Grand Teton National Park
Wyoming

National Park Service
U.S. Department of the Interior

Moose-Wilson Corridor Draft Comprehensive Management Plan / Environmental Impact Statement

October 2015

HOW TO COMMENT ON THIS PLAN

Comments on this draft plan are welcome and will be accepted for 60 days from when the Environmental Protection Agency notice of availability appears in the *Federal Register*.

There are a number of ways to participate in the process and make your voice heard. You are encouraged to submit your comments electronically at the National Park Service Planning, Environment, and Public Comment (PEPC) website: (http://parkplanning.nps.gov/MooseWilson). PEPC allows NPS staff to gather and consider public comments in a cost-effective and timely manner. Comments are stored in a secure database as part of the official administrative record for the plan.

Comments may also be submitted in writing to the following address:

Grand Teton National Park
ATTN: Moose-Wilson Planning Team
PO Drawer 170
Moose, WY 83012-0170

Comments may also be submitted during a public open house that will be announced in the media at the time the plan is released to the public.

Please only submit one set of comments. Public comments and the names of those making comments may be released to the public at the end of the comment period in accordance with the Freedom of Information Act. Although you can ask us in your comment to withhold your personal identifying information from public review, we cannot guarantee that we will be able to do so.

EXECUTIVE SUMMARY

THE MOOSE-WILSON CORRIDOR

The Moose-Wilson corridor covers about 10,300 acres in the southwest corner of Grand Teton National Park. The corridor is bounded roughly by the Teton Range to the west, the Snake River to the east, Teton Park Road to the north, and the park's south boundary. The corridor is an outstanding representation of the park's major natural ecological communities, all of which are within a geographical area less than 5 miles in width and 7 miles in length. The long span of American Indian presence within the corridor is reflected in the archeological record, tribal oral histories, and the enduring cultural connections retained by tribes associated with the park. The corridor also provides many opportunities for a variety of popular visitor uses, including hiking, scenic driving, and horseback riding.

Moose-Wilson Road extends for 7.1 miles through the corridor and serves as the primary access route to several key destinations in the area, including Death Canyon and Granite Canyon Trailheads, Laurance S. Rockefeller Preserve (LSR Preserve), White Grass Dude Ranch and Murie Ranch Historic Districts, and the Sawmill Ponds Overlook. The narrow, winding road provides "back door" access to the south end of Grand Teton National Park and a rustic, slow-driving experience for visitors looking for exceptional scenery and wildlife viewing opportunities. The road is also used by some residents and visitors as a shortcut between the increasingly developed Wyoming Route 390 and destinations within and beyond the park during the summer months.

PURPOSE OF THE PLAN

The overarching purpose of the plan is to establish a long-term vision and comprehensive management strategies within the Moose-Wilson corridor to ensure the protection of significant national park resources and values.

The National Park Service (NPS) completed a parkwide transportation planning effort in 2007 that required implementation of several actions within the Moose-Wilson corridor. Conditions within the corridor have changed since 2007, resulting in the need to reconsider these actions and to evaluate the corridor holistically in this document. Noteworthy changes that have occurred in the area since 2007 include:

- Visitor facilities and trails within the LSR Preserve have been transferred from private ownership to the National Park Service and are now open to the public. This new destination has raised public awareness of the Moose-Wilson corridor, resulting in additional visitation to this once lesser-known area of the park.

- Increased traffic (motor vehicles and bicycles) use of the road. Strategies are needed to manage increasing traffic volumes to ensure visitor safety and quality of experience and to avoid impacts on wildlife, ecological communities, historic character, and other fundamental resources and values.

- Grizzly bears have moved into and frequent the corridor, and other species such as wolves, moose, and black bears are present as well. Increased motor vehicle and bicycle traffic has complicated the management of these species and has raised concerns regarding increased interaction between humans and wildlife.

- Through increased dialogue with tribal representatives and recent archeological surveys, the National Park Service has gained a better understanding of the scope and scale of American Indian cultural and archeological resources within the corridor.

These changed conditions, as well as the unique importance of the corridor as it relates to natural communities, wildlife diversity, and cultural significance has led the National Park Service to initiate a new planning effort that addresses all corridor significant issues together.

THE ALTERNATIVES

This comprehensive plan presents the no-action alternative (alternative A) and three action alternatives (alternatives B, C, and D). The no-action alternative would continue current management and provides a basis for comparing the other alternatives. The action alternatives present a spectrum of visitor opportunities and amenities, as well as different approaches to managing park resources and values within the Moose-Wilson corridor. Alternative C has been identified as the NPS preferred alternative.

Alternative A (No-Action)

This alternative represents the continuation of current management practices related to natural and cultural resources; visitor use; traffic and transportation; park operations; and maintenance of roads, trails, and facilities within the Moose-Wilson corridor. Under this alternative, the area would continue to be managed in accordance with NPS *Management Policies 2006*.

Key Strategies

- Maintain existing Moose-Wilson Road alignment and unpaved section.
- Continue to allow motor vehicles and bicycles to share the road.
- Prevent vehicles entering Moose-Wilson Road from the north from passing through an entrance station.
- Expect to manage wildlife jams with no traffic control measures in place.
- Continue winter road closure without grooming.
- Continue to manage user-created parking, turnouts, and social trails on a case-by-case basis.
- Retain the Death Canyon Trailhead parking area in its current configuration; visitors would continue to be allowed to park in user-created parking areas along the unpaved portion of Death Canyon Road.

Alternative B

This alternative emphasizes the corridor as a visitor destination. Reduced crowding on Moose-Wilson Road and at destinations within the corridor would provide visitors an opportunity for self-discovery. Existing developed areas and facilities would be maintained where appropriate and removed or relocated in some areas to protect natural and cultural resources.

Key Strategies

- Realign two segments of the northern portion of Moose-Wilson Road to address congestion associated with the presence of wildlife, wildlife habitat connectivity, and operational issues.
- Reconstruct and pave the existing, unpaved portion of Moose-Wilson Road, but retain the current road alignment. The width of this newly paved segment would be narrowed to

be consistent with other existing paved portions of the road.

- Address increases in traffic and volume-related congestion by restricting through-traffic in either direction beyond the LSR Preserve Center during peak use periods. This would be accomplished by reconfiguring access to and parking at the LSR Preserve and installing a gate to prevent through-traffic at certain established peak hours during the peak season, thereby encouraging use of the road only as a means for visiting destinations within the corridor at those times. Through-travel by bicycles would not be affected, and the road would continue to be open to motor vehicle through-traffic at all other times.
- Reduce speed limit to 20 miles per hour to improve bicyclist safety because motor vehicles and bicycles would continue to share the road.
- Relocate the Death Canyon Trailhead to a site near White Grass Ranch, approximately 0.4 mile from its current location. A parking lot would be provided for 60 vehicles. The abandoned section of the trailhead access road would be converted to a trail. The remaining unpaved portion of Death Canyon Road would be improved to a single lane with a gravel surface and turnouts for passing.

Alternative C (NPS Preferred)

The emphasis of this alternative is to model the balance of preservation and public use and enjoyment by exemplifying conservation legacies within the corridor. This alternative would manage the intensity and timing of visitor use to effectively provide high-quality visitor opportunities. Development within the corridor would generally be maintained within the existing development footprint. The sense of discovery would predominate in this outstanding and diverse natural ecosystem and cultural history area.

Key Strategies

- Realign the northernmost 0.6-mile section of Moose-Wilson Road to address wildlife habitat connectivity and operational issues. The segment between Sawmill Ponds Overlook and the Death Canyon Road junction would be retained in its existing alignment. The portion of the road adjacent to wetlands would be reconstructed to correct drainage issues and improve road conditions. Wildlife safety mitigation measures would be included in the design of the road reconstruction.
- Reconstruct and pave the existing, unpaved portion of Moose-Wilson Road, but retain the approximate current alignment of the road. The width of this newly paved road segment would be narrowed for consistency with the existing paved portions of the road.
- Address increases in traffic and volume-related congestion on Moose-Wilson Road by limiting the number of vehicles entering the corridor at any one time during peak use periods through timed sequencing techniques. Provide queuing lanes on the north and south ends of the corridor, as needed. If additional traffic management measures would be needed in the future, a corridor reservation system and/or transit system may be considered.
- Reduce speed limit to 20 miles per hour to improve bicyclist safety because motor vehicles and bicycles would continue to share the road.
- Relocate the Death Canyon Trailhead to the current end of pavement on the existing access road (i.e., near the junction with White Grass Road). Parking would be provided for

approximately 80 to 90 vehicles (similar to the current condition of parking demand). The existing 1.0-mile unpaved portion of the trailhead access road (no longer necessary for vehicular traffic) would be converted to a trail.

Alternative D

The emphasis of this alternative is to better integrate the Moose-Wilson corridor with the broader park experience and link it to the region's larger recreational network. Park management would focus on ways to connect people with resources and promote understanding, enjoyment, preservation, and health. To enhance the recreational scenic driving experience, strategies would be used to reduce traffic congestion. Visitors would be provided with opportunities to get out of their vehicles and experience the outstanding natural and cultural landscapes. Additional developments and concentrated visitor use in the corridor would be in focused areas.

Key Strategies

- Realign two segments of the northern portion of Moose-Wilson Road to address congestion associated with the presence of wildlife, wildlife habitat connectivity, and operational issues.
- Maintain the unpaved section of Moose-Wilson Road by grading and treating for dust abatement several times per year.
- Address increases in traffic and volume-related congestion on Moose-Wilson Road by establishing a reservation system during peak use periods. Visitors without reservations would be accommodated on a space available, first-come, first-served basis.
- Construct a multiuse pathway between Moose and the Granite Canyon Entrance.
- Reconfigure and expand the Death Canyon Trailhead parking area at its current location to accommodate 100 vehicles. The 0.4-mile segment of Death Canyon Road between the trailhead and White Grass Ranch would be improved. White Grass Road would be improved to allow one-lane traffic with staggered turnouts. The remaining portion of Death Canyon Road would be removed and the area restored to natural conditions.

Next Steps

Following distribution of the *Draft Moose-Wilson Corridor Comprehensive Management Plan / Environmental Impact Statement*, there will be a 60-day public review and comment period. The NPS planning team will then evaluate comments from other federal and state agencies, tribes, organizations, businesses, and individuals regarding the draft plan and incorporate appropriate changes. A final corridor management plan will then be prepared that will include letters from governmental agencies, substantive comments on the draft document, and NPS responses to those comments.

After release of the final corridor management plan and a 30-day no-action period, a record of decision approving a final plan will be prepared for signature by the NPS regional director. The record of decision will document the NPS selection of an alternative for implementation. The plan will then be implemented, depending on available funding and staffing.

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MAPS

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A GUIDE TO THIS DOCUMENT

The *Moose-Wilson Corridor Comprehensive Management Plan / Draft Environmental Impact Statement* is organized in accordance with the Council on Environmental Quality's implementing regulations for the National Environmental Policy Act and National Park Service (NPS) Director's Order 12.

Chapter 1: Purpose and Need sets the framework for the entire document. It describes why the plan was prepared and what needs it addresses. It gives guidance for these considerations, which are based on the legislated mission of Grand Teton National Park and its purpose, national significance, fundamental resources and values, special mandates and administrative commitments, servicewide mandates and policies, and other planning efforts in the area.

The chapter also details planning opportunities and issues that were raised during public scoping and initial planning team efforts. The alternatives developed and presented in the next chapter address these issues and concerns in varying ways. This chapter concludes with a statement of the scope of the environmental impact analysis—specifically what impact topics were retained or dismissed from detailed analysis and why.

Chapter 2: The Alternatives begins with an explanation of how the alternatives were developed and how the preferred alternative was identified. The four alternatives are then presented. This section includes a description of the no-action alternative (alternative A) and three action alternatives (alternatives B, C, and D). The no-action alternative would continue current management and provides a basis for comparing the other alternatives. The action alternatives present a spectrum of visitor opportunities and amenities, as well as different approaches to managing park resources and values within the Moose-Wilson corridor.

This chapter also includes management directions that are common to all action alternatives, which provide a practical approach to managing the Moose-Wilson corridor that do not vary by alternative. They include a visitor use management framework to sustain desired resource conditions and visitor experiences, best management practices to ensure continued protection of the park's fundamental resources and values, mitigation measures to avoid or minimize potential adverse impacts arising from implementation of the plan, monitoring guidelines to periodically check the status of the resources, and strategies to address climate change.

A comparison of staffing and costs for implementing the alternatives is also included. The evaluation of the environmentally preferred alternative is followed by summary tables of the alternatives and the environmental consequences of implementing the alternative actions.

Chapter 3: Affected Environment describes the environment of the Moose-Wilson corridor that is being analyzed in this environmental impact statement. It focuses on the natural and cultural resources, scenery, the acoustic resources and soundscapes, wilderness, visitor use and experience, traffic and transportation, socioeconomics, and park operations that may be affected by actions proposed in the alternatives.

Chapter 3 does not provide an exhaustive description of the impact topics, but rather enough detail to understand the impacts of implementing the alternatives. These descriptions of the corridor environment establish the basis for the impact analysis in "Chapter 4: Environmental Consequences." The effects of climate change on the corridor environment are also included as part of the introduction of this chapter.

Chapter 4: Environmental Consequences analyzes the environmental impacts of implementing each of the four alternatives. This analysis is the basis for comparing the beneficial and adverse effects of implementing the alternatives. By examining the environmental consequences of all alternatives on an equivalent basis, decision makers can evaluate which approach would create the most desirable combination of benefits with the fewest adverse effects on the park.

This chapter begins a brief explanation of how climate change is considered, followed by a discussion of how cumulative impacts are analyzed for the alternatives. Following this section, the impact analysis is presented. Each impact topic begins with a discussion of methods and assumptions followed by an analysis of each of the four alternatives. After describing the impacts of the alternative, each impact topic then includes a discussion of cumulative effects, followed by a conclusion statement. The impacts of each alternative are also summarized by impact topic in table 9 at the end of "Chapter 2: Alternatives."

Chapter 5: Consultation and Coordination summarizes the opportunities the public had to participate in the planning process, the roles four cooperating agencies played in developing the plan, and consultations that occurred with federal and state agencies and tribes.

The **Appendixes** present the visitor use management framework and capacity determination that is common to all action alternatives. References and a list of the preparers, planning team, and other consultants is also included.

1 Purpose and Need

INTRODUCTION

BACKGROUND

The *Draft Moose-Wilson Corridor Comprehensive Management Plan / Environmental Impact Statement* (Draft CMP/EIS) evaluates appropriate opportunities for visitors to use, experience, and enjoy the 10,300-acre Moose-Wilson corridor while protecting park resources and values. The Draft CMP/EIS provides management guidance for the corridor for the next 20 years and includes an evaluation of alternatives, as well as corresponding environmental impacts.

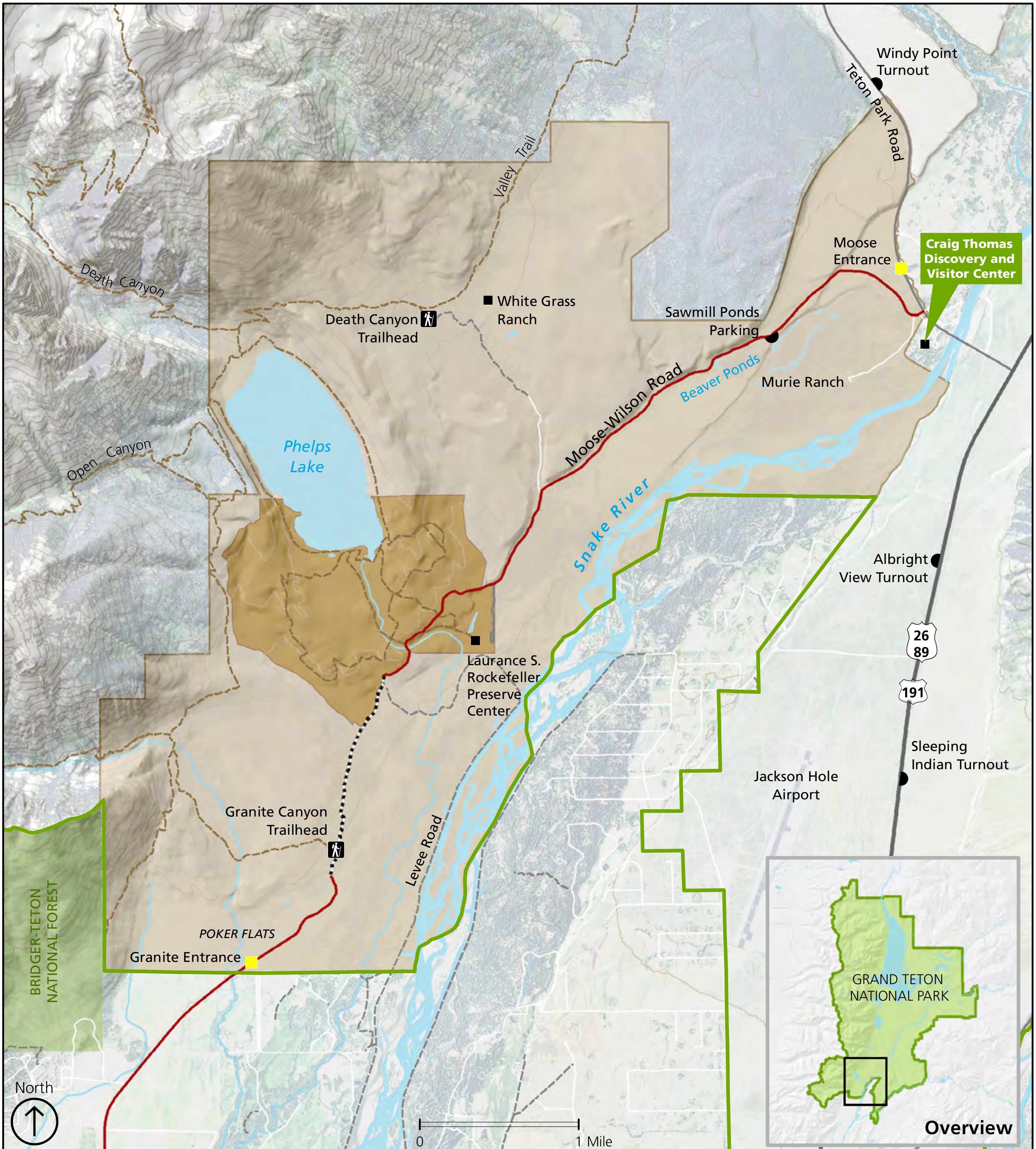
The Draft CMP/EIS was developed by an interdisciplinary planning team led by the National Park Service (NPS). Four cooperating agencies—the Western Federal Lands Highway Division of the Federal Highway Administration, the State of Wyoming, Teton County, and the Town of Jackson provided input on the plan. The National Park Service also consulted with seven tribal governments and other federal, state, and local agencies as the plan was developed. In addition, many opportunities for public input were provided during the development of the plan.

Actions directed by the comprehensive management plan or in subsequent implementation plans will be accomplished over time. While the plan evaluates future funding needs associated with alternatives carried through the plan, there is no guarantee that the actions proposed in this plan will be funded. Budget restrictions, requirements for additional data or regulatory compliance, and competing national park system priorities may prevent implementation of some actions.

PROJECT AREA

The Moose-Wilson project area (used synonymously with the term "corridor" in this plan) covers about 10,300 acres in the southwest corner of Grand Teton National Park (map 1). The corridor is bounded roughly by the Teton Range to the west, the Snake River to the east, the Teton Park Road to the north, and the park's south boundary. The corridor is an outstanding representation of the park's major natural ecological communities, all of which are within a geographical area less than 5 miles in width and 7 miles in length. These natural communities include forests, sagebrush flats, wet meadows and wetlands, lakes, rivers, and ponds, and associated diverse native plant, fish and wildlife populations. The long span of American Indian presence within the corridor is reflected in the archeological record, tribal oral histories, and the enduring cultural connections retained by tribes associated with the park. The corridor also provides many opportunities for a variety of popular visitor uses, including hiking, scenic driving, and horseback riding. The Moose-Wilson and Death Canyon Roads are the two road-based transportation routes in the corridor.

Moose-Wilson Road extends for 7.1 miles through the corridor, and serves as the primary access route to several key destinations in the area, including Death Canyon and Granite Canyon Trailheads, Laurance S. Rockefeller Preserve (LSR Preserve), White Grass Ranch and Murie Ranch Historic Districts, and the Sawmill Ponds Overlook. The Moose-Wilson Road extends northward from the terminus of Wyoming Route 390 at the park's Granite Canyon Entrance to the Teton Park Road at Moose. The road is typically open seasonally from May through October. The narrow,



Legend

Entrance
Trailhead
Turnout
Point of Interest
Trails
Streams
Moose-Wilson Road
Paved
Unpaved
Park Boundary
National Forest
Water Body
Project Area Boundary
Laurance S. Rockefeller Preserve

Moose-Wilson Corridor
Project Area

Grand Teton National Park, Wyoming
National Park Service/U.S. Department of the Interior

Produced by Denver Service Center Planning Division, November 2013

winding, partial gravel road provides "back door" access to the south end of Grand Teton National Park and a rustic, slow-driving experience for visitors looking for exceptional scenery and wildlife viewing opportunities. The road is also used by some residents and visitors as a shortcut between the increasingly developed Wyoming Route 390 and destinations within and beyond the park during the summer months.

PURPOSE AND NEED FOR COMPREHENSIVE CORRIDOR MANAGEMENT PLAN

The overarching purpose of the plan is to establish a long-term vision and comprehensive management strategies within the Moose-Wilson corridor of Grand Teton National Park to ensure the protection of significant national park resources and values.

