly or from erosion) is commonly diverted in unused slopes, which can increase erosion and subsequent loss of vegetation in nearby areas that are not even open to ORV use. Ultimately, the deposition of the eroded materials buries vegetation, causing further plant loss (Wilshire, Shipley, and Nakata 1978).

The loss of more-fertile layers of the soil, as well as the reduction in productivity, adds to the impacts on vegetation by slowing the restoration of disturbed areas (Wilshire, Shipley, and Nakata 1978). In arid

environments, such as those at Lake Meredith, natural recovery of disturbed areas can take many years, which would not occur with ongoing ORV use in all areas of Blue Creek. In one study in Nevada, partial recovery of vegetation—which was primarily nonnative species—and associated soil cover took a minimum of one year (Webb 1983). In addition to the impacts on soils, tire tracks and ruts at the river bottom or creek beds, consisting mainly of grasslands and cottonwoods, result from ORV use at Blue Creek. These tracks and ruts recover during flooding events, although floods are now very rare. Trees in the riparian areas suffer from their roots becoming exposed by vehicle traffic close to the trunks.

In addition to impacts associated with damage to vegetation, ORV use in the national recreation area also has the potential to introduce or spread nonnative plants. Literature reviewed for this plan/EIS addressed both the effects of roads on the spread of invasive species and the potential for seed transport. Gelbard and Belnap (2003) documented that roads and associated environmental disturbances contributed to the spread of invasive species in semiarid grasslands, shrublands, and woodlands of southern Utah, although cover and nonnative species richness was lower near four-wheel-drive tracks than paved roads. A study conducted by the Montana Weed Control Association (Trunkle and Fay 1991) documented the dispersal of plant material from the undercarriage of vehicles, including spotted knapweed (*Centaurea stoebe*) seeds. The results of the study indicated that spotted knapweed seeds are readily disseminated by motor vehicles over long distances. Another study (Rooney 2005) compared soil samples taken from the undercarriages of motorized vehicles to field surveys for seven invasive species in forested areas of Wisconsin. The study found that ORV use may occasionally contribute to long-distance dispersal events. Similarly, researchers investigated the potential for seed transport into Kakadu National Park, Australia, by tourist vehicles. The study identified a low density of seeds on vehicles, and concluded that vehicles were partially responsible for weed seed dispersal but that this did not warrant preventive measures (Osborn et al. 2002). Continued ORV use at the national recreation area has the potential to spread invasive species throughout Blue Creek. Saltcedar, found at Blue Creek, is an invasive species at Lake Meredith. It is managed by first being removed, then burned, followed by being sprayed with an herbicide. Hundreds of acres of saltcedar are managed at the national recreation area.

The active management of nonnative plants, and any efforts required to offset their introduction or spread as a result of ORV use, would likely be successful. The barren areas, altered plant communities, and presence of nonnative vegetation are indicators of the moderate long-term adverse impacts on vegetation associated with ORV use at Blue Creek.

Rosita Flats ORV Use Area

Under alternative A, impacts on vegetation would occur within the 1,740 acres designated for ORV use below the 3,000-foot elevation line at Rosita Flats. Conditions and effects of ORV use at Rosita Flats are the same as those found at Blue Creek. While the same vegetation types are found at Rosita Flats as at Blue Creek, emergent vegetation is found in low-lying areas that may be inundated by lake-level fluctuations and populated with reeds, rushes, cattails, and other vegetation. According to Caudle (1983), Rosita Flats is subject to flooding once or twice a year. Although flooding still occurs, recent years have been dominated by drought conditions and have resulted in historically low water levels; however, vegetation communities still exist. ORV use in the area below the high water line has the potential to cause damage and loss of plants, especially if vehicles get stuck in vegetated areas. However, recovery would occur by the next growing season as a result of the periodic inundation of the area as river levels fluctuate. Periodic inundation restricts ORV use, allowing these areas to recover. Areas above the water line that support other plants would take more time to recover from ORV travel without designated routes, whether intentional or not, because these areas would always be open to ORV use. Areas on the edge of the ORV boundary are made up of soils with higher erosion potential than those found at Blue Creek. Higher erosion potential increases the likelihood for the creation of gullies and enhances the

likelihood of water runoff. These characteristics have the potential to remove vegetation and impede further vegetation growth, both of which can be seen at Rosita Flats.

The active management of nonnative plants, and any efforts required to offset their introduction or spread as a result of ORV use, would likely be successful. The barren areas, altered plant communities, and presence of nonnative vegetation are indicators of the moderate long-term adverse impacts on vegetation associated with ORV use at Rosita Flats.

Cumulative Impacts

The use of ORVs at Lake Meredith began before the national recreation area designated the areas of Blue Creek and Rosita Flats exclusively for their use in the 1970s. Since then, the national recreation area has allowed ORV use only in these two areas. The implementation of closures documented in the Resource Management Plan (NPS 1996) has provided protection for vegetation because ORV use is allowed only in Blue Creek and Rosita Flats. The Resource Management Plan provides goals for the national recreation area that address preserving national recreation area resources, including vegetation, and ensuring organized effectiveness. The national recreation area is currently creating a GMP. Under this plan Lake Meredith will manage natural resources, including vegetation, in a manner consistent with law, NPS policy, and standards. The plan will also identify resource protection zones in the recreation area. Management plans would result in long-term minor adverse effects on vegetation.

Wildland fires have historically played an important role in the area ecosystem. Fires can alter plant population and change resource availability. The Wildland Fire Management Plan (NPS 1998b) for Lake Meredith National Recreation Area is the primary reference for conducting all fire management activities and is intended to help achieve the resource management objectives as presented in the resource management plan. Protection of natural resources, including vegetation and their associated processes, is one of the highest priorities of the plan. This plan is based on a strategy that uses prescribed burns and mechanical methods to remove excess fuel from the system, which would reduce the likelihood of major fires. Fire is a valuable tool for perpetuating native plant life and maintaining or restoring indigenous flora and natural communities to achieve species diversity and community structure similar to those that would occur under natural conditions. The effects of fire management activities on vegetation would be short term, adverse, localized, and minor, with long-term effects being parkwide and beneficial.

Saltcedar (also known as tamarisk) is an invasive plant that occurs throughout Texas and extensively infests the national recreation area. It is estimated that one large saltcedar can use 200 gallons of water per day or 1 acre can use 3 to 7 acre-feet of water per year (TSSWCB 2009). Saltcedar has become common along the streambanks of the Canadian River and its tributaries (CRMWA 2005). There is anecdotal evidence that saltcedar infestations in and around Lake Meredith have reduced the inflow of runoff water from rainfall into the lake. In addition to direct water use of these plants by transpiration, heavily infested floodplain areas tend to trap floodwaters so that losses are greatly increased. Saltcedar also draws salts up to the surface from deep in the soil, increasing the salinity of the streamflow (CRMWA 2005). In 2002, the Entomology Program at the Texas A&M Research and Extension Center began a cooperative effort with the BOR to develop a biological-control program for saltcedar at Lake Meredith. In 2004, as part of a research study, planned releases of *Diorhabda elongata*, a chrysomelid beetle that is an aggressive defoliator of saltcedar, were carried out at two sites in Lake Meredith National Recreation Area. The NPS conducted aerial spraying in late August 2008 on a total of 5,298 acres. Herbicide was applied in an area starting at the southwest boundary of the national recreation area on the Canadian River at Rosita to the Sanford Dam. This treatment included the lakebottom (predrought) and much of the entire shoreline (Wimer 2009b). The aerial spraying was completed in September 2009. Treatment for saltcedar and other nonnative plants will continue by handcrews. Managers of lands adjacent to the national recreation area spray mesquite to help control the invasive plants. Lake Meredith benefits from this because it helps

hinder the spread of the invasive vegetation. The impacts from the use of invasive species removal on vegetation would be short term, minor to moderate, and adverse, with long-term effects on native vegetation being beneficial.

Cottonwoods have declined in the national recreation area as well as in the region as a whole. This is due to a lack of water. A reduction of cottonwoods may lead to native vegetation and invasive species incorporating the areas that were once inhabited by cottonwoods. The overall decline and loss of cottonwoods results in long-term minor adverse impacts on vegetation. However, the potential inhabitance of the area by native vegetation results in long-term beneficial impacts. If the area were inhabited by invasive species, the effects on vegetation would be long term, negligible to minor, and adverse.

Another plant known for its competitive botanical edge in the desert landscape is mesquite (Sharp n.d.). Overgrazed rangelands, openings, and other clearings and areas once dominated by native grasses often become infested with mesquite, which dominates that landscape over time (TPWD 2007). As with saltcedar, mesquite is fire-adapted, making fire management (via prescribed burns) difficult for land managers (Sharp n.d.). Managers of lands adjacent to the national recreation area spray mesquite, which benefits the national recreation area by preventing further spread of invasive vegetation.

As water levels continue to decrease at Lake Meredith, the national recreation area would likely explore additional forms of recreation for visitors to enjoy, including the recent plan to construct a recreational multi-use trail (NPS 2010c) and expand existing non-aquatic recreation activities. A potential increase in ORV use and other non-aquatic recreational activities due to low water levels in the national recreation area could contribute to the adverse impacts of ORVs on vegetation.

Throughout the national recreation area, regularly scheduled maintenance activities are conducted to maintain facilities and ensure visitor safety. These maintenance activities contribute to potential impacts on vegetation. These activities have involved infrastructure maintenance and upkeep, such as ensuring water quality and access. Regular repairs to roads and concrete ramps have also occurred on a continuing basis. Regular park facility maintenance occurs continually at Lake Meredith. Effects on vegetation through maintenance activities would likely be short term, negligible to minor, and adverse, because the majority of maintenance would occur on already disturbed vegetation.

The 2002 Oil and Gas Management Plan for Lake Meredith National Recreation Area (NPS 2002a) was prepared for the purpose of guiding the management of activities associated with the exploration and development of nonfederal oil and gas in the national recreation area. The Oil and Gas Management Plan (NPS 2002a) identifies those park resources and values most sensitive to oil and gas exploration and development disturbance, and defines impact mitigation requirements to protect such resources and values. To protect park resources and values, the plan establishes performance standards for oil and gas exploration and development, and it provides pertinent information to oil and gas owners and operators to facilitate compliance with applicable regulations. As of 2002, there were 170 active nonfederal oil and gas operations in the national recreation area. The construction and operation of these facilities has the potential to create short- and long-term minor to moderate adverse impacts.

The overall impact of these past, current, and future actions on vegetation would be long term, minor to moderate, and adverse. When combined with the long-term moderate adverse impacts under alternative A, long-term moderate adverse cumulative impacts on vegetation in the area of analysis would result.

Conclusion

Localized short- and long-term moderate adverse effects on vegetation would occur under alternative A as a result of localized impacts, including damage to plants; erosion, which can result in further loss of vegetation; reduction in soil productivity, which can affect natural recovery; and the potential introduction or spread of nonnative plants. The parkwide long-term minor to moderate adverse impacts of past, present, and reasonably foreseeable future actions both inside and outside the national recreation area, when combined with the localized short- and long-term moderate adverse impacts from continued ORV use under alternative A, would result in localized long-term moderate adverse cumulative impacts on vegetation.

IMPACTS OF ALTERNATIVE B: ZONE SYSTEM – SEPARATION OF VISITOR USES, WITH A PERMIT FOR EDUCATIONAL PURPOSES

Under alternative B the national recreation area would, in part, base the designation of routes and areas on a zoning system. One purpose would be the separation of visitor uses that have the potential to conflict with one another. Established zones could include camping -only zones, hunting zones, resource protection zones, low-speed zones, and beginner zones.

Alternative B would also include a no-charge permit system, in which permits would be issued to ORV users after they read educational materials. The NPS would revoke the permits if riders are found off designated routes. If a rider violates the rules in any of the ORV use areas three times, the rider would be permanently barred from receiving any kind of public use permit at the national recreation area. Increased resource protection (such as temporary closures of the ORV use areas) and enforcement of ORV rules (such as implementation of permits) would result in long-term benefits for vegetation.

At Blue Creek and Rosita Flats, the installation of post -and -cable fencing to delineate various ORV zones could lead to localized short-term negligible to minor adverse impacts on vegetation. Visitor use within designated camping zones at both areas would have negligible adverse effects on vegetation, because camping areas would already be disturbed.

Blue Creek ORV Use Area

Under alternative B, ORV use would only be allowed on sandy bottom areas and on designated routes at Blue Creek, and ORVs would be prohibited from operating on any vegetation. Designated routes would be marked, likely with carsonite posts. The installation of these posts would lead to short-term negligible adverse impacts on vegetation.

Vegetation in these designated areas includes yucca grassland, mesquite grassland, mixed grassland, unconsolidated shore, mixed forest, bare land, vegetated cliffs, riverine grassland, disturbed grassland, and emergent scrub/shrub. Because ORV use would be restricted to designated routes and areas and would not be allowed to occur on vegetated terrain, impacts on these vegetation communities would likely be negligible and adverse.

By limiting ORV use to designated routes, vegetation in previously disturbed areas no longer designated would have the opportunity to recover and impacts would be long term and beneficial. In the location of ORV routes and areas, or for any vegetation that exists in designated routes and sandy bottoms, impacts would be short and long term, minor, and adverse. Additionally, long-term beneficial impacts on vegetation would result from the establishment of a resource protection zone, because vegetation in these areas would have the opportunity to recover.

Because alternative B would include a zoning system, no-charge permit system, and increased resource management, the overall impact of alternative B on vegetation at Blue Creek would be expected to be long term, minor, and adverse. Adverse impacts would be localized along open ORV routes and use areas due to continued disturbance along those routes.

Rosita Flats ORV Use Area

Under alternative B, ORV use at Rosita Flats would be allowed on currently denuded land and on designated marked routes where there has been extensive ORV use previously. Because of this, additional damage to vegetation and soils in these areas would not be expected. Routes and areas designated for ORV use under alternative B at Rosita Flats would occur in the following vegetation types: yucca grassland, mesquite grassland, mixed grassland, unconsolidated shore, mixed forest, bare land, vegetated cliffs, riverine grassland, disturbed grassland, emergent vegetation, and emergent scrub/shrub. Impacts on vegetation would be long term, minor, and adverse because ORV use would be restricted to already disturbed areas or specific routes.

The proposed low-speed ORV “beginner” zone is a well-established ORV loop route, and further damage to vegetation would not be expected.

Impacts from vehicles with a wheel width less than 64 inches in the proposed resource protection zone would be short and long term, negligible, and adverse stemming from the continued vehicle use. Long-term beneficial impacts would occur from the prohibition of larger vehicles and the subsequent preservation of vegetation species. Posts marking routes and posts and cables marking ORV use areas would have effects on vegetation similar to those previously described: short term, negligible, and adverse.

Because alternative B would include a zoning and permit system, designated access points at the riverbed at Rosita Flats, and increased resource management and law enforcement, the overall impact of alternative B on vegetation at Rosita Flats would be expected to be long term, minor, and adverse. Adverse impacts would be localized along open ORV routes and use areas due to continued disturbance along those routes.

Cumulative Impacts

Past, present, and reasonably foreseeable future actions with the potential for impacts on vegetation under alternative B would be identical to those under alternative A: impacts would be parkwide, long term, minor to moderate, and adverse. In combination with the localized long-term minor adverse impacts of alternative B, cumulative impacts on vegetation would be parkwide, long term, minor, and adverse.

Conclusion

Localized short- and long-term minor adverse impacts on vegetation could occur in areas open to ORV use. These adverse impacts would occur in fewer vegetated areas under alternative B because more of the land would be closed to ORVs compared to under alternative A. The designation of ORV routes and areas would allow previously disturbed vegetated areas the opportunity to recover. As a result, there would be long-term beneficial impacts on vegetation associated with closed routes and areas. In combination with the parkwide long-term minor to moderate adverse impacts of past, present, and reasonably foreseeable future actions, cumulative impacts on vegetation would be parkwide, long term, minor, and adverse.

IMPACTS OF ALTERNATIVE C: MANAGEMENT THROUGH USE OF A PERMIT SYSTEM AT CURRENT ORV USE AREAS

Under alternative C, the national recreation area would manage ORV use through a permit system and through the establishment of use limits. Permits would include a fee and initially there would be no limit on the number of permits issued. ORV routes and areas would be the same as those under alternative B, except that there would be one designated ORV use area in Rosita Flats instead of two.

The requirements of the permit system would increase visitor recognition of vegetation and educate visitors on proper ORV use and the effects of ORVs on vegetation. These educational requirements of the permit system would create a sense of ownership of the national recreation area for ORV users and leave an avenue open for possible revocation of permits if these rules are violated, resulting in long-term beneficial impacts.

The implementation of educational signs and a “tread lightly” pamphlet for ORV use would inform visitors of the effects of ORVs on vegetation, resulting in long-term beneficial impacts from an increase in visitor knowledge and awareness. An ORV use limit would be implemented based on indicators and standards developed through the GMP process. The development of a use limit would result in long-term benefits for vegetation by limiting the number of vehicles in the ORV use areas and reducing disturbance of habitat. Overall impacts from the permit system, the use limit, and education and outreach efforts would be long term and beneficial, with further beneficial impacts on vegetation if future permits are restricted.

Blue Creek ORV Use Area

ORV use under alternative C would incorporate the same routes and areas as described under alternative B, and ORV use on vegetation would be prohibited. The following vegetation types are in the Blue Creek area: yucca grassland, mesquite grassland, mixed grassland, unconsolidated shore, mixed forest, bare land, vegetated cliffs, riverine grassland, disturbed grassland, and emergent scrub/shrub. However, because ORV use would be restricted to designated routes and areas and would not be allowed on vegetated terrain, impacts on these vegetation communities would likely be negligible and adverse.

Limiting ORV use to sandy bottom areas and designated routes would allow vegetation in previously disturbed areas where ORV use is no longer designated the opportunity to recover; impacts would be long term and beneficial. In the location of ORV routes/areas, or for any vegetation that exists in designated routes and sandy bottoms, impacts would be short and long term, minor, and adverse.

In addition to established routes at Blue Creek, alternative C would also involve the designation of camping sites. Each campsite would be designated, rather than just a large area as under alternative B, and would have amenities such as a fire ring and a picnic table. Although the camping sites are previously disturbed, vegetation still exists and further camping at these sites would result in short-term negligible to minor adverse impacts on vegetation. In addition, the potential installation of an interpretive wayside exhibit program at Blue Creek, as funding and permit fees allow, could result in short-term negligible adverse impacts on vegetation.

Because alternative C would include use limits, a fee-based permitting system, an interpretive wayside program, and increased resource protection, the overall impact of alternative C on vegetation at Blue Creek would be expected to be long term, minor, and adverse. Adverse impacts would be localized along open ORV routes and use areas due to continued disturbance along those routes.

Rosita Flats ORV Use Area

ORV use at Rosita Flats under alternative C would incorporate the same routes and areas as alternative B. However, under alternative C, ORV use at Rosita Flats would be restricted to a designated area south of the river, where extensive ORV use is currently allowed, and to other designated ORV routes. Additionally, the area east of Bull Taco Hill would not be a designated ORV use area, further reducing the area impacted.

Open ORV routes and use areas under alternative C at Rosita Flats would occur in the following vegetation types: yucca grassland, mesquite grassland, mixed grassland, unconsolidated shore, mixed forest, bare land, vegetated cliffs, riverine grassland, disturbed grassland, emergent vegetation, and emergent scrub/shrub. However, because ORV use would be limited in Rosita Flats, impacts on vegetation would be long term, minor, and adverse.

Limiting ORV use at Rosita Flats would allow vegetation in previously disturbed areas that are no longer designated the opportunity to recover; impacts would be long term and beneficial.

Because alternative C would include use limits, a fee-based permitting system, designated access points at the riverbed at Rosita Flats, and increased resource protection and law enforcement, the overall impact of alternative C on vegetation would be expected to be long term, minor, and adverse. Impacts would be localized along open ORV routes and use areas due to continued disturbance along those routes.

Cumulative Impacts

Past, present, and reasonably foreseeable future actions with the potential for impacts on vegetation under alternative C would be identical to those under alternative A: impacts would be parkwide, long term, minor to moderate, and adverse. In combination with the localized long-term minor adverse impacts of alternative C, cumulative effects on vegetation would be parkwide, long term, minor, and adverse.

Conclusion

Localized short- and long-term minor adverse impacts on vegetation would occur in areas open to ORV use. However, there would be impacts in fewer vegetated areas because several areas would be closed to ORVs. Vegetation in these closed areas would have the opportunity to recover, resulting in long-term beneficial impacts on vegetation associated with closed routes and areas. In combination with the parkwide long-term minor to moderate adverse impacts of past, present, and reasonably foreseeable future actions, cumulative impacts on vegetation would be parkwide, long term, minor, and adverse.

Impacts of Alternative D: Management through Use of a Zoning and Permitting System at Current ORV Use Areas

Under alternative D the national recreation area would, in part, base the designation of routes and areas on a zoning system. One purpose would be the separation of visitor uses that have the potential to conflict with one another, similar to the system under alternative B. In addition, a fee -permit system would be instituted that would allow the national recreation area to provide additional enforcement and amenities in the ORV use area, but no use limits would be established.

As described under alternative C, the fee-based permit system would ultimately exclude ORV riders who were caught repeatedly violating the resource protection rules. The permit system would also seek to educate ORV users about ORV rules and resource protection. For these reasons, the fee-based permit system would benefit vegetation in the national recreation area over the long term.

Blue Creek ORV Use Area

Under alternative D, ORV routes and areas at Blue Creek would occur in places containing the following vegetation types: yucca grassland, mesquite grassland, mixed grassland, unconsolidated shore, mixed forest, bare land, vegetated cliffs, riverine grassland, disturbed grassland, and emergent scrub/shrub. However, ORV use would be restricted to approved routes and trails, and would not be allowed to occur on vegetated terrain outside marked routes. As a result, vegetation outside designated routes and areas would have the opportunity to recover, resulting in long-term beneficial impacts.

As described under alternative B, ORV use would only be permitted on sandy bottom areas and designated routes at Blue Creek; zones would be established for camping. Impacts on vegetation from continued ORV use in designated routes and areas would be short and long term, minor, and adverse. As described for alternative A, adverse impacts would be localized in the vicinity of routes and areas open to ORV use and would not be expected to affect population numbers, ecological or biological processes, or the overall viability and stability of plant communities.

The potential installation of an interpretive wayside exhibit program at Blue Creek (as funding and permit fees allow) could result in short-term negligible adverse impacts on vegetation from removal of and damage to vegetation during the construction and use of the exhibits.

Because alternative D would include a zoning system, a fee-based permitting system, an interpretive wayside program, and increased resource protection, the overall impact of alternative D on vegetation at Blue Creek would be expected to be long term, minor, and adverse as well as long term and beneficial. Adverse impacts would be localized along open ORV routes and use areas due to continued disturbance along those routes.

Rosita Flats ORV Use Area

Under alternative D, the management of ORV use would include zones as described for alternative B and a permit system as described for alternative C. The use of zones, as described for alternative B, would result in continued ORV activities in areas that are currently extensively used. Continued ORV use in these areas would result in long-term minor adverse impacts. The use of a permit system at Rosita Flats, as described for alternative C, would result in ORVs being restricted to areas south of the river, where use is already extensive. Impacts on vegetation would be long term, minor, and adverse in this area. The restriction of ORV use through a permit system and zones would result in long-term beneficial impacts on previously disturbed areas by providing vegetation in those areas the opportunity to recover.

Other elements associated with alternative B that are also present in alternative D include the installation of post -and -cable fencing and signs around the ORV boundary, leading to short-term negligible to minor adverse impacts on vegetation. In addition, the existing road leading to designated camping areas would be improved; however, because the area is previously disturbed no further effects on vegetation would occur.

Because alternative D would include a zoning system, a fee-based permitting system, designated access points at the riverbed at Rosita Flats, and increased resource protection and law enforcement, the overall impact of alternative D on vegetation at Rosita Flats would be expected to be long term, minor, and adverse. Impacts would be localized along open ORV routes and use areas due to continued disturbance along those routes.

Cumulative Impacts

Past, present, and reasonably foreseeable future actions with the potential for impacts on vegetation under alternative D would be identical to those under alternative A: impacts would be parkwide, long term, minor to moderate, and adverse. In combination with the localized long-term minor adverse impacts of alternative D, cumulative effects on vegetation would be parkwide, long term, minor, and adverse.

Conclusion

Localized short- and long-term minor adverse impacts on vegetation could occur in areas open to ORV use. However, impacts would occur in fewer vegetated areas because only designated routes and specific areas would be open to ORVs. Vegetation in these closed areas would have the opportunity to recover, resulting in long-term beneficial impacts on vegetation associated with closed routes and areas. In combination with the parkwide long-term minor to moderate adverse impacts of past, present, and reasonably foreseeable future actions, cumulative impacts on vegetation would be parkwide, long term, minor, and adverse.

WATER RESOURCES

GUIDING REGULATIONS AND POLICIES

NPS *Management Policies 2006*, Section 4.6.1 (NPS 2006b), addresses water resource management and states that the NPS will perpetuate surface and groundwater as integral components of park ecosystems and avoid the pollution of park waters by human activities occurring in and outside the park units. The NPS will take all necessary actions to maintain or restore the quality of surface and groundwater in the park units in a manner consistent with all applicable regulations.

METHODOLOGY, ASSUMPTIONS, AND INTENSITY DEFINITIONS

The methodology used for assessing impacts on water resources was based on a review of existing data on the water quality of Lake Meredith and the vicinity. Impacts on waters of Lake Meredith could occur from land-based actions that affect water quality through runoff and sedimentation. The study area for this analysis is composed of the two areas located within the boundaries of Blue Creek and Rosita Flats. The intensity of impacts on water resources are defined as follows:

Negligible: Impacts would result in a change to water quality, but the change would be so slight that it would not be of any measurable or perceptible consequence.

Minor: Impacts would result in a change to water quality, but the change would be of little consequence and localized. Mitigation measures, if needed to offset adverse effects, would be simple and successful.

Moderate: Impacts would result in a change to water quality that would be measurable and localized. Mitigation measures, if needed to offset adverse effects, could be extensive, but would likely be successful.

Major: Impacts would result in a change to water quality that would be measurable and would have substantial consequences on a regional scale. Extensive mitigation measures would be needed to offset any adverse effects, and their success would not be guaranteed.

Duration: Short-term—Impacts would last less than three years.

Long-term—Impacts would last more than three years.

Study Area

For the analysis of the impacts of the alternatives, the study for this topic is defined as the waters contained within the boundaries of Rosita Flats and Blue Creek ORV use areas and the slopes of the immediately surrounding vicinity. The study area for cumulative impacts is defined as Lake Meredith National Recreation Area and adjacent land. Sedimentation and runoff from continuing ORV use and directly related activities, such as hunting and camping, would potentially affect water quality in these tributary waters and the waters of greater Lake Meredith. ORV use could occur throughout Blue Creek along the creek bottom from cutbank to cutbank and throughout Rosita Flats below the 3,000-foot elevation line. Together, these ORV use areas constitute less than 20 percent or 1/5 of the total national recreation area.

IMPACTS OF ALTERNATIVE A: NO ACTION – CONTINUATION OF CURRENT MANAGEMENT

Under alternative A, the management of ORV use and access at the national recreation area would continue current management strategies based on the 2007 *Interim OHV Use Plan* (NPS 2007a), the regulations contained in 36 CFR 7.57, and the Superintendent's Compendium (NPS 2008d).

Blue Creek ORV Use Area

ORV use at Blue Creek ORV use area would continue under the no-action alternative. Surface water quality in the ORV use area would continue to be impacted through ongoing disturbances under current management. Sedimentation of surface waters in Lake Meredith would continue to result from the ongoing erosion of soils due to ORV use. However, such impacts would be relatively limited in extent, because the most pronounced erosion would be contained to the extreme edges of the cutbanks and the eastern extent of the ORV use area (outside of water sources), which is characterized by soils having a moderate erosion potential.

Additionally, no ORV routes or use areas would be established, the allowable ORV use area (cutbank to cutbank) would not be marked, and no posts or other physical markers would be installed to limit ORV use to specific areas. This would result in continuing impacts throughout Blue Creek, because drivers would be able to easily traverse the entire area with no restrictions. Incremental contributions to existing surface water quality impairments (under the Clean Water Act) would result from runoff of MTBE, an additive blended with gasoline during the refining process that might leak from motor vehicles during operation. This pollutant may already be present in Lake Meredith due to the large amount of watercraft use. Water quality effects would be detectable in adjacent creeks and these impacts would continue under current conditions. As a result, adverse impacts on surface water quality in the Blue Creek ORV use area would be localized, long term, and moderate.

Rosita Flats ORV Use Area

ORV use at the Rosita Flats ORV use area would continue under the no-action alternative and surface water quality in the Rosita Flats ORV use area would continue to be affected through ongoing disturbances similar to those described for Blue Creek. Soils classified as having moderate or high erosion potential are located along the edges of the Rosita Flats ORV use area. Sedimentation of surface waters of

the national recreation area would continue to result from the ongoing erosion of soils due to ORV use. Incremental contributions to existing surface water quality impairments would also result from runoff of MTBE, as described previously. Water quality effects would be detectable in adjacent creeks and these impacts would continue under current conditions. As a result, adverse impacts on surface water quality in the Rosita Flats ORV use area would be localized, long term, and moderate.

Cumulative Impacts

Several past, present, and reasonably foreseeable future actions would result in adverse and beneficial cumulative impacts on water quality at both ORV use areas in the national recreation area. In the past, damming of the Canadian River and the long-term presence of agricultural land uses adjacent to the reservoir have negatively impacted water quality through surface water impoundment and introduction of chemical fertilizers and pesticides, as well as erosion and siltation into Lake Meredith. ORV use occurring prior to the establishment of the national recreation area resulted in impacts on water quality through runoff of leaked fuels and oils as well as the erosion of embankments, contributing to an increase in turbidity. Local and regional water resources would be adversely affected by the lowering of the lake level and groundwater pumping. These impacts on water quality are expected to continue, contributing to cumulative impacts over time. In an effort to control the spread of invasive saltcedar, the NPS conducted aerial spraying in late August 2008 on a total of 5,298 acres. Herbicide was applied in an area starting at the southwest boundary of the national recreation area on the Canadian River at Rosita, to the Sanford Dam. This treatment included the lakebottom (predrought) and much of the entire shoreline (Wimer 2009b) and was completed in September 2009. Treatment for saltcedar and other nonnative plants will continue by handcrews. These methods of control could result in short-term minor to moderate adverse impact on water quality at Lake Meredith (i.e., water degradation from herbicides). Overall, these actions have the potential to result in localized short- and long-term minor adverse cumulative impacts on water quality.

In addition to actions with adverse cumulative effects on water resources, there are also some actions with long-term beneficial cumulative impacts on water quality. For example, the management actions of CRMWA and the development and implementation of a national recreation area GMP will, over time, result in improving protection of water resources through the enforcement of regulatory policies and the development of programs to ensure that water quality standards are met and goals for the administrative district are achieved. Plans specifically related to ORV use that could contribute to cumulative impacts include the Resources Management Plan (NPS 1996), which provides goals for the national recreation area that address preserving national recreation area resources. As mentioned above, the national recreation area is currently developing a GMP that will articulate the long-term vision that will guide the management of the national recreation area for the next 15 to 20 years. The decision to develop a GMP is, in part, a response to changes in the recreational opportunities at Lake Meredith because of changes in the lake level. During the planning process, the national recreation area will explore different approaches to preserve the important recreational opportunities, natural resources, and cultural histories of the national recreation area (NPS n.d.c). Upon implementation of the GMP, the national recreation area will manage natural resources, including water quality, in a manner consistent with law, NPS policy, and standards.

The Wildland Fire Management Plan (NPS 1998b) is the primary reference for conducting all fire management activities and is intended to help achieve the resource management objectives as presented in the Resource Management Plan. The perpetuation of natural resources and their associated processes is one of the highest priorities for the plan, which is based on a strategy of using prescribed burns and mechanical methods to remove excess fuel from the system, reducing the likelihood of major wildfires and providing benefits to native vegetation. Fire management plans are considered a key tool in maintaining and improving current levels of grassland resources by promoting the restoration of uplands to native grasses and controlling brush such as mesquite (CRMWA 2005). Restoring the native

ecosystem's natural regime includes enhancing water filtration and soil stability. This would result in long-term beneficial impacts on water quality in the national recreation area.

The overall impact of these past, current, and future actions on water resources would be short and long term, minor, and adverse as well as long term and beneficial, and when combined with the localized long-term moderate adverse impacts of alternative A, would result in long-term minor adverse cumulative impacts on water resources.

Conclusion

Under alternative A, continued ORV use at Blue Creek and Rosita Flats would result in long-term localized moderate adverse impacts on water quality due to ongoing disturbances under current management that would continue to impact surface water quality in the ORV use areas. Sedimentation of surface waters in Lake Meredith would continue to result from the ongoing erosion of soils due to ORV use. The short- and long-term minor adverse and long-term beneficial effects of past, present, and reasonably foreseeable future actions, when combined with the long-term moderate adverse impacts of alternative A, would result in long-term minor adverse cumulative impacts on water resources.

IMPACTS OF ALTERNATIVE B: ZONE SYSTEM – SEPARATION OF VISITOR USES, WITH A PERMIT FOR EDUCATIONAL PURPOSES

Under alternative B the national recreation area would, in part, base the designation of routes and areas on a zoning system, one purpose of which would be the separation of visitor uses that have the potential to conflict with one another. Established zones could include camping-only zones, hunting zones, resource protection zones, low-speed zones, and beginner zones. A no-charge ORV permit system would also be implemented where the permits could be revoked if riders are found off designated routes.

Blue Creek ORV Use Area

Under alternative B, the establishment of a zone system and separation of visitor uses would promote protection of water resources at Blue Creek ORV use area. Although intensification of disturbances would occur in designated camping areas, these impacts would potentially be mitigated by the establishment of no-camping areas in vegetated areas. During the installation of carsonite posts to mark ORV routes and post -and -cable fencing to mark zones (such as camping zones), limited disturbances to soils would occur from the installation of materials, resulting in short-term adverse impacts on soils. However, once established, ORV use areas would be delineated, reducing the potential for erosion outside the established ORV routes and areas. Consequently, long-term beneficial impacts on water quality would result from the establishment of the zone system. The implementation of a permit system in which riders found off route would have their permits revoked would create an incentive to comply, thereby reducing impacts on water quality as users are directed away from areas more sensitive to erosion. As a result of these protections, vegetation throughout the use area would be less vulnerable to damage and removal and would provide an erosion control function through root structure and the effect of wind diffusion. Speed limits would lead to greater protections to water quality by protecting vegetation, which provides an erosion control function, from the higher likelihood of damage that can occur from vehicles operating at high speeds. Because the operation of ORVs at high speeds can also result in accelerated removal of soil substrate, speed limits of 15 mph in camping zones and a low-speed zone near the highway bridge would further reduce impacts from soil erosion and sedimentation on the nearby stream. While leakage of fuels, erosion, and sedimentation would continue to adversely impact water quality in portions of the ORV use area where travel is still permitted, disturbances would be contained to already-disturbed portions of the ORV use area. As a result, adverse impacts on water resources in the Blue Creek ORV use area would be localized, short to long term, and minor to moderate.

Rosita Flats ORV Use Area

Under alternative B, the establishment of a zone system and separation of visitor uses would promote resource protection at the Rosita Flats ORV use area. The establishment of a resource protection zone would prohibit vehicles with a wheel width greater than 64 inches from driving on approximately 1,040 acres of the Rosita Flats ORV use area, resulting in long-term benefits for water resources. Moreover, carsonite posts to mark ORV routes and post -and -cable fencing to mark zones (such as camping zones) would be installed under this alternative. Consequently, long-term beneficial impacts would accrue from the establishment of the zone system. Overall, adverse impacts on water resources in the Rosita Flats ORV use area would be localized, short to long term, and minor to moderate.

Cumulative Impacts

The effects of past, present, and reasonably foreseeable future actions on water resources would be as described for alternative A: short and long term, minor, and adverse as well as long term and beneficial. Overall, the impacts of these actions, when combined with the localized short- and long-term minor to moderate adverse impacts of alternative B, would result in long-term minor adverse cumulative impacts on water resources.

Conclusion

Under alternative B, continued ORV use at Blue Creek and Rosita Flats would result in short- and long-term localized minor to moderate adverse impacts on water resources. Incremental contributions to erosion and resulting sediment delivery to streams would result from the intensification of uses in certain areas and would impact water resources at those locations. However, this impact would potentially be mitigated by the establishment of zoning restrictions. The short- and long-term minor adverse and long-term beneficial effects of past, present, and reasonably foreseeable future actions, when combined with the short- to long-term minor to moderate adverse impacts of alternative B, would result in long-term minor adverse cumulative impacts on water resources.

Impacts of Alternative C: Management through Use of a Permit System at Current ORV Use Areas

Under alternative C, the national recreation area would manage ORV use through a permit system as well as through the establishment of use limits. Permits would include a fee and initially there would be no limit on the number of permits issued. Fees from the permits would be used to add amenities to the ORV use areas, including pit toilets, fire rings, and picnic tables. ORV routes and areas would be the same as those established under alternative B, except there would be one designated ORV use area in Rosita Flats instead of two.

Blue Creek ORV Use Area

Under alternative C, revised management strategies for ORV use at Blue Creek would promote resource protection. The establishment of an ORV route system for the Blue Creek ORV use area would discourage further disturbance in sensitive portions of the ORV use area. These routes would be established on already-disturbed user-created ORV trails. Restrictions would also be placed on camping, which would be permitted only in already-disturbed areas of the use area. The implementation of a permit system in which riders found off route would have their permits revoked would create an incentive to comply, thereby reducing impacts on water quality as users are directed away from areas more sensitive to erosion. Further, the establishment of speed limits (35 mph on ORV routes and 55 mph on the sandy

river bottom) would lead to greater protections to water quality by protecting vegetation. Vegetation provides an erosion control function, which would be preserved under this alternative by protection vegetation from the higher likelihood of damage that can occur from vehicles operating at high speeds. Overall, these expanded resource protection measures would result in long-term beneficial impacts on water quality under alternative C by reducing and containing the extent of soil erosion and runoff into adjacent waters. Leakage of fuels, erosion, and sedimentation would continue to adversely impact water quality in portions of the ORV use area where travel is still permitted. However, these impacts would not be detectable throughout most of the ORV use area because they would cause very little or no physical disturbance when compared with current conditions. Thus, the implementation of expanded resource protection measures under alternative C would result in localized short-term minor to moderate adverse impacts on water resources in the Blue Creek ORV use area.

Rosita Flats ORV Use Area

Under alternative C, the establishment of a user-fee permit system, while placing no strict limit on entry, would potentially reduce the amount of visitation, which would place a lesser burden on existing resources, thereby reducing impacts on water quality. Moreover, alternative C would retain the option of limited entry if a study of user capacity determined that such an option was warranted. The prospect of limited visitation would promote resource protection at the Rosita Flats ORV use area. The intensification of visitor use in certain areas, such as the proposed ORV use area and designated camping areas, would impact resources at those locations. Further, leakage of fuels, erosion, and sedimentation would continue to adversely impact water quality in portions of the ORV use area where travel is still permitted. However, some impacts on water quality would likely be mitigated by restrictions on vehicle entry to camping locations, because under this alternative access to campsites (other than delineated campgrounds) would be available on foot only. Overall, adverse impacts on water resources in the Rosita Flats ORV use area would be localized, long term, and minor to moderate.

Cumulative Impacts

The effects of past, present, and reasonably foreseeable future actions on water resources would be as described for alternative A: short and long term, minor, and adverse as well as long term and beneficial. Overall, the impacts of these actions, when combined with the localized short- to long-term minor to moderate adverse impacts of alternative C, would result in long-term minor adverse cumulative impacts on water resources.

Conclusion

Under alternative C, continued ORV use at Blue Creek and Rosita Flats would result in short- to long-term localized minor to moderate adverse impacts on water resources. Impacts on water quality would result from the intensification of uses in certain areas and would impact water resources at those locations. However, this impact would potentially be mitigated by the establishment of use restrictions such as hike-in -only camping. The short- and long-term minor adverse and long-term beneficial effects of past, present, and reasonably foreseeable future actions, when combined with the short- to long-term minor to moderate adverse impacts of alternative C, would result in long-term minor adverse cumulative impacts on water resources.

Impacts of Alternative D: Management through Use of a Zoning and Permitting System at Current ORV Use Areas

Under alternative D the national recreation area would, in part, base the designation of routes and areas on a zoning system, one purpose of which would be the separation of visitor uses that have the potential to

conflict with one another, similar to the system under alternative B. ORV use zones established under this alternative could include camping-only zones, hunting zones, resource protection zones, low-speed zones, and beginner zones. In addition, a fee -permit system would be instituted that would allow the national recreation area to provide additional enforcement and amenities in the ORV use area, but no use limits would be established.

Blue Creek ORV Use Area

Under alternative D, the establishment of a zone system and separation of visitor uses would promote the protection of water resources at Blue Creek ORV use area by limiting impacts to discrete portions of the use area. Although intensification of disturbances would occur in designated camping areas, these impacts would potentially be mitigated by the establishment of no-camping areas in vegetated areas. Because the operation of ORVs at high speeds can also result in accelerated removal of soil substrate, speed limits of 15 mph in camping zones and a low-speed zone near the highway bridge would lead to greater protections to water quality by protecting vegetation, which provides an erosion control function, from the higher likelihood of damage that can occur from vehicles operating at high speeds. A low-speed zone near the highway bridge would further reduce impacts from soil erosion and sedimentation on the nearby stream. While leakage of fuels, erosion, and sedimentation would continue to adversely impact water quality in portions of the ORV use area where travel is still permitted, disturbances would be contained to already-disturbed portions of the ORV use area.

Ongoing ORV use among national recreation area personnel for law enforcement and other purposes would continue to result in less-than-substantial impacts on water quality because such use is subject to strict regulation of speeds and constrained whenever possible to designated routes.

Although the establishment of use limits would not occur under alternative D, the implementation of a permit system in which riders found off route would have the potential to have their permits revoked would create an incentive to comply, thereby reducing impacts on water quality.

Educational measures such as “tread lightly” pamphlets would provide beneficial impacts on water quality from increased awareness and behavior modification among ORV users.

As a result of these improvements to ORV use management under alternative D, adverse impacts on water resources in the Blue Creek ORV use area would be localized, short to long term, and minor.

Rosita Flats ORV Use Area

Under alternative D, the establishment of a zone system and separation of visitor uses would promote resource protection at the Rosita Flats ORV use area. As described for alternative B, the establishment of a resource protection zone would prohibit vehicles with a wheel width greater than 64 inches from driving on approximately 1,040 acres of the Rosita Flats ORV use area, resulting in long-term benefits for water resources. Moreover, the installation of carsonite posts to mark ORV routes and post -and -cable fencing to mark zones (such as camping zones) would benefit water resources by ensuring that ORV users comply with established zones.

Although the establishment of use limits would not occur under alternative D, the establishment of a user-fee permit system would potentially reduce the amount of visitation, which would place a lesser burden on existing resources, thereby reducing impacts on water quality. Additionally, a permit system in which riders found off route could have their permits revoked would create an incentive to comply, further reducing impacts on water quality.

As stated for alternative C, fuel leakage, erosion, and sedimentation would continue to adversely impact water quality in portions of the ORV use area where travel is still permitted. However, some impacts on water quality would likely be mitigated by restrictions on vehicle entry to camping locations, because access to campsites (other than delineated campgrounds) would be available on foot only.

Ongoing ORV use among national recreation area personnel for law enforcement and other purposes would continue to result in less-than-substantial impacts on water quality because such use is subject to strict regulation of speeds and constrained whenever possible to designated routes.

Educational measures such as "tread lightly" pamphlets would provide beneficial impacts on water quality from increased awareness and behavior modification among ORV users.

As a result of these improvements to ORV use management under alternative D, adverse impacts on water resources in the Rosita Flats ORV use area would be localized, short to long term, and minor.

Cumulative Impacts

The effects of other past, present, and reasonably foreseeable future actions on water resources would be as described for alternative A: short and long term, minor, and adverse as well as long term and beneficial. Overall, the impacts of these actions, when combined with the localized short- to long-term minor adverse impacts of alternative D, would result in long-term minor adverse cumulative impacts on water resources.

Conclusion

Under alternative D, continued ORV use at Blue Creek and Rosita Flats would result in short- and long-term localized minor adverse impacts on water resources. Incremental contributions to erosion and resulting sediment delivery to streams would result from the intensification of uses in certain areas and would impact water resources at those locations. However, this impact would potentially be offset by the establishment of zoning restrictions. The short- and long-term minor adverse and long-term beneficial effects of past, present, and reasonably foreseeable future actions, when combined with the short- to long-term minor adverse impacts of alternative D, would result in long-term minor adverse cumulative impacts on water resources.

SOUNDSCAPES AND THE ACOUSTIC ENVIRONMENT

GUIDING REGULATIONS AND POLICIES

The NPS Organic Act establishes and authorizes the NPS "to conserve the scenery and the natural and historic objects and wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations" (16 USC 1). An intact natural soundscape enhances visitor experience and allows for natural functioning of wildlife communication.

Regarding general park soundscape management, NPS *Management Policies 2006*, Section 4.9, "Soundscape Management," requires that the NPS "preserve, to the greatest extent possible, the natural soundscapes of parks." Additionally, the NPS "will restore to the natural condition wherever possible those park soundscapes that have become degraded by the unnatural sounds (noise), and will protect natural soundscapes from unacceptable impacts" (NPS 2006b, Section 4.9). Director's Order 47: Soundscape Preservation and Management, was developed to emphasize NPS policies "that will require, to the fullest extent practicable, the protection, maintenance, or restoration of the natural soundscape

resource in a condition unimpaired by inappropriate or excessive noise sources." This director's order also directs park managers to measure acoustic conditions, differentiate existing or proposed human-made sounds that are consistent with park purposes, set acoustic goals based on the sounds deemed consistent with the park purpose, and determine which noise sources are impacting the parks (NPS 2000).

Additionally, 36 CFR 2.12, "Audio Disturbance," prohibits the operation of motorized vehicles in national parks in excess of 60 dBA at a distance of 50 feet from the source or, if below that noise level, noise that is unreasonable. Reasonableness is dependent on several factors, including the nature and purpose of the actor's conduct, location and time of occurrence, the park purpose, and the impact the noise has on park users (36 CFR 2.12).

METHODOLOGY, ASSUMPTIONS, AND INTENSITY DEFINITIONS

Acoustics modeling was conducted to evaluate the potential impacts of the alternatives on natural soundscapes. A brief overview of the modeling methodology and assumptions is provided below. For additional detailed technical information, refer to the *Lake Meredith National Recreation Area Acoustic Monitoring and Modeling of Off-road Vehicles* (NPS 2011c).

Source Characterization

In order to model the noise emissions from a source, the source must first be characterized. Due to the number of different types of ORVs operating at Lake Meredith National Recreation Area, it was necessary to create a "composite source" to represent average noise emissions for modeling purposes. The composite source was developed based on noise monitoring 20 feet from the entrance to the Rosita Flats ORV use area and included ATVs, motorcycles(both two- and four-stroke engine types), and four-wheel-drive vehicles. Four-wheel -drive vehicles compose the majority of the ORVs entering the national recreation area. Figure 26 provides an example of some of the types of vehicles incorporated in the composite source.

For modeling purposes, three composite sources were developed:

- The Average Composite Source—This source represents the average of the measured ORV noise emissions.
- The Composite Source Plus One Standard Deviation (σ)—This composite represents the noise levels from ORVs with higher than average emissions. Approximately 16 percent of the ORVs would be expected to exceed this level. Modeling this level makes it possible to assess potential impacts from pass-bys of some of the loudest vehicles.
- 96 dBA Composite Source—For modeling of alternatives that incorporate a limit on ORV sound levels, a third composite source was created based on the proposed 96 dBA limit (measured 1.5 feet, or 0.5 meter, from the tailpipe). This composite source is referred to as the "96 dBA composite source" and results in ORV noise emission levels lower than the existing average.

FIGURE 26: EXAMPLES OF OFF-ROAD VEHICLES INCORPORATED IN THE COMPOSITE SOURCE

Table 17 summarizes the maximum sound level (L_{max}) for the three composite sources at a distance of 6 meters, which is close to the distance from the trail at the entrance to Rosita Flats to where the measurements were taken.

TABLE 17: L_{MAX} FOR COMPOSITE SOURCES AT 6 METERS

	L_{max} (dBA)
Average Composite Source	80.1
Composite Source +1σ	88.3
96 dBA Composite Source	75.2

Noise Model

For this plan/EIS, the NPS used the Noise Model Simulation (NMSim) model for analysis of ORVs. Information on the predominant ORV trails within the Rosita Flats and Blue Creek ORV use areas was entered into NMSim as appropriate for each alternative.

The metric chosen for modeling was the A-weighted L_{max}. While consideration of other indicators could be desirable, there is insufficient information on the number of ORVs using each area and the precise location of the vehicles at specific times to model time-dependent metrics such as L_{eq} or percent time audible. The modeling of L_{max} provides a reasonable basis for comparing the sound level contours resulting from the various alternatives that involve restrictions on operating areas and vehicle sound

emissions limits. The modeling computes the L_{max} noise levels that would result from the composite source vehicle operating on all trails and in areas where ORV use is not restricted to trails.

Study Area

Separate study areas were used for the Blue Creek and Rosita Flats ORV use areas. The study areas and soundscapes modeling extend beyond the boundaries of the national recreation area.

Analysis Scenarios

Table 18 provides a summary of the alternatives/analysis scenarios modeled for soundscapes impacts.

TABLE 18: SOUNDSCAPES MODELING SCENARIOS

	Alternative A		Alternative B		Alternative C		Alternative D	
Composite Sources	Blue Creek	Rosita Flats	Blue Creek	Rosita Flats	Blue Creek	Rosita Flats	Blue Creek	Rosita Flats
Average Composite Source	✓	✓						
Composite Source +1σ	✓	✓						
96 dBA Composite Source			✓	✓	✓	✓	✓	✓

Intensity Definitions

This section explains the context for setting the definitions and explains the scientific rationale for the definitions that were selected.

Context—It is important to base intensity definitions on the park-specific context, including consideration of the park purpose, legislative requirements, and visitor expectations. As stated in the national recreation area's enabling legislation, Congress established Lake Meredith National Recreation Area in 1990 "to provide for public outdoor recreation use and enjoyment of the lands and waters associated with Lake Meredith in the State of Texas, and to protect the scenic, scientific, cultural, and other values contributing to the public enjoyment of such lands and waters" (16 USC 460eee) (PL 101-628). ORV use has taken place at Rosita Flats and Blue Creek since at least the 1950s and today this area is still popular with ORV enthusiasts. Because ORV use at the national recreation area is an integral component of the experience for some visitors, ORV use at Blue Creek and Rosita is permitted under a special regulation (36 CFR 7.57).

Based on this context of the importance of ORV use to the experience and purpose of the national recreation area, the soundscapes intensity definitions for Blue Creek and Rosita Flats ORV use areas need to allow higher noise levels than would be acceptable in other areas of Lake Meredith National Recreation Area or at other national parks where ORV use is not as important. It would not be reasonable to set definitions for these areas so low that no ORV use would be permitted in the Blue Creek and Rosita Flats areas given that they have been set aside specifically to allow for ORV recreation experiences.

Geographic Considerations—Both the Blue Creek and Rosita Flats ORV use areas are located in relatively narrow bands of NPS land, surrounded by undeveloped private land. Therefore, the potential exists for natural soundscapes on private land to be impacted by ORV activity within the boundaries of Lake Meredith National Recreation Area (and vice versa). Although the NPS has no management

authority over land beyond the boundaries of Lake Meredith National Recreation Area, the potential for soundscapes impacts of the alternatives extending beyond the park boundaries needs to be considered for NEPA purposes. A soundscapes study area extending 1/2 mile from the park boundary line was established for the Blue Creek and Rosita Flats areas (see figures 27 and 28). Although ORV sounds could be audible at greater distances, potential impacts in terms of increases in L_{max} would be greatest within and near the ORV use areas. The modeled L_{max} levels are generally under 30 dBA at the boundaries of the study areas, which is close to current ambient levels, further supporting the reasonableness of the 1/2-mile criterion.

The definitions are based on two criteria: (1) the level at which noise interferes with speech at a distance of 1 meter and (2) the reduction in listening area caused by ORV noise emissions. The rationale for the definitions is discussed below.

Negligible:	65 dBA or greater in 0 percent to 10 percent of the study area	and	50 percent reduction in listening area in 0 percent to 29 percent of the study area
Minor:	65 dBA of greater in 11 percent to 30 percent of the study area	and	50 percent reduction in listening area in 30 percent to 59 percent of the study area
Moderate:	65 dBA or greater in 31 percent to 60 percent of the study area	and	50 percent reduction in listening area in 60 percent to 89 percent of the study area
Major:	65 dBA or greater in 61 percent to 100 percent of the study area	and	50 percent reduction in listening area in 90 percent to 100 percent of the study area

The 65 dBA L_{max} level was selected based on studies of speech interference (EPA 1974). The potential for speech interference from a noise depends on the distance between the speaker and listener and the acceptable level of intelligibility. Figure 29 illustrates definitions for speech interference for various distances and intelligibility levels. Speech in a normal voice is 95 percent intelligible at 65 dBA at a distance of 1 meter. Intensity definitions are based in part on the percentage of the study area in which ORV noise would exceed these conditions. At the negligible level of impact, speech interference would occur in only a small portion of the study area (10 percent or less), while over 60 percent of the area would experience speech interference at the major level of impact. The minor and moderate levels are at intermediate points between these percentages.

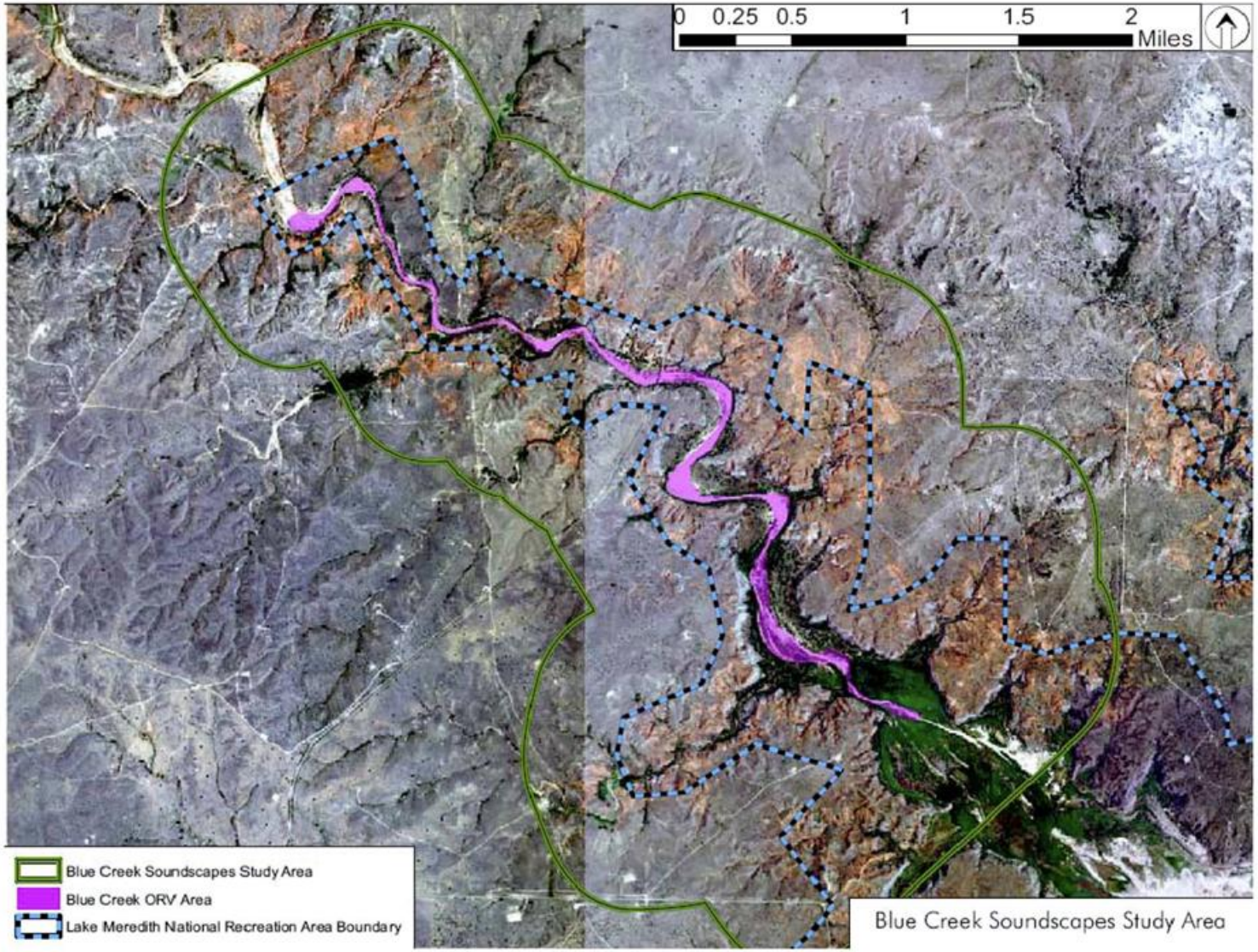


FIGURE 27: BLUE CREEK SOUNDSCAPES STUDY AREA

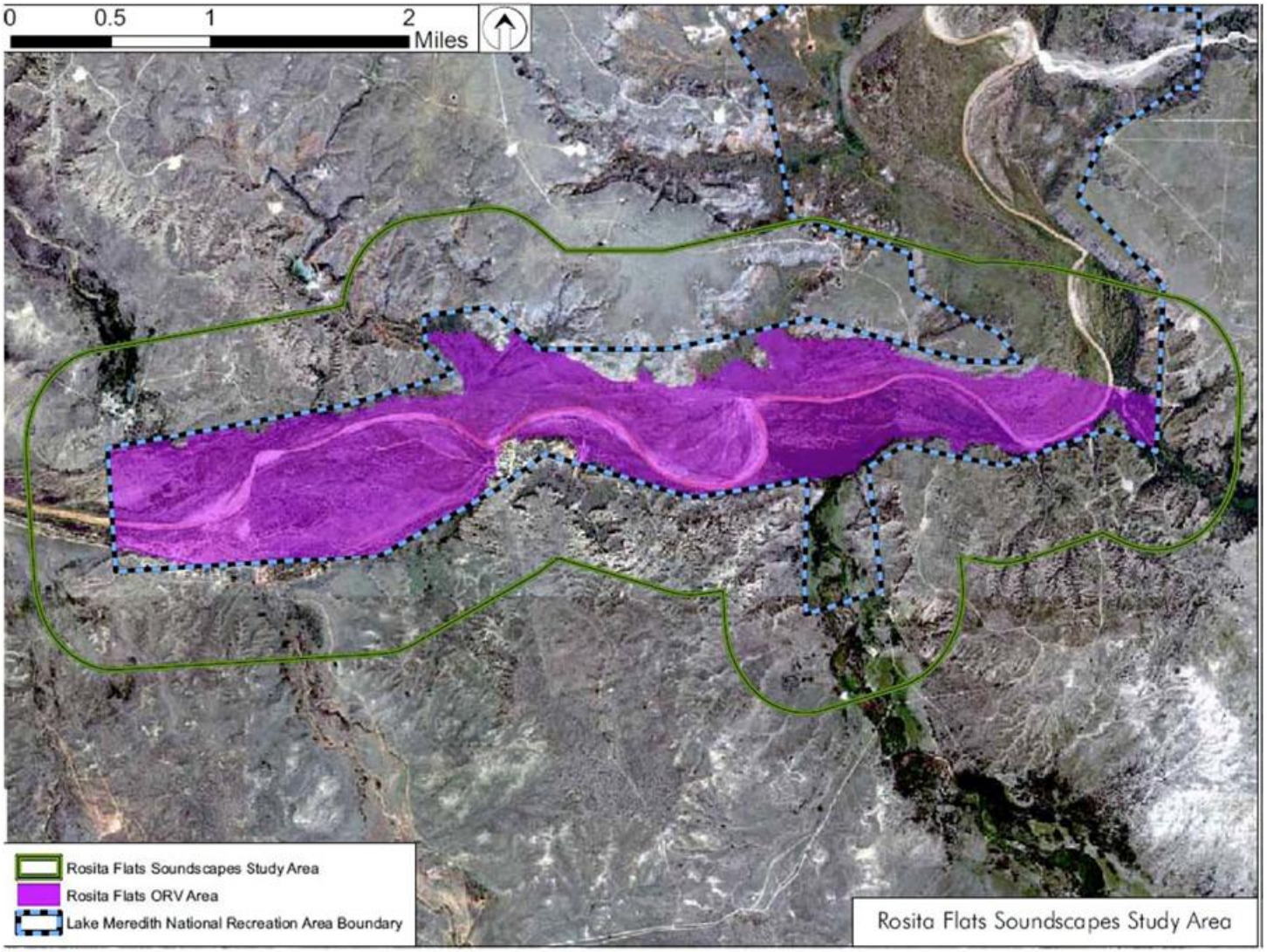
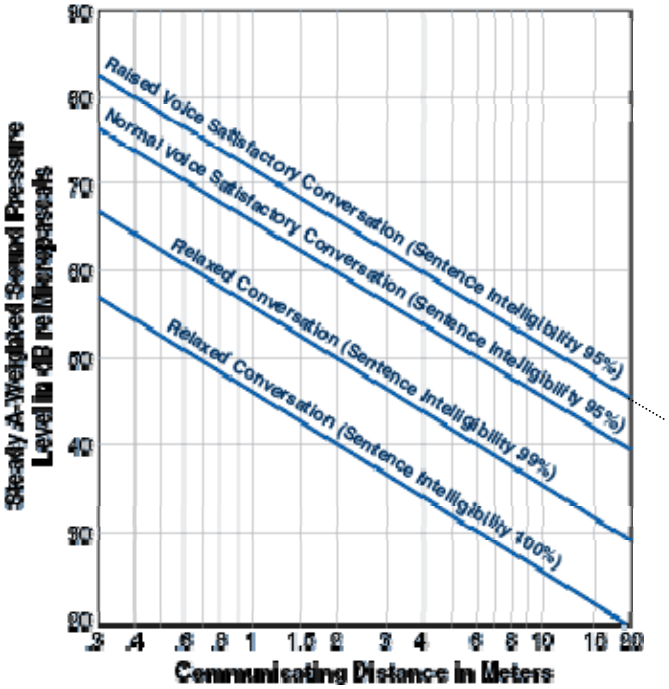


FIGURE 28: ROSITA FLATS SOUNDSCAPES STUDY AREA



Source: EPA 1974.

FIGURE 29: SPEECH INTERFERENCE

The reduction in listening area definition was selected to be protective of wildlife and the ability of humans to hear desirable natural sounds. Reduction in listening area quantifies the loss of hearing ability to humans and animals as a result of an increase in ambient noise level. Under natural ambient conditions a sound is audible within a certain area around a visitor or animal. If the ambient sound level is increased due to a noise event, the area in which the sound is audible decreases. Table 19 and figure 30 illustrate the relationship between increased ambient sound level and listening area reduction.

TABLE 19: REDUCTION IN LISTENING AREA DUE TO INCREASES IN AMBIENT SOUND LEVELS

Ambient Sound Level Increase (dBA)	3	6	10	20
Percent Reduction in Listening Area	50%	75%	90%	99%
Percent Reduction in Alerting Distance	30%	50%	70%	90%

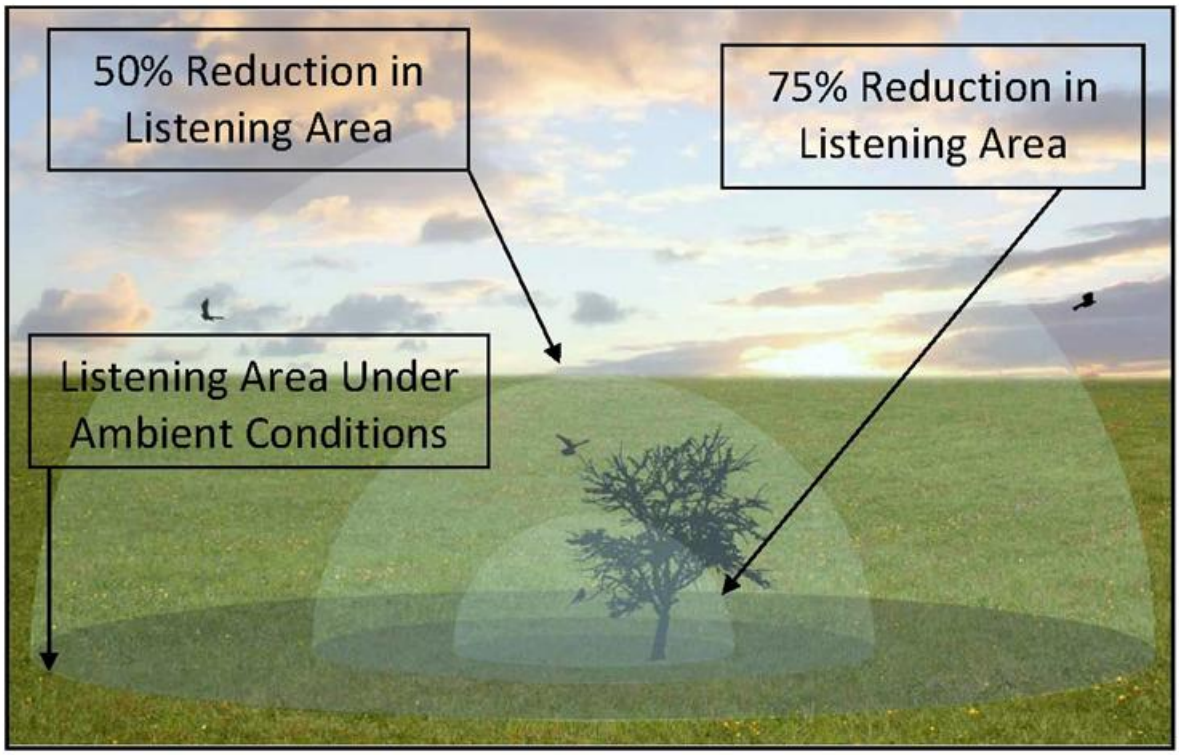


FIGURE 30: REDUCTION IN LISTENING AREA

For example, under natural ambient conditions, an owl perched in a tree may be able to hear a mouse scurrying through the brush anywhere within an area of 100 square meters (1,076 square feet) of the perch. If a noise event increases the ambient level by 3 dBA, the area in which the owl can hear a mouse would decrease by 50 percent to approximately 50 square meters (538 square feet).

Reduction in alerting distance is closely related to reduction in listening area. The residual alerting distance is equal to the square root of the residual listening area. Instead of addressing losses in terms of an area, reduction in alerting distance expresses the reduction as a linear distance from a source. For example, under natural ambient conditions, a hiker may be alerted to the sound of a flash flood at a distance of 1 mile. If a noise such as an ORV increases the ambient level by 6 dBA, the distance at which the flood could be detected would decrease by 50 percent to approximately 1/2 mile (2,640 feet).

Visitors and wildlife are impacted by their failure to hear natural sounds that would have been audible in the absence of noise: a bird misses the sound of a worm, a mouse misses the footfall of a coyote, a visitor misses the sound of a distant waterfall. Reductions in listening area and alerting distance capture these types of impacts.

For this project, reduction in listening area was determined using the natural ambient sound level from monitoring data combined with an approximation of the ambient sound level under the various alternatives. A 50 percent reduction in listening area (e.g., a 3 dBA increase in ambient sound levels) in 90 percent or more of the study area was defined as a major impact. A 50 percent reduction in listening area in 29 percent or less of the study area was defined as a negligible impact. The minor and moderate levels are at intermediate points between these percentages. The natural ambient noise level for the Blue Creek area is 28 dBA, therefore noise levels above 31 dBA will cause a 50 percent or greater reduction in

listening area. The natural ambient noise level for the Rosita Flats area is 31 dBA, therefore noise levels above 34 dBA will cause a 50 percent or greater reduction in listening area.