The National Park Service completed a parkwide transportation planning effort in 2007 that required implementation of several actions within the Moose-Wilson corridor. Conditions within the corridor have changed since 2007, resulting in the need to reconsider these actions and to evaluate the corridor holistically in this document. Noteworthy changes that have occurred in the area since 2007 include:

- Visitor facilities and trails within the LSR Preserve have been transferred from private ownership to the National Park Service and are now open to the public. This new destination has raised public awareness of the Moose-Wilson corridor, resulting in additional visitation to this once lesser-known area of the park.

- Increased traffic (motor vehicles and bicycles) use of the road. Strategies are needed to manage increasing traffic volumes to ensure visitor safety and quality of experience and to avoid impacts on wildlife, ecological communities, historic character, and other fundamental resources and values.

- Grizzly bears have moved into and frequent the corridor, and other species such as wolves, moose, and black bears are present as well. Increased motor vehicle and bicycle traffic has complicated the management of these species and has raised concerns regarding increased interaction between humans and wildlife.

- Through increased dialogue with tribal representatives and recent archeological surveys, the National Park Service has gained a better understanding of the scope and scale of American Indian cultural and archeological resources within the corridor.

These changed conditions, as well as the unique importance of the corridor as it relates to natural communities, wildlife diversity, and cultural significance has led the National Park Service to initiate a new planning effort that addresses all of the corridor's significant issues together. Please refer to the "Planning Issues and Opportunities" section for more detailed information about these and other issues in the project area.

This comprehensive plan presents several management options within the corridor that provide appropriate opportunities for visitors to use, experience, and enjoy the area while protecting the park's nationally significant resources.

FOUNDATION FOR PLANNING AND MANAGEMENT

This section provides the underlying principles that guided the development of this plan. It identifies what is most important to the park, notes special mandates and administrative commitments that affect management of the Moose-Wilson corridor, and identifies fundamental resources and values within the corridor. All of the alternatives in this plan were designed to be consistent with the park's purpose, significance, and fundamental resources and values, as well as applicable laws, and NPS policies.

Park Purpose

The park purpose is the foundational reason(s) for the establishment of a park. A park purpose statement is grounded in a thorough analysis of the legislation and legislative history of the park and may include information from studies generated prior to the park's establishment.

The purposes of Grand Teton National Park are as follows:

- Preserve and protect the spectacular scenery of the Teton Range and the valley of Jackson Hole.
- Protect a unique geologic landscape that supports abundant diverse native plants and animals and associated cultural resources.
- Protect wildlands and wildlife habitat within the Greater Yellowstone Area including the migration route of the Jackson elk herd.
- Provide recreational, educational, and scientific opportunities compatible with these resources for enjoyment and inspiration.

Park Significance

Park significance statements express why the park's resources and values are important enough to justify national park designation. They describe why an area is important within a global, national, regional, and systemwide context and are directly linked to the purpose of the park.

Grand Teton National Park is significant for the following reasons:

- The iconic mountain landscape of the Teton Range rises dramatically above the flat valley of Jackson Hole creating a compelling view that has inspired people to explore and experience the area for thousands of years. The sudden rise of rugged peaks contrasts with the horizontal sagebrush flats. Glacial lakes at the foot of the mountains reflect and expand the view. Opportunities to view an impressive array of wildlife are extraordinary. The awesome grandeur of the ever present Teton Range under changing weather conditions and seasons provides a superlative setting for unmatched visitor experiences.
- Grand Teton National Park preserves one of the world's most impressive and highly visible fault block mountain ranges, which abruptly rises 7,000 feet and is juxtaposed with landscapes shaped by glacial processes and braided river geomorphology. The Teton Range is one of the continent's youngest mountain ranges, yet exposes some of the oldest rocks on Earth.
- Grand Teton National Park is at the heart of one of the earth's largest intact temperate ecosystems with a full complement of native Rocky Mountain plants and animals, including grizzly bears, gray wolves, North American bison, pronghorn, and one of the world's largest elk herds.

- The park represents one of the most notable conservation stories of the 20th century, which continues to inspire present and future generations. The formation of the park, a process that took more than half a century, was a struggle between private economic interests and a concern for conserving the Teton Range and valley floor. From prehistoric times to the present day, numerous diverse cultures, cultural trends, and values influenced the Teton Range and Jackson Hole valley.
- Within the park, visitors can easily experience peaceful solitude, wilderness character, and a rare combination of outdoor recreational and educational activities, world-renowned wildlife and landscapes, and the cultural amenities of a vibrant community throughout the year. Visitors of all abilities and interests can enjoy opportunities for physical, emotional, and inspirational experiences in an unspoiled environment.
- As part of the Greater Yellowstone Ecosystem, the park offers easily accessible and unparalleled opportunities for scientific research and educational study of temperate zone natural systems and processes in a range of elevations and the human relationships to these systems. The relatively pristine landscape serves as a "control" or baseline for scientific study.

Park Fundamental Resources and Values

Fundamental resources and values are those features, systems, processes, experiences, stories, scenes, sounds, smells, or other attributes determined to merit primary consideration during planning and management processes because they are essential to achieving the purpose of the park and maintaining its significance.

The following are the fundamental resources and values of Grand Teton National Park:

Scenery

- natural beauty, wildlife, clean air, relative lack of development
- sagebrush flats that provide a platform for viewing

Geologic Processes

- Teton fault and other seismic areas
- ongoing glacial/hydrologic processes
- volcanic history and linked underground geothermal features and systems
- braided river geomorphology

Ecological Communities

- geography, location, size, and connectivity of the Greater Yellowstone Ecosystem
- extreme topography in a small area that leads to diverse vegetation communities
- full complement of native birds and mammals—natural predator-prey interactions that reflect the health of the ecosystem
- natural occurrences, such as fire, landslides, flooding, drought, and insect infestations, are allowed to influence the landscape

Aquatic Resources

- lakes, free-flowing water
- riparian habitat for native species, including Yellowstone cutthroat trout and Snake River cutthroat trout
- clean water, including outstanding natural resource waters

Cultural History and Resources

- American Indian use and spiritual reverence
- history of the fur trade and westward expansion reflected in place names, paintings, photographs, homestead structures, and dude ranches
- story of the hard won battle for conservation evident in structures such as the Maude Noble Cabin, Murie Ranch, Lucas-Fabian Cabin, and John D. Rockefeller, Jr. Memorial Parkway
- mountaineering history of the Teton Range

Natural Soundscapes

- sounds associated with predator avoidance, prey detection, mating, and other behavioral interactions
- biological sounds such as birds singing, fish splashing, and elk bugling
- physical sounds such as waterfalls, rapids, wind in vegetation, and thunder

Visitor Experience in an Outstanding Natural Environment

- spectacular setting and quality natural environment
- opportunities to observe wildlife
- full spectrum of access, ability level, activities, interpretation and educational opportunities are available year-round
- wilderness character, opportunities for solitude, natural lightscapes, natural soundscapes

Fundamental Resources and Values within the Moose-Wilson Corridor

As an integral part of Grand Teton National Park, the Moose-Wilson corridor contains most of the park's fundamental resources and values listed above. The following provides a description of these resources and values as they relate to the park's broader foundation document.

Scenery. The Moose-Wilson corridor contains an exceptionally wide variety of scenery that can be viewed throughout the seasons. The iconic peaks of the Teton Range and its high elevation canyons offer a unique view not readily found in other areas of Grand Teton National Park. Stunning views of Phelps Lake and Death Canyon can be found along trails within the Laurance S. Rockefeller Preserve. Other exceptional scenic landscapes within the corridor include the Snake River, forests, sagebrush flats, and wet meadows and wetlands. These diverse scenic landscapes and visual qualities foster a sense of discovery and provide visitors with opportunities to view wildlife, especially along Moose-Wilson Road.

Geologic Processes. The Moose-Wilson corridor provides a glimpse into the geologic forces shaping this region. Earthquakes generated on the Teton fault lifted the Teton Range to the west, while melting glaciers left behind outwash plains carved by the Snake River to the east. Small earthquakes occasionally shake the region, suggesting the power of future mountain-building. Evidence of past glaciations flanks the corridor. Terraces carved by melting glaciers rise above the modern river; while piedmont lakes dammed by glacial moraines lie at the mouth of U-shaped canyons. All the while, rainfall and freeze-thaw cycles cause landslides and rock falls.

Ecological Communities and Wildlife. The Snake River's extensive riparian habitats are closer to the Teton Range in the Moose-Wilson corridor than at any other location in the park, providing an outstanding representation of the park's major natural ecological communities within a relatively limited geographic area. Aspens, chokecherries, willows, various conifers, and other vegetation provide forage and exceptional cover for protection of wildlife. Consequently, a large variety of wildlife can be found in this small area. This natural constriction between the river and the mountains functions as an important wildlife corridor within Grand Teton National Park. Prominent wildlife species within the corridor include grizzly and black bears, wolves, elk, moose, beavers, and migratory birds.

Aquatic Resources. The Moose-Wilson corridor contains a portion of the designated wild and scenic Snake River; its associated floodplain and riparian areas; Phelps Lake; and a complex system of high-value wetlands, mountain seeps, springs, and streams. The mountain streams, such as Granite and Open Canyon Creeks and others, drain critical cold water into the Snake River, providing important refugia for spawning fish species and cold water aquatic species. The diverse aquatic communities in the corridor provide important habitat for beaver and other wildlife, as well as sustain appropriate visitor uses.

Cultural History and Resources. For at least the last 10,000 years, people have traveled and settled along the Snake River corridor at the base of the Teton Range. The long span of American Indian presence in the corridor is reflected in the archeological record, tribal oral histories, and the enduring cultural connections retained by tribes associated with the park. European American fur trappers entered the area in the early 19th century followed by government explorers, prospectors, and homesteaders. Cattle ranching and later dude ranching became important economic activities during the 20th century. Two significant dude ranches along the Moose-Wilson corridor (Murie Ranch and White Grass Ranch) are designated historic districts—Murie Ranch is one of only two national historic landmarks in Grand Teton National Park. Moose-Wilson Road, first developed in the latter 19th century as a wagon road serving local ranches and residences, meets the criteria for listing in the National Register of Historic Places (NRHP), continuing the tradition of tourism and recreation.

The history of the Muries and the Rockefellers is also associated with resource stewardship and the emerging national conservation movement in the 20th century.

Natural Soundscapes and Acoustic Resources. Because of the diversity of habitats and wildlife species, the Moose-Wilson corridor has abundant and varied natural sounds that not only enhance visitor experience, but serve a critical ecological role. Spring's early morning bird chorus heralds the arrival of migrants and the resumption of breeding activities for many species of wildlife. Territories are defended and mates are attracted through the use of songs and calls. In the wetland areas, amphibians join the chorus for the same purposes. Summer brings thunderstorms and the sounds of insects during warm afternoons. Elk bugling in the fall portends the upcoming winter season with both its winter snow storms and impressive silent nights. The sound of flowing water from the Snake River and its cascading tributaries and the common sound of wind pervades the forests and sagebrush flats year-round. These sounds add depth and meaning for visitors, as does the opportunity to hear nothing—the sound of natural quiet.

Visitor Experience in an Outstanding Natural Environment. The Moose-Wilson corridor provides an excellent area in which visitors may immerse themselves in the spectacular natural setting of the Teton Range. Visitors have extraordinary opportunities to observe wildlife, experience solitude, explore wilderness, appreciate dark night skies, and listen to the sounds of natural quiet. They can also experience a multitude of recreational opportunities, including hiking, cycling, winter use, and equestrian activities. The Moose-Wilson Road provides a gateway to many of these unique experiences. Whether hiking to Phelps Lake, accessing climbing routes and wilderness areas through Granite and Death Canyons, riding horseback through Poker Flats, exploring the historic districts of White Grass Dude Ranch and Murie Ranch, or discovering the Laurance S. Rockefeller Preserve, visitors of the Moose-Wilson corridor can become intimately involved in one of the most scenic and rustic road corridors found in any national park.

Special Mandates and Administrative Commitments Related to the Moose-Wilson Corridor

The following are portions of significant public laws and administrative actions that expressly commit park management to certain practices.

Conservation Easement Establishing the Laurance S. Rockefeller Preserve (October 15, 2007). In 2007, the Estate of Laurance S. Rockefeller signed a conservation easement for the Laurance S. Rockefeller Preserve within the boundaries of Grand Teton National Park, containing approximately 1,106 acres of land. Per the easement, the Laurance S. Rockefeller Preserve was to become a place of physical and spiritual renewal, to serve as a model for achieving balance between preservation of natural values and public use, and to demonstrate that citizens working in partnership with their government can achieve important goals. The Laurance S. Rockefeller Preserve is intended to inspire appreciation and reverence for the beauty and diversity of the natural world, to demonstrate the importance of protecting the land and providing public access and to foster individual responsibility for conservation stewardship.

An important element of any decisions reached through the Moose-Wilson corridor planning process will be consistent with the terms of the conservation easement. This requirement pertains to actions taken within the LSR Preserve, as well as to actions that are considered elsewhere within the corridor but which have the potential to affect the conservation values within the Preserve. Furthermore, the conservation easement states that the portion of Moose-Wilson Road within the Preserve be maintained in its current width and alignment with no additional features or improvements of any kind. The alternatives included in this plan are consistent with these provisions.

Access to Private and Public Lands (Public Law 81-787). The act that established Grand Teton National Park requires that rights-of-way be designated and opened across federal lands within the park boundary to provide access to or from state or private lands within the exterior boundaries, or to and from national forest, state, or private lands adjacent to the boundary. On a practical level, this provision requires the National Park Service provide access to nonfederal lands within the park and adjacent to its boundary.

Continuation of Leases and Permits (Public Law 81-787). The act that established Grand Teton National Park requires that any valid leases, permits, or licenses that were in effect at the time the park was established remain in effect in accordance with their provisions.

Fisheries and Wildlife Management (Memorandum of Understanding between the National Park Service and the Wyoming Game and Fish Commission, July 3, 1973). In a memorandum of understanding dated July 3, 1973, between the National Park Service and the Wyoming Game and Fish Commission, the National Park Service agreed to: (1) manage areas it administers in Wyoming to benefit fish and wildlife consistent with the NPS management policies for national parks, monuments, and recreation areas; (2) consult with the Wyoming Game and Fish Commission before initiating research or any program or regulation that may affect distribution, numbers, species, or public use of fish and wildlife populations found within or adjacent to NPS-administered areas; (3) regulate public uses of wildlife resources in accordance with state laws and regulations (except in Yellowstone National Park) and in a manner compatible with NPS management objectives. The National Park Service may prohibit or restrict, after consultation with the commission, such uses as are reasonably necessary to comply with management objectives; and (4) cooperate in joint enforcement of applicable state laws pertaining to hunting, fishing, and boating.

Wilderness Management (Wilderness Act of 1964 [Public Law 88-577; 16 USC 1131–1136]; Grand Teton National Park Wilderness Recommendation). Pursuant to the Wilderness Act of 1964, the National Park Service evaluated lands within Grand Teton National Park for possible designation by Congress as wilderness. In 1978, a wilderness recommendation was provided to Congress, which included 122,604 acres as recommended wilderness and an additional 20,850 acres as potential wilderness. About 1,650 acres of the potential wilderness lies within the Moose-Wilson corridor, in the vicinity of Phelps Lake. Over the years, the park staff has reviewed and revised its wilderness maps on numerous occasions; however, the actual recommendation that was sent to Congress in 1978 has never been superseded. Under current NPS management policies, the park staff manages all of the lands that were included in the 1978 recommendation, as well as all other lands that have been identified as potential wilderness or eligible for wilderness designation, to ensure no action would be taken that would diminish their wilderness eligibility until Congress takes action.

COMPLIANCE WITH THE NATIONAL ENVIRONMENTAL POLICY ACT, NATIONAL HISTORIC PRESERVATION ACT, AND OTHER MANDATES

This section briefly discusses the most pertinent servicewide laws and policies related to planning and managing Grand Teton National Park and the Moose-Wilson corridor. Regardless of which alternative is selected for implementation in the Record of Decision, the National Park Service must comply with all of these laws and policies. The alternatives in this comprehensive management plan address the desired future conditions that are not mandated by law and policy and must be determined through a planning process.

National Environmental Policy Act

Pursuant to section 102(2)(C) of the National Environmental Policy Act of 1969, as amended (42 *United States Code* (USC) 4341 et seq.) (NEPA), the National Park Service has prepared an environmental impact statement identifying and evaluating four alternatives for the Moose-Wilson corridor plan. Regulations governing NEPA compliance are set by the President's Council on Environmental Quality (CEQ) (40 *Code of Federal Regulations* (CFR) parts 1500–1508), and Department of the Interior NEPA regulations (43 CFR 46). CEQ regulations establish requirements and the process for agencies to fulfill their obligations under the National Environmental Policy Act. This environmental impact statement documents compliance with NEPA requirements, including the following fundamental requirements: (1) to make careful, complete, and analytical study of the impacts of any proposal, and alternatives to that proposal, if it has the potential to significantly affect the human environment, well before decisions are made; and (2) to be diligent in involving any interested or affected members of the public in the planning process.

Compliance with the National Historic Preservation Act of 1966 (54 USC 300101 et seq.) (NHPA) is integrated into the NEPA compliance process using NHPA criteria for analysis of impacts on cultural resources (see below). The NEPA process is also used to coordinate compliance with other federal laws and regulations applicable to the decisions to be made as part of this plan, including, but not limited to,

- Clean Water Act (33 USC 1251 et seq.)
- Clean Air Act, as amended (42 USC 7401 et seq.)
- Endangered Species Act (16 USC 1531 et seq.)
- Migratory Bird Treaty Act (16 USC 703 et seq.)
- Golden Eagle Protection Act (16 USC 668)
- Architectural Barriers Act (42 USC 4151 et seq.)
- Rehabilitation Act (29 USC 701 et seq.)
- American Indian Religious Freedom Act (42 USC 1996)
- Archaeological Resources Protection Act (16 USC 470aa et seq.)
- Native American Graves Protection and Repatriation Act (25 USC 3001 et seq.)
- Executive Order 11593, “Protection and Enhancement of the Cultural Environment”
- Executive Order 11988, “Floodplain Management”
- Executive Order 11990, “Protection of Wetlands”
- Executive Order 13007, “Indian Sacred Sites”
- Executive Order 13112, “Invasive Species”
- Executive Order 13186, “Responsibility of Federal Agencies to Protect Migratory Birds”

National Historic Preservation Act

Section 106 of the National Historic Preservation Act directs federal agencies to take into account the effect of any undertaking (a federally funded or assisted project) on historic properties. A *historic property* is any district, building, structure, site, or object (including resources considered by American Indians to have cultural and religious significance) that is eligible for listing in the National Register of Historic Places because the property is significant at the national, state, or local level in US history, architecture, archeology, engineering, or culture. Section 106 provides the Advisory Council on Historic Preservation (ACHP), the Wyoming State Historic Preservation Office (SHPO), and federally recognized American Indian tribes an opportunity to comment on assessment of effects by the undertaking. In this document, the undertaking is the implementation of the actions outlined in this plan’s preferred alternative.

Other Laws, Regulations, Executive Orders, and Policies Related to Moose-Wilson Corridor

The National Park Service must comply with law and policy to protect environmental quality and resources, to preserve cultural resources, and to provide public services. Applicable law and policy related to resource management includes the Clean Water Act, the Endangered Species Act, the National Historic Preservation Act, the Native American Graves Protection and Repatriation Act (NAGPRA), and Executive Order 11990, “Protection of Wetlands.” Law and policy related to public services and access includes the Rehabilitation Act and the Architectural Barriers Act. A comprehensive management plan is not needed to decide that it is appropriate to protect endangered species, control nonnative species, protect archeological sites, conserve artifacts, or provide access compliant with the Architectural Barriers Act Accessibility Standards. Laws and policies have already decided these and many other management-related actions for the National Park Service. The National Park Service would work to meet these requirements with or without a new corridor management plan.

Some of these laws and executive orders are applicable solely or primarily to units of the national park system. These include the NPS Organic Act of 1916, which created the National Park Service; the General Authorities Act of 1970; the act of March 27, 1978 (relating to the management of the national park system); and the National Parks Omnibus Management Act (1998). Other laws and executive orders have much broader application such as the Endangered Species Act (ESA); the National Historic Preservation Act; Executive Order 11990, “Protection of Wetlands”; and Executive Order 13112, “Invasive Species.”

NPS Organic Act of 1916 (54 USC 100101(b) et seq.). Commonly known as the NPS Organic Act, the act provides the fundamental management direction for all units of the national park system:

> [P]romote and regulate the use of the Federal areas known as national parks, monuments, and reservations . . . by such means and measure as conform to the fundamental purpose of said parks, monuments and reservations, which purpose is to conserve the scenery and the natural and historic objects and the 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.

National Park System General Authorities Act of 1970 (54 USC 100101(b) et seq.). The General Authorities Act affirms that while all national park system units remain “distinct in character,” they are “united through their interrelated purposes and resources into one national park system as cumulative expressions of a single national heritage.” The act makes it clear that the NPS Organic Act and other protective mandates apply equally to all units of the system. Further, amendments state that NPS management of park units should not “derogate[e]. . .the purposes and values for which these various areas have been established.”

Amending the General Authorities Act, the March 27, 1978, law commonly known as the Redwood Act further states that the National Park Service may not allow degradation of the values and purposes for which the various park units were established unless authorized by Congress. This act also affirms that if a conflict occurs between visitor use and protection of resources, the intent of Congress is to favor resource protection.

Public Law 81-787, 1950. This law established Grand Teton National Park as a 310,521-acre (125,663-hectare [ha]) national park system unit that includes portions of both the Teton Range and Jackson Hole. The rights of residents and others legally occupying and using lands within the park in 1950 were also specified in the law.