SUMMARY OF IMPACTS

The acoustic modeling report (NPS 2011c) summarizes the modeling results for the Blue Creek and Rosita Flats study area. Tables 20 through 23 show the number of hectares at or above the speech interference and listening area reduction criteria.

TABLE 20: BLUE CREEK STUDY AREA SOUNDSCAPES MODELING RESULTS

Blue Creek	Area with > 50% in Listening Area (> 31 dBA) (Hectares)	% of Study Area	Area Subject to Speech Interference (> 65 dBA) (Hectares)	% of Study Area
Alternative A Average Composite Source	885	38.1%	129	5.6%
Alternative A Composite Source + 1σ	1,343	57.8%	197	8.5%
Alternatives B and C 96 dBA Composite Source	700	30.1%	107	4.6%
Alternative D 96 dBA Composite Source	699	30.1%	110	4.7%

TABLE 21: ROSITA FLATS STUDY AREA SOUNDSCAPES MODELING RESULTS

Rosita Flats	Area with > 50% in Listening Area (> 34 dBA) (Hectares)	% of Study Area	Area Subject to Speech Interference (> 65 dBA) (Hectares)	% of Study Area
Alternative A Average Composite Source	1,872	67.4%	903	32.5%
Alternative A Composite Source + 1σ	2,353	84.8%	1,004	36.2%
Alternative B 96 dBA Composite Source	1,231	44.4%	218	7.9%
Alternative C 96 dBA Composite Source	1,231	44.4%	214	7.7%
Alternative D 96 dBA Composite Source	1,271	45.8%	246	8.8%

TABLE 22: SUMMARY OF SOUNDSCAPES IMPACTS FOR BLUE CREEK

Blue Creek	Area with > 50% in Listening Area (> 31 dBA) (Hectares)	% of Study Area	Listening Area Impact	Area Subject to Speech Interference (> 65 dBA) (Hectares)	% of Study Area	Speech Interference Impact	Overall Impact
Alternative A Average Composite Source	885	38.1%	Minor	129	5.6%	Negligible	Minor
Alternative A Composite Source + 1σ	1,343	57.8%	Minor	197	8.5%	Negligible	Minor
Alternatives B and C 96 dBA Composite Source	700	30.1%	Minor	107	4.6%	Negligible	Minor
Alternative D 96 dBA Composite Source	699	30.1%	Minor	110	4.7%	Negligible	Minor

TABLE 23: SUMMARY OF SOUNDSCAPES IMPACTS FOR ROSITA FLATS

Rosita Flats	Area with > 50% in Listening Area (> 31 dBA) (Hectares)	% of Study Area	Listening Area Impact	Area Subject to Speech Interference (> 65 dBA) (Hectares)	% of Study Area	Speech Interference Impact	Overall Impact
Alternative A Average Composite Source	1,872	67.4%	Moderate	903	32.5%	Moderate	Moderate
Alternative A Composite Source + 1σ	2,353	84.8%	Moderate	1,004	36.2%	Moderate	Moderate
Alternative B 96 dBA Composite Source	1,231	44.4%	Minor	218	7.9%	Negligible	Minor
Alternative C 96 dBA Composite Source	1,231	44.4%	Minor	214	7.7%	Negligible	Minor
Alternative D 96 dBA Composite Source	1,271	45.8%	Minor	246	8.8%	Negligible	Minor

IMPACTS OF ALTERNATIVE A: NO ACTION – CONTINUATION OF CURRENT MANAGEMENT

Blue Creek ORV Use Area

Under alternative A, ORV use at Blue Creek would result in 5.6 percent of the study area with a L_{max} at or above 65 dBA, assuming the average composite source. The average composite source would result in long-term negligible adverse impacts on soundscapes. The average composite source is the most representative of the ORVs using the national recreation area. The composite source +1σ results in 8.5 percent of the Blue Creek area at or above 65 dBA or a long-term minor adverse impact on soundscapes, illustrating the effect of the loudest vehicles at the national recreation area. As shown in figures 31 and 32, the majority of the Blue Creek study area affected by L_{max} levels at or above 65 dBA is located within the boundaries of Lake Meredith National Recreation Area and close to the narrow area where ORV use would be permitted under alternative A.

Under alternative A, ORV use at Blue Creek would result in 38.1 percent of the study area with a greater than 50 percent reduction in listening area, assuming the average composite source. The average composite source would result in long-term minor adverse impacts on soundscapes. The average composite source is the most representative of the ORVs using the national recreation area. The composite source +1σ would result in 57.8 percent of the study area with a greater than 50 percent reduction in listening area and a long-term minor adverse impact on soundscapes, illustrating the effect of the loudest vehicles at the national recreation area.

For Blue Creek the overall impact on soundscapes from alternative A would be minor, long term, and adverse.

Rosita Flats ORV Use Area

Under alternative A, ORV use at Rosita Flats would result in 32.5 percent of the study area with L_{max} at or above 65 dBA, assuming the average composite source. The average composite source would result in long-term moderate adverse impacts on soundscapes. The average composite source is the most representative of the ORVs used at the national recreation area. The composite source +1σ would result in 36.2 percent of the Rosita Flats area at or above 65 dBA, or a long-term moderate adverse impact on soundscapes, illustrating the effect of the loudest vehicles at the national recreation area (figures 33 and 34). Under alternative A, ORV use at Rosita Flats would result in 67.4 percent of the study area with a greater than 50 percent reduction in listening area, assuming the average composite source. The average composite source would result in long-term moderate adverse impacts on soundscapes. The average composite source is the most representative of ORVs being used at the national recreation area. The composite source +1σ results in 84.8 percent of the study area with a greater than 50 percent reduction in listening area and a long-term moderate adverse impact on soundscapes, illustrating the effect of the loudest vehicles at the national recreation area.

For Rosita Flats the overall impact on soundscapes from alternative A would be long term, moderate, and adverse.

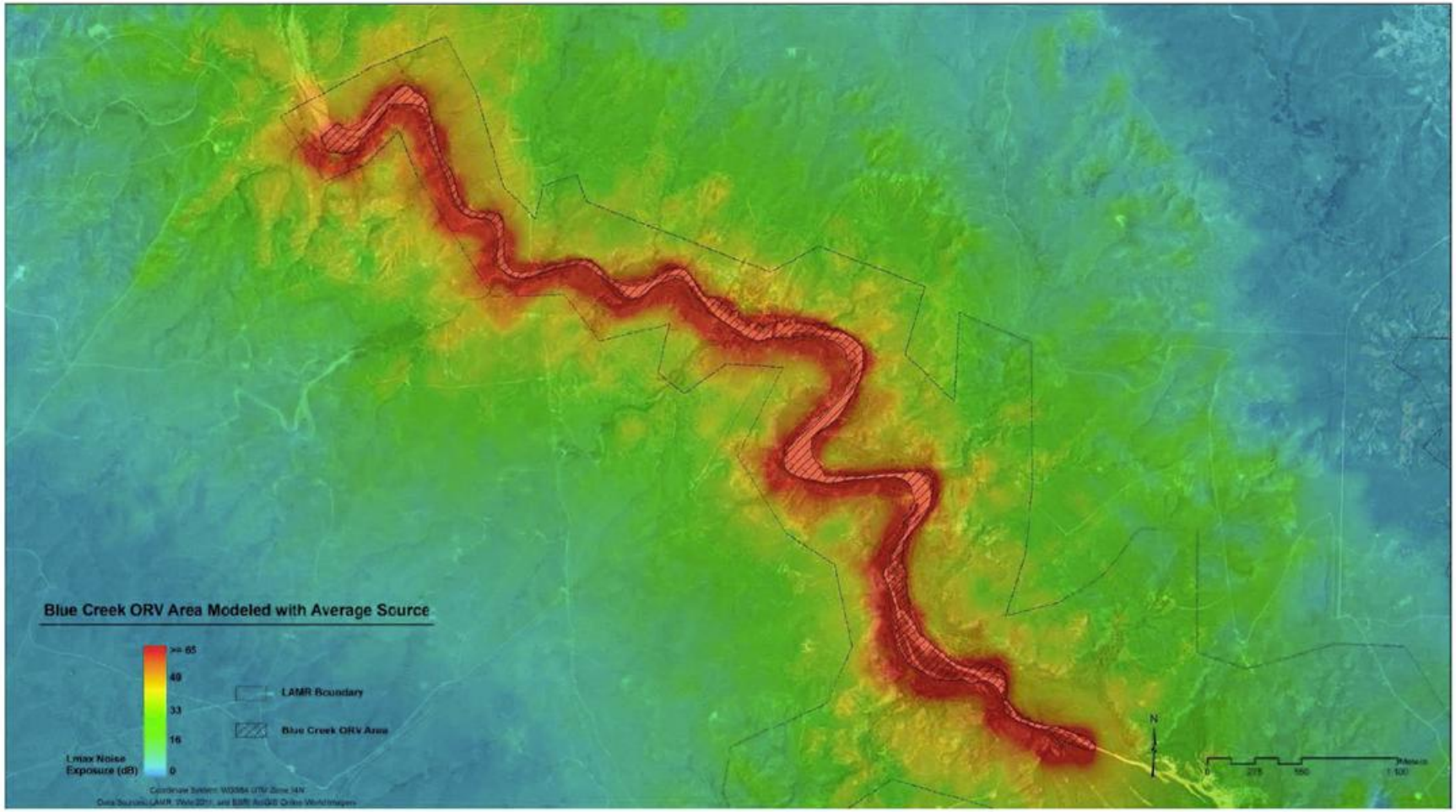


FIGURE 31: LAKE MEREDITH ALTERNATIVE A: BLUE CREEK OFF-ROAD VEHICLE USE AREA MODELED WITH AVERAGE SOURCE

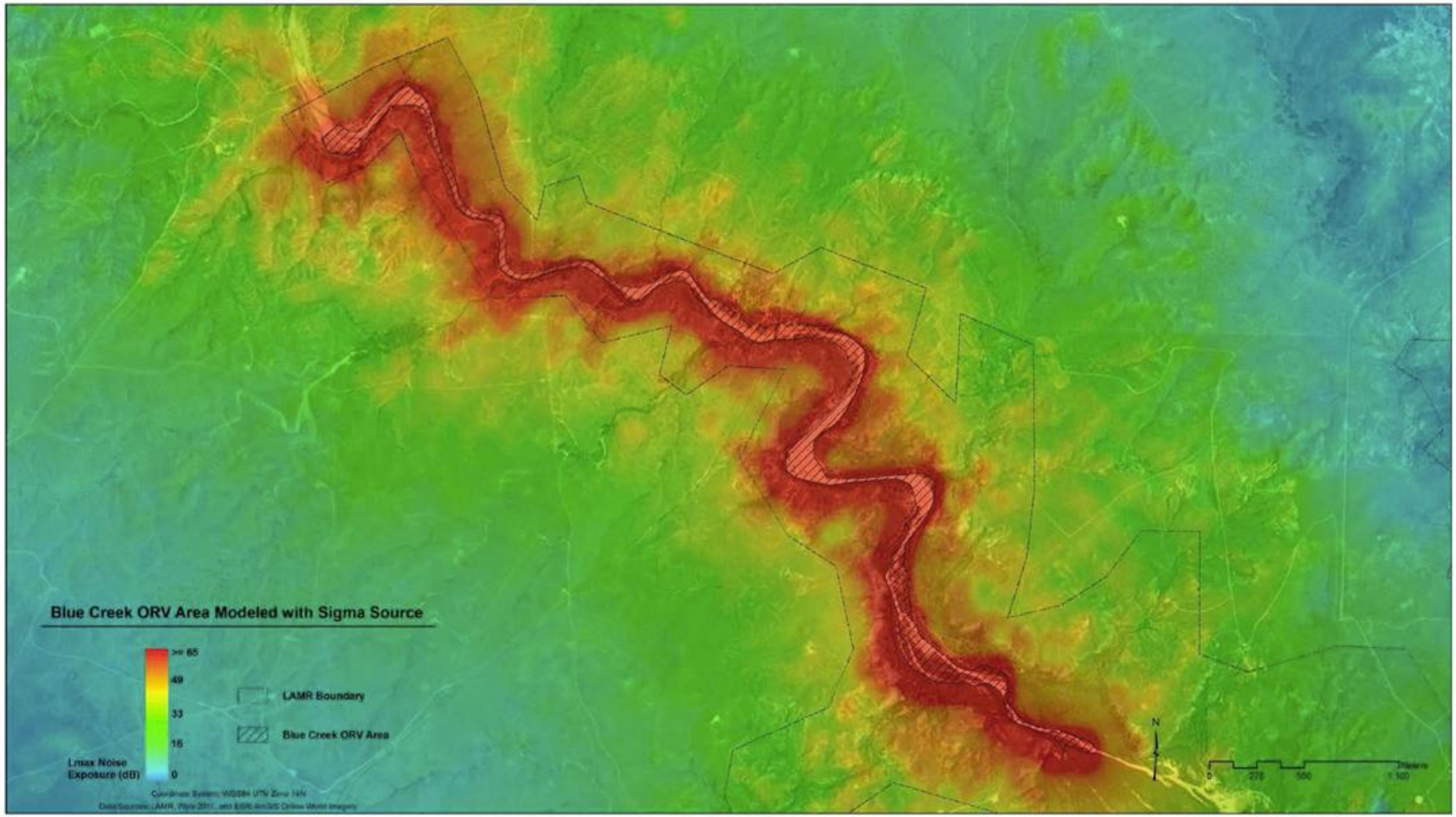


FIGURE 32: LAKE MEREDITH ALTERNATIVE A: BLUE CREEK OFF-ROAD VEHICLE USE AREA MODELED WITH SIGMA SOURCE

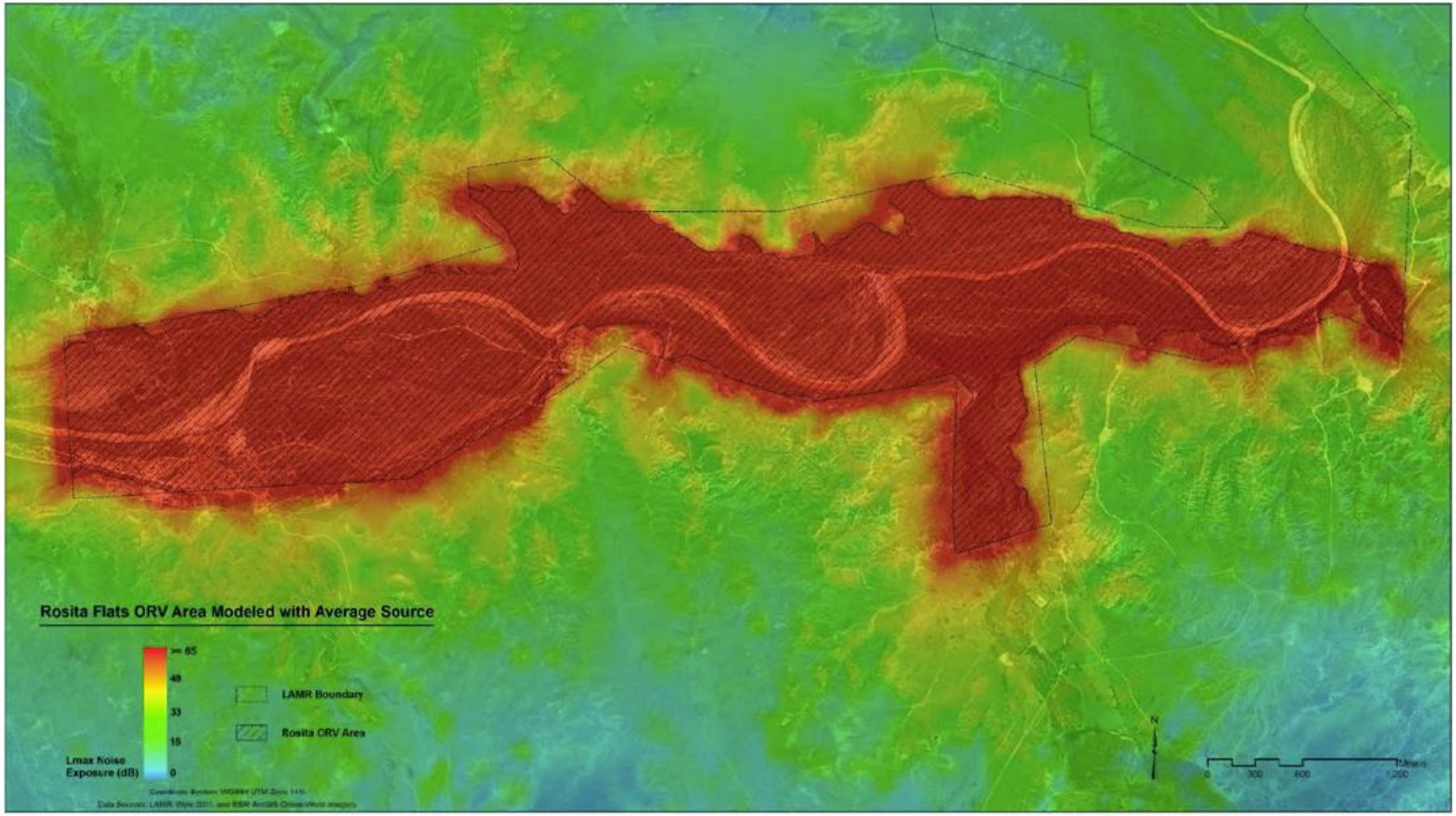


FIGURE 33: LAKE MEREDITH ALTERNATIVE A: ROSITA FLATS OFF-ROAD VEHICLE USE AREA MODELED WITH AVERAGE SOURCE

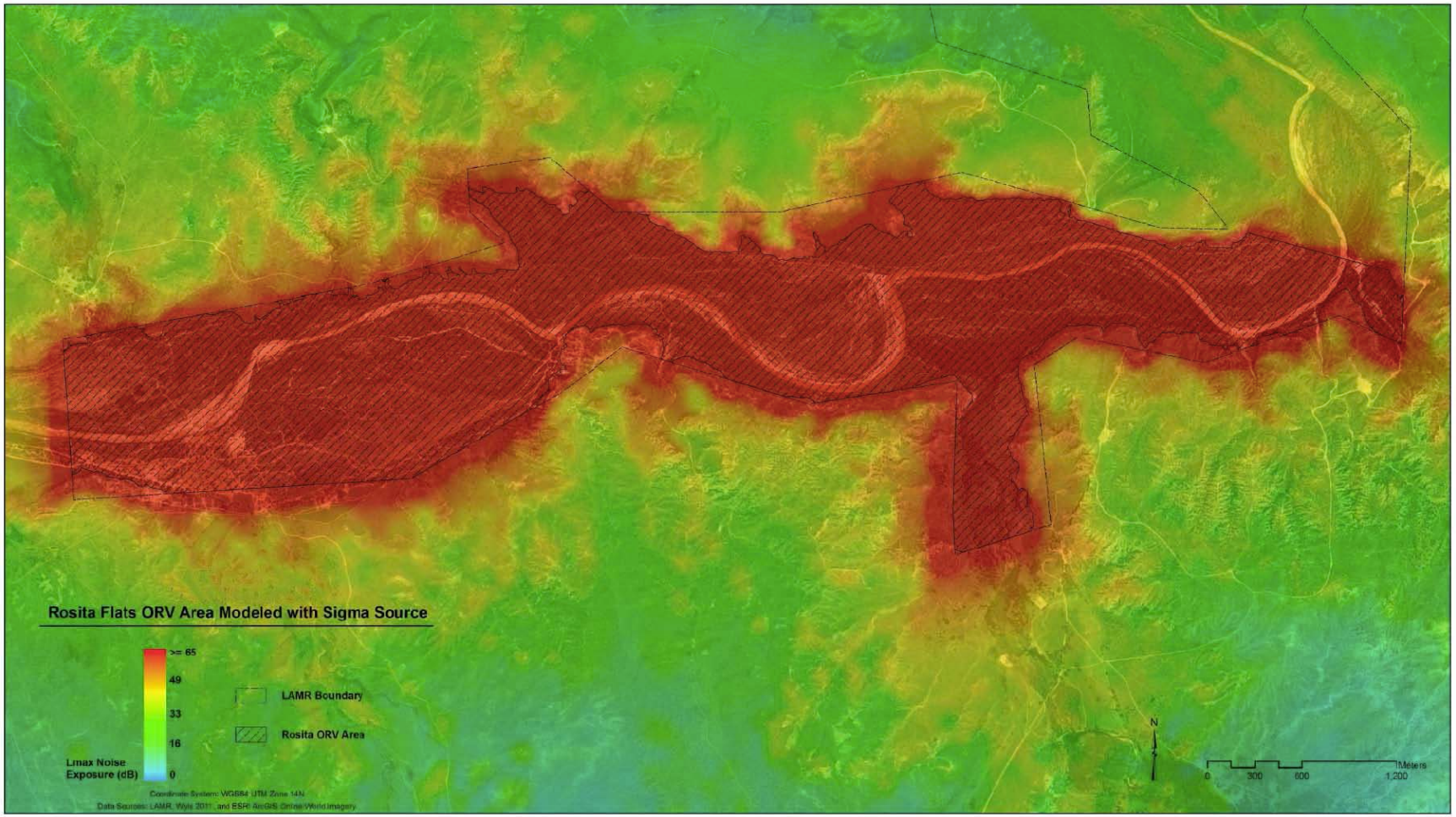


FIGURE 34: LAKE MEREDITH ALTERNATIVE A: ROSITA FLATS OFF-ROAD VEHICLE USE AREA MODELED WITH SIGMA SOURCE

Cumulative Impacts

Past, present, and reasonably foreseeable future actions both outside and within the national recreation area have the potential to impact soundscapes in the national recreation area. Actions by others potentially contributing to cumulative impacts on soundscapes in the vicinity of the Blue Creek and Rosita Flats ORV use areas include the following.

The existing soundscapes at Blue Creek and Rosita Flats are affected by FM 1913 and U.S. Highway 287, respectively. FM 1913 passes directly through the Blue Creek area near the two monitoring sites, but it was not possible to distinguish the traffic noise on FM 1913 from ORV noise in the soundscapes monitoring study summarized in chapter 3. Highway 287 is located 1.5 miles west of the entrance to Rosita Flats. Noise from Highway 287 could be distinguished from ORV noise in the monitoring at Rosita Flats. The traffic noise on Highway 287 was characterized as a distant drone that was audible almost all hours of the day. According to the Texas Department of Transportation, average annual daily traffic on Highway 287 in 2009 was 12,400. Traffic volumes on FM 1913 are substantially lower (average annual daily traffic of 220) (Texas Department of Transportation 2010). However, due to the greater proximity, individual vehicle pass-bys would be audible at a higher sound level for visitors to the Blue Creek area near FM 1913. ORV traffic will continue to influence soundscapes at Blue Creek and Rosita Flats in the future.

The soundscapes monitoring study found that non-natural sounds from oil derrick generators were audible (at low sound levels) at all monitoring locations for almost all hours of the day and night (e.g., non-natural sounds audible 100 percent or near 100 percent of the time). At the time of the 2002 Final Oil and Gas Management Plan, there were 170 active nonfederal oil and gas operations in the Lake Meredith National Recreation Area and Alibates Flint Quarries National Monument. The reasonably foreseeable development scenario associated with the Oil and Gas Management Plan EIS estimated 22.8 billion cubic feet of natural gas and 420,000 barrels of oil could be produced from Lake Meredith National Recreation Area by 2022 and that up to 85 additional wells could be drilled to extract these resources (NPS 2002a). Oil and gas development can also occur on the lands outside the national recreation area. While the specific location of future oil and gas development is not known, it is reasonable to anticipate that oil and gas development will continue to contribute non-natural sounds audible at Blue Creek and Rosita Flats.

At Blue Creek, the impacts of past, present, and reasonably foreseeable future actions, combined with the long-term minor adverse impacts of alternative A, would result in long-term minor adverse cumulative impacts on natural soundscapes. At Rosita Flats, the impacts of past, present, and reasonably foreseeable future actions, combined with the long-term moderate adverse impacts of alternative A, would result in long-term moderate adverse cumulative impacts on natural soundscapes.

Conclusion

The effects of alternative A on soundscapes at Blue Creek would be long term, minor, and adverse. The effects of alternative A on soundscapes at Rosita Flats would be long term, moderate, and adverse. Cumulative impacts on soundscapes would be long term, minor to moderate, and adverse.

IMPACTS OF ALTERNATIVE B: ZONE SYSTEM – SEPARATION OF VISITOR USES, WITH A PERMIT FOR EDUCATIONAL PURPOSES

Blue Creek ORV Use Area

Under alternative B, ORV use at Blue Creek would result in 4.6 percent of the study area with a L_{max} at or above 65 dBA. The 96 dBA composite source under alternative B would result in long-term negligible

adverse speech interference impacts. As shown in figure 35, the area of the Blue Creek study area affected by L_{max} levels at or above 65 dBA is slightly greater under alternative B compared to alternative A because of the addition of camping zones where ORV use would be permitted for access purposes. Under alternative B, ORV use at Blue Creek would result in 30.1 percent of the study area with a greater than 50 percent reduction in listening area. This would result in long-term minor adverse listening area impacts.

For Blue Creek the overall soundscapes impact from alternative B would be minor, long term, and adverse.

Rosita Flats ORV Use Area

Under alternative B, ORV use at Rosita Flats would result in 7.9 percent of the study area with a L_{max} at or above 65 dBA. The 96 dBA composite source under alternative B would result in long-term negligible adverse speech interference impacts. Comparing figure 33 (alternative A) and figure 36 (alternative B) shows the substantial reduction in the area with L_{max} levels at or above 65 dBA as a result of the designation of specific ORV zones and routes within Rosita Flats, including the resource protection zone, and the tailpipe noise emissions limit under alternative B. Under alternative B, ORV use at Rosita Flats would result in 44.4 percent of the study area with a greater than 50 percent reduction in listening area. This would result in long-term minor adverse listening area impacts.

For Rosita Flats, the overall soundscapes impact from alternative B would be minor, long term, and adverse.

Cumulative Impacts

The impacts on soundscapes from other past, present, and reasonably foreseeable future actions would be the same as described for alternative A. At Blue Creek, the impacts of past, present, and reasonably foreseeable future actions, combined with the long-term minor adverse impacts of alternative B, would result in long-term minor adverse cumulative impacts on natural soundscapes. At Rosita Flats, the impacts of past, present, and reasonably foreseeable future actions, combined with the long-term minor adverse impacts of alternative B, would result in long-term minor adverse cumulative impacts on natural soundscapes.

Conclusion

The effects of alternative B on soundscapes at Blue Creek would be long term, minor, and adverse. The effects of alternative B on soundscapes at Rosita Flats would be long term, minor, and adverse. Cumulative impacts on soundscapes would be long term, minor, and adverse.

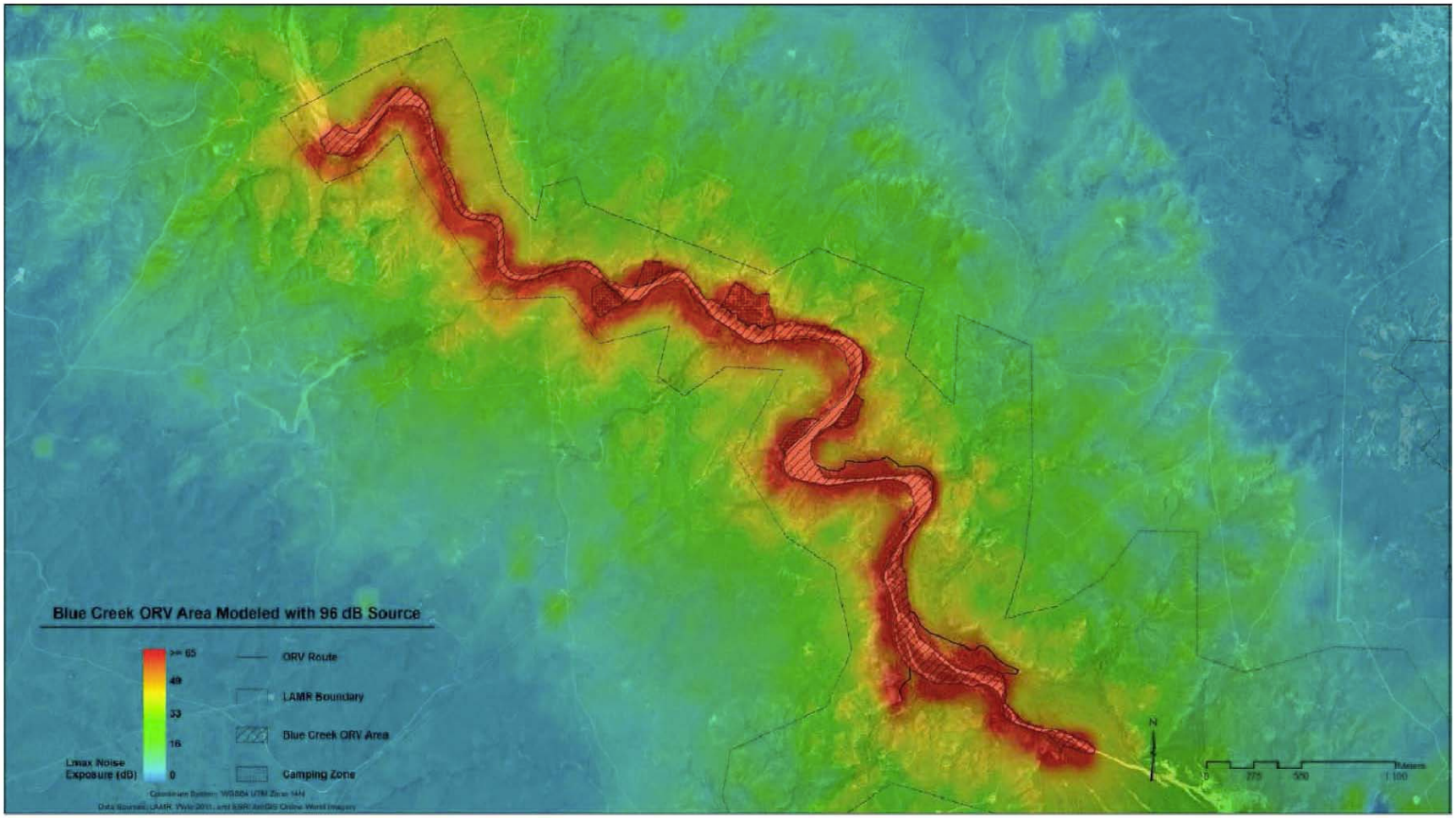


FIGURE 35: LAKE MEREDITH ALTERNATIVE B AND C: BLUE CREEK OFF-ROAD VEHICLE USE AREA MODELED WITH 96 DB SOURCE

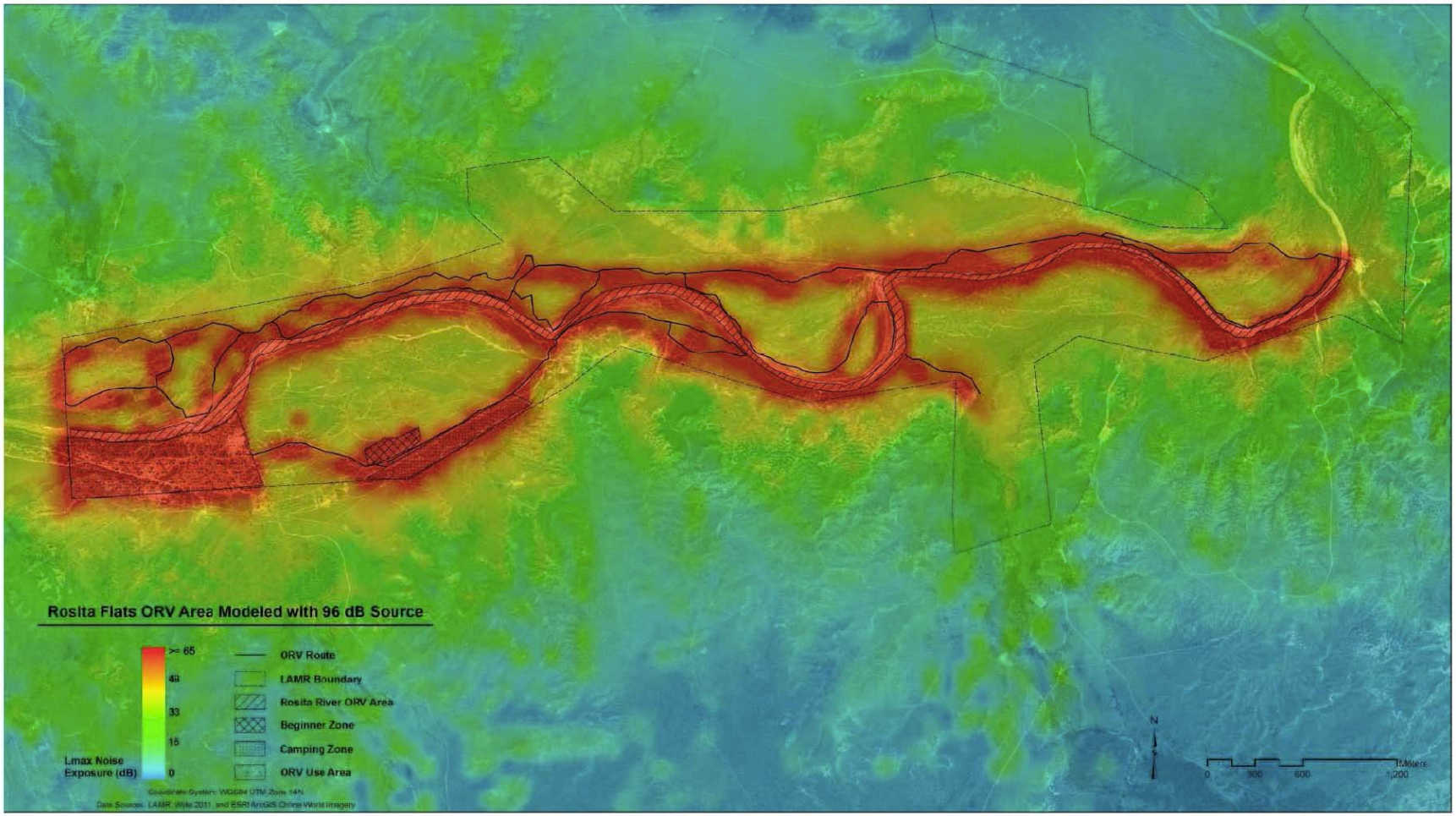


FIGURE 36: LAKE MEREDITH ALTERNATIVE B: ROSITA FLATS OFF-ROAD VEHICLE USE AREA MODELED WITH 96 DB SOURCE

IMPACTS OF ALTERNATIVE C: MANAGEMENT THROUGH USE OF A PERMIT SYSTEM AT CURRENT ORV USE AREAS

Blue Creek ORV Use Area

In terms of soundscapes impacts at Blue Creek, alternative C would be identical to alternative B. Figure 35 represents the L_{max} contour levels for alternatives B and C. Under alternative C, ORV use at Blue Creek would result in 4.6 percent of the study area with a L_{max} at or above 65 dBA. The 96 dBA composite source under alternative C would result in long-term negligible adverse speech interference impacts. As shown in figure 35, the area of the Blue Creek study area affected by L_{max} levels at or above 65 dBA is slightly greater under alternative C compared to alternative B because of the addition of camping zones where ORV use would be permitted for access purposes. Under alternative C, ORV use at Blue Creek would result in 30.1 percent of the study area with a greater than 50 percent reduction in listening area. This would result in long-term minor adverse listening area impacts.