Clean Air Act of 1970 (as amended). The Clean Air Act regulates airborne emissions of a variety of pollutants from area, stationary, and mobile sources. The amendments to the act were added primarily to fill gaps in earlier regulations pertaining to acid rain, ground-level ozone, stratospheric ozone depletion, and air toxics. Also, it identified 189 hazardous air pollutants. The act requires the US Environmental Protection Agency (EPA) to set national health-based air quality standards to protect against common pollutants (e.g., ozone, carbon monoxide, sulfur dioxide, nitrogen dioxide, lead, and particulate matter) and national standards for major new sources of pollution, including automobiles, trucks, and electric power plants.

Clean Water Act of 1972. The 1972 Clean Water Act strives to restore and maintain the integrity of US waters. The Clean Water Act grants authority to the states to implement water quality protection through best management practices and water quality standards. The act gives the Environmental Protection Agency the authority to set effluent standards on an industry basis and water quality standards for all contaminants in surface waters. Section 404 of the Clean Water Act establishes a program to regulate the discharge of dredged or fill material into waters of the United States, including wetlands. Proposed activities are regulated through a permit review process.

Endangered Species Act of 1973 (as amended). The US Fish and Wildlife Service (USFWS) provides for listing and protection of endangered and threatened species and in some cases their critical habitat. The act requires the National Park Service to identify all federally listed endangered, threatened, and candidate species that occur in each park unit and promote their conservation and recovery. The act requires consultation under section 7 of the act if any listed species would be adversely affected.

Archaeological Resources Protection Act of 1979. This act, as amended, defines archeological resources as any material remains of past human life that are at least 100 years old and are of scientific interest. With penalties for violators, it requires federal permits for the excavation and removal of artifacts on federal lands. It provides for the custody and preservation of excavated artifacts and materials and related data having to do with archeological survey and excavation records. It provides for confidentiality within the federal agency of archeological site locations so that information is not shared with the public. It encourages cooperation with other parties to improve and increase the protection of archeological resources. Amended in 1988, it requires the development of plans for surveying public lands and for recording and reporting incidents of suspected violations.

Native American Graves Protection and Repatriation Act of 1990. The Native American Graves Protection and Repatriation Act assigns ownership or control of American Indian human remains, funerary objects, sacred objects, and objects of cultural patrimony that are excavated or discovered on federal or tribal lands to lineal descendants, affiliated Indian tribes, or Native Hawaiian organizations. Among its provisions, the act establishes criminal penalties for trafficking in human remains or cultural objects and requires federal agencies and museums receiving federal funding to inventory American Indian human remains and associated funerary objects in their possession or control and to identify their cultural and geographical affiliations.

The Wilderness Act of 1964. The Wilderness Act requires that all federal lands be evaluated for their eligibility for inclusion within the national wilderness preservation system. For those lands that possess wilderness characteristics, no action that would diminish their wilderness eligibility will be taken until after Congress and the president have taken final action.

Code of Federal Regulations. Title 36, chapter 1, provides regulations "for the proper use, management, government, and protection of persons, property, and natural and cultural resources within areas under the jurisdiction of the National Park Service."

Title 36, section 4.30, specifically addresses the use of bicycles in national park units. Under the regulation, bicycle use is prohibited except on park roads and on designated routes. Bicycle routes may only be designated if a written determination is made that this use is ". . .consistent with the protection of the park's natural, scenic and aesthetic values, safety considerations and management objectives and will not disturb wildlife or park resources." The regulation further specifies that a route designed for bicycle use, like in the Moose-Wilson corridor, shall be promulgated as a special regulation.

Executive Order 11593, "Protection and Enhancement of the Cultural Environment." This executive order instructs all federal agencies to initiate measures to ensure all federally owned sites, structures, and objects of historical, architectural, or archeological significance are preserved, restored, and maintained. The order directs agencies to "exercise caution. . . to assure that any federally owned property that might qualify for nomination [to the National Register of Historic Places] is not inadvertently. . . demolished, or substantially altered." In cases where a federal action may result in the substantial alteration or demolition of such a property, agencies are directed to take measures to make or have made records of the property.

Executive Order 11990, "Wetlands Protection." This executive order requires the National Park Service to (1) exhibit leadership and act to minimize the destruction, loss, or degradation of wetlands; (2) protect and improve wetlands and their natural and beneficial values; and (3) refrain from direct or indirect assistance of new construction projects in wetlands unless there are no feasible alternatives to such construction and the proposed action includes all feasible measures to minimize damage to wetlands.

Executive Order 11988, "Floodplain Management." The executive order requires federal agencies to avoid, to the extent possible, the long- and short-term adverse impacts associated with the occupancy and modifications of floodplains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative. All federal agencies are directed to avoid, if possible, development and other activities in the 100-year (or base) floodplain. The order requires that existing structures or facilities in such areas and needing rehabilitation, restoration, or replacement be subject to the same scrutiny as new facilities or structures. (In the case of historic structures, this scrutiny will be but one factor in determining their preservation.) The order prohibits placing highly significant and irreplaceable records, historic objects, structures, or other cultural resources, or any critical actions (actions for which even a slight risk is too great) in the 500-year floodplain.

Executive Order 13007, "Indian Sacred Sites." In managing federal lands, this executive order directs federal agencies, to the extent practicable, permitted by law, and consistent with essential agency functions, 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. If a federal action may affect the physical integrity of, the ceremonial use of, or the access to these sites by American Indian religious practitioners in federally recognized tribes, then consultations are required with the associated tribe as part of the planning and approval process.

Executive Order 13112, "Invasive Species." This executive order seeks to prevent the introduction of invasive species; to provide for their control; and to minimize the economic, ecological, and human health impacts they cause. Federal agencies are directed to use their programs and authorities to prevent the introduction of invasive species, detect and respond rapidly to control populations of such species in a cost-effective and an environmentally sound manner, monitor invasive species populations accurately and reliably, provide for restoration of native species and habitat conditions in invaded ecosystems, conduct research on invasive species and develop technologies to prevent their introduction, provide environmentally sound control of invasive species, and promote public education on invasive species and the means to address them. The order directs agencies to not authorize, fund, or carry out any action likely to cause or promote the introduction or the spread of invasive species unless the agencies determine that the benefits of this action clearly outweigh the potential harm and that they take all feasible and prudent measures to minimize the risk of harm.

Federal Executive Order 13693, "Planning for Federal Sustainability in the Next Decade." This executive order is intended to direct federal agencies to continue their leadership in sustainability and greenhouse gas emission reductions. It directs each agency to propose percentage reduction targets for agencywide reductions of scopes 1, 2, and 3 greenhouse gas emissions in absolute terms by the end of fiscal year (FY) 2025 relative to a fiscal year 2008 baseline. Providing focus areas and agency reduction goals, it states that federal agencies have the opportunity to reduce direct greenhouse gas emissions by at least 40% over the next decade, while at the same time fostering innovation, reducing spending, and strengthening the communities in which federal facilities operate. Focus areas include: energy conservation measures; renewable and alternative energy; water use efficiency and management; fleet and vehicle efficiency and management; building efficiency, performance, and management; sustainable acquisition and procurement; waste prevention and pollution prevention; and regional coordination to identify and address sustainable operations of the federal fleet, water resource management and drought response, climate change preparedness and resilience, and clean energy.

NPS Management Policies 2006. The NPS *Management Policies 2006* describe how the National Park Service will meet its management responsibilities in Grand Teton National Park under the 1916 Organic Act. The alternatives considered in this document incorporate and comply with the provisions of these mandates and policies. Additionally, NPS *Management Policies 2006* addresses the development and designation of bicycle trails in section 9.2.2.4. It states that "the designation of bicycle routes is allowed in developed areas and in special use zones based on a written determination that such use is (1) consistent with the protection of a park's natural, cultural, scenic, and esthetic values; (2) consistent with safety considerations; (3) consistent with management objectives; and (4) will not disturb wildlife or other park resources."

RELATIONSHIP TO OTHER PLANNING EFFORTS

Relevant National Park Service Planning

Master Plan: Grand Teton National Park, Wyoming (1976). This is the conceptual document that established guidelines for management and use of Grand Teton National Park within the bounds of existing legislative commitments. The 1976 master plan classified the Moose-Wilson area under relevant land classifications, visitor experience zones, and management objectives. All of the proposed actions in the Moose-Wilson corridor plan are consistent with the management directions in the 1976 master plan.

Resources Management Plan (1995). This plan describes specific management and research programs and projects that are active or needed to properly protect and manage the natural and cultural resources in Grand Teton National Park and to achieve approved management goals for the park. The plan provides the basis for measuring accomplishments against documented management, monitoring, and research needs and commitments, and for making budget requests. Management objectives for park resources and the importance of ecosystem management are noted. A variety of proposed natural and cultural resource projects are identified, covering such topics as grizzly bear management, vegetation management, and nonnative plant management. All of the proposed actions in the Moose-Wilson corridor plan are consistent with the proposed actions in the 1995 resources management plan.

Grand Teton National Park Trail Standards (1986). This document establishes trail standards for the park. All of the proposed trail modifications in this plan are consistent with these trail standards.

Southwest Entrance Facilities Environmental Assessment, Grand Teton National Park (1998). In 1998, the National Park Service completed an environmental assessment (EA) to help improve visitor services and experiences and resource protection through better law enforcement, access control, information opportunities, and emergency services at the park's southwest (Granite Canyon) entrance of the Moose-Wilson corridor. Although the environmental assessment focused on specific actions related to the Granite Canyon entrance, the National Park Service recognized the need for a comprehensive management plan for the corridor. After re-examining the entrance facilities, the National Park Service is proposing changes to the area in the Moose-Wilson corridor plan, which would modify the 1998 plan.

Moose Entrance Station Replacement Environmental Assessment (2001). This document called for the replacement of the existing Moose Entrance Station to improve visitor services and fee collection and to improve traffic flow and station conditions. Entrance station improvements included widening the existing roadway to accommodate three inbound lanes and one outbound lane and three islands separating the lanes. In addition, three buildings were proposed—two fee collection kiosks and an administrative office building. The staff parking area also was moved to accommodate the increased road width. The Moose-Wilson corridor plan proposes major changes to the existing Moose Entrance Station, including relocation and replacement of the entrance station and the addition of traffic sequencing system lanes and turnarounds.

Murie Ranch Environmental Assessment (2001). The Murie Ranch plan addressed the rehabilitation and adaptive use of the Murie Ranch Historic District. The Murie Ranch rehabilitation and adaptive use project (1) preserved the nationally significant Murie Ranch Historic District through rehabilitation to recognize the role the ranch played in shaping the US conservation movement between 1945 and 1964; (2) conducted repairs, alterations, and additions to the historic property to allow compatible, adaptive use by The Murie Center (TMC) and National Park Service; (3) preserved natural and cultural resources on and surrounding the ranch; and (4) assured that facilities were compatible with other park functions. The Moose-Wilson corridor plan does not propose changes to the Murie Ranch and the 2001 plan.

White Grass Ranch Rehabilitation and Adaptive Use Environmental Assessment / Assessment of Effect, Grand Teton National Park (2005) and Grand Teton National Park Historic Properties Management Plan / Environmental Assessment (2015). These plans describe the rehabilitation and adaptive use of the White Grass Dude Ranch Historic District as a training facility for the NPS Western Center for Historic Preservation. The plans are intended to increase the capacity of the National Park Service to preserve and rehabilitate historic structures in the Intermountain West. The Moose-Wilson corridor plan preferred alternative does not propose changes to White Grass Ranch and the 2005 plan.

Final Transportation Plan / Environmental Impact Statement, Grand Teton National Park (2007). The 2007 plan recommended a preferred system of transportation improvements within the park, including roadways and parking, developing a plan to evaluate the need and feasibility for a transit system within the park, construction of improved road shoulders and multiuse pathways, improvements to developed areas, and development of a traveler information system. More specifically, the plan called for rerouting several road segments and establishing multiuse pathways in various locations throughout the park. Within the Moose-Wilson corridor, the 2007 plan required realignment of 2.5 miles of the northern portion of the road, construction of

3.3 miles of separated shared-use pathways along the southern end of the road between the park boundary and the LSR Preserve, wildlife research and monitoring, and testing various adaptive management strategies for management of traffic on Moose-Wilson Road. After re-examining the decisions in the 2007 parkwide transportation plan, the National Park Service is proposing a number of changes in the management and use of the Moose-Wilson corridor in this plan (see the purpose and need section).

Final Bison and Elk Management Plan / Environmental Impact Statement, National Elk Refuge and Grand Teton National Park (2007). This plan provides the basis for management decisions made by the US Fish and Wildlife Service and the National Park Service for the Jackson bison and elk herds within their respective jurisdictions for a 15-year period. All of the proposed actions in the Moose-Wilson corridor plan are consistent with the management directions in the 2007 bison and elk management plan.

Winter Use Plan / Environmental Assessment and Finding of No Significant Impact, Grand Teton and John D. Rockefeller, Jr. Memorial Parkway (2009). The purpose of this plan is to ensure that park visitors have a range of appropriate winter recreational opportunities, while ensuring that these recreational activities are in an appropriate setting and do not impair or irreparably harm park resources or values. The use of snowmobiles on certain designated routes to access inholdings within Grand Teton or adjacent public or private lands will continue to be allowed, including in the Moose-Wilson corridor. These snowmobiles will not be required to meet best available technology requirements. All of the proposed actions in the Moose-Wilson corridor plan are consistent with the management directions in the 2009 winter use plan.

Moose Headquarters Rehabilitation – Site Work / Environmental Assessment, Grand Teton National Park (2010). This plan provides recommendations for site improvements to the Moose Headquarters area, including the complete reconfiguration of vehicle and pedestrian traffic within the administrative and Moose Landing areas, removal of several temporary buildings, and site restoration work targeted to improve stormwater management. The Moose-Wilson corridor plan does not propose changes to the Moose Headquarters area and the 2010 plan.

Snake River Headwaters Comprehensive River Management Plan / Environmental Assessment (2013a). The Snake River Headwaters Comprehensive River Management Plan (CRMP) / EA outlines strategies to protect and enhance outstandingly remarkable values, free-flowing condition, and water quality of the Snake River Headwaters. The CRMP / EA study area includes portions of the Snake River near Moose, Wyoming, and outlines potential river access improvements at Moose Landing. All of the proposed actions in the Moose-Wilson corridor plan are consistent with the management directions in the 2013 Snake River headwaters plan.

Relevant State and Local Planning

The Teton County/Jackson Hole Community Pathways Master Plan (2007). This plan provided direction to the Jackson Hole Community Pathways Program, which operates as an independent department of the Town of Jackson under the town administrator. The plan was intended to guide the planning, development, management, and operations of existing and future bicycle, pedestrian, and multimodal/recreational transportation infrastructure within Teton County and Jackson Hole. The goal was to create an integrated multimodal system for transportation and recreation. Based on this plan, a network of separated multiuse "pathways" have been built radiating from Jackson.

Jackson/Teton County Comprehensive Plan (2012). Section 7 of this plan focuses on reducing and managing the impacts of traffic growth occurring in Teton County. The plan sets numerical goals for reductions in the share of single-occupant vehicle trips and increases in the share of "alternative mode" (i.e., walking, bicycling, and transit) trips by 2020.

Policy 3.5b in the plan also states the town and county will "strive not to export impacts on other jurisdictions in the region:"

> The Town and County will remain conscious of the impacts of all land use decisions on the greater region and ecosystem. It is not the goal of the community to overextend our resources or jurisdiction into adjacent communities or State and Federally managed lands. The Town and County will work with neighboring jurisdictions and State and Federal agencies to develop common goals related to growth, work toward solutions, and identify resources that can benefit all parties. We will lead by example through planning that considers the entire region.

Amended Teton Village Expansion Resort Master Plan (2013). In this plan, Snake River Associates address development at three primary areas on the southwest border of Grand Teton National Park, including:

1. The Village Core Expansion, which consists of a mixed-use core sub-tract and an associated spaces sub-tract that includes public areas, local and visitor services, pathways, parking, condominiums, townhouses, affordable housing, and employee housing.
2. A residential development south of McCollister Drive.
3. A golf course / Nordic ski area that establishes a continuous buffer to the south of the village.

Expansion and development in these areas has the potential to affect motorized and nonmotorized traffic on Moose-Wilson Road and may impact wildlife habitat and backcountry use of adjacent areas.

Wyoming State Highway 22 and Wyoming State Highway 390 Planning and Environmental Linkages Study (2014). The planning and environmental linkages study (PEL) defines the transportation needs of the existing highways (both of which link to Moose-Wilson Road), and identifies a range of potential alternatives or solutions to address these needs. An outcome of the study will identify near-term improvements for specific needs that are compatible with the long-term vision for the corridor study.

Snake River through Jackson Hole Final River Management Plan (2015). Prepared for Teton County, this plan addresses increasing recreational use and potential impacts on the Snake River and adjacent public lands as it flows through Jackson Hole. The purpose of the plan is to manage recreation access, facilities, and public use to protect or enhance the quality of recreation opportunities and other resource values in the river corridor. Management actions are described regarding allowable uses, facilities and access, visitor capacities, and commercial use management, among other topics.

Jackson/Teton County Integrated Transportation Plan. Jackson and Teton County are developing an integrated transportation plan, which is intended to meet future transportation demands through the use of alternative modes. This plan will include detailed strategies to achieve the transportation objectives in the 2012 comprehensive plan.

SCOPE OF THE MOOSE-WILSON CORRIDOR MANAGEMENT PLAN / ENVIRONMENTAL IMPACT STATEMENT

Planning Issues and Opportunities to be Addressed

Human and Wildlife Interactions. The Moose-Wilson corridor contains some of the richest and most diverse wildlife habitat in Grand Teton National Park. With a variety of wildlife species present in the corridor, including grizzly and black bears, moose, elk, pronghorn, deer, gray wolves, coyotes, and beavers, as well as a myriad of recreational opportunities, the Moose-Wilson corridor has become a popular visitor destination. A key natural resource management challenge associated with the Moose-Wilson corridor is related to the presence of grizzly bears, which have consistently inhabited the corridor since 2008, and may be present within the corridor at any time. The bears use fruit-bearing shrubs and trees and other readily available food sources that are prevalent along Moose-Wilson Road. The proximity of these food sources to the road has created increased viewing opportunities for visitors, which causes frequent "bear jams" and increases the likelihood of unacceptable human-bear interactions. The increase in visitor use has raised concerns over the safety of visitors and wildlife using the Moose-Wilson corridor.

> *How can the National Park Service best balance providing wildlife viewing opportunities, minimizing human impacts on wildlife, and mitigating safety concerns associated with potentially dangerous wildlife such as moose, black bears, and grizzly bears within the corridor?*

Historic Character. Another key resource management challenge is associated with the historic character of Moose-Wilson Road, which was established in the late 1800s as an access road to local ranches and residences. The narrow, winding, partially gravel road provides "back door" access to the southern perimeter of the park and a rustic, slow-driving experience for visitors looking for exceptional scenery and wildlife viewing opportunities. It is also eligible for listing in the National Register of Historic Places. The existing road receives increasingly high traffic volumes and changes to the corridor to accommodate this increase in use could have major irreversible effects on the historic character of Moose-Wilson Road and its national register eligibility.

> *What is the most appropriate way to maintain the rustic, narrow, winding, slow driving experience and historic character of Moose-Wilson Road and other historic properties and sites within the corridor?*

Bicycle and Motor Vehicle Use. The 2007 Record of Decision for the park's transportation plan authorized the development of a multiuse pathway along the portion of Moose-Wilson Road from the Granite Canyon Entrance to the LSR Preserve Center parking lot, via the service road that accesses the Snake River levee. The Record of Decision also required park staff to test a number of different strategies (on an interim basis) for managing the increasing traffic volumes on Moose–Wilson Road. The volume of traffic on the road, combined with the various purposes for which people are traveling the road (e.g., convenience, viewing scenery or wildlife, commuting) is resulting in congestion and conflicts among users. When the National Park Service stated it was considering converting a portion of the road to one way northbound for the 2013 season, many within the community disagreed, expressing strong concerns and called for additional opportunities for public involvement.

In addition, many within the community have strongly urged the National Park Service to develop a multiuse pathway along the entire length of Moose-Wilson Road rather than only along the southern portion as called for in the 2007 Record of Decision. Such a pathway would connect to the Jackson Hole Community Pathways system at the Granite Canyon Entrance and also to the park's pathway system at Moose, completing a roughly 30-mile loop through the town of Jackson, Teton Village, and Moose.

> *What purpose(s) should the road serve in the future? What strategies are most appropriate in managing increasing traffic volumes and uses along the Moose-Wilson corridor? Should a multiuse pathway be provided along some or all of the road?*

Visitor-Related Resource Impacts. The Moose-Wilson corridor faces resource impacts from a variety of visitor activities, including damage from off-road parking along Moose-Wilson and Death Canyon Roads to access trailheads and view wildlife along the roadside, horse use on trails, proliferation of social trails, and prohibited uses on the Snake River levee road. Potential adverse impacts on grizzly bears and other wildlife include the effects of visitors using a multiuse pathway within the corridor.

> *How can the National Park Service manage visitor use in the corridor to ensure that this use does not impact ecological communities, exceptional scenery, wildlife behaviors / wildlife viewing opportunities, or conflicts with other visitor uses?*

Visitor Experience. The visitor experiences provided in the Moose-Wilson corridor are unique to Grand Teton National Park, including recreational opportunities, wildlife viewing, and other cultural and natural resource experiences. The approximately 400,000 visitors that come to the corridor annually for these experiences would potentially be affected by changes to management of the corridor. Roughly 15% of the park's 2.7 million annual visitors travel through the corridor.

> *How can visitor opportunities to recreate, experience and enjoy the resources within the management area be maintained or enhanced? What is the most appropriate way in which the National Park Service can provide increased interpretation and education about the resources and values along the Moose-Wilson corridor?*

Park Operations. Since the roads and facilities within the Moose-Wilson corridor are open on a seasonal basis, as is Teton Park Road, the magnitude to overall park operations is not as great as for other year-round roads and facilities within Grand Teton National Park. However, with increased use of the corridor, especially with vehicle traffic levels, this magnitude continues to increase. Primary park operation challenges for the Moose-Wilson corridor include:

1. managing wildlife-visitor interactions and frequent "wildlife jams" when grizzly bears, black bears, and other popular wildlife species are present
2. managing the LSR Preserve as dictated by the October 15, 2007, *Reserved Conservation Easement Establishing the LSR Preserve* and the *July 25, 2007, Laurance S. Rockefeller Preserve Property Maintenance Plan*
3. managing noxious weeds and other increased resource impacts from parking outside designated parking areas and along Moose-Wilson and Death Canyon Roads
4. managing unauthorized use of the Snake River levee road (e.g., bicycle use and pets)
5. managing resource impacts from use of the horse trails in the corridor
6. increased maintenance of both Moose-Wilson and Death Canyon Roads due to higher traffic volumes (e.g., deterioration of existing road surfaces)

7. determining the level of maintenance operations needed to provide visitors with recreational opportunities during the winter months

With increasing use of the corridor and limited staff and funds, how can the park staff effectively and efficiently protect the corridor's resources, values, and character (including, but not limited to, road and facility maintenance, wildlife management, resource protection and emergency response), while also ensuring high quality visitor experiences?

Issues and Concerns Considered but not Addressed

Regional Transportation. Jackson and Teton County are experiencing increased growth and development. An estimated 3.5 million people travel through the area in both summer and winter. Increasing congestion is occurring, as well as resource impacts, which are affecting Grand Teton National Park. Future traffic volumes anticipated from continuing auto-dominated travel behavior and dispersed development patterns are expected to far exceed the available roadway capacity, resulting in severely diminished mobility in Teton County (Jackson/Teton County 2012 Comprehensive Plan, appendix E). However, the actions that can be taken to address this issue are outside the park, outside the control of the National Park Service, and beyond the scope of this plan. The issue of regional transportation planning has been addressed in a Jackson/Teton County integrated transportation plan. The National Park Service will continue to cooperate with Jackson and Teton County to address regional transportation issues that affect the park, independent of the Moose-Wilson corridor planning process.

Identification of Impact Topics

An important part of planning is seeking to understand the consequences of making one decision over another. To this end, NPS plans are typically accompanied by an environmental compliance document. Environmental impact statements, such as this document, identify the anticipated impacts of possible actions on resources and on park visitors and neighbors. Impacts are organized by topic, such as impacts on visitor experience or impacts on vegetation. Impact topics serve to focus on the environmental analysis and to ensure the relevance of impact evaluation. Impact topics identified for the Draft Moose-Wilson Corridor Comprehensive Management Plan / Environmental Impact Statement were identified based on federal laws and other legal requirements, CEQ guidelines, NPS management policies, staff subject-matter expertise, and issues and concerns expressed by the public and other agencies early in the planning process.

The interdisciplinary planning team conducted a preliminary analysis to determine the anticipated context, duration, and intensity of effects on the human environment from implementing the alternatives. As a result, some impact topics have been eliminated from further analysis because the resources do not occur within the project area, the topics are not an issue for this project, the topics cannot be meaningfully analyzed, or because the anticipated impacts would have no effect or an inconsequential effect on the topic. Impact topics carried forward for analysis were determined to have the potential to result in important impacts as perceived by the National Park Service, stakeholders, or the public.

Table 1 lists the impact topics that are analyzed in detail verses those that have been eliminated from detailed analysis. A brief rationale is then provided for impact topics that have been eliminated from further analysis in this environmental impact statement.

IMPACT TOPICS CONSIDERED BUT DISMISSED FROM DETAILED ANALYSIS

Air Quality

Grand Teton National Park is a class I area under the Clean Air Act. Lands with this designation are subject to the most stringent regulations and limited increases in pollution are permitted in the vicinity. In general, air quality is considered good in the park and in the Moose-Wilson corridor. The area is in attainment for national ambient air quality standards. The alternatives would not affect the class I air quality designation for the park. Emissions from vehicles in the area would not substantially change due to the alternatives. Dust generated by vehicles driving on the unpaved portion of Moose-Wilson Road would be reduced in a couple of the alternatives, including the preferred alternative. The only air quality impacts from the action alternatives would be associated with road maintenance activities and/or new construction-related impacts due to the construction of new facilities (e.g., roads, parking areas, turnoffs, pathways). Pollutants emitted by construction equipment, such as particulate matter, soot, and nitrogen oxides, would be localized and limited to the construction season (from approximately May through October over two years). With air pollution emission and dust abatement mitigation measures and local breezes, which would disperse pollutants, impacts on air quality would be minimal over the project area and highly localized. On a regional level, the amount of pollutants emitted would not be substantial and the impacts on air quality would be similar for all action alternatives. Thus, this topic is not analyzed further in the environmental impact statement.

TABLE 1. IMPACT TOPICS

Impact Topics Analyzed in Detail	Impact Topics Eliminated from Detailed Analysis
▪ Wildlife and Wildlife Habitat ▪ Federal Listed and Candidate Wildlife Species – Grizzly Bear – Canada lynx – Gray wolf – Greater sage-grouse ▪ Wetlands ▪ Hydrology ▪ Water Quality ▪ Vegetation ▪ Soils ▪ Historic Structures, Sites, and Cultural Landscapes ▪ Archeological Resources ▪ Ethnographic Resources ▪ Visual Resources ▪ Acoustic Resources and Soundscapes ▪ Wilderness Character ▪ Visitor Use and Experience ▪ Traffic and Transportation ▪ Socioeconomic Environment ▪ Park Operations	▪ Air Quality ▪ Fisheries ▪ Federal Listed and Candidate Wildlife Species – Western Yellow-billed Cuckoo – Whitebark Pine ▪ Wild and Scenic Rivers ▪ Prime and Unique Farmlands ▪ Night Skies ▪ Carbon Footprint ▪ Energy Requirements and Conservation Potential ▪ Natural or Depletable Resource Requirements and Conservation Potential ▪ Indian Trust Resources ▪ Museum Collections ▪ Environmental Justice

Fisheries

The Moose-Wilson project area contains several perennial streams and lakes that harbor native fish populations, including native cutthroat trout species. All of the fisheries in the watersheds in the project area are generally considered to be relatively stable based on levels of visitation, presence of water development infrastructure, competition from nonnative fish populations, and angling pressure. Some actions are affecting fisheries in localized areas such as loss of water for fish habitat due to diversions and competition due to nonnative fish. But none of the actions being proposed in the alternatives would noticeably change these factors. There would be no substantial change in fisheries habitat conditions that would adversely affect the fisheries. (Furthermore, proposed improvements to correct drainage issues and restoration of wetland functions under several of the alternatives would improve fish habitat.) The application of the proposed hydrological and fisheries mitigation measures, such as using adequately sized culverts and other improvements, to accommodate fish passages would also be expected to avoid adverse impacts on fisheries. Thus, this topic is not analyzed further in the environmental impact statement.

Wild and Scenic Rivers

Although the Snake Wild and Scenic River is within the corridor, no actions are being proposed in this plan that would affect the designated river or its outstandingly remarkable values. All of the actions in the alternatives are consistent with the management directions in the *Snake River Headwaters Comprehensive River Management Plan*.

Western Yellow-Billed Cuckoo

The western yellow-billed cuckoo (*Coccyzus americanus*) distinct population segment was listed by the US Fish and Wildlife Service as a threatened species on October 3,2014 (*Federal Register* 79 (192): 59992-60038). The threatened listing follows a substantial reduction in species population from southern Canada to northern Mexico. Due to substantial levels of habitat loss and degradation, the western yellow-billed cuckoo is nearly extinct in areas west of the Continental Divide and is rare in other areas of the Interior West (NPS 2006). Critical habitat for the western distinct population segment was proposed by the US Fish and Wildlife Service on August 15, 2014 (*Federal Register* 192: 48547-48652), but not within Grand Teton National Park.

The western yellow-billed cuckoo breeds in arid and semi-arid landscapes below 6,000 feet (USFWS 2013a). Typical nesting habitat includes riparian woodlands greater than 50 acres in size that support dense, tall willows (*Salix* spp.) with mature deciduous trees such as cottonwood (*Populus fremontii*; *P. augustifolia*), species that provide well-branched, dense canopies for foraging and nesting. Historically, this species was rare in western Wyoming (USFWS 2013a). The breeding population in the state is extremely low, numbering in the single digits, and breeding remains unconfirmed. The western yellow-billed cuckoo likely does not occur in the project area because the park is outside the historical breeding range of the species. Although the project area lies within the species' western distinct population segment, as defined by the US Fish and Wildlife Service, there are no records of the species occurring in the project area. The only reported confirmed observation of this species occurred in 2000 along the eastern boundary of the park at the Teton Science School's Monitoring Avian Productivity and Survivorship Station (NPS 2009a). Thus, this topic is not analyzed further in the environmental impact statement.

Whitebark Pine

Whitebark pine (*Pinus albicaulis*) is a federal candidate for listing (76 *Federal Register* 42631; July 19, 2011). In Wyoming, this species usually grows above 8,000 feet on cold and windy subalpine to alpine sites. Major threats to whitebark pine include mortality from disease caused by white pine blister rust, predation by mountain pine beetle, climate change, and habitat loss from fire suppression activities (USFWS 2015). No actions are being proposed in this plan that would affect subalpine and alpine areas where the whitebark pine grows in the Moose-Wilson project area. Thus, this topic is not analyzed further in the environmental impact statement.

Prime and Unique Farmlands

In 1980, the Council on Environmental Quality directed federal agencies to assess the effects of their actions on farmland classified by the Natural Resources Conservation Service as prime or unique. Prime farmlands are defined as lands that have the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and are available for these uses. Prime farmlands have the soil quality, growing season, and moisture supply needed to produce economically sustained high yields of crops when treated and managed according to acceptable farming methods, including water management. In general, prime farmlands have an adequate and dependable water supply from precipitation or irrigation, a favorable temperature and growing season, an acceptable acidity or alkalinity, an acceptable salt and sodium content, and few or no rocks. Unique farmlands are lands other than prime farmland that are used for the production of specific high-value food and fiber crops.

Private inholdings of agricultural land exist within the boundaries of Grand Teton National Park. However, there are no designated prime or unique agricultural lands within Grand Teton National Park (Natural Resources Conservation Service [formerly the Soil Conservation Service], unpublished data). None of the actions proposed in the range of alternatives would affect such lands, access to them, or their agricultural properties; therefore, this topic is not analyzed further in the environmental impact statement.

Night Skies

NPS *Management Policies 2006* state the National Park Service will preserve, to the greatest extent possible, the natural lightscapes of park units, including natural darkness. The agency strives to minimize the intrusion of artificial light into the night scene by limiting the use of artificial outdoor lighting to basic safety requirements, shielding the lights when possible, and using minimal impact lighting techniques.

The Moose-Wilson corridor is currently a dark area, with motor vehicle headlights and outdoor and interior lights at Murie Ranch, White Grass Ranch, White Grass Ranger Station, and private residences being the only source of nighttime light in the corridor. However, there are relatively few vehicles driving the road at night and there are few impacts from the direct glare of motor vehicle lights. None of the alternatives being considered in this plan are proposing nighttime lighting in the corridor, and none of the alternatives would be expected to increase nighttime vehicle traffic. No new facilities are being proposed in the alternatives that would necessitate new nighttime lighting in the corridor. Thus, this topic is not analyzed further in the environmental impact statement.

Carbon Footprint

For the purpose of this planning effort, “carbon footprint” is defined as the sum of all emissions of carbon dioxide and other greenhouse gases (e.g., methane and ozone) that would result from implementation of any of the action alternatives. Understanding the carbon footprint of each alternative is important for determining its contribution to climate change.

This impact topic was dismissed from further analysis for several reasons: (1) few changes would occur in the way visitors reach the project area as a result of the alternatives, (2) the minimal new developments proposed in the project area would not noticeably increase greenhouse gas emissions, and (3) newer sustainable building practices should help limit additional greenhouse gas emissions.

None of the action alternatives is expected to result in a substantial boost in visitation to the park. There would be an incremental increase in greenhouse gases compared to the present due to short-term construction activities in the project area. However, under all the action alternatives, existing traffic levels would be maintained, or possibly reduced from current levels, which would prevent an increase in greenhouse gas emissions. Also, under all alternatives, the National Park Service would continue to encourage energy efficiency in its operations (e.g., using low-emission biodiesel fuels to power motor vehicles) to minimize the emission of greenhouse gases. Because of the incremental increases in the amount of greenhouse gas emissions that would result from each alternative, determining a quantitative measurement of their carbon footprint is not practicable.

Energy Requirements and Conservation Potential

None of the management alternatives would result in a major change in energy consumption, energy availability, or costs compared to current conditions. Several proposed actions in the alternatives would help limit increased traffic using the corridor and thus help limit energy consumption. A few facilities are proposed to be built or expanded in the corridor under the action alternatives. The National Park Service would pursue sustainable practices whenever possible in all decisions regarding park operations, facilities management, and developments. Whenever possible, the National Park Service would use energy conservation technologies and renewable energy sources. Thus, none of the management alternatives would result in a major change in energy consumption or energy availability compared to current conditions.

Construction of a multiuse pathway is not expected to have a substantial impact on traffic (and traffic emissions), although it would promote more nonmotorized traffic in some areas. Encouraging the use of more energy-efficient travel modes within the corridor could reduce energy consumption and consumption of nonrenewable resources.

Overall, the impact of the action alternatives on energy requirements and conservation potential would be small, and therefore, this topic is not analyzed further in the environmental impact statement.

Natural or Depletable Resource Requirements and Conservation Potential

None of the alternatives being considered in this plan would result in the extraction of natural or depletable resources from the project area or Grand Teton National Park. It is likely that sand and gravel would need to be extracted for road and pathway construction under the alternatives, but this material would likely be taken from an existing permitted gravel operation within Bridger-Teton National Forest and the project would be designed to ensure that only the minimum amount would be used. Sand and gravel are relatively plentiful in the region and extracting needed material for this project would not deplete these resources. The amount of other materials, such as metals and concrete, that would be required for construction and operation of the road, pathway, and other facilities in the alternatives would be small and would not be detectable compared to the annual, regional use of these materials. Therefore, this topic is not analyzed further in the environmental impact statement.

Museum Collections

None of the actions being considered in this plan would be anticipated to affect the park's museum collections. Any specimens, artifacts, and resource management records collected or generated by the cultural and natural resources management activities discussed in this plan would be permanently retained in the park museum collections and archives in accordance with all NPS policies and guidelines. Collection items would be documented (accessioned and cataloged), preserved, and made accessible for future research and use as appropriate. Therefore, this impact topic is not analyzed further in the environmental impact statement.

Indian Trust Resources

Secretarial Order 3175 requires that any anticipated impacts on Indian trust resources from a proposed project or action by Department of the Interior agencies be explicitly addressed in environmental documents. The federal Indian trust responsibility is a legally enforceable fiduciary obligation of the United States to protect tribal lands, assets, resources, and treaty rights, and it represents a duty to carry out the mandates of federal law with respect to American Indian and Alaska Native tribes. There are no Indian trust resources in the park. Therefore, this topic is not analyzed further in the environmental impact statement.

Environmental Justice

Executive Order 12898 requires all federal agencies to incorporate environmental justice into their missions by identifying and addressing the disproportionately high or adverse human health or environmental effects of their programs and policies on minorities and low-income populations and communities. According to the Environmental Protection Agency, environmental justice is the fair treatment and meaningful involvement of all people, regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Fair treatment means that no group of people, including a racial, ethnic, or socioeconomic group, should bear a disproportionate share of the negative environmental consequences resulting from industrial, municipal, and commercial operations or the execution of federal, state, local, and tribal programs and policies. Teton County, where Grand Teton National Park is located, contains minority and low-income populations; however, environmental justice is dismissed as an impact topic for the following reasons:

- NPS staff and the planning team actively solicited public participation in the planning process and gave equal consideration to input from all persons regardless of age, race, income status, or other socioeconomic or demographic factors.
- Implementation of any of the alternatives would not result in any disproportionate human health or environmental effects on minorities or low-income populations and communities.
- The impacts associated with implementation of the alternatives would not result in any effects that would be specific to any minority or low-income community.

NEXT STEPS IN THE PLANNING PROCESS AND IMPLEMENTATION OF THE PLAN

Following distribution of the Draft CRMP/EIS, there will be a 60-day public review and comment period. The NPS planning team will then evaluate comments from other federal and state agencies, tribes, organizations, businesses, and individuals regarding this draft plan and incorporate appropriate changes. A final corridor management plan will then be prepared, which will include letters from governmental agencies, substantive comments on the draft document, and NPS responses to those comments.

After release of the final corridor management plan and a 30-day no-action period, a record of decision approving a final plan will be prepared for signature by the NPS regional director. The record of decision will document the NPS selection of an alternative for implementation. The plan will then be implemented, depending on funding and staffing.

Implementation

The approval of this plan does not guarantee that the funding and staffing needed to implement the plan will be forthcoming. Full implementation of the approved plan could be many years in the future. The implementation of the approved plan could also be affected by other factors such as changes in visitor use patterns, additional data or regulatory compliance requirements, competing national park system priorities, and unforeseen environmental changes.

Once the comprehensive management plan has been approved, additional feasibility studies and more detailed planning and environmental documentation may be necessary before certain proposed actions are carried out. For example:

- appropriate permits would be obtained before implementing actions that would impact wetlands
- appropriate federal and state agencies would be consulted concerning actions that could affect threatened and endangered species
- appropriate consultation with American Indian tribes and the Wyoming State Historic Preservation Office to minimize or avoid adverse impacts on historic properties and other cultural resources

2 Alternatives

INTRODUCTION

DEVELOPMENT OF THE ALTERNATIVES

The National Environmental Policy Act of 1969, as amended, and NPS policies require that park managers consider a full range of reasonable alternatives, including a no-action alternative and an environmentally preferable alternative, before choosing a preferred alternative. The alternatives should be consistent with the park's purpose and significance, focus on its fundamental and other important resources and values, reflect the range of stakeholders' interests in the park and the desirability of providing for a variety of visitor experiences, and fully consider the potential for environmental impacts.

The Council on Environmental Quality has defined reasonable alternatives as those that are economically and technically feasible and that show evidence of common sense. Alternatives that could not be implemented if they were chosen, or that do not resolve the need for action and fulfill the stated purpose in taking action, to a large degree, should be eliminated as unreasonable before impact analysis begins. Unreasonable alternatives may be those that are unreasonably expensive; that cannot be implemented for technical or logistical reasons; that do not meet park mandates; that are inconsistent with carefully considered, up-to-date park statements of purpose and significance or management objectives; or that have severe environmental impacts—although none of these factors automatically renders an alternative unreasonable. The council is also clear that agencies should not pare down the list to only those alternatives that are inexpensive, easy, or are the park staff's favorite approach. Rather, feasibility is an initial measure of whether the alternative makes sense and is achievable.

This guidance has been used to develop the range of alternatives for the *Moose-Wilson Corridor Comprehensive Management Plan*. The process used to develop the alternatives included six distinct steps that are described below.

1. Inform the Plan
2. Establish the Vision
3. Develop Range of Management Options
4. Formulate the Preliminary Alternatives
5. Analyze Public Comments on the Preliminary Alternatives
6. Refine the Alternatives

Step 1, "Inform the Plan," was used to establish the purpose and need for the plan; define the fundamental resources and values of the Moose-Wilson corridor; review internal and public scoping comments; evaluate existing conditions, trends, issues, and opportunities; and describe current management strategies that define the no-action alternative. Step 2, "Establish the Vision" was then used to develop management goals and desired conditions for the fundamental resources and values within the corridor.

Using the management goals, desired conditions, and issues statements developed earlier, the planning team then developed a "Range of Management Options" to achieve the goals and desired conditions and to address the issues. Management options were based on ideas provided during both internal and public scoping.

Once the management options were developed, they were used to "Formulate the Preliminary Alternatives." By organizing the management options into various configurations, the planning team developed a number of distinct alternative concepts that describe different approaches to achieving the overarching goals and desired conditions of the plan. This step also included the development of mitigation measures, best management practices, monitoring guidelines, strategies to address climate change, and a visitor use management framework that are common to all action alternatives.

The fifth step in the process included public review of the preliminary alternatives and an analysis of public comments received. This additional step is not a NEPA requirement, but it provided an opportunity to hear from the public on the initial management strategies being considered. This feedback allowed the planning team to "Refine the Alternatives" before evaluating their impacts and identifying the NPS preferred alternative.

Four cooperating agencies provided input in the development of alternatives. Representatives from Teton County, the Town of Jackson, the State of Wyoming, and the Federal Highway Administration—Western Federal Lands Highway Division provided ideas on each step of the process. Their feedback on the purpose and need for the plan, planning issues, management options, and key strategies to include in the range of alternatives has been instrumental to the planning effort. Utah State and Penn State Universities also informed the development of the alternatives by reporting their research findings related to transportation and visitor use within the Moose-Wilson corridor. Please refer to "Chapter 3: Affected Environment," for more information on these and other studies that were used to inform the plan.

GOALS AND DESIRED CONDITIONS

As an integral part of Grand Teton National Park, the Moose-Wilson corridor contains most of the park's fundamental resources and values. The following goals and desired conditions have been developed for these fundamental resources and values as part of this comprehensive planning effort. Please refer to chapter 1 for a description of each fundamental resource and value identified within the corridor. Each alternative was developed to be compatible with attaining these goals and desired conditions, as well as meeting the purpose and need for the plan. Please refer to "Chapter 4: Environmental Consequences," for a description of both the beneficial and adverse effects that would result from implementation of the alternatives.