For Blue Creek the overall soundscapes impact from alternative C would be long term, minor, and adverse.

Rosita Flats ORV Use Area

Under alternative C, ORV use at Rosita Flats would result in 7.7 percent of the study area with a L_{max} at or above 65 dBA. The 96 dBA composite source under alternative C would result in long-term negligible adverse speech interference impacts. Comparing figure 33 (alternative A) and figure 37 (alternative C) shows the substantial reduction in the area with L_{max} levels at or above 65 dBA as a result of the designation of specific ORV zones and routes within Rosita Flats and the tailpipe noise emissions limit under alternative C. One difference in soundscapes impacts at Rosita Flats is that alternative C would not include the beginner's area that is part of alternative B.[2] Under alternative C, ORV use at Rosita Flats would result in 44.4 percent of the study area with a greater than 50 percent reduction in listening area. This would result in long-term minor adverse listening area impacts.

For Rosita Flats, the overall soundscapes impact from alternative C would be minor, long term, and adverse.

Cumulative Impacts

Impacts on soundscapes from other past, present, and reasonably foreseeable future actions would be the same as described for alternative A. At Blue Creek, the impacts of past, present, and reasonably foreseeable future actions, combined with the long-term minor adverse impacts of alternative C, would result in long-term minor adverse cumulative impacts on natural soundscapes. At Rosita Flats, the impacts of past, present, and reasonably foreseeable future actions, combined with the long-term minor adverse impacts of alternative C, would result in long-term minor adverse cumulative impacts on natural soundscapes.

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[2] Alternative B includes a resource protection zone in the eastern portion of Rosita Flats where only ATVs, UTVs, and motorcycles would be allowed. The resource protection zone is not part of alternative C. However, the soundscapes modeling framework assumes that a composite source meeting the 96 dBA limit is operating everywhere any ORVs are permitted and does not distinguish between vehicle types. Therefore, the resource protection zone does not affect the L_{max} modeling results.

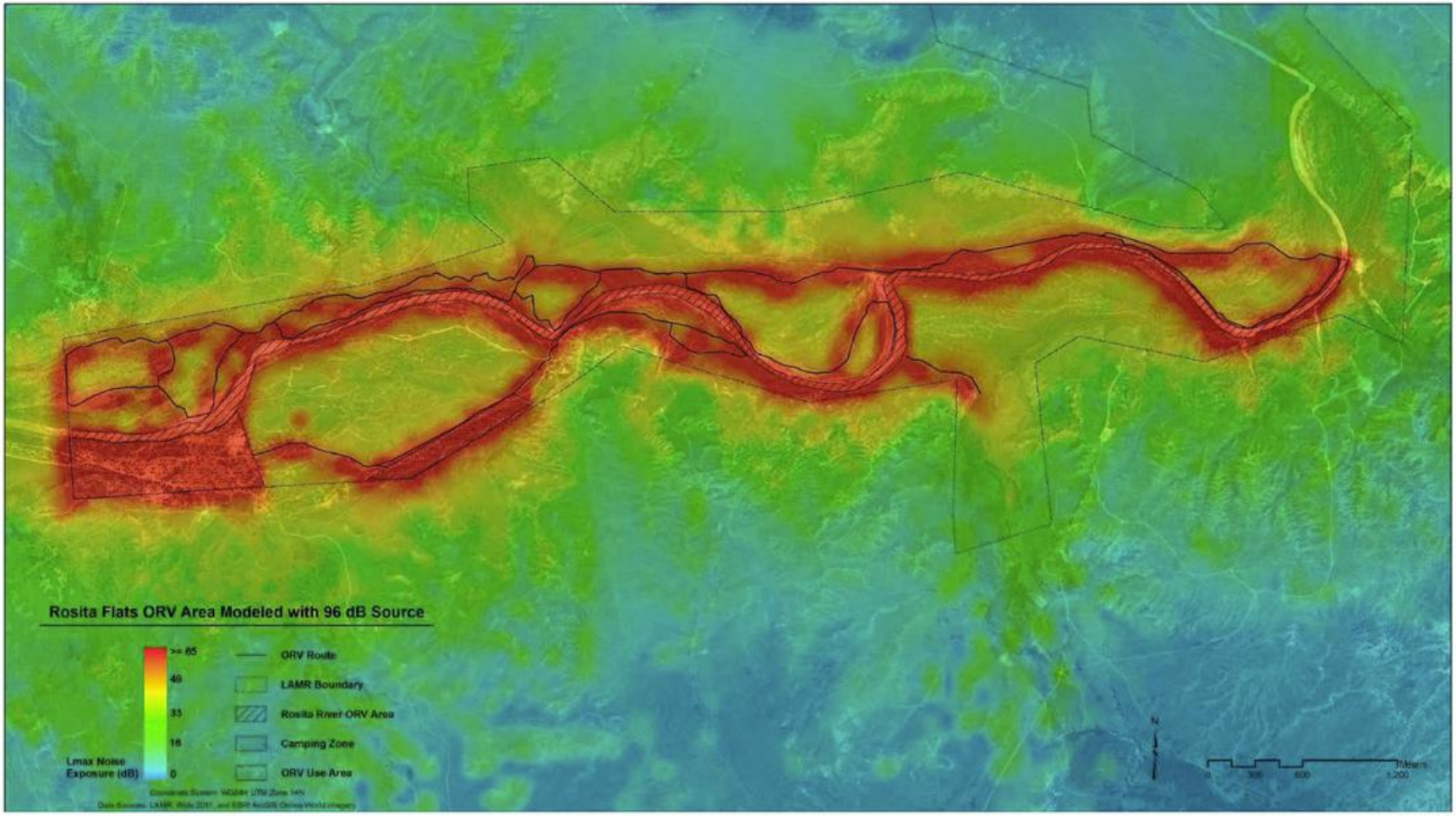

FIGURE 37: LAKE MEREDITH ALTERNATIVE C: ROSITA FLATS OFF-ROAD VEHICLE USE AREA MODELED WITH 96 DBA SOURCE

Conclusion

The effects of alternative C on soundscapes at Blue Creek would be long term, minor, and adverse. The effects of alternative C on soundscapes at Rosita Flats would be long term, minor, and adverse. Cumulative impacts on soundscapes would be long term, minor, and adverse.

IMPACTS OF ALTERNATIVE D: MANAGEMENT THROUGH USE OF A ZONING AND PERMITTING SYSTEM AT CURRENT ORV USE AREAS

For Blue Creek, alternative D is similar to alternative B in that ORVs would be allowed to operate throughout the cutbank-to-cutbank area with the same muffler requirements. The two differences for the noise model consist of more camping zones around the FM 1913 road bridge area and the omission of the southernmost ORV route with the establishment of a resource protection zone. At Rosita Flats, the two changes from alternative B consist of the establishment of a new ORV use area near Bull Taco Hill and a new camping zone near the entrance. These options did not result in changes to the noise modeling output, and the soundscapes impacts of alternative D would be identical to those of alternative B at both Blue Creek and Rosita Flats.

Blue Creek ORV Use Area

Under alternative D, ORV use at Blue Creek would result in 4.7 percent of the study area with a L_{max} at or above 65 dBA. The 96 dBA composite source under alternative D would result in long-term negligible adverse speech interference impacts. As shown in figure 35, the area of the Blue Creek study area affected by L_{max} levels at or above 65 dBA is slightly greater under alternative D compared to alternative B because of the addition of camping zones where ORV use would be permitted for access purposes. Under alternative D, ORV use at Blue Creek would result in 30.1 percent of the study area with a greater than 50 percent reduction in listening area. This would result in long-term minor adverse listening area impacts.

For Blue Creek the overall soundscapes impact from alternative D would be long term, minor, and adverse.

Rosita Flats ORV Use Area

Under alternative D, ORV use at Rosita Flats would result in 8.8 percent of the study area with a L_{max} at or above 65 dBA. The 96 dBA composite source under alternative D would result in long-term negligible adverse speech interference impacts. Compared with alternative A, under alternative D there would be a substantial reduction in the area with L_{max} levels at or above 65 dBA as a result of the designation of specific ORV zones and routes within Rosita Flats, including the resource protection zone, and the tailpipe noise emissions limit under alternative D. Under alternative D, ORV use at Rosita Flats would result in 45.8 percent of the study area with a greater than 50 percent reduction in listening area. This would result in long-term minor adverse listening area impacts.

For Rosita Flats, the overall soundscapes impact from alternative D would be long term, minor, and adverse.

Cumulative Impacts

The impacts on soundscapes from other past, present, and reasonably foreseeable future actions would be the same as described for alternative A. At Blue Creek, the impacts of past, present, and reasonably

foreseeable future actions, combined with the long-term minor adverse impacts of alternative D, would result in long-term minor adverse cumulative impacts on natural soundscapes. At Rosita Flats, the impacts of past, present, and reasonably foreseeable future actions, combined with the long-term minor adverse impacts of alternative D, would result in long-term minor adverse cumulative impacts on natural soundscapes.

Conclusion

The effects of alternative D on soundscapes at Blue Creek would be long term, minor, and adverse. The effects of alternative D on soundscapes at Rosita Flats would be long term, minor, and adverse. Cumulative impacts on soundscapes would be long term, minor, and adverse.

WILDLIFE AND WILDLIFE HABITAT

NPS *Management Policies 2006* states that the NPS "will maintain as parts of the natural ecosystems of parks all plants and animals native to park ecosystems. The term 'plants and animals' refers to all five of the commonly recognized kingdoms of living things and includes such groups as flowering plants, ferns, mosses, lichens, algae, fungi, bacteria, mammals, birds, reptiles, amphibians, fishes, insects, worms, crustaceans, and microscopic plants and animals" (NPS 2006b, Section 4.4.1). The NPS will achieve this by:

- Preserving and restoring the natural abundances, diversities, dynamics, distributions, habitats, and behaviors of native plant and animal populations and the communities and ecosystems in which they occur;
- Restoring native plant and animal populations in parks when they have been extirpated by past human-caused actions; and
- Minimizing human impacts on native plants, animals, populations, communities, and ecosystems, and the processes that sustain them. (NPS 2006b)

NPS *Management Policies 2006* further states, "Superintendents will develop and implement visitor use management plans and take action, as appropriate, to ensure that recreational uses and activities in the park are consistent with its authorizing legislation or proclamation and do not cause unacceptable impacts on park resources or values" (NPS 2006b, Section 8.2.2.1).

METHODOLOGY, ASSUMPTIONS, AND INTENSITY DEFINITIONS

Lake Meredith National Recreation Area provides habitat for a variety of fish, mammals, birds, amphibians, and reptiles, which could be affected by actions described in the proposed alternatives. This includes species disturbance and displacement as a result of vehicle noise, habitat destruction, and species injury or mortality. Much of the existing research has focused on habitat fragmentation, the effects of erosion, and vegetation trampling by visitors. In addition to habitat fragmentation and disruption, an issue of concern is direct species mortality from vehicle collisions.

Impacts on wildlife and wildlife habitat were assessed by determining the current species status and condition of habitat in the national recreation area and evaluating the extent to which ORV access would cause potential impacts. This included an assessment of the potential beneficial effects of closing certain routes/areas to ORVs.

Following are the intensity definitions for impacts on wildlife and wildlife habitat.

Negligible: Wildlife and/or their habitats would not be affected or the effects would be at or below the level of detection, and the changes would be so slight that they would not be of any measurable or perceptible consequence to the wildlife species' population.

Minor: Effects on wildlife and/or their habitats would be detectable, although the effects would be localized and would be small and of little consequence to the species' population. Mitigation measures, if needed to offset adverse effects, would be simple and successful.

Moderate: Effects on wildlife and/or their habitats would be readily detectable, long term, and localized, with consequences at the population level. Mitigation measures, if needed to offset adverse effects, would be extensive and likely successful.

Major: Effects on wildlife and/or their habitats would be obvious, would be long term, and would have substantial consequences to wildlife populations in the region. Extensive mitigation measures would be needed to offset any adverse effects and their success would not be guaranteed.

Duration: Short-term—Impacts would last less than one year.

Long-term—Impacts would last more than one year.

Study Area

The study area for wildlife and wildlife habitat is defined as the Rosita Flats and Blue Creek ORV use areas for the analysis of the impacts of the alternatives and defined as Lake Meredith National Recreation Area and adjacent land for the analysis of cumulative impacts.

IMPACTS OF ALTERNATIVE A: NO ACTION – CONTINUATION OF CURRENT MANAGEMENT

Under alternative A, the management of ORV use and access at the national recreation area would continue current management strategies based on the 2007 *Interim OHV Use Plan* (NPS 2007a), the regulations contained in 36 CFR 7.57, and the Superintendent's Compendium. ORV use would continue to be permitted throughout Rosita Flats below the 3,000-foot elevation line and at Blue Creek along the creek bottom from cutbank to cutbank. No additional management tools such as zoning, permits, or use limits would be implemented.

Although not specific to the national recreation area, documentation of relatively early use of ORVs in desert ecosystems, like those found at the national recreation area, found that ORV use was destructive, causing long-lasting damage to land and aquatic ecosystems, wildlife, soils, and hydrologic flows (New Mexico EMNRD et al. 2008). The continued use of ORVs at the national recreation area would impact fish and wildlife, including species disturbance and displacement, habitat destruction, degraded water quality, and vehicle/wildlife collisions causing injury or mortality to individuals of wildlife species. For example, amphibians and reptiles have been crushed to death or injured by ORV use on public lands (Bury and Luckenbach 2002). In general, habitat fragmentation reduces the size of patches of desert, forest, shrublands, wetlands, and grasslands. This reduces the total area of contiguous habitat available for

wildlife species, especially birds, and increases the isolation of the habitat (Campbell and Johns n.d.), resulting in changes to forage and cover, flows of energy and nutrients, and even the microclimate of the area. Other adverse effects of habitat fragmentation include genetic effects and potential for local extinctions, shifts to invasive species, and increased likelihood of uncharacteristic predation as well as increased exploitation by humans (New Mexico EMNRD et al. 2008).

Other risks range from injury during escape responses to the more-severe habitat avoidance and nest abandonment. Bowles (1995, cited in New Mexico EMNRD et al. 2008) notes that noise is an environmental stressor that can induce startle responses, aversion, and maladaptive behaviors; cause changes in habitat use, communication, predation, foraging, courtship, breeding, and reproduction; produce stress responses such as changes in heart rate and energy consumption; and cause hearing loss. Several studies indicate that wildlife generally experience an increase in heart rate and altered metabolism when introduced to human-made noise (Radle 2007). Noise from motorized vehicles can inhibit the senses of animals that depend on hearing and vibration detection to survive (Berry 1980; Bury 1980); for example, bats and certain reptile species.

Much of the existing research has focused on the effects of erosion and of trampled vegetation due to visitors, and the associated impacts on wildlife habitat values (Joslin and Youmans 1999; Monz et al. 2003). ORV-related impacts on amphibian and reptile species were identified in Montana and include indirect impacts on populations via habitat destruction, chemical contamination, sedimentation, and the creation of migration barriers. Studies of small mammals have reported adverse effects from motorized vehicle use, including population reduction, habitat modification, forage/cover removal, echolocation disturbance, and energy expenditure (Joslin and Youmans 1999).

Further research regarding the adverse effects of human recreational activities on bird species has shown nest desertion and temporary abandonment, as well as changes in foraging habits (Joslin and Youmans 1999). Bird species in the national recreation area that nest on or near the ground near the access routes would most likely be more vulnerable to the effects of motorized vehicles due to the direct exposure of nests and young to visitors and motorized vehicles. Although potential suitable nesting habitat exists near the Blue Creek and Rosita Flats ORV use areas, nesting is not known to occur at those areas (Wimer 2010a). However, it is likely that past and present use of ORVs in the national recreation area has resulted in habitat avoidance and disturbance for both nesting and non-nesting bird species. As a result, continued ORV use would likely result in long-term moderate adverse impacts on nesting and non-nesting bird habitat in the national recreation area.

Among ungulate species (hoofed mammal), such as white-tailed deer, research has shown that the effects of recreational disturbance include relatively high energy expenditures resulting from increased heart rate and altered behavioral response (Joslin and Youmans 1999).

As described in chapter 3, primary threats to several fish species found in the national recreation area include habitat fragmentation and destruction, pollution, and fluctuating water temperatures (NatureServe 2009). In the Blue Creek and Rosita Flats ORV use areas, it is common for rivers and streams to dry up, leaving some fish congregated in small to large puddles. ORVs driven through puddles can result in direct mortality of fish species and/or habitat disruption (Wimer 2010b).

Locally, along open ORV routes and use areas, habitat disturbance and fragmentation would continue to be apparent and individual mortality could occur, especially for smaller mammals and amphibian and reptile species. As indicated in studies of ORV use in other arid ecosystems, even if all ORV users stay on trails, ORVs can cause erosion and stream sedimentation, transport invasive species, raise dust clouds, and disrupt and damage wildlife as well as reducing effective habitat. In general, trails created by ORV users can cause a patchwork of habitat often correlated to reduced ecosystem productivity (New Mexico

EMNRD et al. 2008). The lack of designated ORV routes and use limits would add to the long-term adverse impacts of ORV use at the Blue Creek and Rosita Flats ORV use areas due to unlimited contact between ORVs and wildlife habitat. In addition, no speed limits would be established for either ORV use area under alternative A, which would increase the risk of vehicle/wildlife collisions due to the potential for less reaction time (for both operator and animal). As a result, ORV use in these areas would have localized short- and long-term moderate adverse impacts on wildlife and wildlife habitat.

Although bulletin boards with campground rules and regulations and other national recreation area information exist at Blue Creek and Rosita Flats, no interpretation services would be provided at either areas under alternative A. Education would continue to occur primarily through visitor contact with rangers, park staff, and on-site educational opportunities; however, patrolling by park law enforcement occurs less frequently at Rosita Flats than at Blue Creek due to the remote location of Rosita Flats. Patrolling by ORV would have short-term negligible to minor adverse impacts due to the low numbers of law enforcement vehicles in these areas.

In summary, continued management of ORV use at the Blue Creek and Rosita Flats areas under alternative A would likely result in short- and long-term moderate adverse impacts on wildlife and wildlife habitat.

Cumulative Impacts

Other past, present, and future planning actions in and around the national recreation area have the potential to impact wildlife and wildlife habitat. Prior to the establishment of Lake Meredith as a public recreation area in 1964, the Canadian River and Blue Creek riparian areas were used by the local community for recreation. In the 1960s, ORV use consisted of a few river buggies made from old vehicles converted to operate in the river bottom. Given the length of time ORV use has been occurring at Lake Meredith, it is difficult to measure resource impacts because there is no baseline to measure against (NPS 2007a). The Rosita Flats and Blue Creek ORV use areas were officially designated by special regulation (36 FR 7.57) in the 1970s. It is likely that large-scale efforts to protect vegetation and wildlife at Rosita Flats and Blue Creek did not begin until 1990, when Lake Meredith National Recreation Area was established. Therefore, it is likely that, prior to establishment, ORV use along the Canadian River at Rosita Flats contributed to long-term moderate to major adverse impacts on wildlife and wildlife habitat from vehicles operating without restrictions in aquatic and terrestrial habitat, leading to habitat destruction and fragmentation and direct mortality of fish and wildlife.

Lake Meredith was created by the construction of the Sanford Dam on the Canadian River to allow the impoundment and diversion of water for 11 municipalities of the Texas Panhandle. Although the dam assists in protecting vegetation by preventing uprooting from large-scale floods, the damming of the Canadian River has resulted in long-term moderate adverse impacts on fish that rely on natural flooding to maintain their habitat and compete with invading nonnative aquatic species. Many native fish species, such as the Arkansas River shiner, need frequent natural flooding (which the dam has inhibited) and miles of unimpounded, flowing water to successfully complete their reproductive cycle (USFWS 2005c).

The lake water level, with a record high of 101.8 feet in 1973 (Welch 2010), has drained from 87 feet at the beginning of the decade to 64 feet five years ago (Blackburn 2010) and approximately 30 feet by early January 2012 (CRMWA 2012). As of August 2014, lake water levels were at approximately 44 feet. The decreasing water level is a result of too little rain in the area feeding the creeks and the Canadian River, which supply the lake (CRMWA n.d.). For the past 10 years, rainfall that occurred over much of the state has not occurred within Lake Meredith's watershed. Even in years where near normal rainfall totals have occurred, those rains have not been of the intensity and duration needed to generate significant runoff; it is the large storm events that make a difference in lake levels (CRMWA n.d.). Additionally, the High

Plains aquifer (which includes the Ogallala aquifer) underlies parts of eight states, including Texas, and has been intensively developed for irrigation. Since the establishment of the recreation area, water levels have declined more than 100 feet in some areas and the saturated thickness has been reduced by more than half in others (USGS 2011). The depletion of groundwater in the area contributes to the decreasing lake levels in the national recreation area and a reduction in stream habitat. Decreasing water levels pose a threat to native fish in the area. Microhabitat selection by many fish is highly influenced by water depth and current velocity (USFWS 2005a). In addition, a reduction in available habitat often leads to fish being congregated in small to large puddles of water, leaving them more vulnerable to disruption. Furthermore, as described in chapter 1, the Rosita Flats and Blue Creek ORV use areas can be the only source of drinking water for wildlife in times of drought, attracting more species than normal to the areas and increasing the risk of wildlife disturbance and mortality by ORVs.

Cottonwoods have a high water requirement and grow in old streambeds and damp, low-lying areas where they have access to water (Gober n.d.). Cottonwoods are likely to absorb existing water from puddles, ponds, and streams, leading to reduced habitat availability for fish species. Further reduction in available habitat for fish would contribute to the existing long-term minor to moderate adverse impacts from water loss.

Another contributor to water loss and degradation in the national recreation area and the region is the invasion of nonnative plant species, which compete with native plants such as cottonwood. Saltcedar, or tamarisk, is an invasive plant that exists throughout Texas and extensively infests the national recreation area. Saltcedar spreads quickly and is known to deplete streamflow and produce water quality changes that are not favorable to many species of fish (CRMWA 2005), resulting in long-term moderate adverse impacts. It is estimated that one large saltcedar can use 200 gallons of water per day or one acre can use 3 to 7 acre-feet of water per year (Texas State Soil & Water Conservation Board 2009). Saltcedar has become common along the streambanks of the Canadian River and its tributaries. It is likely that saltcedar has a substantial impact on the amount of water coming into Lake Meredith (CRMWA n.d.). In addition to direct water use of these plants by transpiration, heavily infested floodplain areas tend to trap floodwaters so that water loss is greatly increased. Saltcedar also draws salts up to the surface from deep in the soil, increasing the salinity of the streamflow (CRMWA 2005). Many reptiles, amphibians, and birds use habitat dominated by saltcedar. However, according to one report, saltcedar-dominated landscapes do not provide suitable habitat for more specialized birds, such as woodpeckers and birds that live in cavities. Dense tracts of pure saltcedar are typically unfavorable for most wildlife, and many birds still prefer native cottonwood habitat (Shafroth, Brown, and Merritt 2010). The presence of nonnative plants like saltcedar create long-term moderate to major impacts to fish habitat if left unchecked. However, the Entomology Program at the Texas A&M Research and Extension Center began a cooperative effort with the BOR in 2002 to develop a biological control program for saltcedar at Lake Meredith. In 2004, as part of a research study, planned releases of *Diorhabda elongata*, a chrysomelid beetle that is an aggressive defoliator of saltcedar, were carried out at two sites at the national recreation area. CRMWA conducted aerial spraying in late August 2008 on a total of 5,298 acres. Herbicide was applied in an area starting at the southwest boundary of the national recreation area on the Canadian River at Rosita Flats, to the Sanford Dam. This treatment included the lakebottom (predrought) and much of the entire shoreline (Wimer 2009b) and was completed in September 2009. Treatment for saltcedar and other nonnative plants will continue by handcrews. Although methods of control could result in short-term minor to moderate adverse impacts to fish and other wildlife at Lake Meredith (e.g., water degradation from herbicides, habitat disruption from physical removal), the removal of saltcedar would result in long-term benefits for wildlife and wildlife habitat because it would result in more water in the area.

Another plant known for its competitive botanical edge in the desert landscape is mesquite (Sharp n.d.). Overgrazed rangelands, openings, and other clearings and areas once dominated by native grasses often become infested with mesquite, which over time dominates that landscape (TPWD 2007). As with

saltcedar, mesquite is fire-adapted, making fire management (via prescribed burns) difficult for land managers (Sharp n.d.). Managers of lands adjacent to the national recreation area spray mesquite to help control the invasive plants. Lake Meredith National Recreation Area benefits from this because it helps hinder the spread of the invasive vegetation.

As water levels continue to decrease at Lake Meredith, the national recreation area would likely explore additional forms of recreation for visitors to enjoy, including the recent plan to construct a recreational multi-use trail (NPS 2010c), as well as expanding existing non-aquatic recreation activities. A potential increase in ORV use due to low water levels in the national recreation area could contribute to the adverse impacts of ORVs on fish and other wildlife. The use of ORVs has also been a common means of transportation for visitors engaging in hunting in the national recreation area. Hunting is a popular activity at Lake Meredith National Recreation Area, with game species including dove, turkey, quail, duck, goose, and white-tailed and mule deer. Although the use of ORVs by hunters could result in short- and long-term moderate adverse impacts on fish and wildlife habitat, traveling off designated roads and outside of designated areas within the national recreation area is prohibited (NPS 2009c). Therefore, it is likely that the use of ORVs for hunting purposes would result in short- and long-term minor to moderate adverse impacts on fish and wildlife habitat. Hunting activities would result in short-term minor adverse impacts from the direct removal of wildlife individuals, and long-term minor to moderate adverse impacts from the continued removal of individuals within a species population over time.

Plans specifically related to ORV use that could contribute to cumulative impacts include the Resources Management Plan (NPS 1996), which provides goals for the national recreation area to address preserving national recreation area resources, including aquatic resources and habitat. In addition, the national recreation area is currently developing a GMP articulating the long-term vision to guide the management of the national recreation area for the next 15 to 20 years. The decision to develop a GMP is, in part, a response to changes in the recreation opportunities at Lake Meredith National Recreation Area because of changes in the lake level. The GMP directs the national recreation area in exploring different approaches to preserve the important recreational opportunities, natural resources, and cultural histories of the national recreation area (NPS n.d.c). Upon formal implementation of the plan, the national recreation area would continue the management of natural resources, including fish and wildlife habitat, in a manner consistent with law, NPS policy, and standards. The plan will also serve to identify resource protection zones within the national recreation area. These plans would result in long-term benefits for wildlife and wildlife habitat because they would further provide for the protection of species.

Wildland fires have historically played an important role in the area ecosystem. The Wildland Fire Management Plan (NPS 1998b) is the primary reference for conducting all fire management activities and is intended to help achieve the resource management objectives as presented in the Resource Management Plan. The perpetuation of natural resources and their associated processes is one of the highest priorities for the plan, which is based on a strategy of using prescribed burns and mechanical methods to remove excess fuel from the system, reducing the likelihood of major wildfires and providing benefits to native vegetation and wildlife habitat. Fire management plans are considered a key tool in maintaining and improving current levels of grassland resources by promoting the restoration of uplands to native grasses and controlling brush such as mesquite (CRMWA 2005), which would result in long-term beneficial impacts on wildlife and wildlife habitat in the national recreation area.

The TPWD Wildlife Action Plan (TPWD 2006) provides a statewide roadmap for research, restoration, management, and recovery projects addressing species of greatest conservation need and important habitats. Species of greatest conservation need include terrestrial, freshwater, and marine birds, mammals, reptiles, amphibians, invertebrates, fishes, and plants and plant communities (TPWD 2010). The plan is a requirement for the State Wildlife Grant program, as outlined by the USFWS, which provides state grants to address unmet wildlife conservation needs. In addition to analyzing detailed species information, the

plan also provides broad habitat information within various ecoregions of Texas. The plan recognizes the High Plains ecoregion of Texas, which includes Lake Meredith National Recreation Area, as a "secondary priority ecoregion." The plan explains that this ecoregion has experienced a high rate of conversion to cropland and is one of the least conserved in Texas. Threats to the region include fragmentation, damming of springs, streams and rivers, and surface mining. The Wildlife Action Plan also recognizes the Canadian River Basin in an analysis of various Texas river basins, and explains that threats to the basin include increased silt loads from erosion, which could affect the suitability of riverine habitat, invertebrate production, and fish species survival. While the plan does not identify ORV use as a contributing factor to resource damage within this ecoregion and river basin, ORV activities and management will likely have implications related to the various strategies outlined in this plan/EIS. The plan has recently been updated and is now referred to as the Texas Conservation Action Plan (TPWD 2012). The Texas Conservation Action Plan will continue to provide long-term benefits to wildlife and wildlife habitat.

The overall impact of these past, current, and future actions on wildlife and wildlife habitat would be long term, moderate, and adverse as well as long term and beneficial, and when combined with the short- and long-term moderate adverse impacts under alternative A, would result in long-term moderate adverse and long-term beneficial cumulative impacts on wildlife and wildlife habitat in the area of analysis.

Conclusion

Localized short- and long-term moderate adverse impacts on wildlife and wildlife habitat would result from species disturbance and displacement, habitat damage and fragmentation, and individual mortality. Past, present, and reasonably foreseeable future actions both inside and outside the national recreation area, when combined with the short- and long-term moderate adverse impacts from continued ORV use under alternative A, would result in long-term moderate adverse and long-term beneficial cumulative impacts on wildlife and wildlife habitat.

IMPACTS OF ALTERNATIVE B: ZONE SYSTEM – SEPARATION OF VISITOR USES, WITH A PERMIT FOR EDUCATIONAL PURPOSES

Under alternative B the national recreation area would, in part, base the designation of routes and areas on a zoning system, one purpose of which would be the separation of visitor uses that have the potential to conflict with one another. Established zones could include camping -only zones, hunting zones, resource protection zones, low-speed zones, and beginner zones.

As described in alternative A, ORV use causes wildlife and wildlife habitat disturbance, especially when it occurs off designated routes (either inadvertently or intentionally). Along with habitat fragmentation, disturbance can lead to altered species range and social patterns, as well as individual mortality, resulting in short- and long-term moderate adverse impacts. However, under alternative B, the establishment of specific routes and zones, including camping -only zones, hunting zones, resource protection zones, low-speed zones, and beginner zones, would reduce the potential for wildlife/vehicle collisions, as well as disturbance of those species that use the habitat in zones protected from ORV use. Likewise, signs would be posted prohibiting ORV use in isolated pools during times of drought, which would contribute to long-term benefits for fish and wildlife that use the water as habitat or to drink. Additional species management measures would be implemented to further the protection of the Arkansas River shiner, which would also provide additional long-term benefits to other wildlife in the area. These measures, common to all action alternatives, include the prohibition of driving in isolated pools, allowing parking/staging only in areas outside the wetted channel of the Canadian River, allowing access to the river only from designated access points, conducting studies every two to four years to determine if use is occurring outside the designated routes and areas, including species protection information within educational permit materials, increased enforcement, and developing a monitoring plan to ensure these measures are implements. In

addition, the superintendent always retains the authority to close any portion of the national recreation area for protection of park resources. As described for alternative A, noise is an environmental stressor that can result in adverse impacts on wildlife. Due to these effects, the NPS would establish muffler requirements for all motorized vehicles, which would reduce noise disturbance to wildlife in the national recreation area.

Headlight/taillight requirements would also be established under alternative B. Increased visibility for ORV users along existing ORV routes that would remain open would reduce the potential for wildlife/vehicle collisions at night. Motorized routes are known to reduce effective habitat for many species, including deer. Depending on the species, 0.12 mile (200 meters) up to 0.5 mile (805 meters) on either side of a road or motorized trail may no longer be usable habitat (New Mexico EMNRD et al. 2008). Less mobile species, such as smaller mammals, reptiles, and amphibians, are more likely to be affected in the immediate vicinity of ORV routes.

Law enforcement would be increased at both ORV use areas to ensure resource protection and enforce new ORV rules and regulations. Although short-term negligible to minor adverse impacts would result from low levels of ORV use by law enforcement staff, the overall impact of increased law enforcement at Blue Creek and Rosita Flats would be long term and beneficial from the increased enforcement of resource protection. In addition, in order to encourage compliance, portions of ORV use areas could be closed temporarily to the public if evidence of ORV use is found outside designated routes. Alternative B would also include a no-charge permit system, which would be issued to ORV users once educational materials are read and permits are signed for. The NPS would revoke permits if riders are found off designated routes. If a rider violates the rules in any of the ORV use areas three times, the rider would be permanently barred from receiving any kind of public use permit at the national recreation area. Temporary closures of the ORV use areas, as well as the implementation of permits, would result in long-term benefits for wildlife and wildlife habitat from increased resource protection by enforcing ORV rules.