Scenery

Goal: Preserve the exceptional variety of scenery and wildlife viewing opportunities within the Moose-Wilson corridor.

Desired Conditions:

- All developments and uses are harmonious with the natural and historic character of the Moose-Wilson corridor.
- Scenic vistas and features provide visitors with opportunities to view wildlife and be immersed in the intimate natural settings of the corridor that are not diminished by development and continue to foster a sense of discovery.

Geologic Processes

Goal: Allow natural geologic forces to continue to shape the dynamic landscapes of the Moose-Wilson corridor.

Desired Conditions:

- Geologic features of the corridor are not diminished by developments and continue to provide visitors with a glimpse into the seismic and geomorphic processes of the region.
- Human-made structures and the impacts of construction do not affect long-term geologic development in terms of erosional and other geomorphic processes.

Ecological Communities and Wildlife

Goal: Protect and maintain the natural function, diversity, complexity, and resiliency of the ecological systems and natural communities of the Moose-Wilson corridor; allow natural behaviors of wildlife individuals and species to continue; and maintain the unique habitat characteristics and conditions that result from the distinctive proximity of the Snake River riparian habitat to the Teton Range.

Desired Conditions:

- Ecological integrity and processes, including natural changes and disturbances, remain unimpeded.
- Individual species and plant and wildlife communities function at natural levels of diversity, distribution, and complexity with little human disturbance.
- Human disturbances to the natural behavior of wildlife species and wildlife individuals (including effects of human noise, presence, and interaction with wildlife) are minimized, or eliminated where possible.
- Ecosystems, habitats, and native species impacted by human activities are restored to their natural abundance, diversity, and distribution.
- Sensitive habitats and dynamic areas (and associated/interconnected resources) that are prone to natural disturbances are void of and buffered from future development.
- Nonnative and invasive species are managed to a level so they do not deter from native species abundance, diversity, distribution, and ecological function.

Aquatic Resources

Goal: Protect and restore the natural hydrological features, processes, and functions within the Moose-Wilson corridor, including wetlands, beaver ponds, seeps, springs, floodplains, the Snake River and its many tributaries, and Phelps Lake. Maintain and protect the diverse native aquatic communities and species that rely on the hydrologic features within the Moose-Wilson corridor.

Desired Conditions:

- The natural processes that connect the hydrologic features in the Moose-Wilson corridor are unhindered by park use and management, resulting in the natural evolution of these features.
- The effects of climate change are identified and mitigated to the greatest extent possible, recognizing that hydrologic processes have been altered in this area.
- The physical, chemical, and hydrological properties of the Snake River, its tributary streams, ponds, and Phelps Lake reflect natural water quality conditions that meet or exceed applicable water quality standards.
- The aquatic habitat in the corridor (and aquatic communities and species that rely on aquatic habitat) possess a diversity and condition that reflect natural levels with little human disturbance.
- The aquatic resources impacted by human activities are managed to maintain and restore their natural condition, abundance, diversity, and distribution.

Cultural History and Resources

Goal: Protect and maintain cultural resources as important links to the human history of the Moose-Wilson corridor, including historical and archeological sites, cultural landscapes, and ethnographic resources.

Desired Conditions:

- The integrity of cultural resources (historical, archeological, and ethnographic) is safeguarded to preserve significant attributes and uses that contribute to historical significance.
- Cultural resources that hold particular meaning to the human history of the corridor or with traditionally associated tribes, people, and groups are fully understood, managed in a sensitive manner, and interpreted where appropriate.
- To the greatest extent possible, management actions affecting National Register of Historic Places-eligible or -listed properties would not degrade their historic integrity or significance.

Natural Soundscapes and Acoustic Resources

Goal: Preserve and restore the natural soundscapes and acoustic resources within the Moose-Wilson corridor.

Desired Conditions:

- Visitors are provided the opportunity to understand and appreciate the importance of natural soundscapes and the acoustic resources of the Moose-Wilson corridor.
- Noise levels that interfere with conversation or interpretive programs rarely occur and are of limited duration, except in high visitor use areas or adjacent to travel corridors.
- Only natural sounds are audible in wilderness and other backcountry areas, except for short duration, infrequent, human-caused sounds.
- The integrity of natural soundscapes and acoustic resources is not diminished by noise from visitor activity and road traffic.
- Noise levels that mask important auditory signals or otherwise affect wildlife behavior are uncommon and limited to locations near roads and high visitor use areas.

Visitor Experience in an Outstanding Natural Environment

Goal: Provide meaningful opportunities to experience and enjoy the rustic character and diverse ecosystems of the Moose-Wilson corridor.

Desired Conditions:

- Visitor use levels and experiences within the corridor are characterized as intimate, unhurried, slow in pace, leisurely, and uncongested. Conflicts between visitors are minimal as various activities and experiences are not detrimental to one another.
- Moose-Wilson Road provides access to the distinct experiences of the road and places within the corridor, including Laurance S. Rockefeller Preserve, Phelps Lake, Granite and Death Canyons, White Grass Ranch, and the Snake River.
- Visitors continue to find a diverse range of opportunities in the Moose-Wilson corridor and the fundamental resources and values found in it throughout all seasons.
- A primitive character is created through minimal development, which maintains rustic character through strategic and sustainable design elements and decisions.
- The level of development is the minimum necessary to provide the desired visitor experience while protecting the scenery, habitat, wildlife, and rustic qualities of the Moose-Wilson corridor.
- The experience of visitors to the Laurance S. Rockefeller Preserve is consistent with the terms of the

conservation easement and property management plan. Management of the entire corridor and actions taken by the National Park Service are also consistent with those requirements, whether occurring within or outside the LSR Preserve.

- Opportunities are available for visitors to safely enjoy the area and its resources through a variety of appropriate activities, consistent with their own skills, abilities, and experience. Information is available to visitors to assist them in making informed decisions about how to safely enjoy the park.
- To the extent feasible, park programs, services, and facilities are accessible to and usable by all people, including those with disabilities.
- The vast majority of visitors are highly satisfied with park facilities, services, and recreational opportunities.

IDENTIFICATION OF THE NPS PREFERRED ALTERNATIVE

The preferred alternative is defined in the Department of the Interior NEPA regulations as the alternative that the National Park Service determines "would best accomplish the purpose and need of the proposed action while fulfilling its statutory mission and responsibilities, giving consideration to economic, environmental, technical, and other factors" (43 CFR 46.420(d)). Identification of the NPS preferred alternative for the Moose-Wilson Corridor Comprehensive Management Plan involved evaluating the alternatives in a manner that addressed the elements included in the NEPA regulations. These elements include:

- Which alternative best meets the purpose and need for taking action?
- Which alternative best meets the NPS statutory mission and responsibility?
- Which alternative best meets the consideration of environmental impacts?
- Which alternative best meets the consideration of technical factors (such as costs and ability to implement a sustainable decision)?
- Which alternative best meets the consideration of other factors (such as stakeholder interest and federal, state, and tribal consultations)?

Identification of a preferred alternative is within the discretion of the National Park Service.

Pursuant to Director's Order 12, a superintendent may make recommendations regarding the preferred alternative to the regional director in consideration of input from the project team (referred to in Director's Order 12 as interdisciplinary teams, or project review teams), which includes resource and compliance specialists who have worked on and provided input into the EIS process.

A four-day workshop occurred at Grand Teton National Park December 9–12, 2014, to identify the preferred alternative. Twenty-seven staff members representing all divisions from the park attended the workshop. The discussions to identify the preferred alternative considered all relevant information, including the potential beneficial and adverse effects of each alternative so that the nature and extent of likely impacts could be understood. Workshop sessions were organized by the 10 management topics presented under each alternative (see the next section of this chapter for more information). This allowed staff to consider a combination of management strategies from the range of alternatives to build the preferred alternative, rather than simply identifying one of the established alternatives as the agency's preferred approach.

Once all preferred strategies were identified from the range of alternatives, they were then reviewed collectively by the planning team. Due to similarities between the preferred strategies and alternative C, the team chose to modify this alternative and identify it as the preferred alternative (rather than craft an entirely new alternative). To retain a full range of reasonable alternatives, some strategies from the other action alternatives were also modified during this process. Please refer to the subsequent sections of this chapter for a full description of the range of alternatives, including the NPS preferred alternative.

It is important to note that when identifying a preferred alternative, no final agency action is being taken. The purpose of identifying a preferred alternative is to let the public know which alternative the agency is leaning toward selecting at the time a draft environmental impact statement is released. Public input is a key element of the NEPA process and the National Park Service wants to solicit and fully consider public feedback on the agency's preferred alternative before it is selected. When an alternative is selected for implementation after the release of a final environmental impact statement, the rationale for selecting that alternative is provided in the Record of Decision.

ALTERNATIVES

ORGANIZATION OF THE ALTERNATIVES

This section includes a description of the no-action alternative (alternative A) and three action alternatives (alternatives B, C, and D). The no-action alternative would continue current management and provides a basis for comparing the other alternatives. The action alternatives present different approaches to managing park resources and values within the Moose-Wilson corridor, including a spectrum of visitor opportunities and amenities.

A concept statement for each alternative is presented followed by strategies that would guide Grand Teton National Park management of the Moose-Wilson corridor. These strategies are organized by the following 10 management topics:

1. Traffic Management along Moose-Wilson Road
2. Physical Characteristics of Moose-Wilson Road
3. Moose-Wilson Road Realignments
4. Turnouts and Parking
5. Bicycle Use
6. Commercial Activity
7. Death Canyon
8. Winter Access and Use
9. Visitor Use and Experience / Education and Interpretation
10. Horse Use

ALTERNATIVE A (NO ACTION)

Concept Statement

This alternative represents the continuation of current management practices related to natural and cultural resources; visitor use; traffic and transportation; operations; and maintenance of roads, trails, and facilities within the Moose-Wilson corridor. The description of the no-action alternative is only a subset of current management practices to compare specific management strategies that are proposed in the action alternatives. Park management, such as law enforcement, emergency response, trail management, fire management, and facility management are not included below because no changes are being proposed to these routine operations within the corridor.

Traffic Management Along Moose-Wilson Road

- The road would continue to provide two-way travel between the Moose and Granite Canyon Entrances in the same manner as the existing conditions.
- The Moose-Wilson Road would be open to motor vehicle use from early/mid-May through October 31.

Physical Characteristics of Moose-Wilson Road

- The physical characteristics of the road would remain unchanged. The unpaved portion of the road would remain unpaved.

Moose-Wilson Road Realignments

- The road would be retained in its existing alignment and width.

Turnouts and Parking

- Parking lots and visitor-created roadside turnouts would generally remain their current size and in the same locations. Changes would be addressed on a case-by-case basis.

Bicycle Use

- Bicycles would continue to be allowed on roads and parking areas that are open to public vehicular traffic and not allowed on trails.

- During seasonal periods when Moose-Wilson Road is closed to motor vehicles, bicycles would continue to be permitted to use Moose-Wilson Road, Death Canyon Road, and the LSR Preserve Road when they are free of snow and ice.

Commercial Activity

- Current commercial visitor services within the corridor would continue to be permitted.

- Park-authorized road-based tours and photography workshops would continue.

- Guided horseback riding in the Moose-Wilson corridor would continue at current use levels and on currently authorized trails.

- Guided skiing and snowshoeing would continue under current use limits.

Death Canyon

- The unpaved section of the road would be maintained to current standards. The road would continue to be signed as four-wheel drive recommended.

- The trailhead parking area would be maintained in its current configuration.

- Visitors would continue to be allowed to park in user-created parking areas along the unpaved portion of the road.

Winter Access and Use

- The unplowed section of Moose-Wilson Road would continue to extend from the Death Canyon Road junction to Granite Canyon Trailhead. The unplowed portion of the road would be available for cross-country skiing and snowshoeing, but would not be groomed.

- Northern winter parking would occur at an unimproved parking area north of the Death Canyon Road junction. Southern winter parking would occur at the Granite Canyon Trailhead.

Visitor Use and Experience / Education and Interpretation

- Visitor services, such as staffed interpretation at the LSR Preserve, interpretive waysides, interpretive publications, ranger programs, and education programs, would continue to be provided.

- Park staff would continue to actively manage visitor use and congestion associated with the presence of wildlife.

- A variety of backcountry-oriented activities would continue to be available in the corridor, including camping, hiking, climbing, swimming, boating, rafting, floating, cross-country skiing, backcountry skiing, snowshoeing, horseback riding, and fishing.

- Backcountry patrols would continue to monitor hiker and backpacker compliance with regulations and visitor use counters would monitor use at trailheads.

Horse Use

- Horse use would continue to be restricted to established horse trails and routes. No off-trail horseback riding would be allowed.

- Management of the Poker Flats horse trails would continue as approved through previous environmental compliance.

- Outside Poker Flats, use of horse trails would continue as illustrated on the Alternative A map.

- Trail crossings: Use of existing trail crossings over Moose-Wilson Road would continue as illustrated on the alternative A map.

- Parking and trailheads: Horse trailer parking would continue at Sawmill Ponds (from the north), Death Canyon Road junction (from the north), Granite Canyon Trailhead (from the south), and Poker Flats (from the south).

- Trailer through-traffic restrictions would continue for public and commercial users. No horse trailer traffic would be allowed on Moose-Wilson Road between the Granite Canyon Trailhead and the Death Canyon Road junction.

Grand Teton National Park
Wyoming

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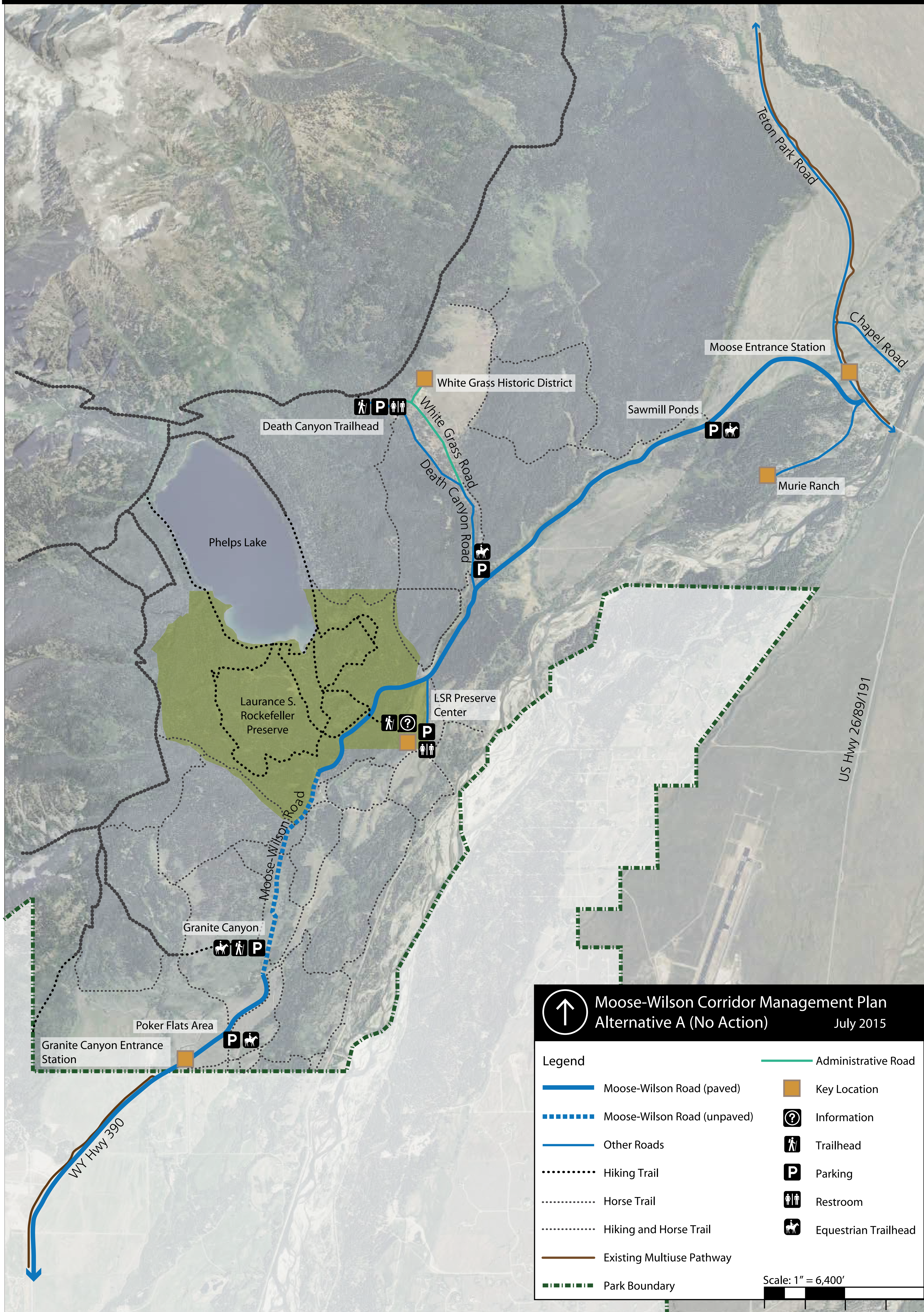

ALTERNATIVE B

Concept Statement

This concept emphasizes the corridor as a visitor destination. Reduced crowding on Moose-Wilson Road and at destinations within the corridor would provide visitors an opportunity for self-discovery. Existing developed areas and facilities would be maintained where appropriate and removed or relocated in some areas to protect natural and cultural resources.

Traffic Management Along Moose-Wilson Road

- Provide traveler alerts before entrances to inform visitors of potential traffic congestion, full parking lots, and wait times, and give them the opportunity to choose an alternate route before entering the corridor. These alerts would be planned and coordinated with the Wyoming Department of Transportation and other stakeholder agencies, as appropriate.

- Moose-Wilson Road would be open to motor vehicles from about May 15 through October 31.

- Reduce speed limit along Moose-Wilson Road to 20 miles per hour (mph) to improve safety for motor vehicles, bicyclists, and wildlife. This would be achieved through management actions such as proactive education at entrances, signage, and enforcement techniques.

- Adaptive Strategy: Address increases in traffic and volume-related congestion by restricting through-traffic in either direction beyond the Laurance S. Rockefeller Preserve during peak use periods. This would be accomplished by reconfiguring access to and parking at the Preserve and installing gates to prevent through-traffic at certain established peak hours during the peak season, thereby encouraging use of the road only as a means for visiting destinations within the corridor at those times. Through-travel by bicycles would be available at all times, and the road would continue to be open to motor vehicle through-traffic during all nonpeak times. (Please refer to the visitor use management framework section of this chapter for more information about the visitor capacity determination.)

Physical Characteristics of Moose-Wilson Road

- Reconstruct and pave the existing, unpaved portion of Moose-Wilson Road, but retain the approximate current alignment. The width of this newly paved segment would be narrowed to be consistent with other existing paved portions of the road.

- Repair and resurface existing paved portions of Moose-Wilson Road.

- Develop Moose-Wilson corridor design standards and apply to design and maintenance of roads, parking areas, turnouts, etc., in the corridor (also see the “Turnouts and Parking” section).

- Address road drop-off by incorporating a “safety edge” to improve the edge of the pavement and allow errant vehicles (motorized and nonmotorized) to safely return to the road.

Moose-Wilson Road Realignments

- Two segments of the northern portion of Moose-Wilson Road would be realigned to address wildlife habitat connectivity, congestion associated with the presence of wildlife, and operational issues. The new road segments would be constructed to emulate the slow-speed, narrow, winding character of the road corridor.

  - The 0.6-mile section of roadway between Murie Ranch Road and the base of the hill near Sawmill Ponds would be abandoned and restored to natural conditions. A new road segment would be constructed to intersect with Teton Park Road at its junction with the Chapel of the Transfiguration Road.

  - The segment between Sawmill Ponds Overlook and the Death Canyon Road junction would be realigned east of the beaver ponds to improve wetland functions and habitat connectivity. The old roadway would be removed and restored to natural conditions.

Turnouts and Parking

- Apply design solutions to roadside parking that would reduce resource impacts from unofficial off-road parking. Signage, physical barriers, or other means would be strategically placed along the corridor to deter visitors from causing resource damage associated with parking in undesignated areas.

- Install officially designated parking turnouts along Moose-Wilson Road that are strategically placed and clearly defined to accommodate a total of up to 120 vehicles (similar to the current condition of parking demands). Each turnout would be designed and sized to accommodate between one and three vehicles.

- Develop Moose-Wilson corridor design standards and apply to design and maintenance of roads, parking areas, turnouts, etc., in the corridor (also see "Physical Characteristics of Moose-Wilson Road").

- Increase the use of park staff and volunteers to assist in maintaining traffic flow and parking management during wildlife activity periods.

- Reconfigure the access and parking at the LSR Preserve to prevent through-traffic at certain peak periods when necessary to alleviate congestion.

Bicycle Use

- During seasonal periods when Moose-Wilson Road is closed to motor vehicles, bicycles would continue to be permitted to use Moose-Wilson Road, Death Canyon Road, and the LSR Preserve Road when they are free of snow and ice.

- Bicycles would continue to share Moose-Wilson Road with motor vehicles.

- Bicyclists would be allowed to pass through Moose-Wilson Road when the gates at the LSR Preserve are closed at certain established peak periods to prevent motorized vehicle through-traffic.

- Facilitate a safe transition from traveling on the existing multiuse pathways onto Moose-Wilson Road at the south and north ends of the corridor.

- Reduce the speed limit along Moose-Wilson Road to 20 mph to improve bicyclist safety (also see "Traffic Management").

- Provide road markers and/or signage that orient and provide safety information for bicyclists traveling through the corridor.

- Provide an appropriate number of bike racks at destination points along the corridor.

Commercial Activity

- A limited number of resource-focused, corridor-specific, road-based tours (limited either by the number of operators or the number of trips) would be permitted in the corridor. Corridor-specific, resource-based interpretation would be required. Learning-focused commercial visitor activities, such as photography workshops, could be permitted.

- Limit group size according to current Moose-Wilson Road vehicle size restrictions. Caravans would not be allowed.

- Tours would continue to operate when the gate on Moose-Wilson Road is closed at the LSR Preserve, with the same travel limits that apply to noncommercial visitors.

- Guided horseback riding in the Moose-Wilson corridor would continue at current permitted use levels on designated horse trails.

- Guided skiing and snowshoeing would continue at current use levels (a five-year average taken from 2012–16) and would be limited to locations deemed appropriate.

- Taxis and all other nonpark-dependent commercial traffic would be prohibited in the corridor.

- Shuttle services could be authorized by park management provided that the number of visitors accessing the corridor via shuttles is allocated based on current corridor capacity.

- Special events, typically managed through special use permits, such as bike events and site-specific special events, would be prohibited in the corridor, with the exception of park-administered events.

Death Canyon

- The Death Canyon Trailhead would be relocated to a site near White Grass Ranch, approximately 0.4 mile from its current location. A parking lot would be provided for up to 60 vehicles (approximately 20 vehicles less than the current condition of parking demand), serving both the trailhead and visitors to White Grass Ranch. The abandoned section of the trailhead access road would be converted to a trail. The remaining unpaved portion of Death Canyon Road would be improved to a single lane with gravel surface and turnouts for passing.

- White Grass Ranger Station would become a backcountry cabin for administrative uses only (no vehicular access).

Winter Access and Use

- The unplowed portion of Moose-Wilson Road would extend from the Murie Ranch Road junction to the Granite Canyon Trailhead. The unplowed portion of the road would be available for cross-country skiing and snowshoeing, but would not be groomed. The unplowed portion of the road would not be open to mechanized vehicles (e.g., snowmobiles and snow bikes).

- Winter recreational activities would use the old road alignment between Murie Ranch Road and the new road alignment for skiing and snowshoeing. Northern winter parking would occur at the Craig Thomas Discovery and Visitor Center. Southern winter parking would occur at the Granite Canyon Trailhead.

Visitor Use and Experience / Education and Interpretation

- Visitor services such as staffed interpretation at the LSR Preserve, interpretive waysides, interpretive publications, ranger programs, and education programs would continue to be provided.

- Park staff would continue to actively manage visitor use and congestion associated with the presence of wildlife.

- A variety of backcountry-oriented activities would continue to be available in the corridor, including camping, hiking, climbing, swimming, boating, rafting, floating, cross-country skiing, backcountry skiing, snowshoeing, horseback riding, and fishing.

- Backcountry patrols would continue to monitor hiker and backpacker compliance with regulations and visitor use counters would monitor use at trailheads.

- In keeping with the goal of self-discovery within the corridor, minimal low-impact interpretive media would be provided. Messaging would focus on the significant natural and cultural resources of the corridor, as identified and studied during this planning process. Pre-visit information and electronic media would be used to prepare visitors prior to entering the corridor and a "sense of arrival" would be provided to cue visitors that they are entering a unique natural and cultural setting.

Horse Use

- Horse use would continue to be restricted to established horse trails and routes. No off-trail horseback riding would be allowed.

- Management of the Poker Flats horse trails would continue as approved through previous environmental compliance.

- Outside Poker Flats, trails that cannot be sustained would be removed and/or re-routed. Trails that have been identified by horse users as no longer being used due to redundancy or impacts on resources would be restored to natural conditions; horse routes (e.g., two-tracks, roads, powerline rights-of-way) would be designated for horse use to ensure consistent access throughout the corridor (e.g., connects Poker Flats trails with north corridor trails).

- Trail crossings: Delineate (with signage) a minimum number of horse crossings over Moose-Wilson Road (based on trail locations).

- Parking and trailheads: Horse trailer parking and trailhead access would continue to occur at Death Canyon Road junction (from the north) and Poker Flats (from the south). These parking areas would be improved for trailer parking. *Note: No horse trailer parking would occur at Sawmill Ponds Overlook and Granite Canyon Trailhead.*

- Trailer through-traffic restrictions would continue for public and commercial users. No horse trailer traffic would be allowed on Moose-Wilson Road between Poker Flats and the Death Canyon Road junction.

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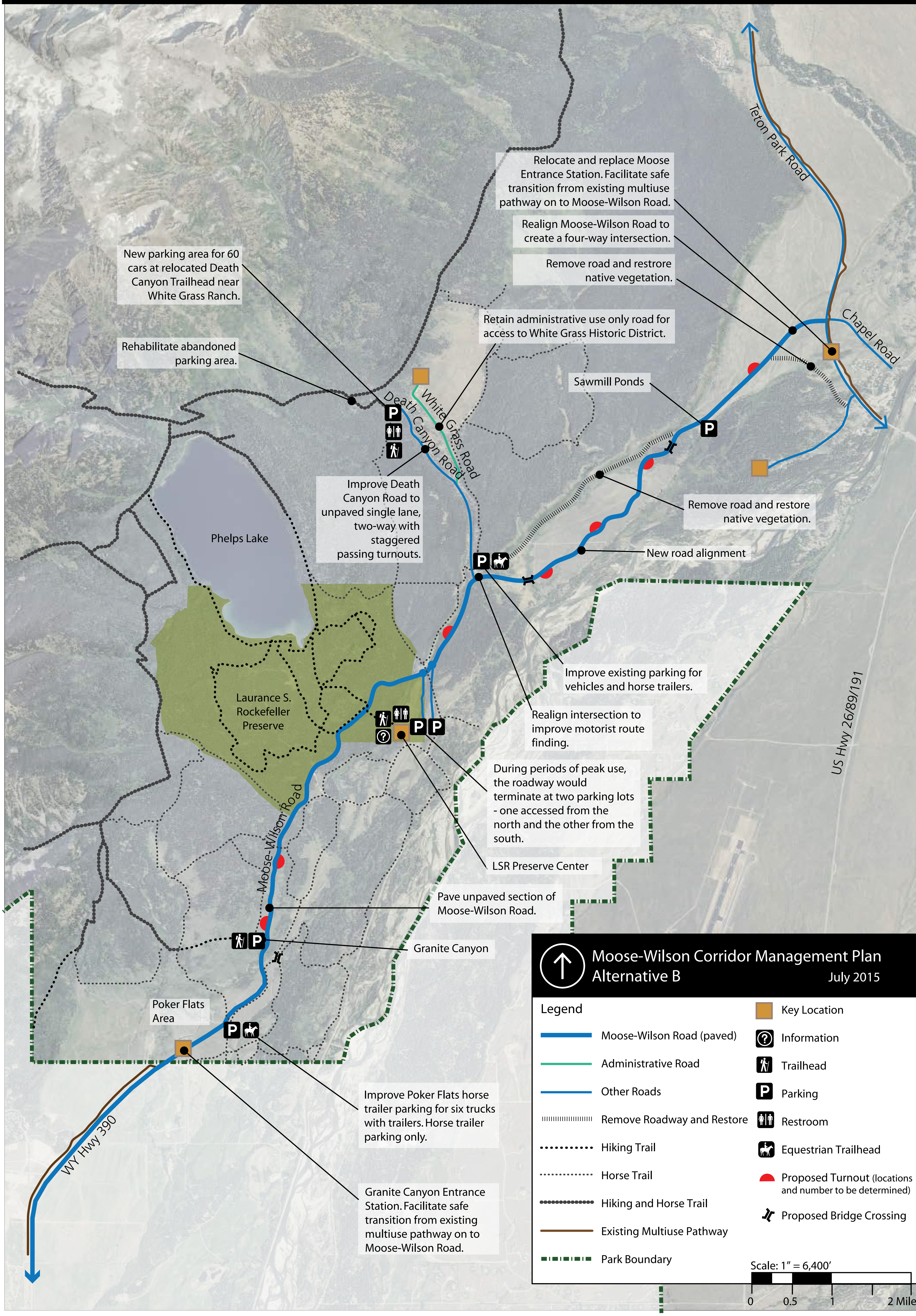

ALTERNATIVE C (NPS PREFERRED)

Concept Statement

The emphasis of this concept is to seek to be a model for the balance of preservation and public use and enjoyment by exemplifying conservation legacies within the corridor. The alternative would manage the intensity and timing of visitor use to effectively provide high-quality visitor opportunities. Development within the corridor would generally be maintained within the existing development footprint. The sense of discovery would predominate in this outstanding and diverse natural ecosystem and cultural history area.

Traffic Management Along Moose-Wilson Road

- Provide traveler alerts before entrances to inform visitors of potential traffic congestion, full parking lots, and wait times, and give them the opportunity to choose an alternate route before entering the corridor. These alerts would be planned and coordinated with the Wyoming Department of Transportation and other stakeholder agencies, as appropriate.

- Moose-Wilson Road would be open to motor vehicles from about May 15 through October 31.

- Reduce speed limit along Moose-Wilson Road to 20 mph to improve safety for motor vehicles, bicyclists, and wildlife. This would be achieved through management actions such as proactive education at entrances, signage, and enforcement techniques.

- Adaptive Strategy: Address increases in traffic and volume-related congestion on Moose-Wilson Road by limiting the number of vehicles entering the corridor at any one time during peak use periods through timed sequencing techniques. Provide queuing lanes on the north and south ends of the corridor. If additional traffic management measures are needed in the future, a corridor reservation system or transit system may be considered. Bicycle use currently represents a small percentage of visitation to the corridor and would therefore be permitted to bypass the queuing lanes. If monitoring associated with indicators and thresholds demonstrates an increase in impacts on visitor experience or resources in the corridor due to bicycle use, management actions would be taken to manage the number of bicycles entering the corridor in a similar manner to vehicles. (Please refer to the visitor use management framework section of this chapter for more information about the indicators and thresholds and visitor capacity determination.)

Physical Characteristics of Moose-Wilson Road

- Reconstruct and pave the existing, unpaved portion of Moose-Wilson Road, but retain the approximate current alignment. The width of this newly paved segment would be narrowed to be consistent with other existing paved portions of the road.

- Repair and resurface existing paved portions of Moose-Wilson Road.

- Develop Moose-Wilson corridor design standards and apply to design and maintenance of roads, parking areas, turnouts, etc., in the corridor (also see “Turnouts and Parking”).

- Address road drop-off by incorporating a "safety edge" to improve the edge of the pavement and allow errant vehicles (motorized and nonmotorized) to safely return to the road.

Moose-Wilson Road Realignments

- The northernmost segment of Moose-Wilson Road would be realigned to address wildlife habitat connectivity and operational issues. The 0.6-mile section of roadway between Murie Ranch Road and the base of the hill near Sawmill Ponds would be abandoned and restored to natural conditions. A new road segment would be constructed to intersect with Teton Park Road at its junction with the Chapel of the Transfiguration Road. The new road segment would be constructed to emulate the slow-speed, narrow, winding character of the road corridor.

- The segment between Sawmill Ponds Overlook and the Death Canyon Road junction would be mostly retained in its existing alignment. The portion of the road adjacent to wetlands would be reconstructed to improve wetland function, correct drainage issues, and improve road conditions. Some minor alignment changes may be necessary to accommodate the wetlands, wildlife, and vegetation concerns. Wildlife safety mitigation measures would be included in the road reconstruction design. This may include slight modifications to the road alignment, recontouring the slope, improving visibility, and creating vegetation setbacks (without creating conditions that would encourage drivers to accelerate through the area). All available and emerging management techniques would be used to reduce undesirable human-wildlife encounters, particularly during high wildlife use periods (August through October). This may include the need for additional temporary road closures and increased use of park staff and volunteers.

Turnouts and Parking

- Apply design solutions to roadside parking that would reduce resource impacts from unofficial off-road parking. Signage, physical barriers, or other means would be strategically placed along the corridor to deter visitors from causing resource damage associated with parking in undesignated areas.

- Install officially designated parking turnouts along Moose-Wilson Road that are strategically placed and clearly defined to accommodate a total of up to 120 vehicles (similar to the current condition of parking demands). Each turnout would be designed and sized to accommodate between one and three vehicles.

- Develop Moose-Wilson corridor design standards and apply to design and maintenance of roads, parking areas, turnouts, etc., in the corridor (also see "Physical Characteristics of Moose-Wilson Road").

- Increase the use of park staff and volunteers to assist in maintaining traffic flow and parking management during wildlife activity periods.

- Install a vault toilet near the parking lot at Granite Canyon Trailhead within the existing disturbed area. Additional vault toilets may be installed at both the north and south corridor entrances, as needed.

Bicycle Use

- During seasonal periods when Moose-Wilson Road is closed to motor vehicles, bicycles would continue to be permitted to use Moose-Wilson Road, Death Canyon Road, and the LSR Preserve Road when they are free of snow and ice.
- Bicycles would continue to share Moose-Wilson Road with motor vehicles.
- If monitoring associated with indicators and thresholds demonstrates an increase in impacts on visitor experience or resources in the corridor due to bicycle use, the number of bicycles entering the corridor would be managed in a similar manner as vehicles through timed sequencing techniques.
- Pave the unpaved portion of Moose-Wilson Road to improve biking safety and enhance visitor experience in this segment (also see "Physical Characteristics of Moose-Wilson Road").
- Facilitate a safe transition from traveling on the existing multiuse pathways onto Moose-Wilson Road at the south and north ends of the corridor.
- Reduce speed limit along Moose-Wilson Road to 20 mph to improve bicyclist safety (also see "Traffic Management").
- Provide road markers and/or signage that orient and provide safety information for bicyclists traveling through the corridor.
- Provide an appropriate number of bike racks at destination points along the corridor.

Commercial Activity

- Road-based tours would be permitted within the corridor. These tours would not be limited in number, but would be subjected to the same corridor capacity limit during peak use periods that applies to noncommercial visitors. Tours would include a broad array of interpretive topics. Learning-focused commercial visitor activities, such as photography workshops, could be permitted, but limited to numbers based on current corridor capacity.
- Limit group size according to current Moose-Wilson Road vehicle size restrictions. Caravans would not be allowed.
- Guided horseback riding in the Moose-Wilson corridor would continue at current permitted use levels on designated horse trails.
- Guided skiing and snowshoeing would continue at current use levels (a five-year average taken from 2012–16) and would be limited to locations deemed appropriate.
- Taxis and all other nonpark-dependent commercial traffic would be prohibited in the corridor.
- Shuttle services could be authorized by park management provided that the number of visitors accessing the corridor via shuttles is allocated based on current corridor capacity.

- Special events, typically managed through special use permits, such as bike events and site-specific special events, would be prohibited in the corridor, with the exception of park-administered events.

Death Canyon

- Death Canyon Trailhead would be relocated to the current end of pavement on the existing access road (i.e., near the junction with White Grass Road). Parking would be provided for approximately 80 to 90 vehicles (similar to the current condition of parking demand). The existing 1.0-mile unpaved portion of the trailhead access road (no longer necessary for vehicular traffic) would be converted to a trail.

- The restroom would be relocated to the new trailhead location.

- White Grass Ranger Station would become a backcountry cabin for administrative uses only (no vehicular access).

Winter Access and Use

- The unplowed section of Moose-Wilson Road would continue to extend from the Death Canyon Road junction to Granite Canyon Trailhead. The unplowed portion of the road would be available for cross-country skiing and snowshoeing, but would not be groomed. The unplowed portion of the road would not be open to mechanized vehicles (e.g., snowmobiles and snow bikes).

- Northern winter parking would occur at an unimproved parking area north of the Death Canyon Road junction. Southern winter parking would occur at the Granite Canyon Trailhead.

Visitor Use and Experience / Education and Interpretation

- Visitor services such as staffed interpretation at the LSR Preserve, interpretive waysides, interpretive publications, ranger programs, and education programs would continue to be provided.

- Park staff would continue to actively manage visitor use and congestion associated with the presence of wildlife.

- A variety of backcountry-oriented activities would continue to be available in the corridor, including camping, hiking, climbing, swimming, boating, rafting, floating, cross-country skiing, backcountry skiing, snowshoeing, horseback riding, and fishing.

- Backcountry patrols would continue to monitor hiker and backpacker compliance with regulations and visitor use counters would monitor use at trailheads.

- In keeping with the goal of self-discovery within the corridor, minimal low-impact interpretive media would be provided. Messaging would focus on the significant natural and cultural resources of the corridor, as identified and studied during this planning process. Pre-visit information and electronic media would be used to prepare visitors prior to entering the corridor and a "sense of arrival" would be provided to cue visitors that they are entering a unique natural and cultural setting.

Horse Use

- Horse use would continue to be restricted to established horse trails and routes. No off-trail horseback riding would be allowed.

- Management of the Poker Flats horse trails would continue as approved through previous environmental compliance.

- Outside Poker Flats, trails that cannot be sustained would be removed and/or rerouted. Trails that have been identified by horse users as no longer being used due to redundancy or impacts on resources would be removed; horse routes (e.g., two-tracks, roads, powerline rights-of-way) would be designated for horse use to ensure consistent access throughout the corridor (e.g., connects Poker Flats trails with north corridor trails).

- Trail crossings: Delineate (with signage) a minimum number of horse crossings over Moose-Wilson Road (based on trail locations).

- Parking and trailheads: Horse trailer parking and trailhead access would continue to occur at Sawmill Ponds (from the north), Death Canyon Road junction (from the north), and Poker Flats (from the south). These parking areas would be improved for trailer parking. *Note: No horse trailer parking would occur at the Granite Canyon Trailhead.*

- Trailer through-traffic restrictions would continue for public and commercial users. No horse trailer traffic would be allowed on Moose-Wilson Road between Poker Flats and the Death Canyon Road junction.

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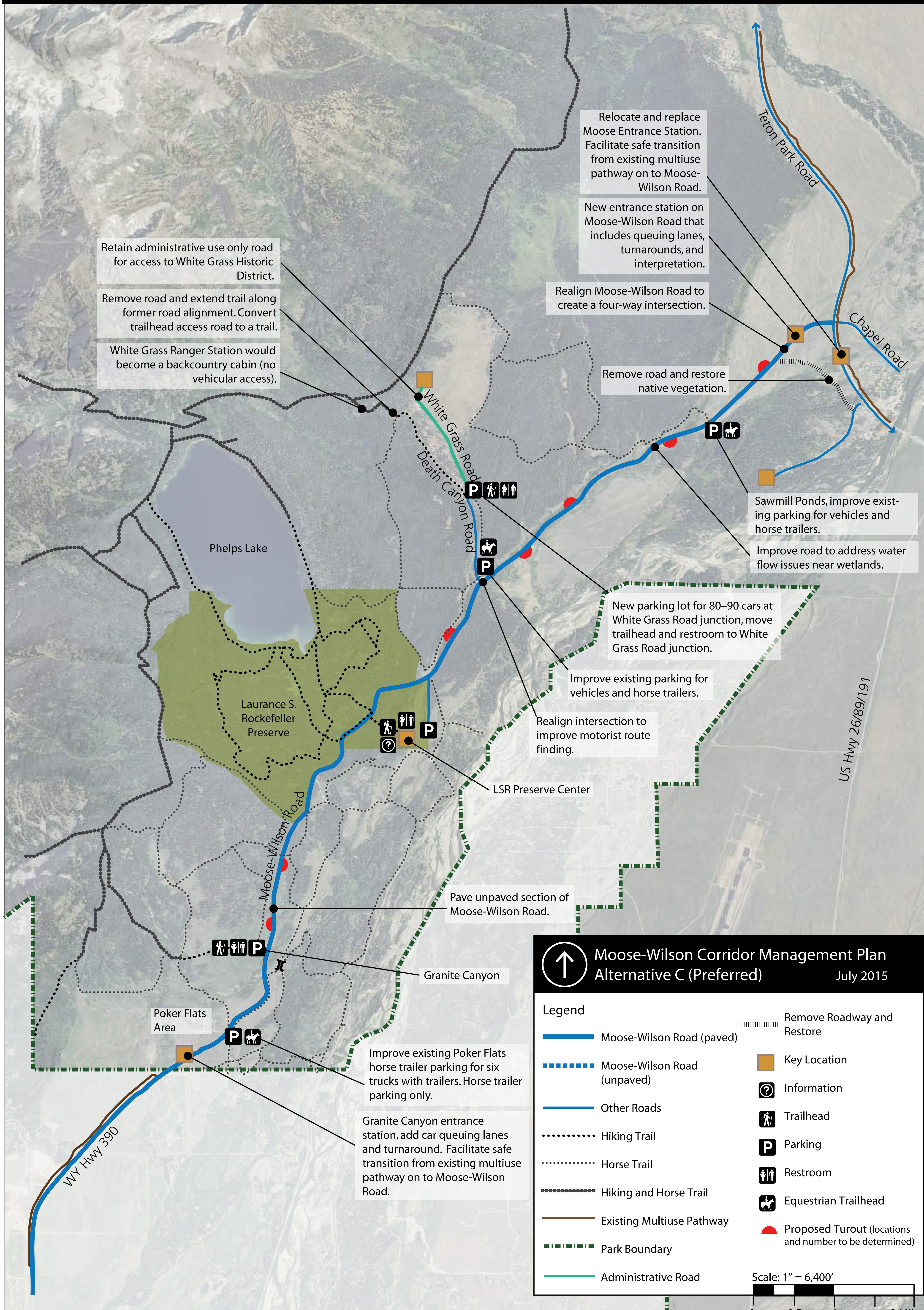

ALTERNATIVE D

Concept Statement

The emphasis of this concept is to better integrate the Moose-Wilson corridor with the broader park experience and link it to the region's larger recreational network. Park management would focus on ways to connect people with resources and promote understanding, enjoyment, preservation, and health. To enhance the recreational scenic driving experience, strategies would be used to reduce traffic congestion. Visitors would be provided with opportunities to get out of their vehicles and experience the outstanding natural and cultural landscapes. Additional developments and concentrated visitor use in the corridor would be located in focused areas.