Under alternative B, ORV use at Blue Creek and Rosita Flats would be prohibited on vegetation, which would contribute to long-term benefits to wildlife and habitat by reducing a source of habitat and species disturbance, allowing these areas to recover. Recovery of these areas could eventually reduce habitat fragmentation in the Rosita Flats and Blue Creek ORV use areas, especially for less mobile species such as smaller mammals, reptiles, and amphibians. However, other species would also ultimately benefit from less fragmented habitat. Beneficial effects would also occur by educating visitors about ORV rules and safety through signs, literature, and park and community events.

The implementation of designated ORV access points at the riverbed would protect fish and wildlife habitat at Rosita Flats by localizing impacts (i.e., damage to habitat) to certain areas along the river. However, long-term moderate adverse impacts on fish would result from the continued use of ORVs in the riverbed introducing direct habitat disturbance and adversely affecting water quality. Other factors under alternative B would contribute to long-term benefits for wildlife and wildlife habitat at the Rosita Flats area, including the use of post -and -cable fencing to better define where ORV use is permitted. Where posts and cables and signs are installed to better define permitted ORV use areas, long-term benefits would result because vegetation outside ORV use areas would be protected from ORVs and would be able to recover, hence increasing the amount of suitable habitat for wildlife at the national recreation area.

Because alternative B would include a zoning system, designated access points at the riverbed at Rosita Flats, and increased resource management and law enforcement, the overall impact of alternative B on wildlife and wildlife habitat would be expected to be short and long term, minor, and adverse. Impacts would most likely be short term in areas removed from vehicle routes. Impacts could be long term at localized areas along ORV routes due to continued disturbance along those routes.

Cumulative Impacts

Past, present, and reasonably foreseeable future actions that have the potential for impacts under alternative B would be identical to those under alternative A. The overall impact of these past, current, and future actions on wildlife and wildlife habitat would be long term, moderate, and adverse and long term and beneficial, and when combined with the short- and long-term minor adverse impacts under alternative B, would result in long-term minor to moderate adverse and long-term beneficial cumulative impacts on wildlife and wildlife habitat in the area of analysis.

Conclusion

Although short- and long-term moderate adverse impacts on wildlife and wildlife habitat could occur due to continued use of ORVs in the Rosita Flats and Blue Creek ORV use areas, impacts would be less than under alternative A as a result of increased resource management. The use of a zone system, including a resource protection zone, as well as restrictions on driving in isolated pools in times of drought, designation of ORV access points at the riverbed at Rosita Flats, and implementing other protection measures for the Arkansas River shiner (which would also benefit other species) would result in long-term beneficial impacts on wildlife and wildlife habitat at both ORV use areas. Therefore, overall impacts under alternative B would be short and long term, minor, and adverse. Past, present, and reasonably foreseeable future actions both inside and outside the national recreation area, when combined with the impacts of alternative B, would result in long-term minor to moderate adverse and long-term beneficial cumulative impacts on wildlife and wildlife habitat.

Impacts of Alternative C: Management through Use of a Permit System at Current ORV Use Areas

Under alternative C, the national recreation area would manage ORV use through a permitting system as well as through the establishment of use limits. Permits would include a fee and initially there would be no limit on the number of permits issued. ORV routes and areas would be the same as those under alternative B, except there would be one designated ORV use area in Rosita Flats instead of two.

As described in alternative A, ORV use causes wildlife and wildlife habitat disturbance, especially when it occurs off designated routes (either inadvertently or intentionally). Along with habitat fragmentation, disturbance can lead to altered species range and social patterns, decreased biodiversity, and individual mortality, resulting in short- and long-term moderate adverse impacts. However, under alternative C, a monitoring plan would be developed that would look at vegetation, erosion, and other predetermined factors that could assist in protecting fish and wildlife habitat. In addition, the use of a fee-based permitting system required to access ORV use areas and the development of use limits would contribute to long-term benefits for fish and other wildlife by limiting habitat disturbance and fragmentation, as well as reducing the potential for wildlife/vehicle collisions. As described in alternative B, motorized routes are known to reduce effective habitat for many species, including deer. However, less mobile species such as smaller mammals, reptiles, and amphibians are more likely to be affected by vehicle collisions in the ORV use areas. An ORV use limit would be implemented based on indicators and standards developed through the GMP process. The development of a use limit would result in long-term benefits for wildlife by limiting the number of vehicles in the ORV use areas and reducing the disturbance of habitat and the potential for wildlife/vehicle collisions. A use limit would reduce noise disturbance in the national recreation area, which would benefit all wildlife species, especially birds, deer, and other mammals.

Similar to alternative B, recommended speed limits in ORV use areas and vehicle requirements (muffler and headlight/taillight requirements) under alternative C would contribute to long-term benefits. As described for alternative B, ORV use limits and vehicle requirements would reduce the likelihood of ORV

users striking wildlife due to reduced visibility or reaction time, as well as decreasing noise disturbance. As described under alternative B, increased law enforcement under alternative C could result in short-term negligible to minor adverse impacts from low levels of ORV use by law enforcement staff; however, the overall impact of increased law enforcement at Blue Creek and Rosita Flats would be long term and beneficial from the increased enforcement of resource protection. In addition, increased law enforcement under alternative C would be further enhanced by aerial imagery to track new user-created routes and noncompliance, helping ensure that ORV users comply with rules and regulations established to protect natural resources. The national recreation area would explore options for having law enforcement staff located closer to the Rosita Flats ORV use area, which would assist in the protection of resources by enforcing compliance with regulations regarding ORV use at the national recreation area.

Unique to alternative C is the designation of camping sites as well as tent camping in areas that have no vegetation or previously disturbed vegetation. In tent camping areas, visitors in these areas would be required to walk to their campsites because vehicles must be parked off vegetation along designated ORV routes or areas. This requirement would protect undisturbed vegetation and wildlife habitat from future disruption and damage, and could potentially assist in vegetation recovery by limiting access of ORVs to specific areas of the national recreation area.

Under alternative C, as with alternative B, ORV use at Blue Creek and Rosita Flats would be prohibited on vegetation, which would contribute to long-term benefits for wildlife and habitat as a result of removing a source of habitat and species disturbance, allowing these areas to recover. Recovery of these areas could eventually reduce habitat fragmentation, especially for smaller mammals, reptiles and amphibians, and some ground- and shrub-nesting birds. As described for alternative B, beneficial effects would also occur by educating visitors about ORV rules and safety through signs, literature, and park and community events. Similar to alternative B, ORV users would be required to read and sign educational materials prior to obtaining a permit. The NPS would revoke ORV use permits if riders are found off designated routes, which would assist in ensuring compliance with recreational use rules.

Like alternative B, the use of post -and -cable fencing to better define where ORV use is permitted would contribute to long-term benefits by reducing the likelihood of ORVs driving outside designated areas/routes. Also similar to alternative B, the implementation of designated access points at the riverbed, prohibition of driving in isolated pools, and implementing other actions for the protection of the Arkansas River shiner (see alternative B) would localize impacts to fish and wildlife habitat; however, long-term moderate adverse impacts to fish would result from continued use of ORVs in the riverbed.

Because alternative C would include use limits, a fee-based permitting system, designated access points at the riverbed at Rosita Flats, an interpretive wayside program, and increased resource protection and law enforcement, the overall impact of alternative C on wildlife and wildlife habitat would be expected to be short and long term, minor, and adverse. Impacts would most likely be short term in areas removed from vehicle routes, because the impacts would likely be noise-related and would be temporary. Impacts could be long term, minor, and adverse in localized areas along ORV routes due to continued disturbance along those routes.

Cumulative Impacts

Past, present, and reasonably foreseeable future actions that have the potential for impacts under alternative C would be identical to those under alternative A. The overall impact of these past, current, and future actions on wildlife and wildlife habitat would be long term, moderate, and adverse as well as long term and beneficial, and when combined with the short- and long-term minor adverse impacts under alternative C, would result in long-term minor to moderate adverse and long-term beneficial cumulative impacts on wildlife and wildlife habitat in the area of analysis.

Conclusion

Although short- and long-term moderate adverse impacts on wildlife and wildlife habitat could occur due to the continued use of ORVs in the Blue Creek and Rosita Flats ORV use areas, the impacts would be less than under alternative A due to increased resource management, resulting in short- and long-term minor adverse impacts under alternative C. The development of a monitoring plan and interpretive wayside program, the implementation of use limits and permitting system, the designation of ORV access points at the riverbed at Rosita Flats, and implementing other protection measures for the Arkansas River shiner (which would also benefit other species) would result in long-term beneficial impacts on wildlife and wildlife habitat at both ORV use areas. Past, present, and reasonably foreseeable future actions both inside and outside the national recreation area, when combined with the short- and long-term minor adverse impacts of alternative C, would result in long-term minor to moderate adverse and long-term beneficial cumulative impacts on wildlife and wildlife habitat.

IMPACTS OF ALTERNATIVE D: MANAGEMENT THROUGH USE OF A ZONING AND PERMITTING SYSTEM AT CURRENT ORV USE AREAS

Under alternative D the national recreation area would, in part, base the designation of routes and areas on a zoning system, one of the purposes of which would be the separation of visitor uses that have the potential to conflict with one another, similar to the system under alternative B. In addition, a fee -permit system would be instituted that would allow the national recreation area to provide additional enforcement and amenities in the ORV use area, but no use limits would be established.

As described under alternative A, ORV use causes wildlife and wildlife habitat disturbance, especially when it occurs off designated routes (either inadvertently or intentionally). Along with habitat fragmentation, disturbance can lead to altered species range and social patterns, decreased biodiversity, and individual mortality, resulting in short- and long-term moderate adverse impacts. However, the establishment of designated routes and zones under alternative D would reduce the potential for such disturbances to occur. Posted speed limits would reduce the potential for wildlife/vehicle collisions, and the restriction of ORV use to designated zones would eliminate ORV impacts in areas protected from ORV use, including impacts on vegetation and habitat, as well as noise-related impacts that contribute to habitat avoidance and changes in behavior and physiology. In addition, ORV use on vegetation would be prohibited, which would reduce habitat and species disturbance, allowing certain areas to recover. Signs would be posted prohibiting ORV use in isolated pools during times of drought, which would contribute to long-term benefits for fish and other wildlife that use isolated pools as habitat or to drink. Protection measures implemented for the Arkansas River shiner (detailed under alternative B) would provide additional protection to other species within the recreation area. Muffler and headlight/taillight requirements would also reduce disturbances to wildlife, as described under alternative B.

Similar to alternative C, tent camping sites would be designated under alternative D. In tent camping areas, visitors would be required to walk to their campsites because vehicles must be parked off vegetation along designated ORV routes or areas. As described for alternative C, this requirement would protect undisturbed vegetation and wildlife habitat from disruption and damage, and allow vegetation recovery by limiting ORV access to specific areas of the national recreation area.

As with alternative B, new resource protection rules and regulations would be established under alternative D, including increased law enforcement. Also similar to alternative B, increased law enforcement under alternative D could result in short-term negligible to minor adverse impacts; however, the overall impact of increased law enforcement at Blue Creek and Rosita Flats would be beneficial in the long term due to the increased enforcement of resource protection.

As described under alternative C, the fee-based permit system would ultimately exclude ORV riders who are caught repeatedly violating the resource protection rules. The permit system would also seek to educate ORV users about ORV rules and resource protection. For these reasons, the fee-based permit system would have a long-term beneficial impact on wildlife and wildlife habitat. Beneficial impacts from designating ORV access points to the Canadian River and using post -and -cable fencing to delineate ORV areas would be the same as those described under alternative C.

In these ways, the implementation of the zoning system would reduce the impact of ORVs on wildlife and wildlife habitat in the Blue Creek and Rosita Flats ORV use areas. The overall impact of alternative D on wildlife and wildlife habitat in these areas would therefore be short and long term, minor, and adverse. As described for the other alternatives, impacts would most likely be short term in areas removed from vehicle routes, and long term at localized areas along ORV routes due to the continued ORV use there.

Cumulative Impacts

Past, present, and reasonably foreseeable future actions that have the potential for impacts affecting the Blue Creek and Rosita Flats ORV use areas under alternative D would be identical to those described under alternative A. The overall impact of these past, current, and future actions on wildlife and wildlife habitat would be long term, moderate, and adverse, and when combined with the short- and long-term minor adverse impacts under alternative D for Blue Creek and Rosita Flats, would result in long-term minor adverse and long-term beneficial cumulative impacts on wildlife and wildlife habitat.

Conclusion

Although the continued use of ORVs at Blue Creek and Rosita Flats would result in localized short- and long-term moderate adverse impacts on wildlife and wildlife habitat, impacts would be less than under alternative A due to increased resource management, resulting in short- and long-term minor adverse impacts under alternative D. The implementation of a zoning system and fee-based permitting system, as well as the enactment of resource protection rules, such as the headlight/taillight and muffler requirements and the prohibition on driving on vegetation, would result in long-term beneficial impacts on wildlife and wildlife habitat at the Blue Creek and Rosita Flats ORV use areas. Additional beneficial impacts would result from prohibitions on driving through isolated pools, establishing designed access point to the river, and implementing protection measures for the Arkansas River shiner (which would also benefit other species). Past, present, and reasonably foreseeable future actions both inside and outside the national recreation area, when combined with the overall short- and long-term minor adverse impacts under alternative D, would result in long-term minor adverse and long-term beneficial cumulative impacts on wildlife and wildlife habitat.

THREATENED AND ENDANGERED SPECIES / SPECIES OF CONCERN

GUIDING REGULATIONS AND POLICIES

The ESA (16 USC 1531 et seq.) mandates that all federal agencies consider the potential effects of their actions on species listed as threatened or endangered. If the NPS determines that an action may affect a federally listed species, consultation with the USFWS is required to ensure that the action would not jeopardize the species' continued existence or result in the destruction or adverse modification of critical habitat. Section 2 of the ESA states, "all Federal departments and agencies shall seek to conserve endangered species and threatened species and shall utilize their authorities in furtherance of the purposes of this Act" (16 USC 1531[c][1]). Section 7(a)(1) of the ESA states,

> The Secretary shall review other programs administered by him and utilize such programs in furtherance of the purposes of this Act. All other Federal agencies shall, in consultation with and with the assistance of the Secretary, utilize their authorities in furtherance of the purposes of this Act by carrying out programs for the conservation of endangered species and threatened species listed pursuant to Section 4 of this Act. (16 USC 1536(a)(1).

NPS *Management Policies 2006* states that the NPS will survey for, protect, and strive to recover all species native to NPS units that are listed under the ESA, and proactively conserve listed species and prevent detrimental effects on these species (NPS 2006b, Section 4.4.2.3). NPS *Management Policies 2006* also states, "[the NPS will] manage state and locally listed species in a manner similar to its treatment of federally listed species to the greatest extent possible" (NPS 2006b, Section 4.4.2.3).

SPECIES TO BE EVALUATED

As described in chapter 3, the Arkansas River shiner is listed as threatened by the USFWS. Within the national recreation area, this species is present in the Canadian River, from Chicken Creek upstream to the U.S. Highway 287 bridge, which runs through the Rosita Flats ORV use area (Wilde 2010). The Arkansas River shiner does not occur in the Blue Creek ORV use area and park staff is unaware of any historical existence of the species in that area. In addition, the Blue Creek area does not contain habitat that would be conducive to or support future Arkansas River shiner populations (Wimer 2010b). Therefore, evaluation of the effects of ORV management actions on the Arkansas River shiner focuses exclusively on the Rosita Flats ORV use area, where the existence of the fish has been confirmed.

METHODOLOGY, ASSUMPTIONS, AND INTENSITY DEFINITIONS

The following information was used to assess impacts on the Arkansas River shiner from ORV management actions:

- The existence of the species in areas likely to be affected by actions described in the alternatives.
- Habitat loss or alteration caused by the alternatives.
- Displacement and disturbance potential of the actions and the species' potential to be affected by the activities.

Potential impacts on the federally threatened Arkansas River shiner were evaluated based on available data on the species' past and present existence at Lake Meredith National Recreation Area, scientific literature on the species, life history, scientific studies on the impacts of human disturbance on the shiner, and documentation of the species' association with humans and ORVs. Information on habitat and other existing data were acquired from staff at Lake Meredith National Recreation Area, the USFWS, and available literature.

Following are the intensity definitions for evaluating impacts on the Arkansas River shiner.

Negligible: There would be no observable or measurable impacts on the Arkansas River shiner, its habitat, or the natural processes sustaining it. Impacts would be well within natural fluctuations.

Minor: Impacts on the Arkansas River shiner, its habitat, or the natural processes sustaining it would be detectable, but would not be outside the natural range of variability. Occasional responses by some individuals to disturbance could be expected, but without interference to feeding, spawning, or other factors affecting population levels. Sufficient habitat in the national recreation area would remain functional to maintain a sustainable population in the national recreation area.

Moderate: Impacts on the Arkansas River shiner, its habitat, or the natural processes sustaining it would be detectable and could be outside the natural range of variability. Frequent responses by some individuals to disturbance could be expected, with some negative impacts on feeding, spawning, or other factors affecting local population levels. Some impacts might occur during critical periods of reproduction or in key habitats in the national recreation area and result in injury or mortality to one or more individuals. However, sufficient population numbers and habitat in the national recreation area would remain functional to maintain a sustainable population in the national recreation area.

Major: Impacts on the Arkansas River shiner, its habitat, or the natural processes sustaining it would be detectable, would be expected to be outside the natural range of variability, and would be permanent. Frequent responses by some individuals to disturbance would be expected, with negative impacts on feeding, spawning, or other factors resulting in a decrease in national recreation area population levels or a failure to restore levels that are needed to maintain a sustainable population in the national recreation area. Impacts would occur during critical periods of reproduction or in key habitats in the national recreation area and result in direct mortality or loss of habitat. Local population numbers, population structure, and other demographic factors might experience large declines.

Duration: Short-term effects would last up to one year.

Long-term effects would last more than one year.

Study Area

The study area for the Arkansas River shiner is defined as the Rosita Flats ORV use area for the analysis of the impacts of the alternatives and defined as Lake Meredith National Recreation Area and adjacent land for the analysis of cumulative impacts.

IMPACTS OF ALTERNATIVE A: NO ACTION – CONTINUATION OF CURRENT MANAGEMENT

Under alternative A, the management of ORV use and access at the national recreation area would be a continuation of management based on the 2007 *Interim OHV Use Plan* (NPS 2007a), the regulations contained in 36 CFR 7.57, and the Superintendent's Compendium. ORV use would continue to be permitted throughout Rosita Flats below the 3,000-foot elevation line.

As described for wildlife and wildlife habitat, ORVs cause long-lasting damage to land and aquatic ecosystems, wildlife, soils, and hydrologic flows. Even if all ORV users stay on designated trails, they cause erosion and stream sedimentation, transport invasive species, disrupt and damage wildlife, and

reduce effective habitat. Motorized road and trail crossings through aquatic habitats degrade water quality, affect bank stability, damage riparian vegetation, and increase stream deposition, thus reducing habitat quality for aquatic species, including fish and their aquatic insect food sources (New Mexico EMNRD et al. 2008). Soils classified as having moderate or high erosion potential are located along the edges of the Rosita Flats ORV use area. Sedimentation of surface waters of the national recreation area would continue to result from the ongoing erosion of soils due to ORV use. Incremental contributions to existing surface water quality impairments would also result from runoff of MTBE, as previously described under the soils analysis.

As described in chapter 3, factors contributing to the decline of the Arkansas River shiner include modification of the duration and timing of streamflows, habitat loss, stream depletion, and water quality degradation (70 FR 59828). In addition, it is common for rivers and streams to dry up in the national recreation area, leaving fish congregated in puddles and vulnerable to impacts from ORVs that drive through the puddles (Wimer 2010a). The continued use of ORVs at Rosita Flats would likely result in habitat disturbance, degraded water quality due to soil erosion and sedimentation, and disruption of the reproductive cycle due to the potential for injury and direct mortality during all life stages, leading to short- and long-term moderate adverse impacts on the Arkansas River shiner. The lack of designated routes, use limits, and the lack of restrictions on the hours of vehicle operation would add to the long-term adverse impacts of ORV use at Rosita Flats, because an unlimited number of ORVs would have unrestricted access to the riparian habitat of the Arkansas River shiner.

Although Rosita Flats has bulletin boards with campground rules and regulations and other park information, no interpretation services would be provided at Rosita Flats under alternative A. Education would continue to occur primarily through visitor contact with rangers, park staff, and on-site educational opportunities; however, patrolling by park law enforcement occurs less frequently at Rosita Flats than at Blue Creek due to the remote location of Rosita Flats. The lack of interpretation and education services at the Rosita Flats ORV use area would contribute to long-term minor adverse impacts on the Arkansas River shiner from limited awareness of sensitive habitat, which would be further exacerbated by limited law enforcement patrols due to the remote location of Rosita Flats.

In summary, continued management of ORV use at the Blue Creek and Rosita Flats areas under alternative A would likely result in short- and long-term moderate adverse impacts on the Arkansas River shiner.

Cumulative Impacts

Other past, present, and future planning actions within and around the national recreation area have the potential to impact the Arkansas River shiner. Prior to the establishment of Lake Meredith as a public recreation area in 1964, the Canadian River and Blue Creek riparian areas were used by the local community for recreation. In the 1960s, OHV use consisted of a few river buggies made from old vehicles converted to operate in the river bottom. Given the length of time ORV use has been occurring at Lake Meredith, it is difficult to measure resource impacts because there is no baseline to measure against (NPS 2007a). The Rosita Flats and Blue Creek ORV use areas were officially designated by a special regulation (36 FR 7.57) in the 1970s. It is likely that large-scale efforts to protect vegetation and wildlife at Rosita Flats and Blue Creek did not begin until 1990, when Lake Meredith National Recreation Area was established. Therefore, it is likely that prior to the establishment of the national recreation area, ORV use along the Canadian River at Rosita Flats contributed to long-term moderate to major adverse impacts on Arkansas River shiner habitat. These impacts were caused by vehicles operating in aquatic habitat, leading to reduced water quality from sediment delivery, habitat fragmentation, and direct mortality of Arkansas River shiners (both adult and juvenile) and shiner eggs.

Lake Meredith was created by the construction of the Sanford Dam on the Canadian River to allow the impoundment and diversion of water for 11 municipalities of the Texas Panhandle. Although the dam assists in protecting downstream vegetation by preventing uprooting from large-scale floods, the damming of the Canadian River has resulted in long-term moderate to major adverse impacts on the Arkansas River shiner by inhibiting frequent natural flooding, which is important in maintaining the shiner's habitat and helps it compete with invading nonnative aquatic species. The dam has eliminated stream habitat, limiting the amount of habitat necessary to provide the Arkansas River shiner with the 130 miles of unimpounded, flowing water it needs to successfully complete its reproductive cycle (USFWS 2005d).

In recent years, the Lake Meredith water level has continued to drop. The lake water level, with a record high of 101.8 feet in April 1973 (Welch 2010), has drained from 87 feet at the beginning of the decade (Blackburn 2010) to a record low of 26.14 feet in August 2013 (CRMWA 2014). The decreasing water level is as a result of too little rain in the area feeding the creeks and the Canadian River, which supply the lake (Amarillo Globe-News 2010; CRMWA n.d.). Over the past 10 years, rainfall that has occurred over much of the state has not occurred within Lake Meredith's watershed. Even in years where near normal rainfall totals have occurred, those rains have not been of the intensity and duration needed to generate significant runoff; it is the large storm events that make a difference in lake levels (CRMWA n.d.). Additionally, the High Plains aquifer (which includes the Ogallala aquifer) underlies parts of eight states, including Texas, and has been intensively developed for irrigation. Since establishment of the recreation area, water levels have declined more than 100 feet in some areas and the saturated thickness has been reduced by more than half in others (USGS 2011). The depletion of groundwater in the area contributes to the decreasing lake levels in the national recreation area and a reduction in stream habitat. Decreasing water levels pose a substantial threat to native fish in the area, including the Arkansas River shiner, resulting in long-term minor to moderate adverse impacts. Microhabitat selection by the Arkansas River shiner is highly influenced by water depth and current velocity (USFWS 2005b). In addition, a reduction in available habitat often leads to fish being congregated in small to large puddles of water, leaving them more vulnerable to disruption.

Cottonwoods have a high water requirement and grow in old streambeds and damp, low-lying areas where they have access to water (Gober n.d.). Cottonwoods are likely to absorb existing water from puddles, ponds, and streams, leading to reduced habitat availability for the Arkansas River shiner. Further reduction in available habitat for the Arkansas River shiner would contribute to the existing long-term minor to moderate adverse impacts of water loss.

Another contributor to water loss and degradation in the national recreation area and region is the invasion of nonnative plant species, which compete with native plants like cottonwood. Saltcedar, or tamarisk, is an invasive plant that exists throughout Texas and extensively infests the national recreation area. Saltcedar spreads quickly and is known to deplete streamflow and produce water quality changes that are not favorable to the Arkansas River shiner (CRMWA 2005). It is estimated that one large saltcedar can use 200 gallons of water per day or one acre can use 3 to 7 acre-feet of water per year (Texas State Soil & Water Conservation Board 2009). Saltcedar has become common along the streambanks of the Canadian River and its tributaries. It is likely that saltcedar has a substantial impact on the amount of water coming into Lake Meredith (CRMWA n.d.). In addition to direct water use of these plants by transpiration, heavily infested floodplain areas tend to trap floodwaters so that water loss is greatly increased. Saltcedar also draw salts up to the surface from deep in the soil, increasing the salinity of the streamflow (CRMWA 2005). The presence of nonnative plants like saltcedar pose long-term moderate to major threats to Arkansas River shiner habitat if left unchecked. However, the Entomology Program at the Texas A&M Research and Extension Center began a cooperative effort with the BOR in 2002 to develop a biological control program for saltcedar at Lake Meredith. In 2004, as part of a research study, planned releases of *Diorhabda elongata*, a chrysomelid beetle that is an aggressive defoliator of

saltcedar, were carried out at two sites at the national recreation area. CRMWA conducted aerial spraying in late August 2008 on a total of 5,298 acres. Herbicide was applied in an area starting at the southwest boundary of the national recreation area on the Canadian River at Rosita, to the Sanford Dam. The treatment included the lakebottom (predrought) and much of the entire shoreline (Wimer 2009b) and was completed in September 2009. Treatment for saltcedar and other nonnative plants will continue by handcrews. Although methods of control could result in short-term minor to moderate adverse impacts on the Arkansas River shiner (i.e., water degradation from herbicides, habitat disruption from physical removal, etc.), the removal of saltcedar would result in long-term benefits for the Arkansas River shiner and its associated habitat because it would result in more water in the area.

Another plant known for its competitive botanical edge in the desert landscape is mesquite (Sharp n.d.). Overgrazed rangelands, openings, and other clearings and areas once dominated by native grasses often become infested with mesquite, which over time dominates that landscape (TPWD 2007). As with saltcedar, mesquite is fire-adapted, making fire management (via prescribed burns) difficult for land managers (Sharp n.d.). Managers of lands adjacent to the national recreation area spray mesquite to help control the invasive plants. Lake Meredith National Recreation Area benefits from this because it helps hinder the spread of the invasive vegetation.

As water levels continue to decrease at Lake Meredith, the national recreation area will likely explore additional forms of recreation for visitors to enjoy, including the recent plan to construct a recreational multi-use trail (NPS 2010c) and expand existing non-aquatic recreation activities. A potential increase in ORV use due to low water levels in the national recreation area could contribute to the adverse impacts of ORVs on the Arkansas River shiner. The use of ORVs has also been a common means of transportation for visitors engaging in hunting in the national recreation area. Hunting is a popular activity at the national recreation area, with game species including dove, turkey, quail, duck, goose, and white-tailed and mule deer. Although the use of ORVs by hunters could result in short- and long-term moderate impacts on fish and wildlife habitat, traveling off designated roads and outside of designated areas within the national recreation area is prohibited (NPS 2009c). Therefore, it is likely that the use of ORVs for hunting purposes would result in short- and long-term minor adverse impacts on Arkansas River shiner habitat.

Plans specifically related to ORV use that could contribute to cumulative impacts include the Resources Management Plan (NPS 1996), which provides goals for the national recreation area that address preserving national recreation area resources, including aquatic resources and habitat. In addition, the national recreation area is currently developing a GMP articulating the long-term vision to guide the management of the national recreation area for the next 15 to 20 years. The decision to develop a GMP is, in part, a response to changes in the recreation opportunities at Lake Meredith because of changes in the lake level. The GMP directs the national recreation area in exploring different approaches to preserve the important recreational opportunities, natural resources, and cultural histories of the national recreation area (NPS n.d.c). Upon formal implementation of the plan, the national recreation area would continue the management of natural resources, including the Arkansas River shiner and its associated habitat, in a manner consistent with law, NPS policy, and standards. The plan will also serve to identify resource protection zones within the national recreation area. These plans would result in long-term benefits for the Arkansas River shiner and its associated habitat because they would further provide for the protection of the species.

Wildland fires have historically played an important role in the area's ecosystem. The Wildland Fire Management Plan (NPS 1998b) for Lake Meredith National Recreation Area is the primary reference for conducting all fire management activities and is intended to help achieve the resource management objectives as presented in the Resource Management Plan. The perpetuation of natural resources and their associated processes is one of the highest priorities for the plan, which is based on a strategy of using

prescribed burns and mechanical methods to remove excess fuel from the system, reducing the likelihood of major wildfires and providing benefits to native vegetation and wildlife habitat. Fire management plans are considered a key tool in maintaining and improving current levels of grassland resources by promoting the restoration of uplands to native grasses and controlling brush such as mesquite (CRMWA 2005), which would result in long-term beneficial impacts on the Arkansas River shiner and its associated habitat.

The TPWD Wildlife Action Plan (TPWD 2006) provides a statewide roadmap for research, restoration, management, and recovery projects addressing species of greatest conservation need and important habitats. Species of greatest conservation need include terrestrial, freshwater, and marine birds, mammals, reptiles, amphibians, invertebrates, fishes, and plants and plant communities (TPWD 2010). The plan is a requirement for the State Wildlife Grant program, as outlined by the USFWS, which provides state grants to address unmet wildlife conservation needs. In addition to analyzing detailed species information, the plan also provides broad habitat information within various ecoregions of Texas. The plan recognizes the High Plains ecoregion of Texas, which includes Lake Meredith National Recreation Area, as a "secondary priority ecoregion." The plan explains that this ecoregion has experienced a high rate of conversion to cropland and is one of the least conserved in Texas. Threats to the region include fragmentation, damming of springs, streams, and rivers, and surface mining. The Wildlife Action Plan also recognizes the Canadian River Basin in an analysis of various Texas river basins, and explains that threats to the basin include increased silt loads from erosion, which could affect the suitability of riverine habitat, invertebrate production, and Arkansas River shiner survival. While the plan does not identify ORV use as a contributing factor to resource damage in this ecoregion and river basin, ORV activities and management will likely have implications related to the various strategies outlined in this plan/EIS. The plan has recently been updated and is now referred to as the Texas Conservation Action Plan (TPWD 2012). The Texas Conservation Action Plan will continue to provide long-term benefits to wildlife and wildlife habitat.

The USFWS initiated the evaluation of potential critical habitat along the Canadian River from U.S. Highway 54 in New Mexico to the mouth of Coetas Creek in the central Texas Panhandle, a location within the bounds of Lake Meredith National Recreation Area. This proposed area, Unit 1a, was excluded from the final rule designating critical habitat for the Arkansas River shiner in 2005; however, the USFWS states that Unit 1a "supports a viable population of the species and is considered to be within the 'core' of the Arkansas River shiner population." Unit 1a was excluded because the majority of this reach is in private ownership, except for the small segment located within the boundaries of Lake Meredith. In addition, the USFWS felt that the benefits of excluding the units from this final critical habitat designation outweighed the benefits of designating the unit as critical habitat due to the development and partial implementation of a conservation/management plan for the Arkansas River shiner (USFWS 2005c). Although critical habitat is designated in the national recreation area, the implementation of a conservation/management plan and the acknowledgment of the area as supporting a viable population contribute to long-term benefits for the Arkansas River shiner.

Although some past, present, and future actions have contributed and would contribute to long-term benefits for the Arkansas River shiner, the benefits are primarily localized and a result of management actions. In addition to these beneficial management actions, there are adverse impacts that have resulted from habitat loss and degradation caused by the presence of the dam, invasive species, recreational activities, and water loss. Therefore, the overall impact of these past, current, and future actions on the Arkansas River shiner would be long term, moderate, and adverse. When combined with the short- and long-term moderate adverse impacts under alternative A, long-term moderate adverse cumulative impacts on the Arkansas River shiner would result in the area of analysis.

Conclusion

Under alternative A, short- and long-term moderate adverse effects on the Arkansas River shiner could occur as a result of localized impacts including disturbance, mortality, or damage to/loss of habitat. Past, present, and reasonably foreseeable future actions both inside and outside the national recreation area, when combined with the short- and long-term moderate adverse impacts from continued ORV use under alternative A, would result in long-term moderate adverse cumulative impacts on the Arkansas River shiner.

IMPACTS OF ALTERNATIVE B: ZONE SYSTEM – SEPARATION OF VISITOR USES, WITH A PERMIT FOR EDUCATIONAL PURPOSES

Under alternative B the national recreation area would designate routes and areas based on a zoning system that would separate potentially conflicting visitor uses. Established zones could include camping-only zones, hunting zones, resource protection zones, low-speed zones, and beginner zones.

As described for alternative A, the continued use of ORVs in the national recreation area would pose a threat to the Arkansas River shiner due to habitat disturbance, degraded water quality due to soil erosion and sedimentation, disruption of the reproductive cycle, and/or direct mortality, leading to short- and long-term moderate adverse impacts on the Arkansas River shiner.