Traffic Management Along Moose-Wilson Road

- Provide traveler alerts before entrances to inform visitors of potential traffic congestion, full parking lots, and wait times, and give them the opportunity to choose an alternate route before entering the corridor. These alerts would be planned and coordinated with the Wyoming Department of Transportation and other stakeholder agencies, as appropriate.

- Moose-Wilson Road would be open to motor vehicles from about May 15 through October 31.

- Adaptive Strategy: Address increases in traffic and volume-related congestion on Moose-Wilson Road by establishing a reservation system during peak use periods. Visitors without reservations would be accommodated on a space available, first-come, first-served basis. Bicycle use currently represents a small percentage of visitation to the corridor and would therefore be permitted to bypass the reservation lanes. If monitoring associated with indicators and thresholds demonstrates an increase in impacts on visitor experience or resources in the corridor due to bicycle use, management actions would be taken to manage the number of bicycles entering the corridor in a similar manner to vehicles. (Please refer to the visitor use management framework section of this chapter for more information about the visitor capacity determination.)

Physical Characteristics of Moose-Wilson Road

- Repair and resurface the paved and gravel portions of Moose-Wilson Road. The unpaved section of the road would remain unpaved and would be graded and treated for dust abatement several times per year.

- Develop Moose-Wilson corridor design standards and apply to design and maintenance of roads, parking areas, turnouts, etc., in the corridor (also see "Turnouts and Parking").

Moose-Wilson Road Realignments

- Two segments of the northern portion of Moose-Wilson Road would be realigned to address congestion associated with the presence of wildlife, wildlife habitat connectivity, and operational issues. The new road segments would be constructed to emulate the slow-speed, narrow, winding character of the road.

  – The 0.6-mile section of roadway between Murie Ranch Road and the base of the hill near Sawmill Ponds would be abandoned and restored to natural conditions. A new segment constructed to intersect with Teton Park Road at its junction with the Chapel of the Transfiguration Road.

– The segment between Sawmill Ponds Overlook and the Death Canyon Road junction would be realigned to the east of the beaver ponds to restore wetland functions and habitat connectivity. The old roadway would be removed and restored to natural conditions.

Turnouts and Parking

- Apply design solutions to roadside parking that would reduce resource impacts from unofficial off-road parking. Signage, physical barriers, or other means would be strategically placed along the corridor to deter visitors from causing resource damage associated with parking in undesignated areas.

- Install officially designated parking turnouts along Moose-Wilson Road that are strategically placed and clearly defined to accommodate a total of up to 120 vehicles (similar to the current condition of parking demands). Each turnout would be designed and sized to accommodate between one and three vehicles.

- Develop Moose-Wilson corridor design standards and apply to design and maintenance of roads, parking areas, turnouts, etc., in the corridor (also see “Physical Characteristics of Moose-Wilson Road”).

- Increase the use of park staff and volunteers to assist in maintaining traffic flow and parking management during wildlife activity periods.

- Install vault toilets at Sawmill Ponds Overlook and Granite Canyon Trailhead in existing disturbed areas near the parking lots.

Bicycle Use

- Construct a multiuse pathway parallel to Moose-Wilson Road between Moose and the Granite Canyon Entrance (please refer to map for general alignment).

- If monitoring associated with indicators and thresholds demonstrates an increase in impacts on visitor experience or resources in the corridor due to bicycle use, the number of bicycles entering the corridor would be managed in a similar manner as vehicles through a reservation system.

- Provide signage that orients bicyclists to the corridor.

- Provide an appropriate number of bicycle racks at destination points in the corridor.

- During the winter, bicycles would only be permitted to use the pathway when it is free of snow and ice.

- The multiuse pathway would be closed from sunset to sunrise (or provide specific hours) daily and during wildlife-related temporary closures.
- No special events would be permitted on the pathway.

Commercial Activity

- Road-based tours would be permitted through a limited number of operators; these trips would have an allocation when a reservation system is implemented. Interpretation would be required, but could include a broad array of interpretive topics. Additional activity or learning-focused commercial visitor activities, such as photography workshops, could be permitted, but limited to numbers based on current corridor capacity.

- Road-based tours would be given priority access (an allocation within the reservation system) and would be required to provide trips in a manner that promotes access of the road to the greatest number of visitors; this may occur through higher occupancy vehicles, trips that avoid crowded destinations in the corridor, or other methods.

- Limit group size according to current Moose-Wilson Road vehicle size restrictions. Caravans would not be allowed.

- Guided horseback riding in the Moose-Wilson corridor would continue at current permitted use levels on designated horse trails.

- Additional guided ski and snowshoe tours on the groomed road would be considered. Guided skiing and snowshoeing current use levels (a five-year average taken from 2012–16) and would be limited to locations deemed appropriate.

- Guided bicycle tours on the new pathway would be considered.

- Taxis would be allowed to provide transportation service to and from locations in the corridor with appropriate permits. All other nonpark-dependent commercial traffic would be prohibited.

- Shuttle services could be authorized by park management provided the number of visitors accessing the corridor via shuttles is allocated based on current corridor capacity.

- Special events, typically managed through special use permits, such as bike events and site-specific special events, would be prohibited in the corridor, with the exception of park-administered events.

Death Canyon

- The Death Canyon Trailhead parking area would be reconfigured and expanded at its current site to accommodate up to 100 vehicles (approximately 20 vehicles more than the current condition of parking demand). The 0.4-mile segment of Death Canyon Road between the trailhead and White Grass Ranch would be improved. A new road segment between Death Canyon Road and White Grass Road would be constructed. White Grass Road would be improved to allow one-lane traffic with staggered turnouts. The remaining portion of Death Canyon Road would be removed and the area restored to natural conditions. The vault toilet and White Grass Ranger Station would remain in their existing locations.

Winter Access and Use

- The unplowed section of Moose-Wilson Road would extend from the Sawmill Ponds Overlook to Granite

Canyon Trailhead. The unplowed portion of the road would not be open to mechanized vehicles (e.g., snowmobiles and snow bikes).

- Enhance winter recreational opportunities (i.e., cross-country skiing) by improving parking and seeking a partner to groom the unplowed section of Moose-Wilson Road.

- Northern winter parking would occur at the Sawmill Ponds Overlook. Southern winter parking would occur at the Granite Canyon Trailhead.

Visitor Use and Experience / Education and Interpretation

- Visitor services such as staffed interpretation at the LSR Preserve, interpretive waysides, interpretive publications, ranger programs, and education programs would continue to be provided.

- Park staff would continue to actively manage visitor use and congestion associated with the presence of wildlife.

- A variety of backcountry-oriented activities would continue to be available in the corridor, including camping, hiking, climbing, swimming, boating, rafting, floating, cross-country skiing, backcountry skiing, snowshoeing, horseback riding, and fishing.

- Backcountry patrols would continue to monitor hiker and backpacker compliance with regulations and visitor use counters would monitor use at trailheads.

- In keeping with the goal of self-discovery within the corridor, minimal low-impact interpretive media would be provided. Messaging would focus on the significant natural and cultural resources of the corridor, as identified and studied during this planning process. Pre-visit information and electronic media would be used to prepare visitors prior to entering the corridor and a "sense of arrival" would be provided to cue visitors that they are entering a unique natural and cultural setting.

- Establish viewing areas to allow visitors to appreciate vista points. Use viewing areas to concentrate use. Provide short nature trails and interpretive materials to enhance experience.

Horse Use

- Horse use would continue to be restricted to established horse trails and routes. No off-trail horseback riding would be allowed.

- Management of Poker Flats horse trails would continue as approved through previous environmental compliance.

- Outside Poker Flats, trails that cannot be sustained would be removed and/or rerouted. Trails that have been identified by horse users as no longer being used due to redundancy or impacts on resources would be removed; horse routes (e.g., two-tracks, roads, powerline rights-of-way) would be designated for horse use to ensure consistent access throughout the corridor (e.g., connects Poker Flats trails with north corridor trails).

- Trail crossings: Delineate (with signage) a minimum number of horse crossings over Moose-Wilson Road (based on trail locations).

- Parking and trailheads: Horse trailer parking would continue to take place at Sawmill Ponds (from the north), Death Canyon Road junction (from the north), Granite Canyon Trailhead (from the south), and Poker Flats (from the south).

- Trailer through-traffic restrictions would continue for public and commercial users. No horse trailer traffic would be allowed on Moose-Wilson Road between Granite Canyon Trailhead and the Death Canyon Road junction.

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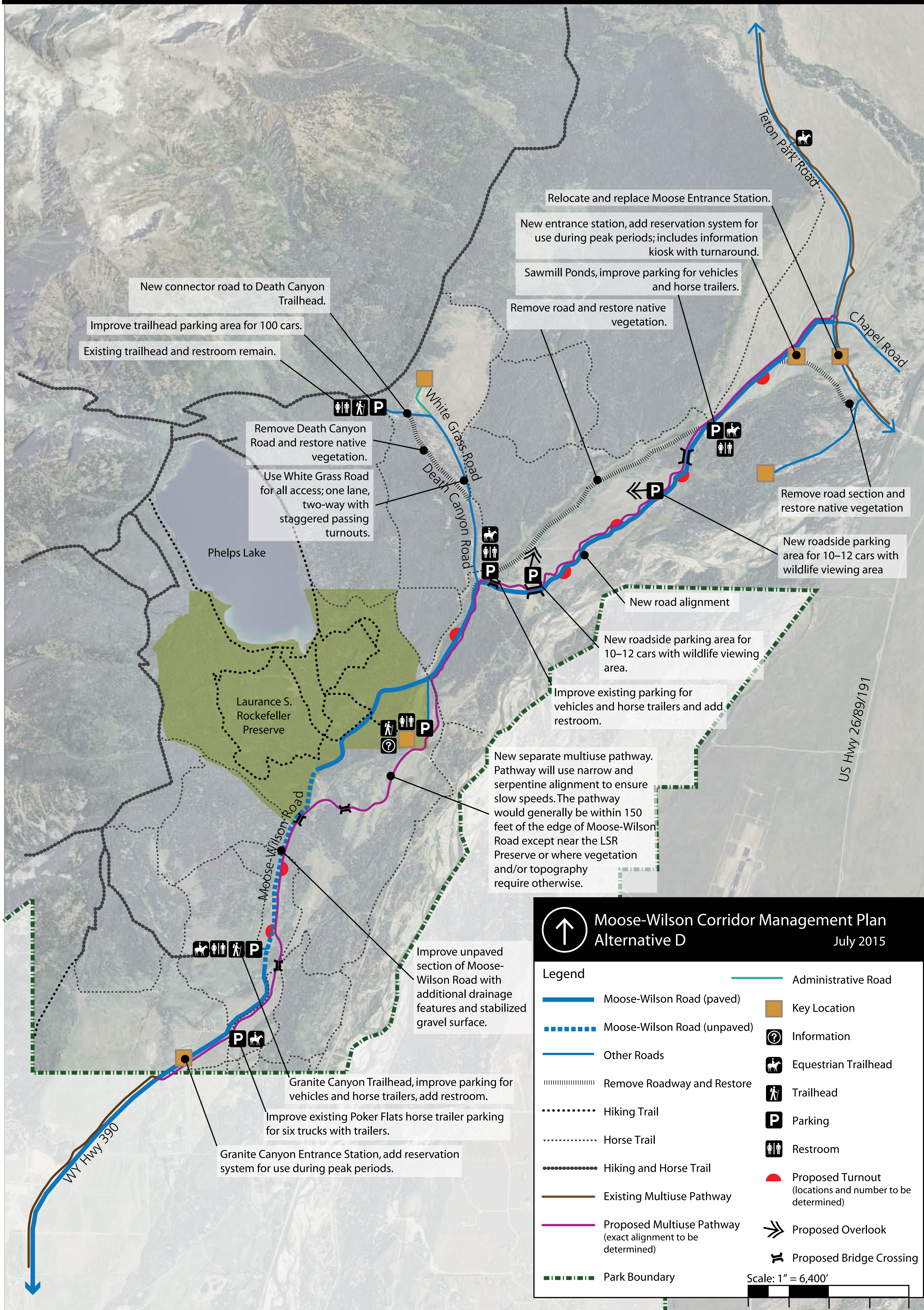

Site Planning

In addition to the alternative management strategies and overview maps provided above, more detailed site planning has been developed. This additional detail not only provides more clarity about the proposed strategies being considered for implementation, but also allows a greater level of environmental analysis. The site plans included under this section are organized by the following topics:

- Death Canyon Enlargement (alternatives B, C, and D)
- Laurance S. Rockefeller Preserve Enlargement (alternative B)
- Granite Canyon Entrance Enlargement (alternatives B, C, and D)
- Moose Entrance Enlargement (alternatives B, C, and D)
- Multiuse Pathway (alternative D)
- Roadside Parking (alternative D)
- Roadside Turnouts (common to all action alternatives)

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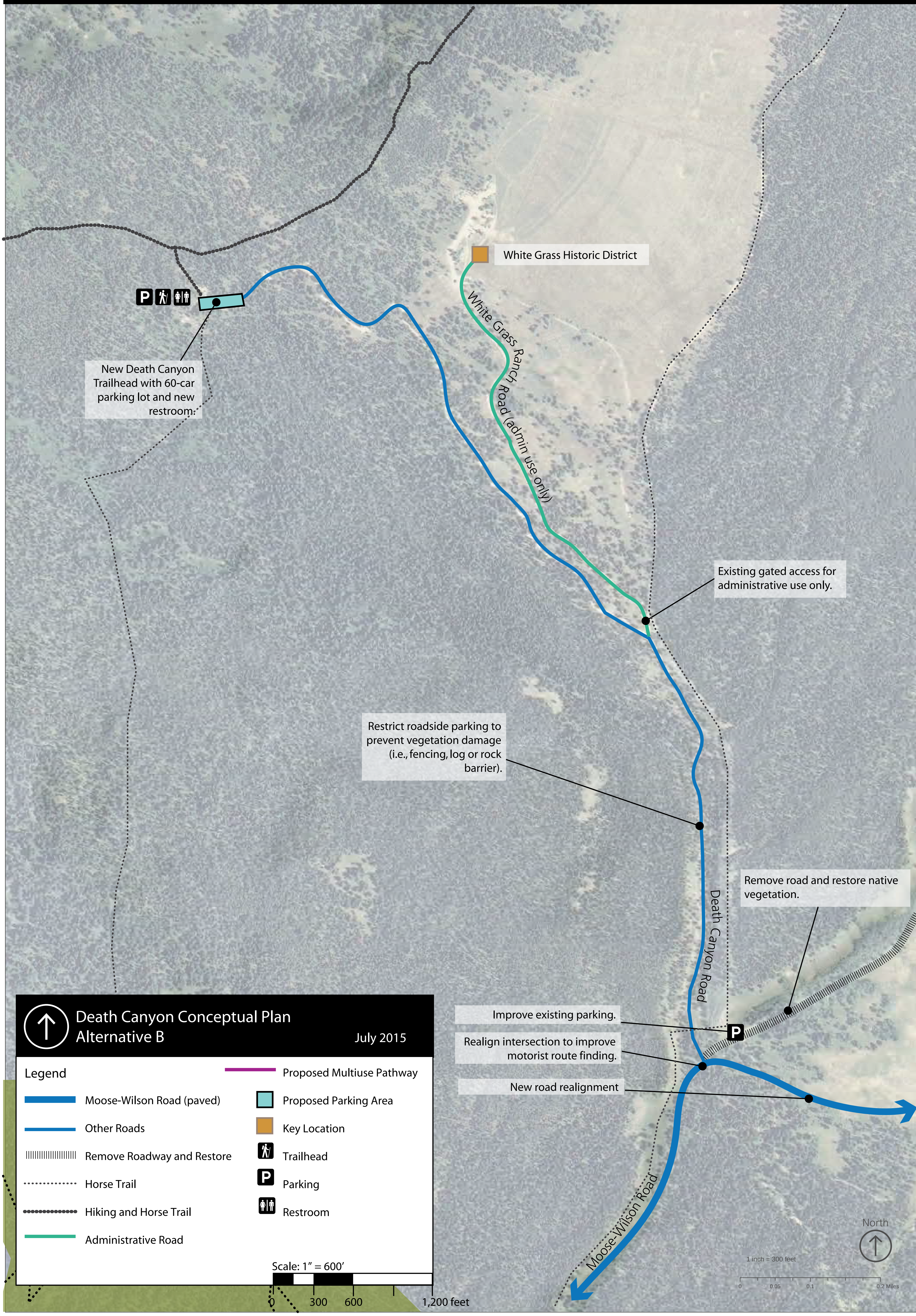

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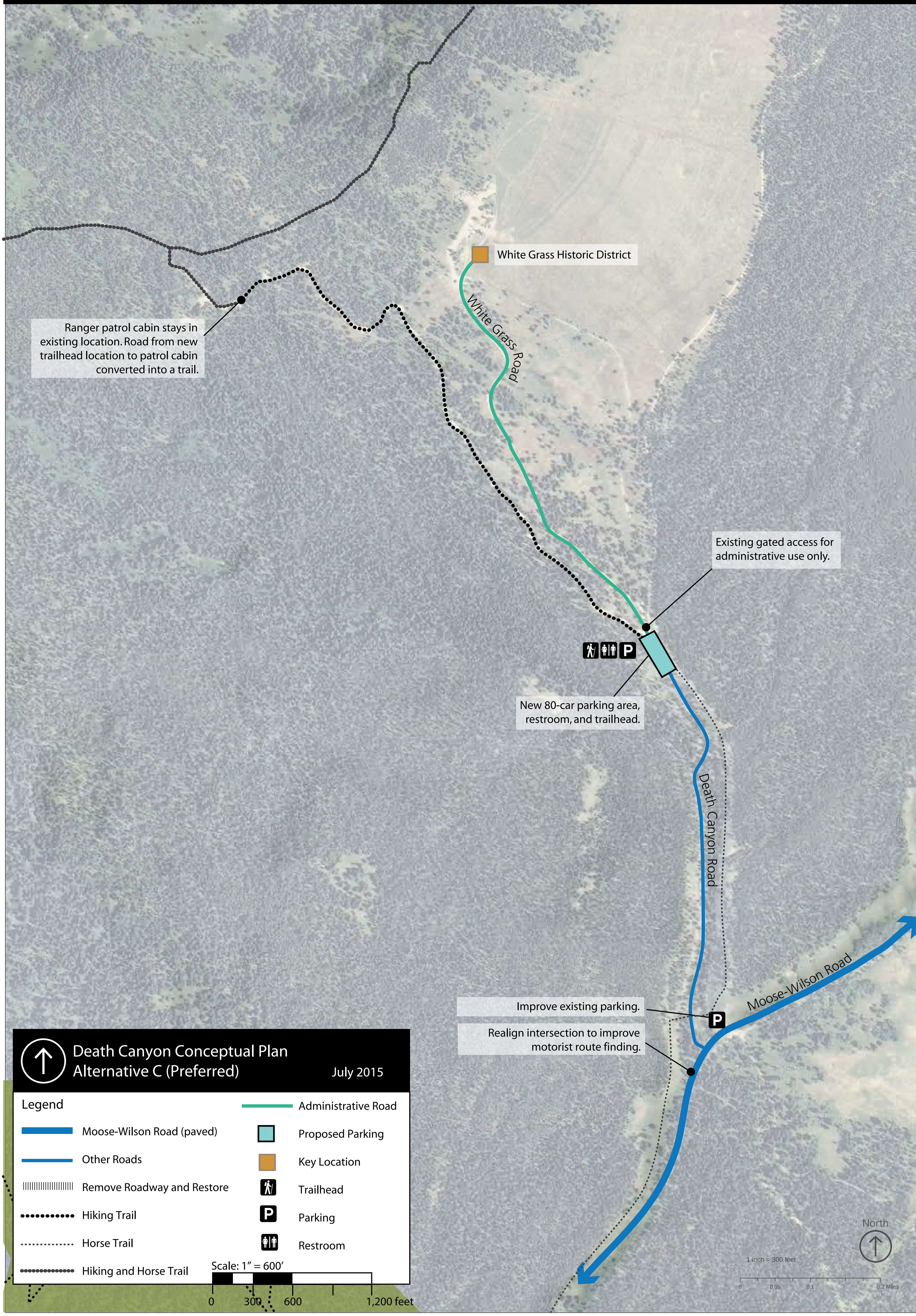