Management measures including prohibiting parking or staging of any kind of vehicles adjacent to or in the river, restricting ORV use to designated routes, and implementing designated ORV access points at the riverbed and resource protection zones under alternative B would contribute to the protection of the Arkansas River shiner habitat at Rosita Flats by limiting ORVs from driving through riparian habitat and localizing impacts to certain areas. Limiting ORV use in riparian habitat would minimize erosion by avoiding highly erodible soils and would minimize sedimentation by protecting vegetation. However, long-term moderate adverse impacts on the Arkansas River shiner would persist from the continued use of ORVs in the riverbed. Additional protection would be offered from the establishment of a resource protection zone. This zone, an area of approximately 1,040 acres, would be established north and east of the Bull Taco Hill ORV use area to protect vegetation and reduce oil erosion. This zone would permit only vehicles with a wheel width of 64 inches or less, reducing disturbance in these areas.

Signs would be posted prohibiting ORV use in isolated pools during times of drought, which would help mitigate the adverse impacts of ORV use by preventing ORVs from driving through puddles containing congregated fish. The use of post-and-cable fencing and signs under alternative B to identify specific zone boundaries would further protect the shiner by reducing the likelihood of ORVs driving outside designated areas/routes, which can result in the destruction of habitat (e.g., erosion and sedimentation) and direct mortality of Arkansas River shiners (both adult and juvenile) and shiner eggs.

Law enforcement would be increased at the Rosita Flats ORV use area to assist in resource protection and enforce new ORV rules and regulations. Although short-term negligible to minor adverse impacts could result from low levels of ORV use by law enforcement staff, the overall impact of increased law enforcement at Rosita Flats would be long term and beneficial from the increased enforcement of resource protection. In addition, in order to encourage compliance, portions of designated ORV use areas could be closed temporarily to the public if evidence of ORV use is found outside designated routes or if degraded resource conditions (excessive rutting, erosion, etc.) are present. Every 2 to 4 years, aerial photography would be used to determine if ORV use is occurring outside of designated routes and areas.

Alternative B would also include a no-charge permit system, which would be issued to ORV users once educational materials are read and permits are signed for. Educational messages would include

information about the prohibition of driving in isolated pools or entering and leaving the river at undesignated access points, as well as information about the Arkansas River shiner. These materials could contain the statement, “The U.S. Fish and Wildlife Service recommends during low water that ORV users do not drive in the river or isolated pools but may cross the channel when needed.” The NPS would revoke permits if riders are found off designated routes, which can result in destruction of riparian habitat (e.g., erosion and sedimentation) and direct mortality of Arkansas River shiners (both adult and juvenile) and shiner eggs. If a rider violates the rules in any of the ORV use areas three times, the rider would be permanently barred from receiving any kind of public use permit at the national recreation area. Temporary closures of the ORV use areas if evidence of ORV use is found outside designated routes, as well as the implementation of permits, would help lessen the impacts of ORV use on the Arkansas River shiner by ensuring that ORV users stay on designated routes in order to preserve potentially sensitive shiner habitat. Additional educational materials concerning Arkansas River shiner protection could be provided on existing park bulletin boards and any boards or kiosks added to campground areas to further awareness of Arkansas River shiner conservation.

Four to six times per week, on-the-ground NPS law enforcement would patrol and monitor for prohibited driving in isolated pools and the wetted channel, as well as other ORV violations. Monitoring for incidental take of the Arkansas River shiner would occur at this time. Law enforcement patrols may be added as funding from ORV permits becomes available under the various alternatives.

As described in chapter 2, the national recreation area would monitor the shiner population every three to five years to ensure that additional management is not necessary. Educational material would be provided when a visitor receives a permit that would include information about the prohibition of driving in full pools or entering and leaving the river at undesignated access points, as well as other information about the Arkansas River shiner. These protection measures would help mitigate the adverse impacts of ORV use on the shiner. In addition, the NPS would provide sufficient guidance to its employees and contracted employees to minimize incidental take and to ensure compliance with the terms and conditions of the biological opinion (USFWS 2014).

Because alternative B would include a zoning system, designated ORV access points at the riverbed, and increased resource management and law enforcement, the overall impact of alternative B on the Arkansas River shiner would be less than described for alternative A. However, unlimited ORV use would continue at Rosita Flats and ORVs would still be allowed in the riverbed. Therefore, the overall impact of alternative B would be expected to be short and long term, minor to moderate, and adverse.

Cumulative Impacts

Past, present, and reasonably foreseeable future actions that have the potential for impacts under alternative B would be identical to those under alternative A. The overall impact of these past, current, and future actions on the Arkansas River shiner would be long term, moderate, and adverse, and when combined with the short- and long-term minor to moderate adverse impacts under alternative B, would result in long-term minor to moderate adverse cumulative impacts on the Arkansas River shiner in the area of analysis.

Conclusion

Short- and long-term moderate adverse impacts on the Arkansas River shiner could occur in localized areas due to the continued use of ORVs in the Rosita Flats area. However, the use of a zone system, including a resource protection zone, as well as designating ORV access points at the riverbed and restrictions on driving in isolated pools in times of drought, and the other protection measures outlined in the biological opinion would help mitigate these adverse impacts on Arkansas River shiner habitat.

Therefore, overall impacts under alternative B would be short and long term, minor to moderate, and adverse. Past, present, and reasonably foreseeable future actions both inside and outside the national recreation area, when combined with the impacts of alternative B, would result in long-term minor to moderate adverse cumulative impacts on the Arkansas River shiner.

IMPACTS OF ALTERNATIVE C: MANAGEMENT THROUGH USE OF A PERMIT SYSTEM AT CURRENT ORV USE AREAS

Under alternative C, the national recreation area would manage ORV use through a permit system as well as through the establishment of use limits. Permits would include a fee and initially there would be no limit on the number of permits issued. ORV routes and areas would be the same as those under alternative B.

As described for alternative A, the continued use of ORVs in the national recreation area would pose a threat to the Arkansas River shiner due to habitat disturbance, degraded water quality due to soil erosion and sedimentation, disruption of the reproductive cycle, and/or direct mortality, leading to short- and long-term moderate adverse impacts on the Arkansas River shiner. However, ORV use limits would be implemented based on indicators and standards developed through the GMP process. The development of use limits would help mitigate the adverse impacts of ORV use on the Arkansas River shiner and its associated habitat by limiting the number of ORVs operating in the national recreation area, thereby reducing their potential impacts on the Arkansas River shiner and its habitat. To assist in the implementation of the use limits, a monitoring plan would be developed that would address vegetation, erosion, and other predetermined factors, and which would increase awareness of habitat destruction and the potential for follow-up actions to protect species habitat.

In addition, a fee-based permit system would be established for access to ORV use areas. Similar to alternative B, ORV users would be required to read educational materials and sign for a user permit prior to obtaining the permit under alternative C, which would assist in protecting the Arkansas River shiner by educating ORV users about resource protection and reducing the likelihood of ORVs driving outside designated areas/routes. Educational messages for the permit would include information about the prohibition of driving in isolated pools or entering and leaving the river at undesignated access points, as well as other information about the Arkansas River shiner. These materials could also contain the statement, “The U.S. Fish and Wildlife Service recommends during low water that ORV users do not drive in the river or isolated pools but may cross the channel when needed.” Additional educational materials concerning Arkansas River shiner protection could be provided on existing park bulletin boards and any boards or kiosks added to campground areas to further awareness of Arkansas River shiner conservation.

As mentioned under alternative B, increased law enforcement under alternative C could result in short-term negligible to minor adverse impacts from low levels of ORV use by law enforcement staff; however, the overall impact of increased law enforcement at Rosita Flats would be long term and beneficial due to the increased enforcement of resource protection. In addition, increased law enforcement under alternative C would be further enhanced by aerial imagery to track new user-created routes/noncompliance, helping ensure that ORV users comply with rules and regulations that protect natural resources. Every two to four years, aerial photography would be used to determine if ORV use is occurring outside of designated routes and areas. The national recreation area would also explore options for having law enforcement staff located closer to the Rosita Flats ORV use area, which would assist in the protection of Arkansas River shiner habitat by enforcing compliance in order to preserve potentially sensitive shiner habitat.

Four to six times per week, on-the-ground NPS law enforcement would patrol and monitor for prohibited driving in isolated pools and the wetted channel, as well as other ORV violations. Monitoring for incidental take of the Arkansas River shiner would occur at this time. Law enforcement patrols may be added as funding from ORV permits becomes available under the various alternatives.

Similar to alternative B, the implementation of designated ORV access points at the riverbed, posting signs to prohibit driving in isolated pools, and prohibitions on parking or staging vehicles within the wetted river channel would help protect Arkansas River shiner habitat at Rosita Flats by limiting ORVs from driving through riparian habitat and localizing impacts; however, long-term moderate adverse impacts on the Arkansas River shiner would persist from the continued use of ORVs in the riverbed.

As described for alternative B, the national recreation area would monitor the shiner population every three to five years to ensure that additional management is not necessary. Additionally, when a visitor receives a permit, educational material would be provided, including the prohibition on driving in full pools or entering and leaving the river at undesignated access points, as well as other information about the Arkansas River shiner. These protection measures would help mitigate the adverse impacts of ORV use on the shiner. In addition, the NPS would provide sufficient guidance to its employees and contracted employees to minimize incidental take and to ensure compliance with the terms and conditions of the biological opinion (USFWS 2014).

Because alternative C would include ORV use limits, a fee-based permit system, designated ORV access points at the riverbed, and increased resource protection and law enforcement, the overall impact of alternative C on the Arkansas River shiner would be less than described for alternative A. However, unlimited ORV use would continue until use limits are determined, and ORVs would still be allowed in the riverbed. Therefore, the overall impact of alternative C would be expected to be short and long term, minor, and adverse.

Cumulative Impacts

Past, present, and reasonably foreseeable future actions that have the potential for impacts under alternative C would be identical to those under alternative A, resulting in long-term moderate adverse impacts. These impacts, when combined with the short- and long-term minor adverse impacts under alternative C, would result in long-term minor to moderate adverse cumulative impacts on the Arkansas River shiner.

Conclusion

Short- and long-term moderate adverse effects on the Arkansas River shiner could occur in localized areas due to the continued use of ORVs in the Rosita Flats area. However, the implementation of use limits, a fee-based permit system, the designation of ORV access points at the riverbed, and increased resource management, as well as other protection measures resulting from the biological opinion (USFWS 2014), would help mitigate the adverse impacts of ORV use on the Arkansas River shiner and its associated habitat. Therefore, the overall impacts of implementing alternative C would be short and long term, minor, and adverse. Past, present, and reasonably foreseeable future actions both inside and outside the national recreation area, when combined with the impacts of alternative C, would result in long-term minor to moderate adverse cumulative impacts on the Arkansas River shiner.

IMPACTS OF ALTERNATIVE D: MANAGEMENT THROUGH USE OF A ZONING AND PERMITTING SYSTEM AT CURRENT ORV USE AREAS

Under alternative D, the national recreation area would, in part, base the designation of routes and areas on a zoning system. One purpose of the zoning system would be to separate visitor uses that have the potential to conflict with one another, similar to the system under alternative B. In addition, a fee permit system would be instituted that would allow the national recreation area to provide additional enforcement and amenities in the ORV use area but would not establish use limits.

As described under alternative A, the continued use of ORVs in the national recreation area would pose a threat to the Arkansas River shiner due to habitat disturbance, degraded water quality from soil erosion and sedimentation, disruption of the reproductive cycle, and/or direct mortality, resulting in short- and long-term moderate adverse impacts.

Similar to alternative B, implementing designated ORV access points at the riverbed, prohibitions on driving through isolated pools, prohibiting parking or staging in the wetted river channel, and resource protection zones under alternative D would contribute to the protection of Arkansas River shiner habitat at Rosita Flats by limiting ORVs from driving through riparian habitat and localizing impacts to certain areas. However, long-term moderate adverse impacts on the Arkansas River shiner would persist from the continued use of ORVs in the riverbed.

New resource protection rules and regulations would be established under alternative D, including increased law enforcement, which could result in short-term negligible to minor adverse impacts as described for alternative B. However, the overall impact of increased law enforcement at Rosita Flats would be long term and beneficial. Similar to alternative C, law enforcement would further be enhanced under alternative D by the use of aerial imagery every two to four years to track new user-created routes/noncompliance, helping ensure that ORV users are in compliance with rules and regulations in place to protect natural resources. Additionally, the option for having law enforcement staff located closer to the Rosita Flats ORV use area would be explored under alternative D. As stated for alternative C, this would assist in the protection of the Arkansas River shiner habitat by enforcing compliance in order to preserve potentially sensitive shiner habitat.

As described under alternative C, the fee-based permit system would ultimately exclude ORV riders who are caught repeatedly violating the resource protection rules. The fee-based permit system could help mitigate adverse impacts of ORV use on the Arkansas River shiner by educating ORV users about resource protection and reducing the likelihood of ORVs driving outside designated areas. Educational messages for the permit would include information about the prohibition of driving in isolated pools or entering and leaving the river at undesignated access points, as well as other information about the Arkansas River shiner. These materials could also contain the statement, “The U.S. Fish and Wildlife Service recommends during low water that ORV users do not drive in the river or isolated pools but may cross the channel when needed.” Additional educational materials concerning Arkansas River shiner protection could be provided on existing park bulletin boards and any boards or kiosks added to campground areas to further awareness of Arkansas River shiner conservation.

As described for alternative B, the national recreation area would monitor the shiner population every three to five years to ensure that additional management is not necessary. Additionally, when a visitor receives a permit, educational material would be provided that would include the prohibition on driving in full pools or entering and leaving the river at undesignated access points, as well as other information about the Arkansas River shiner. These protection measures would help mitigate the adverse impacts of ORV use on the shiner. In addition, the NPS would provide sufficient guidance to its employees and

contracted employees to minimize incidental take and to ensure compliance with the terms and conditions of the biological opinion (USFWS 2014).

Four to six times per week, on-the-ground NPS law enforcement would patrol and monitor for prohibited driving in isolated pools and the wetted channel, as well as other ORV violations. Monitoring for incidental take of the Arkansas River shiner would occur at this time. Law enforcement patrols may be added as funding from ORV permits becomes available under the various alternatives.

Because alternative D would include a zoning system, designated ORV access points at the riverbed, a fee-based permit system, and increased resource management and law enforcement, the overall impact of alternative D on the Arkansas River shiner at Rosita Flats would be less than described for alternative A. Unlimited ORV use would continue at Rosita Flats and ORVs would still be allowed in the riverbed but use limits would be implemented if needed for resource protection. Therefore, the overall impact of alternative D would be expected to be short and long term, minor and adverse.

Cumulative Impacts

Past, present, and reasonably foreseeable future actions that have the potential for impacts affecting the Rosita Flats ORV use area under alternative D would be identical to those described for alternative A, resulting in long-term moderate adverse impacts. These impacts, when combined with the short- and long-term minor to moderate adverse impacts of alternative D, would result in long-term minor to moderate adverse cumulative impacts on the Arkansas River shiner at the Rosita Flats ORV use area.

Conclusion

Although the continued use of ORVs at Rosita Flats would result in short- and long-term moderate adverse impacts on the Arkansas River shiner in localized areas, impacts would be less than under alternative A due to increased resource management which would result in long-term beneficial impacts, but there would be long-term minor adverse impacts. The implementation of a zoning system and fee-based permit system as well as the resource protection measures that would be implemented as part of the biological opinion (USFWS 2014), would help mitigate the adverse impacts of ORV use on the shiner at Rosita Flats. Past, present, and reasonably foreseeable future actions both inside and outside the national recreation area, when combined with the overall short- and long-term minor to moderate adverse impacts under alternative D, would result in long-term minor to moderate adverse impacts on the Arkansas River shiner.

ARCHEOLOGICAL RESOURCES

GUIDING REGULATIONS AND POLICIES

Federal actions that have the potential to affect cultural resources are subject to a variety of laws. The National Historic Preservation Act (1966, as amended) is the principal legislative authority for managing cultural resources associated with NPS projects. Generally, Section 106 of the act requires all federal agencies to consider the effects of their actions on cultural resources listed on or determined eligible for listing in the National Register of Historic Places. Such resources are termed “historic properties.” Agreement on how to mitigate effects on historic properties is reached through consultation with the State Historic Preservation Officer; the Tribal Historic Preservation Officer, if applicable; and the Advisory Council on Historic Preservation, as necessary. In addition, federal agencies must minimize harm to historic properties that would be adversely affected by a federal undertaking. Section 110 of the act requires federal agencies to establish preservation programs for the identification, evaluation, and nomination of historic properties to the National Register of Historic Places.

The National Historic Preservation Act established the National Register of Historic Places, the official list of the nation's historic places worthy of preservation. Administered by the NPS, the National Register of Historic Places is part of a national program to coordinate and support public and private efforts to identify, evaluate, and protect America's historic and archeological resources. The criteria applied to evaluate properties are contained in 36 CFR 60.4. The quality of significance in American history, architecture, archeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association, and either:

(a) Are associated with events that have made a significant contribution to the broad patterns of our history;

(b) Are associated with the lives of persons significant in our past;

(c) Embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or

(d) Have yielded or may be likely to yield, information important in prehistory or history.

Cultural resources that meet the eligibility criteria for listing in the National Register of Historic Places are considered "significant" resources and must be taken into consideration during the planning of federal projects.

Other important laws or executive orders designed to protect cultural resources include, but are not limited to the following:

- NPS Organic Act—to conserve the natural and historic objects within parks unimpaired for the enjoyment of future generations
- American Indian Religious Freedom Act—to protect and preserve for American Indians access to sites, use and possession of sacred objects, and the freedom to worship through ceremonials and traditional rites
- Archeological Resources Protection Act—to secure, for the present and future benefit of the American people, the protection of archeological resources and sites that are on public lands and Indian Lands
- NEPA—to preserve important historic, cultural, and natural aspects of our national heritage
- Executive Order 11593, "Protection and Enhancement of the Cultural Environment)—to provide leadership in preserving, restoring, and maintaining the historic and cultural environment of the nation
- Executive Order 13007, "Indian Sacred Sites")—to accommodate access to and ceremonial use of Indian sacred sites by Indian religious practitioners and avoid adversely affecting the physical integrity of such sacred sites.

Through the legislation and the executive orders listed above, the NPS is charged with the protection and management of cultural resources in its custody. This is further implemented through Director's Order 28: Cultural Resource Management, NPS *Management Policies 2006* (NPS 2006b), and the 2008 "Programmatic Agreement among the National Park Service (U.S. Department of the Interior), the Advisory Council on Historic Preservation, and the National Conference of State Historic Preservation Officers for Compliance with Section 106 of the National Historic Preservation Act" (NPS 2008c). These documents charge NPS managers with avoiding, or minimizing to the greatest degree practicable, adverse

impacts on park resources and values. Although the NPS has the discretion to allow certain impacts in parks, that discretion is limited by the statutory requirement that park resources and values remain unimpaired, unless a specific law directly provides otherwise.

METHODOLOGY, ASSUMPTIONS, AND INTENSITY DEFINITIONS

The NPS categorizes cultural resources as archeological resources, cultural landscapes, historic structures, museum objects, and ethnographic resources. As noted in the "Scoping Process and Public Participation" section in the "Purpose of and Need for Action" chapter, only the topic of impacts on archeological resources has been retained for detailed analysis in this plan/EIS.

The descriptions of effects on cultural resources that are presented in this section are intended to comply with the requirements of NEPA.

CEQ regulations and the NPS Director's Order 12 call for a discussion of the appropriateness of mitigation, as well as an analysis of how effective the mitigation would be in reducing the intensity of a potential impact (e.g., reducing the intensity of an impact from major to moderate or minor). Any resultant reduction in the intensity of an impact due to mitigation, however, is an estimate of the effectiveness of mitigation under NEPA only. Cultural resources are non-renewable resources, and adverse effects generally consume, diminish, or destroy the original historic materials or form, resulting in a loss in the integrity of the resource that can never be recovered.

Negligible: The impact would be at the lowest level of detection or barely measurable, with no perceptible consequences, either adverse or beneficial, to archeological resources.

Minor: The impact would affect an historic site or district or an archeological site with the potential to yield information important in prehistory or history. The historic context of the affected site(s) would be local.

Moderate: The impact would affect an archeological site with the potential to yield information important in prehistory or history. The historic context of the affected site would be statewide. For a National Register of Historic Places eligible or listed historic district, the impact would be readily apparent and/or change a character-defining feature(s) of the resource to the extent that its National Register of Historic Places eligibility would be jeopardized.

Major: The impact would affect an archeological site with the potential to yield important information about human history or prehistory. The historic context of the affected site would be national. The impact would be severe for eligible or listed historic districts. The impact would change a character-defining feature or features of the resource, diminishing the integrity of a National Register eligible or listed resource to the extent that it would no longer be eligible for or listed on the National Register of Historic Places.

Study Area

The study area for archeological resources is considered to be the boundaries of the ORV use areas in Blue Creek and Rosita Flats and adjacent lands outside the national recreation area boundary for cumulative impacts.

IMPACTS OF ALTERNATIVE A: NO ACTION – CONTINUATION OF CURRENT MANAGEMENT

Under alternative A, ORV use would continue to be permitted throughout Blue Creek along the creek bottom from cutbank to cutbank and in Rosita Flats below the 3,000-foot elevation line. ORV and other motorized vehicle use would have impacts including soil disturbance, compaction, vegetation loss, and erosion, which in turn can lead to disturbance of surface and subsurface archeological sites. Impacts would result from the damage or destruction that occurs when motorized vehicles drive over and/or near archeological sites. The weight and torque of such vehicles easily damages fragile surface deposits and, consequently, surface and subsurface features (e.g., remains of houses, burials, hearths, storage pits, and other features), as well as breaking artifacts. Site integrity, a necessary element for listing a cultural resource in the National Register of Historic Places, is also affected by the visible changes caused by vehicle tracks and erosion (Sowl and Poetter 2004). According to the Bureau of Land Management, ORV use leads to an increase in visitation to previously inaccessible lands and increases the intentional and inadvertent damage of archeological resources through surface disturbances (Bureau of Land Management 2000). Impacts could also occur because soil erosion caused by ORVs exposes artifacts, making them susceptible to unauthorized collection (Sowl and Poetter 2004).

Blue Creek ORV Use Area

Known archeological sites in the Blue Creek area include village or hamlet sites and one possible multiple human burial site, all of which are sensitive to damage caused by ORVs driving over sites and eroding soil. Villages and hamlets include stone foundations and architectural remains along with other portable cultural items and artifact scatters. There is also the potential for unknown, subsurface sites in this area that could be subject to erosion and damage due to ORV use. Although ORV use is permitted at Blue Creek only along the creek bottom from cutbank to cutbank, there is evidence that some riders stray outside the permitted use area and cause erosion on terraces above the creek where archeological sites exist.

Rosita Flats ORV Use Area

Known archeological sites in the Rosita Flats area include a village site, campsites, open sites, and one cave habitation site, mostly on ridges above the river. There is also the potential for unknown, subsurface sites in this area that could be subject to erosion and damage due to ORV use. Although ORV use is permitted only below the 3,000-foot elevation line, there is evidence that some riders stray outside the permitted use area and cause erosion on terraces and ridges above the river where archeological sites exist.

Alternative A would result in continued potential impacts on various archeological resources along or near open routes or access. Alternative A would have long-term major adverse impacts on archeological resources because ORV use as currently regulated would continue and would have the potential to impact archeological sites.

Cumulative Impacts

Past impacts on archeological resources have been caused by other development inside and outside the national recreation area, including the construction and maintenance of oil and gas wells. However, the Rosita Flats and Blue Creek areas have not been heavily developed for oil and gas extraction.

Lake Meredith National Recreation Area Master Plan (NPS 1973) states that staff should be continually aware of the presence of prehistoric and historic sites so that maintenance and construction will not

destroy sites the NPS is charged with preserving. The plan also states that once research and survey of national recreation area lands for cultural resources is complete, management of those resources will evolve.

The current Fire Management Plan (NPS 1998b) states that areas of proposed prescribed burns will be subject to inventory for cultural resources, which would be a beneficial impact for archeological resources because it would allow for the avoidance of those sites. It also states that known archeological sites will be protected as much as possible during wildland fire fighting. The most likely adverse impact on archeological sites would occur during the use of heavy equipment to fight fires.

There has been recreational ORV use in the Lake Meredith area since its establishment as a recreation area in the 1970s. The implementation of Executive Order 11644 allows for ORV use on public lands; however, the Resources Management Plan (NPS 1996) states that several archeological sites have been damaged within and outside the ORV use areas. The plan lists protection of cultural resources as one of the national recreation area's goals and objectives without listing specific actions.

ORV use also occurs on adjacent private lands. While most of the vehicular use inside the national recreation area is by typical street-legal cars and trucks, much of the vehicular use on adjacent lands involves the use of ORVs such as ATVs, jeeps, or other high-clearance vehicles. The use of vehicles off formal roads has the potential to cause adverse impacts on archeological resources similar to those described previously, and as a result, related impacts are expected to continue.

It is expected that the implementation of the forthcoming GMP will mandate resource protection zones, especially those that limit motorized vehicle access, which will also help protect archeological resources.

Despite some beneficial actions, overall impacts from other past, present, and reasonably foreseeable future actions on archeological resources would be long term, minor to moderate, and adverse (impacts would be noticeable to readily apparent, and would affect some resources over a relatively large area). In combination with the long-term major adverse impacts of alternative A, overall cumulative impacts would be long term, major, and adverse.

Conclusion

Alternative A would result in continued potential long-term major adverse impacts on archeological resources along or near open ORV use areas, routes, or access points. Cumulative impacts would be long term, major, and adverse.

IMPACTS OF ALTERNATIVE B: ZONE SYSTEM – SEPARATION OF VISITOR USES, WITH A PERMIT FOR EDUCATIONAL PURPOSES

Under alternative B, ORVs would only be allowed on sandy bottom areas and designated routes at Blue Creek, with ORV use prohibited on vegetated areas. At Rosita Flats, the area south of the river and east of Bull Taco Hill (both currently denuded of vegetation) would be established as ORV use areas and would be open to ORV use. Access to the riverbed from ORV use areas would be from designated access points only. Outside ORV use areas, ORV use would be permitted only on designated, marked routes.

Alternative B would also institute a zoning system that would be a "layer" on top of these routes and areas that would further manage use. A resource protection zone would be established to protect vegetation and reduce soil erosion east of Bull Taco Hill at Rosita Flats. In this zone, only ORVs with a wheel width less than 64 inches would be permitted.

Alternative B would also include increased coordination with the State of Texas if a new state park adjacent to Rosita Flats is established. This effort would include coordinating the resources of the NPS and the state in this area, particularly law enforcement and interpretive resources. Within the recreation area, archeological resources in ORV routes or areas would be protected either with barriers or other methods of restricting access, including establishing routes that bypass these areas. Should additional resources be discovered within ORV routes or areas, the resources would be protected from ORV use.

Blue Creek ORV Use Area

As with alternative A, impacts on known and unknown archeological sites in the Blue Creek area could occur due to ORV use under alternative B. Although ORV use would be permitted at Blue Creek only along the creek bottom and designated routes and non-vegetated areas, there is current evidence that some riders stray outside the permitted use area and cause erosion on terraces above the creek where archeological sites exist. However, these occurrences should be reduced under alternative B because ORV permit holders may have their permits revoked if they enter closed areas. In addition, measures would be taken to restrict access to areas where resources are located within an ORV route.

Rosita Flats ORV Use Area

Under alternative B, the denuded area south of the river and the area east of Bull Taco Hill would be subject to impacts similar to those described under alternative A; additional protection measures would be implemented for known resource areas. Archeological resources in the ORV use area and along designated, marked routes would be protected through a variety of management measures and further impacts to these sites would be limited. An education program to make users aware of the potential impacts on cultural resources caused by ORVs, as well as the ability to recommend revocation of ORV permits, would benefit archeological sites by encouraging users to stay within designated use areas. If a new state park adjacent to Rosita Flats is established, coordination with the State of Texas could result in either negligible or beneficial impacts on archeological resources, depending on the level of enforcement of ORV use between the federal and state agencies.

Alternative B would have long-term minor adverse impacts on archeological resources because resources do exist in the ORV use areas, but would be protected though limited site access in known resource areas.

Cumulative Impacts

The effects of other past, present, and reasonably foreseeable future actions on archeological resources would be the same as described for alternative A: long term, minor to moderate, and adverse. Overall, the impacts of these actions, when combined with the long-term minor to moderate adverse impacts of alternative B, would result in long-term minor to moderate adverse cumulative impacts on archeological resources.

Conclusion

Alternative B would result in long-term minor adverse potential impacts on archeological resources along or near open ORV areas, routes, or access points. Measures would be implemented to restrict access to the sensitive areas. Cumulative impacts would be long term, minor to moderate, and adverse.

IMPACTS OF ALTERNATIVE C: MANAGEMENT THROUGH USE OF A PERMIT SYSTEM AT CURRENT ORV USE AREAS

Under alternative C, the national recreation area would manage ORV use through a permit system, as well as through the establishment of use limits. Permits would include a fee and initially there would be no limit on the number of permits issued. ORV routes and areas would be the same as those under alternative B, except a second ORV use area east of Bull Taco Hill would not be established.

Education and outreach efforts at Blue Creek and Rosita Flats would be the same as those under alternative B, in addition to post-and-cable fences and signs around the ORV use boundary at Rosita Flats to better define allowable ORV use in this area. This alternative could also include the installation of an interpretive wayside exhibit program at Blue Creek, as funding from the permit fees allows.

Within the recreation area, archeological resources in ORV routes or areas would be protected either with barriers or other methods of restricting access, including establishing routes that bypass these areas. Should additional resources be discovered within ORV routes or areas, the resources would be protected from ORV use.

Blue Creek ORV Use Area

As with alternatives A and B, impacts on known and unknown archeological sites in the Blue Creek area could occur due to ORV use under alternative C, but would be mitigated restricting access in areas where archeological resources are present along ORV routes or areas. Although ORV use would be permitted at Blue Creek only along the creek bottom, designated routes, and non-vegetated areas, there is current evidence that some riders stray outside the permitted use area and cause erosion on terraces above the creek where archeological sites exist. An education program to make users aware of the potential impacts on cultural resources caused by ORVs would benefit archeological sites through encouraging ORV users to observe designated use areas. Similarly, a wayside interpretive program could be used to educate and inform the public on the importance of observing designated use areas to protect sensitive cultural resources. The permit system would have no initial limits on the number issued, which would keep usage levels near current levels. The ability to recommend the revocation of permits under alternative C for violation of ORV regulations would be beneficial and would increase compliance; therefore, the ORV use and resulting potential impacts would remain the same as under alternative A, with some benefits from the recommendation to revoke ORV permits, at Blue Creek unless it exceeds the user capacity.

Rosita Flats ORV Use Area

Under alternative C, the denuded area south of the river would be subject to similar impacts as under alternative A, but potential impacts to archeological sites would be mitigated by restricting access in areas where archeological resources are present along ORV routes or areas. Archeological resources in the ORV use area and along designated, marked routes could be directly or indirectly impacted by ORVs riding over sites resulting in erosion at higher elevations above the river but access restrictions in these resource areas would mitigate the potential impacts. An education program to make users aware of the potential impacts on cultural resources caused by ORVs would benefit archeological sites by encouraging users to stay within designated use areas. Post-and-cable fences and signs around the ORV use boundary at Rosita Flats would have a beneficial impact on archeological sites because they would restrict users from riding at the higher elevations where sites exist. The permit system would have no initial limits on the number issued, which would keep usage levels near current levels. The ability to recommend the revocation of permits under alternative C for violation of ORV regulations as well as the potential for user limits would be beneficial and would increase compliance; therefore, the ORV use and resulting potential

impacts would remain the same as under alternative A, with some additional benefits from the ability to recommend the revocation of ORV permits, at Rosita Flats.

Alternative C would have long-term minor adverse impacts on archeological resources. Where sites do exist, they would be protected with access restrictions.

Cumulative Impacts

The effects of other past, present, and reasonably foreseeable future actions on archeological resources would be as described for alternative A: long-term, minor to moderate, and adverse. Overall, the impacts of these actions, when combined with the long-term minor to moderate adverse impacts of alternative C, would result in long-term minor to moderate adverse cumulative impacts on archeological resources.

Conclusion

Alternative C would result in long-term minor adverse potential impacts on archeological resources along or near open ORV areas, routes, or access points; where sites do exist, they would be protected with access restrictions. Cumulative impacts would be long-term, minor to moderate, and adverse.

Impacts of Alternative D: Management through Use of a Zoning and Permitting System at Current ORV Use Areas

Under alternative D, the national recreation area would manage ORV use through both a zone system (such as in alternative B) and a permit system (as described in alternative C). Permits would include a fee and initially there would be no limit on the number of permits issued. ORV routes and areas would be the same as those under alternative B.

Education and outreach efforts at Blue Creek and Rosita Flats would be the same as those under alternative B, in addition to post-and-cable fences and signs around the ORV use boundary at Rosita Flats to better define allowable ORV use in this area. This alternative could also include the installation of an interpretive wayside exhibit program at Blue Creek, as funding from the permit fees allow.

Within the recreation area, archeological resources in ORV routes or areas would be protected either with barriers or other methods of restricting access, including establishing routes that bypass these areas. Should additional resources be discovered within ORV routes or areas, the resources would be protected from ORV use.

Alternative D has been identified as the NPS preferred alternative. On July 1, 2014, the NPS sent a letter to the Texas Historical Preservation Officer requesting concurrence that there would be no adverse impacts to historic properties from implementation of the proposed action. The Texas Historical Preservation Officer provided concurrence on July 23, 2014.

Blue Creek ORV Use Area

As with all alternatives, impacts on known and unknown archeological sites in the Blue Creek area could occur due to ORV use under alternative D; however these impacts would be mitigated through the use of access restrictions in areas with these known resources. Although ORV use would be permitted at Blue Creek only along the creek bottom and designated routes and non-vegetated areas, there is current evidence that some riders stray outside the permitted use area and cause erosion on terraces above the creek where archeological sites exist. An education program to make users aware of the potential impacts on cultural resources caused by ORVs would benefit archeological sites through encouraging ORV users

to observe designated use areas. Similarly, a wayside interpretive program could be used to educate and inform the public on the importance of observing designated use areas to protect sensitive cultural resources. The permit system would have no initial limits on the number issued, which would keep usage levels near current levels. The recommendation to revoke permits under alternative D for violation of ORV regulations would be beneficial and would increase compliance; therefore, the ORV use and resulting potential impacts would remain the same as under alternative A, with some benefits from the ORV permits, at Blue Creek.

Rosita Flats ORV Use Area

Under alternative D, the denuded area south of the river would be subject to the same impacts as under alternative B, as well as the additional ORV use area near Bull Taco Hill. Archeological resources in the ORV use area and along designated, marked routes could be impacted by ORVs riding over sites and the potential for increased erosion at higher elevations above the river, but known sites would be avoided to the greatest extent possible. If sites are located in these areas, access restrictions would be put in place to mitigate potential impacts. An education program to make users aware of the potential impacts on cultural resources caused by ORVs would benefit archeological sites by encouraging users to stay within designated use areas. Post-and-cable fences and signs around the ORV use boundary at Rosita Flats would have a beneficial impact on archeological sites because they would restrict users from riding at the higher elevations where sites exist. The permit system would have no initial limits on the number issued, which would keep usage levels near current levels. The ability to recommend the revocation of permits under alternative D for violation of ORV regulations would be beneficial and would increase compliance; therefore, the ORV use and resulting potential impacts would remain the same as under alternative A, with some additional benefits from the recommendation to revoke ORV permits at Rosita Flats. In the designated resource protection zone, long-term beneficial impacts would occur due to a reduction in ORV disturbance.

Alternative D would result in continued potential impacts on various archeological resources along or near open ORV routes or access points; however, access restrictions would minimize these impacts. Alternative D would have long-term minor adverse impacts on archeological resources.

Cumulative Impacts

The effects of other past, present, and reasonably foreseeable future actions on archeological resources would be as described for alternative A: long-term, minor to moderate, and adverse. Overall, the impacts of these actions, when combined with the long-term minor to moderate adverse impacts of alternative D, would result in long-term minor to moderate adverse cumulative impacts on archeological resources.

Conclusion

Alternative D would result in long-term minor adverse potential impacts on archeological resources along or near open ORV areas, routes, or access points. Where sites do exist, they would be protected with access restrictions. Cumulative impacts would be long-term, minor to moderate, and adverse.

VISITOR USE AND EXPERIENCE / HEALTH AND SAFETY

GUIDING REGULATIONS AND POLICIES

NPS *Management Policies 2006* (NPS 2006b, Section 8.2) states that the enjoyment of park resources and values by the people of the United States is part of the fundamental purpose of all parks and the NPS is

committed to providing appropriate, high-quality opportunities for visitors to enjoy the parks. Because many forms of recreation can take place outside a national park setting, the NPS will therefore seek to

- Provide opportunities for forms of enjoyment that are uniquely suited and appropriate to the superlative natural and cultural resources found in the parks
- Defer to local, state, and other federal agencies; private industry; and non-governmental organizations to meet the broader spectrum of recreational needs and demands.

To provide for enjoyment of the parks, the NPS will encourage visitor activities that

- Are appropriate to the purpose for which the park was established
- Are inspirational, educational, or healthful, and otherwise appropriate to the park environment
- Will foster an understanding of and appreciation for park resources and values, or will promote enjoyment through a direct association with, interaction with, or relation to park resources
- Can be sustained without causing unacceptable impacts on park resources or values.

Part of the purpose of Lake Meredith National Recreation Area is to offer diverse, affordable outdoor land- and water-based recreational activities. Its significance lies in the spectacular and diverse scenic, recreational, and cultural resources that visitors enjoy.

CEQ regulations (40 CFR 1508.27) require the NPS to consider the effects of proposed actions on visitor health and safety. The NPS recognizes that both the park resources that attract visitors and some of the specific recreational activities in which visitors participate can present sources of potential hazards. The NPS *Management Policies 2006* states that, "While recognizing that there are limitations on its capability to totally eliminate all hazards, the Service … will seek to provide a safe and healthful environment for visitors and employees." The NPS *Management Policies 2006* also states that "the Service will reduce or remove known hazards and apply other appropriate measures, including closures, guarding, signing, or other forms of education" (NPS 2006b, Section 8.2.5.1). Although the NPS strives to provide a safe and healthful environment for park visitors, park visitors must be aware of risks and assume a substantial degree of responsibility for their own safety when visiting and recreating in park areas. NPS *Management Policies 2006* does not impose park-specific visitor safety prescriptions. Rather, the means by which public safety concerns might be addressed are left to the discretion of the area manager (NPS 2006b, Section 8.2.5.1).

Because ORV use presents a visitor health and safety concern, some alternatives include new requirements for ORVs.

METHODOLOGY, ASSUMPTIONS, AND INTENSITY DEFINITIONS

The purpose of this impact analysis is to evaluate the potential for change in visitor use and experience / health and safety by identifying projected increases or decreases in both motorized vehicle use and other visitor uses, and determining whether these projected changes would affect the desired visitor experience.

Negligible: Visitors would likely be unaware of impacts associated with proposed changes. There would be no noticeable change in visitor experience or public health and safety.

Minor: Changes in visitor experience would be slight and detectable, but would not appreciably limit or enhance any critical characteristics of the visitor experience. Other areas of the national recreation area would remain available for similar visitor experience and use without degradation of national recreation area resources and values. The impact on visitor safety would be measurable or perceptible, but it would be limited to a relatively small number of visitors at localized areas. There would not be an appreciable effect on public health and safety.

Moderate: Changes in visitor experience would be readily apparent. The visitor would be aware of the effects associated with the alternative and would likely be able to express an opinion about the changes. Other areas of the national recreation area would remain available for similar visitor experience and use without degradation of national recreation area resources and values, but visitor satisfaction might be measurably affected (visitors could be either satisfied or dissatisfied). The impact on visitor safety would be readily apparent and would result in substantial, noticeable effects on public health and safety on a local scale.

Major: Impacts on visitor experience would be readily apparent and would have substantial consequences. The visitor would be aware of the effects associated with the alternative, and would likely express a strong opinion about the changes. The change in visitor use and experience proposed would prevent some visitors from enjoying national recreation area resources and values. Some visitors who desire to continue their use and enjoyment of the activity / visitor experience would be required to pursue their choice in other available local or regional areas. The impact on visitor safety would be readily apparent and would result in substantial, noticeable effects on public health and safety on a regional scale.

Duration: Short-term impacts would occur sporadically throughout a year, but would generally last no more than three weeks per year.

Long-term impacts would occur more than three weeks per year and likely for consecutive years.

Study Area

The geographic study area for the visitor use and experience / health and safety analysis, including the cumulative impacts analysis, includes the entire area within the national recreation area boundary.

IMPACTS OF ALTERNATIVE A: NO ACTION – CONTINUATION OF CURRENT MANAGEMENT

Under alternative A, the management of ORV use and access at the national recreation area would continue current management strategies based on the 2007 *Interim OHV Use Plan* (NPS 2007a), the regulations contained in 36 CFR 7.57, and the Superintendent's Compendium. ORV use would continue to be permitted throughout Rosita Flats below the 3,000-foot elevation line and at Blue Creek along the creek bottom from cutbank to cutbank. No additional management tools such as zoning, permits, or use limits would be implemented.

Under alternative A, ORV education would occur through visitor contact with rangers, maintenance staff, and other park staff, as well as through on-site learning opportunities. Visitors would be given trash bags to use during busy weekends. The use of trash bags by visitors would potentially keep the national recreation area cleaner and more enjoyable for users, resulting in beneficial impacts on visitor use and experience / health and safety.

Visitors would be permitted to camp throughout Rosita Flats and Blue Creek under alternative A, with no specific areas or sites designated for camping. Campfires would be regulated under the Superintendent's Compendium. If the fire danger is high, the national recreation area would prohibit campfires, resulting in short-term benefits to visitor health and safety. Amenities at Blue Creek currently include picnic tables, trash receptacles, and pit toilets. Currently at Rosita Flats, picnic tables and trash receptacles are available for visitor use. These amenities would continue to be offered at the two ORV use areas as funding permits. The continued provision of amenities would have long-term beneficial impacts for national recreation area users. However, if funding for these amenities becomes limited the NPS may no longer be able to provide these services and short- and long-term minor adverse impacts could result.

Law enforcement would continue to patrol Blue Creek and Rosita Flats, with more frequent patrols at Blue Creek due to the remote location of Rosita Flats. According to an ASU 2004 visitor study (ASU 2004), ORV users voiced concerns that national recreation area amenities are often destroyed and that use areas are dangerous and not conducive to families. Because no changes to current ORV management and law enforcement would occur under alternative A, long-term minor to moderate adverse impacts on visitor use and experience / health and safety could result if visitors do not feel safe at ORV use areas in the national recreation area.

Under alternative A there would be no change to current visitor use and experience or to access or recreational opportunities. Although some ORV users would benefit from limited regulation and no access restrictions under alternative A, these conditions would adversely affect other users in the national recreation area who perceive a conflict with other uses or are impacted by the noise from ORVs. As a result, impacts of alternative A on visitor use and experience / health and safety would be long term, moderate, and adverse.

Cumulative Impacts

Past, present, and reasonably foreseeable actions that could impact visitor use and experience include those recreational opportunities available in the national recreation area as well as those throughout the Amarillo region. In the national recreation area, the level of Lake Meredith has been decreasing, in part due to water pumping, which has resulted in a decrease in the opportunities for water-based recreation. To address these changes the national recreation area has been planning for other forms of recreation for visitors to enjoy. One of these activity changes is the introduction of a multi-use trail. Visitors would be able to use the trail for pedestrian and bicycle use. Another recreational opportunity currently available is hunting. The current effort for the development and implementation of a GMP would also anticipate the changing availability of recreational opportunities in the national recreation area. In addition to opportunities in the national recreation area, the state of Texas manages the Texas Off-Highway Vehicle Program, which provides for ORV use on state lands. The Sand Drags event also provides an annual recreation event for ORV users in the area. The provision of additional opportunities for recreation inside and outside the national recreation area would have long-term beneficial impacts on visitor use and experience due to the range of activities available, many of them related to ORV use. Although there would be beneficial impacts from additional recreational opportunities, during public scoping for the plan/EIS commenters thought there was a lack of public lands for recreational use, as well as an increasing demand for the available lands. The perception of a lack of opportunities could have long-term moderate adverse impacts if any of the opportunities in the area are reduced. Additionally, expanding

recreational opportunities could result in short- and long-term negligible to moderate adverse impacts on visitor health and safety, depending on the activity.

The state of Texas requires all OHV users to purchase and display a decal prior to operating the vehicle on public lands, including the national recreation area. Failure to obtain this decal constitutes a Class C misdemeanor and could result in the OHV operator being issued a citation. Fines for this offense range from $25 to $500. In addition to OHV decal fees, ORV users in Lake Meredith who are boating also are required to obtain a permit for that use, and later, the national recreation area could implement user fees for other areas. If national recreation area users are required to pay fees for multiple recreational activities, inside and outside the national recreation area, these fees could result in minor to moderate adverse impacts on visitor use and experience.

Past and ongoing planning efforts also influence visitor use and experience in the national recreation area, including the Resources Management Plan, Fire Management Plan, Oil and Gas Management Plan, the Lake Meredith National Recreation Area Master Plan, and visitor use studies. These planning efforts take into account visitor use and safety and the preservation of recreational opportunities in the national recreation area, resulting in long-term beneficial impacts. Implementation of these plans could result in long-term minor adverse impacts because some of these management actions, such as fire management, may temporarily make some of the national recreation area lands inaccessible to visitors while management actions are in progress. Maintenance operations in the national recreation area would result in long-term beneficial impacts because all areas of the unit would be maintained, including trash removal. The requirements of maintenance around the ORV use areas has increased due to the removal of trash cans from state property, resulting in visitors using trash disposal facilities in the national recreation area and increasing the demands on maintenance. These extra demands on national recreation area staff could result in long-term negligible to minor adverse impacts when the national recreation area cannot keep up with this demand.

Overall, these actions would have long-term minor adverse impacts on visitor use and experience / health and safety. These impacts, when combined with the long-term moderate adverse impacts of alternative A, would result in long-term minor to moderate adverse cumulative impacts.

Conclusion

Under alternative A there would be no change to the current visitor use and experience, access, or recreational opportunities. The current safety risk of unregulated ORV use in the national recreation area would remain the same. As a result, impacts on visitor use and experience / health and safety would be long term, moderate, and adverse. Past, present, and reasonably foreseeable future actions both inside and outside the national recreation area, when combined with the long-term moderate adverse impacts under alternative A, would result in long-term minor to moderate adverse cumulative impacts on visitor use and experience / health and safety.

IMPACTS OF ALTERNATIVE B: ZONE SYSTEM – SEPARATION OF VISITOR USES, WITH A PERMIT FOR EDUCATIONAL PURPOSES

Under alternative B the national recreation area would, in part, base the designation of routes and areas on a zoning system. One purpose of these zones would be the separation of visitor uses that have the potential to conflict with one another. Established zones could include camping -only zones, hunting zones, resource protection zones, low-speed zones, and beginner zones. At Blue Creek, ORVs would only be allowed on sandy bottom areas and designated routes, with ORV use prohibited on vegetated areas. ORV use would be permitted at Rosita Flats in the areas south of the river (currently denuded of vegetation) and to the east of Bull Taco Hill. Other ORV use (outside the areas described above) would

be allowed only on designated, marked routes. ORVs could only access the riverbed area from marked and designated access points off designated ORV routes. Driving on vegetation would be strictly prohibited.

A camping -only zone with a 15 mph speed limit would also be established. This zone would allow vehicular access but ORV use would not be permitted, which could result in minor adverse impacts on visitor use and experience by limiting ORV access. Prohibiting ORV use in the zone would likely be overall beneficial for visitors, because the associated noise and safety risks of ORV use would not be a concern for campers. These areas would contain picnic tables and fire pits as funding allows. No additional amenities would be provided beyond what is described under alternative A. The use of the camping zone would have long-term minor adverse and beneficial impacts on visitor use and experience, as well as long-term beneficial impacts on visitor safety.

Park visitors would be able to hunt in the designated hunting zone with ORVs, but recreational ORV use would not be allowed in these areas. Restriction in the hunting zone would last from two to eight weeks (up to two months), resulting in long-term moderate adverse impacts on visitor use and experience for non-hunters from limiting ORV access in this zone. However, restricting ORV use in the hunting zone would benefit visitor health and safety by keeping non-hunters safe from hunting activities. The use of ORVs in the hunting zone by hunters only would benefit visitor use and experience for hunters, because a lower number of ORVs would be affecting wildlife, thus making hunting more favorable. The use of ORVs by hunters could result in long-term negligible to minor adverse impacts because the potential for user conflicts may arise with hunters not using ORVs. According to the ASU 2004 visitor survey, most user-group conflicts related to ORV use tend to be with other user groups perceiving conflicts with ORV users, although ORV users generally do not recognize these conflicts (ASU 2004). Overall, the creation of a hunting zone would result in long-term minor to moderate adverse impacts as well as beneficial impacts on visitor use and experience / health and safety.

ORV users new to “off-roading” would be able to enjoy a beginner loop zone at Rosita Flats. This beginner zone would require riders to keep their speeds below 20 mph. At Blue Creek a new low-speed zone for family use would be implemented on either side of the FM 1913 bridge. The beginner loop zone and low-speed family zone would likely attract users that would otherwise visit other ORV use areas. The implementation of the proposed zones would be beneficial to visitor use and experience / health and safety, especially if the riders are new to the sport. A zone that requires low speeds could aid riders in feeling more comfortable learning without feeling intimidated by more skilled riders using faster speeds. Riders would be restricted to speeds no greater than 15 mph within sight of the bridge (about half a mile in either direction). This low-speed zone would allow families to play in the water without the associated safety risks of ORV use at excessive speeds. Therefore, the beginner zone would have long-term beneficial impacts on visitor use and experience / health and safety.

A resource protection zone would be designated at Rosita Flats north of the beginner and camping zones and east of the ORV use area around Bull Taco Hill where only vehicles with a wheel width less than 64 inches would be permitted (for example, most ATVs, UTVs, and motorcycles) would be permitted. Park officials would delineate the boundary of use zones using signs, caronsite posts, or post -and -cable fencing to better define the user zones. The resource protection zone would create beneficial impacts for visitors, because this zone would help to keep resources in a state where they can be enjoyed by users in the future. However, designating a resource zone at Rosita Flats could also lead to long-term negligible to minor adverse impacts on visitor use and experience by limiting ORV use in the area.

The establishment of zones would, for the most part, result in long-term beneficial impacts because it would provide for a separation of uses and reduce perceived user conflicts. However, as previously described, designating zones (e.g., hunting and resource protection) within the national recreation area

could result in long-term minor to moderate adverse impacts on visitor use and experience by limiting ORV use and preventing some visitors from enjoying certain resources and areas they find important.

Under alternative B, a no-cost permit would be required to operate ORVs in Blue Creek and Rosita Flats. The permit would provide visitors with ORV regulations and information. Permits would be obtained online, at the visitor center, at local shops, or from rangers in the field. The operator would need to sign the permit and keep it with the vehicle, and the permit could be revoked at any time for violation of ORV regulations. Implementing a permit system could have short-term moderate adverse impacts on visitor use and experience, because some visitors may consider the process of obtaining a permit inconvenient. However, long-term beneficial impacts would also result, because it is expected that greater compliance with ORV regulations would lead to an improved visitor experience.

Under alternative B, the establishment of zones and the implementation of a permit system would have beneficial impacts for some visitors by providing a separation of uses, reducing noise impacts in certain areas, improving the safety of ORV use at the national recreation area, and enhancing resource conditions. However, for a minority of visitors, limiting access at Rosita Flats for part or all of the year would result in long-term moderate adverse impacts. The overall impacts of alternative B on visitor use and experience / health and safety would be long term, minor to moderate, and adverse as well as long term and beneficial.

Cumulative Impacts

Past, present, and reasonably foreseeable future actions that would impact visitor use and experience / health and safety under alternative B would be the same as those under alternative A, and impacts would be long term, minor, and adverse. These impacts, when combined with the minor to moderate adverse and long-term beneficial impacts of alternative B, would result in long-term minor to moderate adverse and long-term beneficial cumulative impacts.

Conclusion

Although the establishment of zones and the implementation of a permit system would have adverse impacts for the majority of visitors by requiring visitors to obtain an ORV permit, beneficial impacts would result from the separation of visitor uses, improved safety, and enhanced resource conditions at the national recreation area. A minority of users would experience moderate adverse effects by loss of access to the resource protection zone and temporary loss of the hunting zone in Rosita Flats. Some users could experience long-term negligible to minor adverse impacts because the potential for user conflicts may arise with hunters not using ORVs in the hunting zone. Overall, impacts under alternative B would be long term, minor to moderate, and adverse as well as long term and beneficial for ORV users at the national recreation area. Past, present, and reasonably foreseeable future actions both inside and outside the national recreation area, when combined with the impacts of alternative B, would result in long-term minor to moderate adverse and long-term beneficial cumulative impacts on visitor use and experience / health and safety.

Impacts of Alternative C: Management through Use of a Permit System at Current ORV Use Areas

Under alternative C, the national recreation area would manage ORV use through a permit system as well as through the establishment of use limits. Permits would include a fee, and initially there would be no limit on the number of permits issued. ORV routes and areas would be the same as those under alternative B, except there would be one designated ORV use area in Rosita Flats, instead of two.

Under alternative C, the permit (used for both ORV use areas) would be inexpensive and the fee structure would be similar to other permit fee structures that currently exist in the national recreation area. These permits would be available for purchase through the mail, at park headquarters, online, or at other vendors. A kiosk and "Iron Ranger" could also be used to supply daily permits. These permits would be in sticker form so users would place the permit on the bumper of the vehicle, and permits could be revoked for violation of the ORV regulations. The implementation of a fee-based permit system would result in long-term minor adverse impacts on visitor use and experience from any inconvenience associated with obtaining a permit. However, the fees received from these permits would help create and maintain visitor amenities in the ORV use areas, resulting in overall beneficial impacts on visitor use and experience by enhancing amenities that would not otherwise be available. Additionally, a permit system would help ensure compliance with recreation rules and regulations, resulting in long-term benefits to visitor use and experience / health and safety. Overall, users would be aware of the changes associated with requiring ORV use permits, but these changes would be slight and Rosita Flats and Blue Creek would still be open to ORV use to provide for this experience.

Use limits under alternative C could be developed based on indicators and standards developed through the planning process for the GMP. Criteria would be developed and monitored to determine when resources are being impacted and use limits need to be developed. A monitoring plan would be developed to help describe these studies and how implementation would be achieved. Use limits would help mitigate the adverse impacts of ORV use on national recreation area resources, thus benefiting visitor use and experience. However, long-term minor adverse impacts could result for some ORV users from limited/restricted access.

ORV use would not be allowed between 10:00 p.m. and 6:00 a.m., and headlights would be required for all ORVs after dark. This would benefit visitor safety by reducing the risk of collisions because ORVs would be more noticeable. Equipment requirements would be the same as described for alternative A, with the addition that all ATVs would be required to have a triangular orange flag on top of an 8-foot pole attached to the back of the ORV. The addition of the orange flag would aid users and non-users to more easily identify ORVs, which may be difficult to see due to the terrain. Riders would be required to adhere to the same speed limits as under alternative A, as well as a recommended speed limit of 25 mph on ORV routes and 55 mph on sand bottom flats. The speed limits may affect the experience of some visitors; however, the speed limits would be beneficial to the safety of users and non-users by reducing the likelihood of collisions.

Under alternative C, the national recreation area would provide the same education and outreach as described for alternative B. In addition, an interpretive wayside program would be implemented at Blue Creek that would be funded by the fee permit program. The interpretive wayside program and other education and outreach under alternative C would result in long-term beneficial impacts because recreational users would be more aware of ORV regulations providing for an improved visitor experience.

Camping under alternative C would be allowed in designated camping sites for tent and vehicle camping, as under alternative B. A lower speed limit would be enforced in the area where the camping sites are located and recommended speed limits would be provided in Rosita Flats and Blue Creek. Fire pits and designated campsites would be provided using funds from the permit system. Outside designated camping areas at Rosita Flats, tent camping would be permitted only in areas with no vegetation or on previously disturbed vegetation. Visitors would be required to walk to their campsites in these tent camping areas because vehicles would be required to be parked off the vegetation along designated ORV routes or areas. Pit toilets, fire rings, and picnic tables in designated camping areas would be provided on a phased-in basis. Other amenities that may be added, based on funding, include shade shelters, emergency call stations, and additional kiosks and bulletin boards for visitor information, all resulting in long-term

beneficial impacts on visitor use and experience / health and safety. Law enforcement levels would be increased and additional law enforcement resources would be provided from permit fee funds.

The proposed permit fee, while being an additional cost to visitors, would create more visitor amenities that would enhance visitor use and experience at the national recreation area. Additionally, a greater presence of law enforcement and the rangers' ability to revoke ORV permits may cause visitor violations and illegal activity to decrease. Visitor health and safety would further benefit from additional ORV requirements (e.g., headlights, speed limits, and orange flags for ATVs), because they would aid in visibility for non-users and users alike. As a result, impacts on visitor use and experience / health and safety under alternative C would be long term, minor, and adverse, because users would need to adjust to a user fee, as well as long term and beneficial from enhanced safety and additional amenities.

Cumulative Impacts

Past, present, and reasonably foreseeable future actions that would impact visitor use and experience / health and safety under alternative C would be the same as those under alternative A, and impacts would be long term, minor, and adverse. These impacts, when combined with the long-term minor adverse and long-term beneficial impacts of alternative C, would result in long-term minor adverse and long-term beneficial cumulative impacts.

Conclusion

The proposed permit fee, while being an additional cost to visitors, would create more visitor amenities that would enhance visitor use and experience at the national recreation area. Additionally, a greater presence of law enforcement, as well as the rangers' ability to revoke ORV permits, may cause visitor violations and illegal activity to decrease. As a result, impacts under alternative C would be long term, minor, and adverse, because users would need to adjust to a user fee, as well as long term and beneficial from enhanced safety and additional amenities, ORV rules, and education. Past, present, and reasonably foreseeable future actions both inside and outside the national recreation area, when combined with the impacts of alternative C, would result in long-term minor adverse and long-term beneficial cumulative impacts on visitor use and experience / health and safety.

Impacts of Alternative D: Management through Use of a Zoning and Permitting System at Current ORV Use Areas

Under alternative D the national recreation area would, in part, base the designation of routes and areas on a zoning system. One purpose of the zones would be the separation of visitor uses that have the potential to conflict with one another, similar to the system under alternative B. In addition, a fee -permit system would be instituted that would allow the national recreation area to provide additional enforcement and amenities in the ORV use area, but no use limits would be established.

As described for alternative B, the implementation of a zoning system would have long-term beneficial effects by providing for a separation of uses and reducing user conflicts. However, some of the zones, such as the hunting zone that could limit ORV use for up to two months out of the year, or the resource protection zone east of Bull Taco Hill that would restrict the use of ORVs with a wheel width greater than 64 inches, would restrict ORV use in large areas of Rosita Flats. These restrictions would likely have long-term moderate adverse impacts on visitor use and experience because visitors would be highly aware of the effects associated with zoning, and some visitors may be prevented from enjoying park resources they find important. However, restricting ORV use in the hunting zone would benefit visitor health and safety by keeping non-hunters safe from hunting activities. The use of ORVs by hunters could result in long-term negligible to minor adverse impacts because the potential for user conflicts may arise with

hunters not using ORVs. Overall, the creation of a hunting zone would result in long-term minor to moderate adverse impacts as well as beneficial impacts on visitor use and experience / health and safety.

Prohibiting ORV use in the camping zone would likely be overall beneficial for visitors, because the associated noise and safety risks of ORV use would not be a concern for campers. The use of the camping zone would have long-term minor adverse impacts and beneficial impacts on visitor use and experience, as well as long-term beneficial impacts on visitor safety. As described for alternative B, a beginner zone would be established at Rosita Flats under alternative D, resulting in long-term beneficial impacts on visitor use and experience / health and safety. Having a zone that requires low speeds could aid riders in feeling more comfortable learning without feeling intimidated by more skilled riders operating at faster speeds.

At Rosita Flats, the road leading to the designated camping area would be improved, but not paved, to assist in the evacuation of visitors during rainstorms when the area becomes muddy. The improved road would be beneficial to visitors and their safety in the event of a storm.

Alternative D would require ORVs entering the national recreation area (including vehicles transported to the national recreation area on a trailer) to have a permit, as described for alternative C. This permit would be inexpensive and the fee structure would be similar to other permit fee structures that currently exist in Lake Meredith, and would be determined outside of this plan/EIS. The permit could lead to long-term minor adverse impacts because users would be aware of the changes and would be required to pay a minimal fee.

The proposed permit fee, while being an additional cost to visitors, would fund more visitor amenities that would enhance their visits to the national recreation area. The money received from the fees would be used to provide potential additional amenities at Rosita Flats and Blue Creek, including pit toilets, fire rings, and picnic tables. Amenities would be provided on a phased-in basis, based on the level of use the added amenities receive, which would be an indication of demand for additional amenities. Depending on funding and demand, other potential amenities could include shade shelters, emergency call stations, and additional information kiosks or bulletin boards. These improvements and amenities would provide long-term beneficial effects for visitor use and experience. Additionally, a greater presence of law enforcement and the rangers' ability to revoke ORV permits may cause visitor violations and illegal activity to decrease. As a result, impacts on visitor use and experience / health and safety under alternative D would be short term, minor, and adverse, because users would need to adjust to a user fee, but long term and beneficial from the additional amenities, provided education, and reduced illegal activities.

As described for alternative C, operation of ORVs would not be allowed between 10:00 p.m. and 6:00 a.m. and headlights would be required for all ORVs after dark, resulting in long-term benefits to visitor safety by reducing the risk of vehicle collisions. Also similar to alternative C, ATVs would be required to have a triangular orange flag on top of an 8-foot pole attached to the back of the ORV, allowing both users and non-users to more easily identify ORVs which may be difficult to see due to the terrain. Riders would be required to adhere to the same speed limits as under alternative C, resulting in long-term benefits to the safety of users and non-users by reducing the likelihood of collisions.

Education and outreach efforts at Blue Creek and Rosita Flats would be the same as those under alternative B, resulting in long-term beneficial impacts on visitor use and experience / health and safety. In addition, fences and signs would be posted at Rosita Flats to better define the ORV-use boundary, which would limit current ORV use but enhance visitor safety. Similar to alternative C, an interpretive wayside program could be implemented at Blue Creek as funding from the permit fees allows. The wayside program could be expanded based on the level of visitor interest and if funding is available. If implemented, this program would result in long-term beneficial impacts on visitor use and experience /

health and safety because visitors would be more aware of the natural and historic resources in the national recreation area.

The establishment of zones would have beneficial impacts for some users by providing a separation of uses, reducing noise in certain areas, improving the safety of ORV use, and enhancing resource conditions. However, for a minority of visitors, limiting ORV access would result in long-term minor to moderate adverse impacts. The proposed permit fee, while being an additional cost to visitors, would fund more visitor amenities that would enhance visitor use and experience at the national recreation area. Additionally, a greater presence of law enforcement and the rangers' ability to revoke ORV permits may cause visitor violations and illegal activity to decrease. The overall impacts of alternative D on visitor use and experience / health and safety would be long term, minor to moderate, and adverse as well as long term and beneficial.

Cumulative Impacts

Past, present, and reasonably foreseeable future actions that would impact visitor use and experience / health and safety under alternative D would be the same as those under alternative A, and impacts would be long term, minor, and adverse. These impacts, when combined with the long-term minor to moderate adverse and long-term beneficial impacts of alternative D, would result in long-term minor to moderate adverse and long-term beneficial cumulative impacts.

Conclusion

The proposed permit fee, while being an additional cost to visitors, would fund more visitor amenities that would enhance visit use and experience at the national recreation area. Additionally, a greater presence of law enforcement and the rangers' ability to revoke ORV permits may cause visitor violations and illegal activity to decrease, which would have beneficial effects on visitor health and safety. Additionally, the establishment of zones and implementation of a permit system would have beneficial impacts for the majority of visitors by separating uses, implementing rules (speed limits, headlights, and orange flags for ATVs), education, improving safety, and enhancing resource conditions at the national recreation area. Overall, impacts under alternative D would be long term, minor to moderate, and adverse, because users would need to adjust to a user fee and a zoning system, and long term and beneficial due to improvements to visitor use and experience / health and safety. Past, present, and reasonably foreseeable future actions both inside and outside the national recreation area, when combined with the impacts of alternative D, would result in long-term minor to moderate adverse and long-term beneficial cumulative impacts on visitor use and experience / health and safety.

LAKE MEREDITH NATIONAL RECREATION AREA MANAGEMENT AND OPERATIONS

GUIDING REGULATIONS AND POLICIES

Direction for management and operations at Lake Meredith is set forth in the national recreation area's master plan (NPS 1973) and strategic plan (NPS n.d.a) and the Superintendent's Compendium (NPS 2008d). Since the establishment of the ORV special regulation 36 CFR 7.57, ORV use at the national recreation area has changed considerably, in intensity as well as in the types of ORVs used. As stated in the 2007 *Interim OHV Use Plan* (NPS 2007a), given the length of time that ORV use has been occurring at the national recreation area, it is hard to measure the level of impacts on resources, because there is no distinct baseline to measure against.

The master plan identified ORV travel and trail-biking as activities that occur at the national recreation area; however, it focused mainly around water-based uses and not on the development of land-based uses. The plan called for the need to control various visitor uses as user demand increased, noting that some areas should be designated for ORV use. The strategic plan identifies goals pertaining to staffing, fiscal planning, and infrastructure in the national recreation area. The plan also addressed long-term goals that address appropriate "servicewide" goals, as well as park-specific outcomes.

Under the Superintendent's Compendium, the national recreation area set forth the closure and public use limits the staff are required to enforce. Additionally, 16 USC 3 and 36 CFR 1(1–7) describe permit requirements and other restrictions that are imposed under the discretionary authority of the Superintendent. Regulations in the compendium related to ORV use set out areas where ORVs may be used and provide the authority for area closures. The compendium also addresses restrictions on hunting, an activity that is permitted in Blue Creek and Rosita Flats. In 2008, the compendium required recreation fees for lake use (vessels), but not for ORV use.

METHODOLOGY, ASSUMPTIONS, AND INTENSITY DEFINITIONS

National recreation area management and operations, for the purpose of this analysis, refers to the efforts of NPS staff to maintain and administer resources and provide for an effective visitor experience. This includes an analysis of the projected need for staff time and materials in relation to ORV use under each of the alternatives, as well as the various funding mechanisms available to implement these alternatives. The analysis also considers trade-offs for staff time or the budgetary needs required to accomplish the proposed alternatives and discusses each alternative in terms of its impacts on the Interpretation Division, Visitor and Resource Protection Division, Resource Management Division, Facilities Management Division and Southern Plains Fire Group at the national recreation area. Because there are no impacts anticipated for the Park Management and Administrative Division, they are not discussed further in this plan/EIS.

National recreation area staff members from each of the divisions participated in the planning team and were consulted regarding expected staffing and funding needs under each alternative. The impact analysis is based on the current description of national recreation area operations as presented in the "Affected Environment" chapter. The required level of effort is discussed in terms of "full-time equivalents," which represent the hours worked by staff. One full-time equivalent equals 40 hours in one week, which could represent one person working 40 hours a week or two part-time staff members working 20 hours a week each.

The following intensity definitions for evaluating impacts on national recreation area management and operations were determined and applied to adverse impacts.

Negligible: National recreation area operations would not be impacted or the impact would not have a noticeable or measurable impact on the national recreation area or agency operations.

Minor: Impacts would be noticeable and would result in a measurable, but small, change in the national recreation area operations. Any required changes in the national recreation area staffing and funding could be accommodated within normal budget cycles and expected annual funding without appreciably affecting other operations in the national recreation area. Current levels of funding and staffing would not be reduced or increased, but priorities may need to be changed.

Moderate: Impacts would be readily apparent and would result in a substantial change in the national recreation area operations that would be noticeable to staff and the public. Required changes in the national recreation area staffing and/or funding could not be accommodated within expected annual funding and would measurably affect other operations in the national recreation area by shifting staff and funding levels between operational divisions. Increases or decreases in staff and funding would be needed or other national recreation area operations would have to be reduced and/or priorities changed.

Major: Impacts would be readily apparent and would result in a substantial change in the national recreation area operations that would be noticeable to staff and the public and would be markedly different from existing operations. These changes in the national recreation area staffing and/or funding could not be accommodated by expected annual funding and would require the national recreation area to readdress its ability to sustain current national recreation area operations. Increases or decreases in staff and funding would be needed and/or other national recreation area programs would have to be substantially changed or eliminated.

Duration: Short-term effects would last one fiscal year or less.

Long-term effects would continue beyond one fiscal year indefinitely into the future.

Study Area

The study area for direct impacts related to national recreation area management and operations is the ORV use areas of Blue Creek and Rosita Flats. The study area for cumulative impacts is within the national recreation area boundary.

IMPACTS OF ALTERNATIVE A: NO ACTION – CONTINUATION OF CURRENT MANAGEMENT

Under alternative A, the management of ORV use would continue per the requirements of the 2007 *Interim OHV Use Plan* (NPS 2007a), the regulations in 36 CFR 7.57, and regulations contained in the Superintendent's Compendium (NPS 2008d). All routes and areas not closed under these requirements would remain open to ORV use under alternative A.

Approximately 275 acres of area would be permitted for ORV use at Blue Creek, from cutbank to cutbank. Routes at Blue Creek generally stay within 0.5 mile of the creek. At Rosita Flats, 1,740 acres of area would be permitted for ORV use below the 3,000-foot elevation line. ORV use at Rosita Flats is in the Canadian River bed as well as the surrounding hills, in some cases out to a mile or more. Use outside the authorized areas is officially not permitted, although it is difficult for ORV users to determine the exact location of the 3,000-foot contour line. Staffing would remain at three people with an approximate operating cost of $270,000, which is 90 percent of the national recreation area's total $300,000 staffing costs.

Under alternative A, no new facilities or roads would be constructed and the facilities management division would continue to maintain the infrastructure that supports ORV use at the same funding level. Camping is permitted at Blue Creek and Rosita Flats without designated camping areas. Campfires are regulated under the Superintendent's Compendium. When the area is under high fire danger, campfires

are prohibited, following county burn ban regulations. The facilities management division would continue to maintain picnic tables and pit toilets at Blue Creek. Trash pickup would continue on a daily basis from mid-April to September and as needed (two to three times per week) from October to April. At Rosita Flats, picnic tables and trash receptacles would continue to be emptied once a week. Two vehicles would be allotted for trash cleanup around the national recreation area. Trash bags would continue to be provided to visitors on high-use weekends. The yearly cost of maintaining or replacing these amenities would be $8,000 per year. This would include maintaining or replacing trash cans, signs, tables, etc.

The national recreation area currently does not offer visitor interpretation at Blue Creek or Rosita Flats. However, at both ORV use areas, bulletin boards are posted with campground rules and regulations and other national recreation area information. The national recreation area would continue education through visitor contact with rangers, maintenance staff, and other park staff and through on-site educational opportunities. A site bulletin regarding ORV use is available at headquarters and at ranger stations. A larger -scale bulletin board is available at Blue Creek and Rosita Flats for the public to view. Both signs are currently out of date and need to be updated.

Law enforcement staffing levels of seven people would continue enforcement of existing ORV regulations and resource protection measures at current staffing and funding levels. Under alternative A, methods of enforcement would include patrolling Rosita Flats, with more patrols at Blue Creek due to the remote location of Rosita Flats. The national recreation area would also continue the use of interagency law enforcement at large events such as the Sand Drags.

Under this alternative, no NPS vehicle permit would be required to operate an ORV at either ORV use area. A decal is required by the state of Texas for all motorized vehicles, but this is not administered by Lake Meredith. There would be no limitations on the times when vehicles would operate and no new speed limits would be implemented. Additionally, no user capacity would be designated in the Rosita Flats and Blue Creek ORV use areas.

Regularly scheduled maintenance activities would be conducted for facilities and would include infrastructure maintenance and upkeep, standard repairs to roads and concrete ramps, regular park facility maintenance, and monitoring the condition of the McBride House for signs of degradation. Yearly maintenance costs (including fuel for these activities) are approximately $37,000.

The implementation of alternative A would result in no changes to the current management of motorized vehicles in the national recreation area. Therefore, the impacts of managing motorized vehicle access under the no-action alternative would be long term, negligible, and adverse.

Cumulative Impacts

The NPS has started an interactive planning process to develop a GMP that would articulate the long-term vision that would guide the management of the national recreation area for the next 15 to 20 years. The GMP lays the groundwork for the more detailed planning and day-to-day decision making that will follow. The GMP would provide for public use at the national recreation area, identify development and management actions that satisfy recreational needs, and guide all future recreation development and management at the national recreation area. Actions arising from this plan have the potential to increase resource protection and improve visitor use/experience. Short-term impacts on management and operations at the national recreation area would be minor to moderate and adverse, because additional time and funding would be required to implement the plan. However, over the long term, the impacts of implementing the GMP would be beneficial, because the plan would guide management and potentially eliminate or reduce current management issues.

Past, present, and reasonably foreseeable future actions that have the potential for cumulative impacts under alternative A would include the implementation of the 1996 Resource Management Plan, invasive species removal, implementation of the 1998 Wildland Fire Management Plan, and the 2002 Oil and Gas Management Plan. All management plans and actions must be consistent with law, NPS policy and standards. The resource management plan provides goals for the national recreation area that address enhancing recreational opportunities managed by partners and ensuring organizational effectiveness. Additionally, the resource management plan guides treatment for saltcedar and other nonnative plants, which will continue to be managed by the Resource Management Division. The fire management plan defines management of wildland fire and outlines a prescribed fire program for the national recreation area. As stated in the "Lake Meredith National Recreation Area Management and Operations" section in chapter 3, the prescribed fire program would be controlled by the Southern Plains Fire Group, which is responsible for the implementation of prescribed fires in seven parks. The implementation of the oil and gas management plan likely resulted in adverse impacts on national recreation area resources and operations, because an increase in staff and funding was needed during and after construction. All of these plans have resulted in, and would continue to result in, short- and long-term negligible to minor adverse impacts on management and operations from the additional funding and staff required for implementation. However, long-term beneficial impacts would also result, because all the plans would guide current and future management in the national recreation area.

Throughout the national recreation area, regularly scheduled maintenance activities are conducted to maintain facilities and ensure visitor health and safety. These activities have involved infrastructure maintenance and upkeep, such as ensuring water quality and access. Standard repairs to roads and concrete ramps occur on a regular basis. Regular park facility maintenance is continually occurring at Lake Meredith. To ensure that historic structures remain in good condition, the NPS continually monitors the condition of the McBride House to ensure that if any degradation occurs, funding can be sought to stabilize and repair the structure. The potential for impacts on soils, vegetation, park operations, and visitor experience exists from maintenance activities. The national recreation area coordinates with adjacent law enforcement in case of a fire or for large events (such as the Sand Drags).

The annual Sand Drags event, held every February, attracts thousands of spectators and hundreds of motorcycles, four wheelers, sand rails, and river buggies. Although the Sand Drags is private and is held outside the national recreation area, there is a substantial increase in visitor use at Lake Meredith associated with this annual event. This dramatic increase in visitation requires greater law enforcement and park management services, resulting in short-term minor adverse impacts on management and operations. Additionally, the increased intensity of ORV use has the potential to adversely affect natural resources, potentially resulting in further adverse effects on management and operations at the national recreation area.

The Texas Off-Highway Vehicle Program encourages the responsible use of OHVs. The program is also designed to provide funding to develop more OHV friendly recreational areas. Under Texas State Law, an OHV decal is required for all individuals operating an OHV on public land in Texas, or lands that have been purchased with TPWD OHV grants, and is valid for a one-year period. The state of Texas requires that all OHV users purchase and display the decal prior to operating the vehicle on public lands, including in the national recreation area. The program could result in short-term minor adverse impacts because users would be required to purchase the decals. However, long-term beneficial effects could result because revenue generated by the sale of the decal would be used to help municipalities, counties, state or federal agencies, and non-profit corporations to create new or improve existing OHV use areas in national recreation areas in Texas.

Hunting is a popular activity at Lake Meredith, with game species including dove, turkey, quail, duck, goose, and white-tailed and mule deer. The use of ORVs has been a popular means of transportation for

visitors engaging in hunting in the national recreation area. Park rangers ensure that hunting occurs in correctly zoned areas, which results in safety for other visitors using the national recreation area for non-hunting-related activities. Allowing ORVs into hunting areas may have adverse effects for walk-in hunters; the noise and disturbances from ORVs could impact the success of hunters. Impacts on hunters who use ORVs to access hunting areas could be beneficial because they would not be required to walk into hunting areas. As a result, there would be long-term negligible to minor adverse or long-term beneficial impacts on hunters, depending on whether they use ORVs to enter hunting areas.

Permits are required to boat at Lake Meredith. Permits can be purchased at park headquarters in Fritch, the marina at Lake Meredith, or area bait shops. A one-day permit costs $4; a three-day permit, $10; and an annual permit, $40. Permits are half price for holders of the Golden Age or Golden Access Pass. The fees from these permits provide money for the national recreation area to create and maintain amenities for visitor use, resulting in long-term beneficial impacts on management and operations.

Although the plans and projects described above could result in both adverse and beneficial effects on operations and management, the overall parkwide impacts of past, present, and foreseeable future actions would be long term, minor, and adverse. In combination with the long-term negligible adverse impacts of alternative A, overall cumulative impacts on national recreation area operations and management would be parkwide, long term, negligible to minor, and adverse.

Conclusion

Staffing and funding levels would continue at the same levels as currently managed. The total approximate cost of implementing alternative A would be $315,000. Actions under alternative A would result in long-term negligible adverse impacts because there would be no noticeable change in national recreation area management and operations. Past, present, and reasonably foreseeable future actions, when combined with the impacts of implementing alternative A, would result in parkwide long-term negligible to minor adverse impacts on national recreation area management and operations.

IMPACTS OF ALTERNATIVE B: ZONE SYSTEM – SEPARATION OF VISITOR USES, WITH A PERMIT FOR EDUCATIONAL PURPOSES

Under alternative B, the national recreation area would, in part, base the designation of routes and areas on a zoning system, one purpose of which would be the separation of visitor uses that have the potential to conflict with one another. Established zones could include camping -only zones, hunting zones, resource protection zones, low-speed zones, and beginner zones.

The established zones under alternative B would be patrolled by rangers to make sure visitors use zone areas appropriately. A camping zone would be established with a recommended speed limit of 15 mph. No additional amenities would be provided beyond what is described under alternative A.

Recreational ORV use would temporarily be suspended for approximately two to eight weeks (up to two months) during rifle hunting season, and rangers would patrol to ensure there is no recreational ORV use. A new 20 mph low-speed beginner zone would be implemented at Rosita Flats. At Blue Creek a new low-speed zone for family use on either side of the FM 1913 bridge would be developed. Finally, a resource protection zone would be designated east of Bull Taco Hill where ORVs with a wheel width greater than 64 inches would not be permitted. An ORV parking area and fencing would be installed nearby to provide pedestrian access. The cost of building and purchasing posts and cables for fencing would be approximately $250,000. Yearly maintenance and upkeep costs, including fuel for transportation, would be approximately $154,000. This would include maintenance to the proposed fence under this alternative and other actions as described under alternative A. In ORV routes and areas, a recommended speed limit

of 35 mph on ORV routes and 55 mph on sand bottom flats would be added. Enforcement of the zones would increase law enforcement responsibilities because more frequent patrols would be required. In addition, maintenance staff would have increased staff responsibilities from the installation and maintenance of fencing.

The national recreation area would hire a new facility employee at a cost of $45,000 per year and two new law enforcement employees at $200,000 per year. Two new vehicles would be purchased for law enforcement purposes at an approximate cost of $17,000 each. Additionally, one new maintenance vehicle would be purchased for approximately $9,000. The hiring of new employees and purchasing of three new vehicles would result in long-term beneficial impacts because more staff would help the national recreation area's operations run more smoothly and additional vehicles would provide the opportunity for staff to visit more areas of the national recreation area. However, the additional staffing requirements may not be covered by existing funding sources, requiring a shift in staffing or a change in priorities, which would result in long-term moderate adverse impacts.

Under alternative B, a no-cost permit would be required for access to ORV use areas. The permit would consist of a piece of paper or brochure and would contain ORV regulations and information, and could be revoked for violation of the ORV regulations. The permit would need to be signed by the operator and kept in the vehicle. The implementation of an ORV permit would result in additional staff time requirements for both the national recreation area's administrative staff to issue the permit, and the law enforcement staff needed to check users for the permit.

At Blue Creek and Rosita Flats a larger -scale bulletin board would be available for the public to view. The national recreation area would provide safety literature, a "tread lightly" pamphlet, and trash bags to users. ORV and other rules could be printed on the trash bags. Rangers would actively seek out visitors and provide them with safety literature or trash bags, which would increase visitor contact. More educational signs would be posted in ORV use areas. The national recreation area would provide ORV safety programs in local schools, attend the Fritch "Howdy Neighbor Day," and include more education about ORV use at community events. ORV education would be added to the already established "Water Safety Day." The national recreation area would provide signs to local businesses containing the national recreation area's use area map and rules. A volunteer group would be established to help clean up ORV use areas and other efforts. Park interpretive staff would be responsible for implementing these activities and would need to devote more time to education related to ORV management, which could result in short- and long-term minor adverse impacts on management and operations from the additional funding required for implementation. However, these educational efforts would be expected to increase compliance and reduce the need for law enforcement staff, resulting in long-term beneficial impacts on management and operations.

Under this alternative, the facilities management division would provide picnic tables and pit toilets and trash pickup at Blue Creek and Rosita Flats. The implementation of these improvements would cost approximately $1.1 million.

Rules and regulations for ORV use at Blue Creek and Rosita would be enforced by park law enforcement officers. To track noncompliance in ORV use areas and routes, aerial imagery could be used. National recreation area staff would post signs prohibiting ORV use in isolated pools during times of drought. Additionally, if ORV use outside designated routes and areas is found, this could cause routes and areas to be closed temporarily, resulting in increased staffing needs for resource management staff. Park rangers would also measure ORVs for a 96 dBA limit. The national recreation area would also continue the use of interagency law enforcement at large events such as the Sand Drags.

Alternative B would lead to increased ranger patrols as well as increased law enforcement requirements such as temporarily closing areas, patrolling zones, and checking for permit compliance, which could lead to the need for more staff members. In addition, the increase in ORV education would result in more demands on the interpretive staff's time and the installation of fences and amenities would increase requirements for those in facilities management. However, the increase in park patrols and education could decrease the number of visitor violations, resulting in long-term beneficial impacts on these divisions. Therefore, impacts under alternative B in the national recreation area would be long term, minor to moderate, and adverse, with impacts more moderate than minor because a fee permit system would not be in place to help offset additional expenses. Impacts would be apparent and could result in a substantial change in the national recreation area's staffing, either requiring additional funding or requiring shifting of responsibilities in the national recreation area.

Cumulative Impacts

The effects of past, present, and reasonably foreseeable future actions on national recreation area operations and management would be the same as described for alternative A: long term, minor, and adverse. In combination with the long-term minor to moderate adverse impacts of alternative B, overall cumulative impacts on operations and management would be long term, minor to moderate, and adverse.

Conclusion

The implementation of alternative B would require additional efforts from park staff. Law enforcement staff levels would be increased to ensure compliance with the additional regulations under alternative B. Additionally, there would be an increase in responsibilities for the interpretation and resource management staff. The total approximate cost of implementing alternative B would be $1,775,000. The implementation of alternative B would result in long-term minor to moderate adverse impacts on national recreation area management and operations, with impacts more moderate than minor because a fee permit system would not be in place to help offset additional expenses. Past, present, and reasonably foreseeable future actions, when combined with the impacts of implementing alternative B, would result in long-term minor to moderate adverse impacts.

IMPACTS OF ALTERNATIVE C: MANAGEMENT THROUGH USE OF A PERMIT SYSTEM AT CURRENT ORV USE AREAS

Under alternative C, the national recreation area would manage ORV use through a permit system and through the establishment of use limits. Permits would include a fee, and initially there would be no limit on the number of permits issued. ORV routes and areas would be the same as those under alternative B, except there would be one designated ORV use area in Rosita Flats instead of two.

At Rosita Flats ORV use would be redefined. The areas south of the river (currently denuded of vegetation) would be open and designated access points would not be established at the riverbed area. Under this alternative, a fee permit would be required to access ORV use areas. The price of the permit would be based on existing use permits at the national recreation area. This plan/EIS will not set or determine the cost of the fee permit, but it would likely be similar to the current boat permit ($4 per day, $10 for three days, and $40 for an annual permit). The same permit would be allowed at both Blue Creek and Rosita Flats. While there would be no initial limits on the number of permits issue, use limits could be developed based on indicators and standards developed during the GMP process. Permits would be available for purchase at headquarters, by mail, online, or at other vendors, and could be revoked for violation of ORV regulations. A kiosk and "Iron Ranger" could be used to supply daily permits. The permit would be in sticker form and would be placed on the bumper of the ORV. The permit holder would also receive a national recreation area regulations brochure. Money collected from the fee permit

would be used to fund education/interpretation programs, camping amenities, and law enforcement activities. The implementation of an ORV permit would result in additional staff requirements for national recreation area administrative staff to issue the permit and law enforcement staff to check that users have the permit. The use of an "Iron Ranger" would require daily attendance to ensure fees are collected and permits are replenished, which would require more frequent time-consuming trips to Rosita Flats by national recreation area staff.

Under alternative C, the national recreation area would hire a new facility employee at a cost of $45,000 per year, a new law enforcement employee at $100,000 per year, and a new administrative assistant at $35,000 per year. These new employees would be beneficial as they would aid in current operations and would help the national recreation area to run more smoothly. A new law enforcement vehicle would be purchased at an approximate cost of $17,000. This vehicle could be used to make additional trips to Rosita Flats or to patrol other parts of the national recreation area. Additionally, one new maintenance vehicle would be purchased for approximately $9,000. The hiring of new employees and purchasing of new vehicles would result in long-term beneficial impacts because more staff would help the national recreation area's operations run more smoothly and additional vehicles would help staff be able to visit more areas of the national recreation area. Although there would be beneficial impacts, the associated costs could result in short- and long-term minor to moderate adverse impacts on management and operations because some shifts in staffing may result to address ORV management needs.

Under alternative C, park staff would install fencing and signs around the ORV use boundary at Rosita Flats to better define use in the area, requiring additional time for installation and maintenance by facility management staff. The cost of implementation and materials would be approximately $200,000. In addition to the educational programs described under alternative B, an interpretive wayside program would be initiated at Blue Creek and expanded as necessary. The cost of the program would be covered by the permit fee; however, the general overall increase in educational programs would increase responsibilities for park interpretive staff.

Camping areas would be designated as tent and vehicle camping only with lower speed limits, as described under alternative B. Pit toilets, fire rings, and picnic tables in the designated camping areas would be added on a phased-in basis. While these amenities would be a high priority, other amenities could include shade shelters, emergency call stations, and additional kiosks or bulletin boards for more information. The installation and maintenance of additional amenities, although in part covered by fees from the permit system, would increase responsibilities for the facilities management division of the national recreation area. Yearly maintenance and upkeep costs (including fuel) would be approximately $37,000. This would include maintenance to the proposed fence under this alternative and other actions as described under alternative A. The yearly cost of new amenities would be $8,000 per year. This would include new trash cans, signs, tables, and more.

Rules and regulations for ORV use at Blue Creek and Rosita Flats would be enforced by park law enforcement officers, as described under alternative B. In addition, the national recreation area would possibly have law enforcement staff located closer to Rosita Flats. As with alternative B, this would require additional time from law enforcement staff, possible new staff to be hired, as well as accommodations to be found closer to Rosita Flats.

Alternative C would lead to increased ranger patrols, as well as increased law enforcement requirements such as temporarily closing areas, patrolling zones, and checking for permit compliance, which could lead to the need for more staff members. In addition, the increase in ORV education would result in more demands on the interpretive staff's time, and the installation of fences and amenities would increase requirements for those in facilities management. However, the increase in park patrols and education could decrease the number of visitor violations, resulting in long-term beneficial impacts on these

divisions. Although there would be an increase in demands on staff time, alternative C would offset these additional staffing requirements and funds for amenities, in part, by the permit fees for ORV use.

Overall, impacts under alternative C in the national recreation area would be long term, minor to moderate, and adverse, with impacts mostly being minor. Impacts would be apparent and could result in a substantial change in the national recreation area's staffing, either requiring additional funding, which would in part be offset by the permit fees, or requiring shifting of responsibilities in the national recreation area.

Cumulative Impacts

The effects of past, present, and reasonably foreseeable future actions on national recreation area operations and management would be the same as described for alternative A and would be long term, minor, and adverse. In combination with the long-term minor to moderate adverse impacts of alternative C, overall cumulative impacts on operations and management would be long term, minor to moderate, and adverse.

Conclusion

The implementation of alternative C would require additional efforts from national recreation area staff in the areas of law enforcement, resource management, interpretation, and facilities management, which would in part be offset by fees from the ORV permit. The total approximate cost of implementing alternative C would be $442,500 and would be offset, in part, by money collected in the proposed fee system. The implementation of alternative C would result in long-term minor to moderate adverse impacts, which would be more minor than moderate due to the funding from the permit system. Past, present, and reasonably foreseeable future actions, when combined with the impacts of implementing alternative C, would result in long-term minor to moderate adverse cumulative impacts.

IMPACTS OF ALTERNATIVE D: MANAGEMENT THROUGH USE OF A ZONING AND PERMITTING SYSTEM AT CURRENT ORV USE AREAS

Under alternative D, the national recreation area would, in part, base the designation of routes and areas on a zoning system, one purpose of which would be the separation of visitor uses that have the potential to conflict with one another, similar to the system under alternative B. Like under alternative C, a fee permit system would be instituted that would allow the national recreation area to provide additional enforcement and amenities in the ORV use area, but no use limits would be established. Under this alternative, a fee permit would be required for access to the ORV use areas. As described under alternative C, the price of the permit would not be determined in this plan/EIS but would be based on existing use permits at the national recreation area (such as boating fees, which are $4 per day, $10 for three days, or $40 per year) and the same permit would be valid at both Blue Creek and Rosita Flats. Permits would be available for purchase at headquarters, by mail, online, or at other vendors, and could be revoked for violation of ORV regulations. A kiosk and "Iron Ranger" could be used to supply daily permits, which would be in decal form and would be placed on the bumper of the ORV. The permit holder would also receive a national recreation area regulations brochure. As stated under alternative C, the implementation of an ORV permit would result in additional staff time requirements for both administrative and law enforcement staff. Therefore, the implementation of a fee program could possibly lead to short-term minor adverse impacts. However, long-term impacts would be beneficial because fees received from this permit would help fund education/interpretation programs, camping amenities, and law enforcement activities.

Under alternative D, hired staff and vehicle purchases would be the same as under alternative C. The hiring of new employees and purchasing of new vehicles would result in long-term beneficial impacts because additional staff and vehicles would help the national recreation area operations run more smoothly and enable staff to visit more areas of the national recreation area. Changes in current staffing and responsibilities would not be anticipated, because the workload would be more evenly distributed.

Under alternative D, park staff would install fencing and signs around the ORV use boundary at Rosita Flats to better define use in the area, requiring additional time for the installation and maintenance by facility management staff. The cost of fencing and sign materials would be approximately $250,000. Fencing and signs would result in long-term benefits to management and operations because they would better define the ORV use boundary and help park staff ensure that users respect the boundary. Short-term adverse impacts would be minor to moderate because the cost of building and purchasing fencing materials would be $250,000; however, long-term impacts would be beneficial because the fencing and signs would help park staff enforce the boundaries of use areas within the national recreation area.

In addition to the educational programs described under alternative C, an interpretive wayside program would be initiated at Blue Creek and expanded as necessary. The cost of the program would be covered by the permit fee; however, the general overall increase in educational programs would increase responsibilities for park interpretive staff.

Camping areas would be designated as tent and vehicle camping only with lower speed limits, as described under alternative C. Pit toilets, fire rings, and picnic tables in the designated camping areas would be added on a phased-in basis. While these amenities would be a high priority, other amenities could include shade shelters, emergency call stations, and additional kiosks or bulletin boards for more information. An estimated $1.1 million would be allotted to purchase these amenities. The installation and maintenance ($154,000 allowance) of additional amenities, although in part covered by fees from the permit system, would increase responsibilities for the facilities management division of the national recreation area.

Similar to alternatives B and C, rules and regulations for ORV use at Blue Creek and Rosita Flats, including a zoning system, would be enforced by park law enforcement officers and it is possible that law enforcement staff would be located closer to Rosita Flats. This would require additional time from law enforcement staff, as well as accommodations closer to Rosita Flats.

Alternative D would lead to increased ranger patrols and the hiring of a new law enforcement officer, as well as increased law enforcement requirements such as temporarily closing areas, patrolling zones, and checking for permit compliance. In addition, the increase in ORV education would result in minor long-term demands on the interpretive staff's time, and the installation of fences and amenities would increase short-term requirements for those in facilities management. However, the increase in park patrols and education could decrease the number of visitor violations, resulting in long-term beneficial impacts through money received from citations. Although there would be an increase in demands on staff time, alternative D would offset these additional staffing requirements and funds for amenities, in part, by the ORV use permit fees.

Overall, impacts under alternative D in the national recreation area would be long term, minor to moderate, and adverse. Impacts would be apparent and could result in a substantial change in the national recreation area's staffing, either requiring additional funding, which would in part be offset by the permit fees, or requiring the shifting of responsibilities in the national recreation area.

Cumulative Impacts

The effects of past, present, and reasonably foreseeable future actions on national recreation area operations and management would be the same as described for alternative A: long term, minor, and adverse. In combination with the long-term minor to moderate adverse impacts of alternative D, overall cumulative impacts on management and operations would be long term, minor to moderate, and adverse.

Conclusion

The implementation of alternative D would require additional efforts from park staff in the area of law enforcement, which would in part be offset by fees from the ORV permit. The total approximate cost of implementing alternative D would be $1,775,000. The implementation of alternative D would result in long-term minor to moderate adverse impacts, which would be more minor than moderate due to the funding from the permit system. Past, present, and reasonably foreseeable future actions, when combined with the impacts of implementing alternative D, would result in long-term minor to moderate adverse cumulative impacts.

IRREVERSIBLE OR IRRETRIVEABLE COMMITMENTS OF RESOURCES

The NPS must consider whether the effects of the alternatives cannot be changed or are permanent (that is, the impacts are irreversible). The NPS must also consider whether the impacts on a park resource would mean that once gone, the resource could not be replaced; in other words, the resource could not be restored, replaced or otherwise retrieved (NEPA Section102(c)(v)).

An irreversible commitment of resources is defined as the loss of future options. The term applies primarily to the effects of using nonrenewable resources, such as minerals or cultural resources, or to those factors such as soil productivity that are renewable only over long periods. It could also apply to the loss of an experience as an indirect effect of a “permanent” change in the nature or character of the land.

An irretrievable commitment of resources is defined as the loss of production, harvest, or use of natural resources. The amount of recreation activities foregone is irretrievable, the action is not irreversible. If the use changes, it is possible to resume production.

ALTERNATIVE A: NO ACTION – CONTINUATION OF CURRENT MANAGEMENT

Under alternative A, there would be long-term irretrievable impacts to soils, vegetation, water resources, soundscapes, wildlife and wildlife habitat, and the Arkansas River shiner. Impacts to archeological resources due to unrestricted ORV use at Blue Creek and Rosita Flats may be irretrievable. Associated physical damage to these resources would result from continued ORV use in areas where these resources exist. Irretrievable impacts to vegetation, water quality, wildlife and wildlife habitat, and the Arkansas River shiner would be moderate, due to the extent of ORV use across Blue Creek and Rosita Flats, as well as the continuation of an unclear ORV use boundary at both areas. Under this alternative, the ability of visitors to experience these resources may be lost to a great degree.

ALTERNATIVE B: ZONE SYSTEM – SEPARATION OF VISITOR USES, WITH A PERMIT FOR EDUCATIONAL PURPOSES

Under alternative B, ORV use at Rosita Flats and Blue Creek would occur at levels that would impact park resources such as soils, vegetation, water resources, soundscapes, wildlife and wildlife habitat, and

the Arkansas River shiner. These impacts would represent irretrievable, but not irreversible, losses to the quality of the resource. Under this alternative, the ability of visitors to experience these resources may be lost to a certain degree. However, management actions under this alternative would improve conditions of these resources over current conditions. Under this alternative, archeological resources would be protected because ORV use would be confined to designated routes and areas. This alternative would represent a loss of the free driving experience that is currently occurring. However, the permit system and other proposed actions would improve the visitor safety and experience of those who chose to visit the national recreation area. While there would be some irretrievable losses, these would not be irreversible.

ALTERNATIVE C: MANAGEMENT THROUGH USE OF A PERMIT SYSTEM AT CURRENT ORV USE AREAS

Under alternative C, ORV use at Rosita Flats and Blue Creek would occur at levels that would impact park resources such as soils, vegetation, water resources, soundscapes, wildlife and wildlife habitat, the Arkansas River shiner, and archeological resources. These impacts would represent irretrievable, but not irreversible, losses to the quality of the resource. Under this alternative, the ability of visitors to experience these resources may be lost to a certain degree. However, the proposed management actions, including designated routes and areas, a special use permit, additional law enforcement, and other educational efforts would improve the condition of these resources. Under this alternative, archeological resources would be protected because ORV use would be confined to designated routes and areas. This alternative would represent a loss of the unrestricted and free driving experience that is currently occurring. However, the permit system and other proposed actions would improve the visitor safety and experience of those who chose to visit the national recreation area. While there would be some irretrievable losses, these would not be irreversible.

ALTERNATIVE D: MANAGEMENT THROUGH USE OF A ZONING AND PERMITTING SYSTEM AT CURRENT ORV USE AREAS

Under alternative D, ORV use at Rosita Flats and Blue Creek would occur at levels that would impact park resources such as soils, vegetation, water resources, soundscapes, wildlife and wildlife habitat, the Arkansas River shiner, and archeological resources. These impacts would represent irretrievable, but not irreversible, losses to the quality of the resource. Under this alternative, the ability of visitors to experience these resources may be lost to a certain degree. However, the proposed management actions, including the zone system, designated routes and areas, a special use permit, additional law enforcement, and other educational efforts would improve the condition of these resources. Under this alternative, archeological resources would be protected because ORV use would be confined to designated routes and areas. This alternative would represent a loss of the unrestricted and free driving experience that is currently occurring. However, the permit system and other proposed actions would improve the visitor safety and experience of those who chose to visit the national recreation area. While there would be some irretrievable losses, these would not be irreversible.

SUSTAINABILITY AND LONG-TERM MANAGEMENT

In accordance with NEPA, and as further explained in Director's Order 12, consideration of long-term impacts and the effects of foreclosing future options should pervade any NEPA document. According to Director's Order 12, and as defined by the World Commission on Environment and Development, "sustainable development is that which meets the needs of the present without compromising the ability of future generations to meet their needs." For each alternative in a NEPA document, considerations of sustainability must demonstrate the relationship between local short-term uses of the environment and the maintenance and enhancement of long-term productivity. This is described below for each alternative.

The NPS must consider if the effects of the alternatives involve tradeoffs of the long-term productivity and sustainability of park resources for the immediate short-term use of those resources. The NPS must also consider if the effects of the alternatives are sustainable over the long term without causing adverse environmental effects for future generations (NEPA section 102(c)(iv)).

ALTERNATIVE A: NO ACTION – CONTINUATION OF CURRENT MANAGEMENT

Alternative A would trade any long-term productivity for short-term use of resources at the recreation area. Off-road use and demand for a range of visitor opportunities, to include demand for increased motorized access, would likely continue to grow over time or remain at high levels, and use the park's resources at the expense of the long-term productivity and sustainability of soils, vegetation, wildlife and wildlife habitat, threatened and endangered species, and archeological resources.

ALTERNATIVE B: ZONE SYSTEM – SEPARATION OF VISITOR USES, WITH A PERMIT FOR EDUCATIONAL PURPOSES

Alternative B would result in the long-term commitment of human resources and long-term adverse impacts to recreation area visitors and the local economy from restricting the areas where ORV are permitted within the recreation area. However, there would be long-term productivity of the park's natural and physical resources (soils, vegetation, wildlife and wildlife habitat, threatened and endangered species, and archeological resources) and a sustainable use of the resources at Lake Meredith National Recreation Area. To be sustainable, this alternative requires long-term management, including protecting the recreation area's productivity.

ALTERNATIVE C: MANAGEMENT THROUGH USE OF A PERMIT SYSTEM AT CURRENT ORV USE AREAS

Alternative C would result in the long-term commitment of human resources and long-term adverse impacts to recreation area visitors and the local economy from requiring a permit for ORV use. However, there would be long-term productivity of the park's natural and physical resources (soils, vegetation, wildlife and wildlife habitat, threatened and endangered species, and archeological resources) and a sustainable use of the resources at Lake Meredith National Recreation Area. To be sustainable, this alternative requires long-term management, including protecting the recreation area's productivity.

ALTERNATIVE D: MANAGEMENT THROUGH USE OF A ZONING AND PERMITTING SYSTEM AT CURRENT ORV USE AREAS

Alternative D would result in the long-term commitment of human resources and long-term adverse impacts to recreation area visitors and the local economy from restricting the areas where ORV are permitted within the recreation area. However, there would be long-term productivity of the park's natural and physical resources (soils, vegetation, wildlife and wildlife habitat, threatened and endangered species, and archeological resources) and a sustainable use of the resources at Lake Meredith National Recreation Area. To be sustainable, this alternative requires long-term management, including protecting the recreation area's productivity.

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