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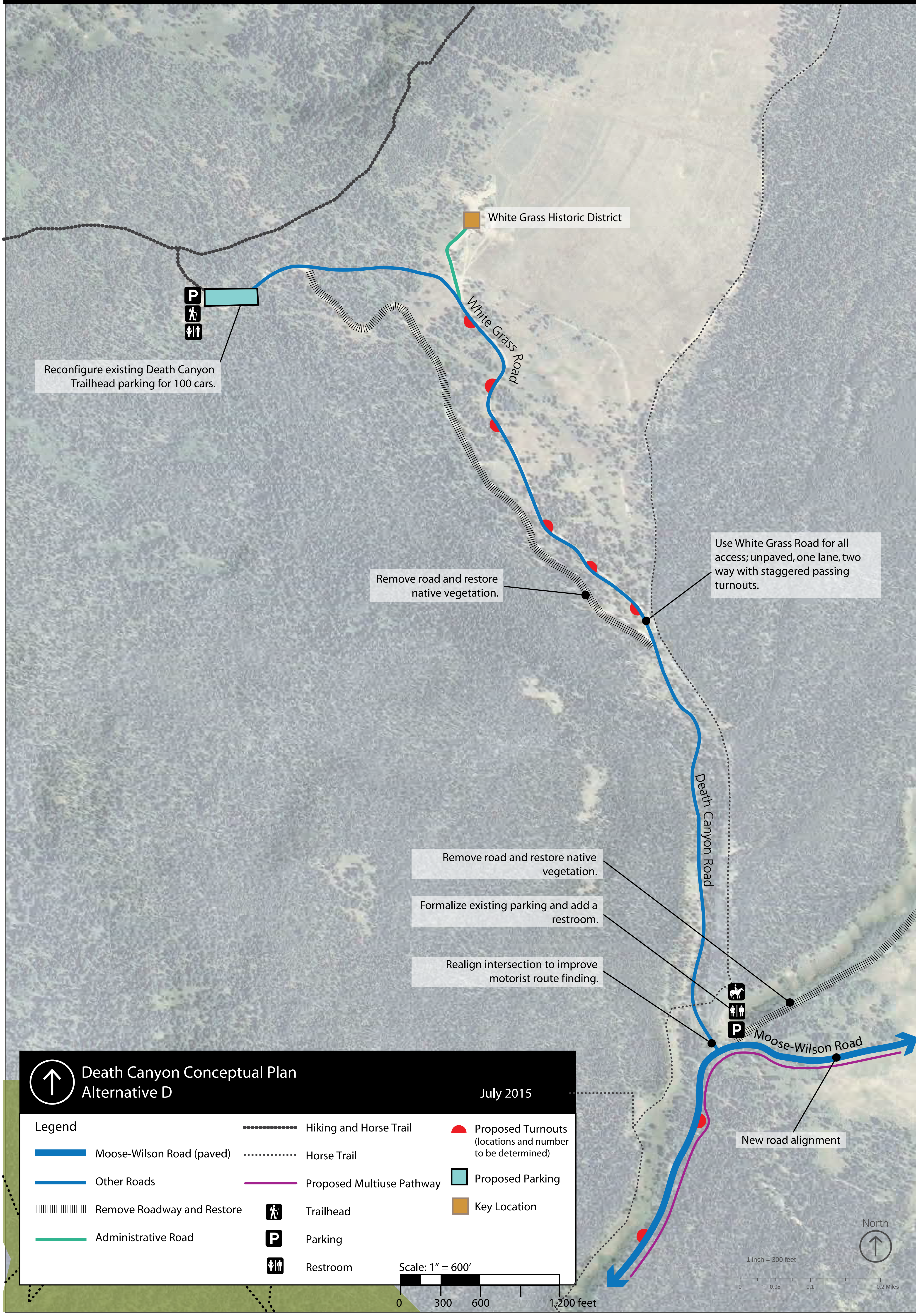

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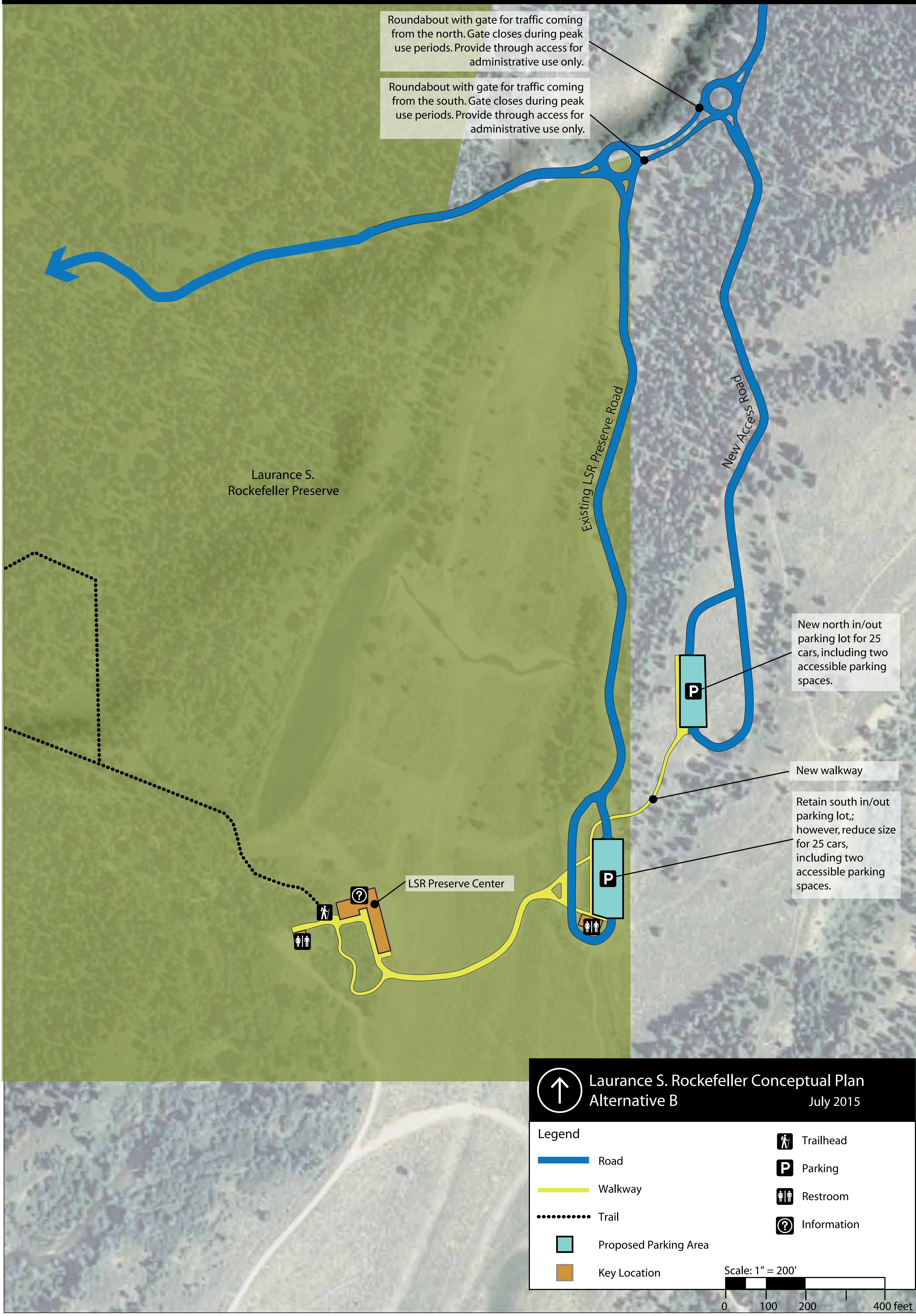

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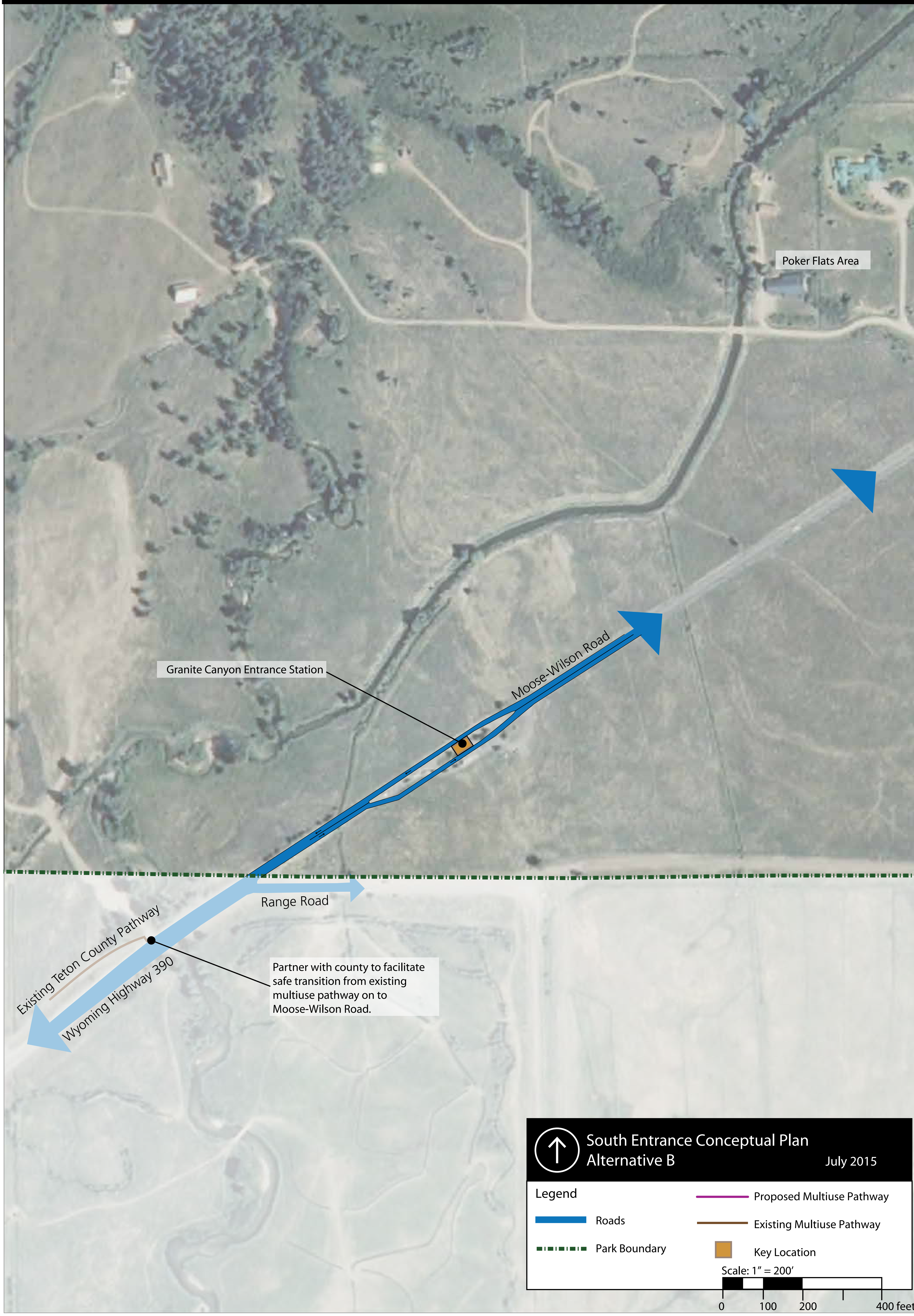

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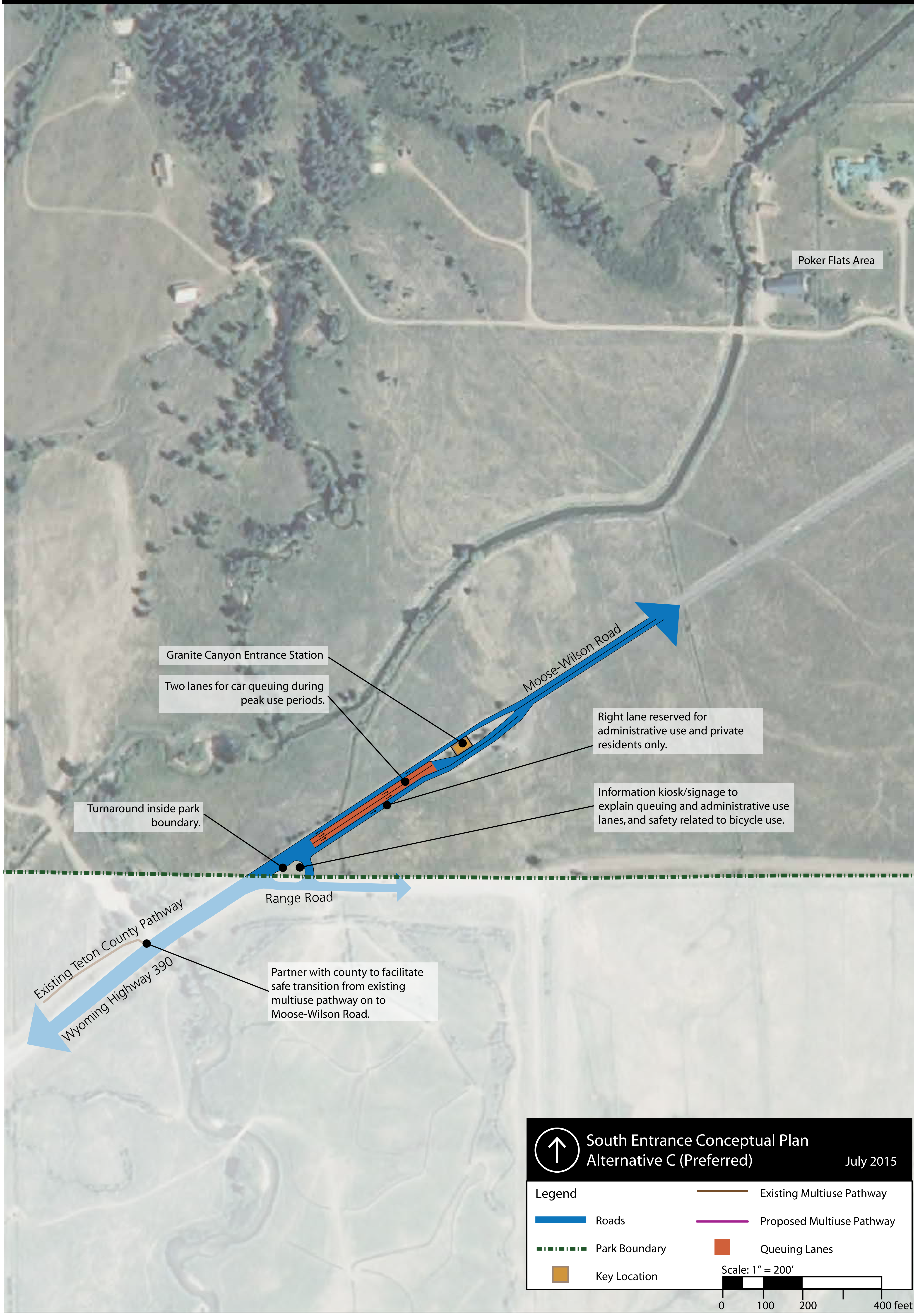

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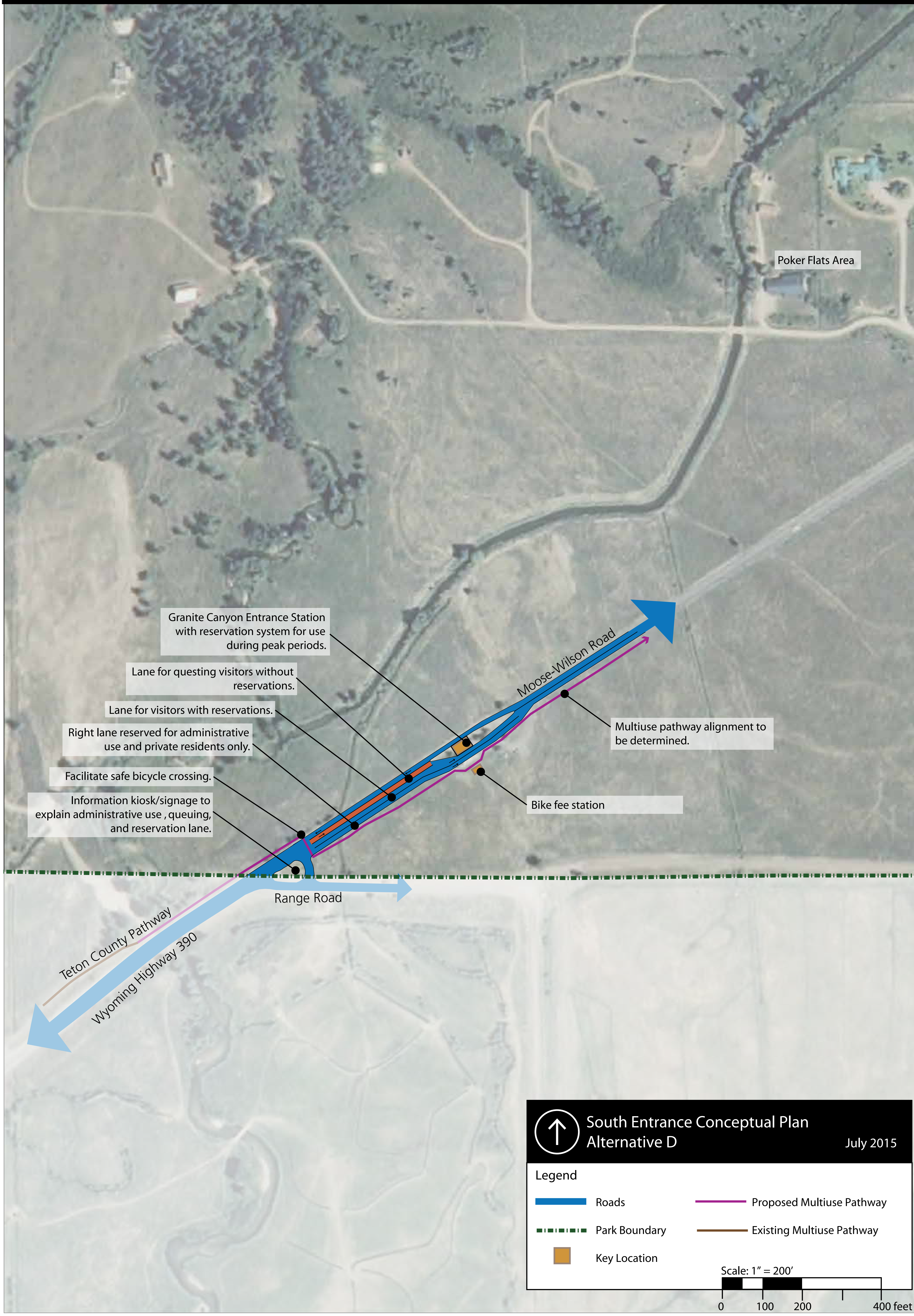

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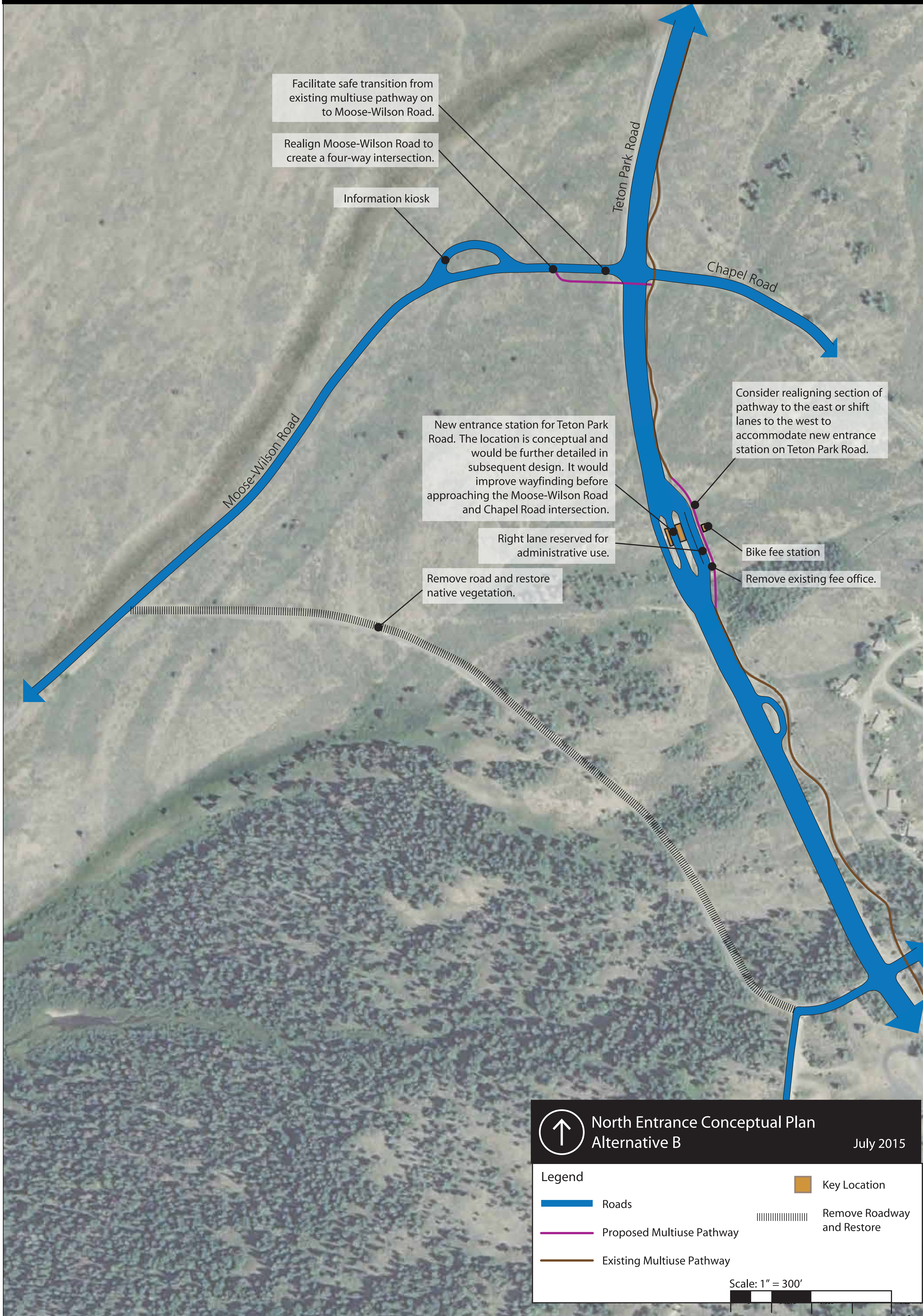

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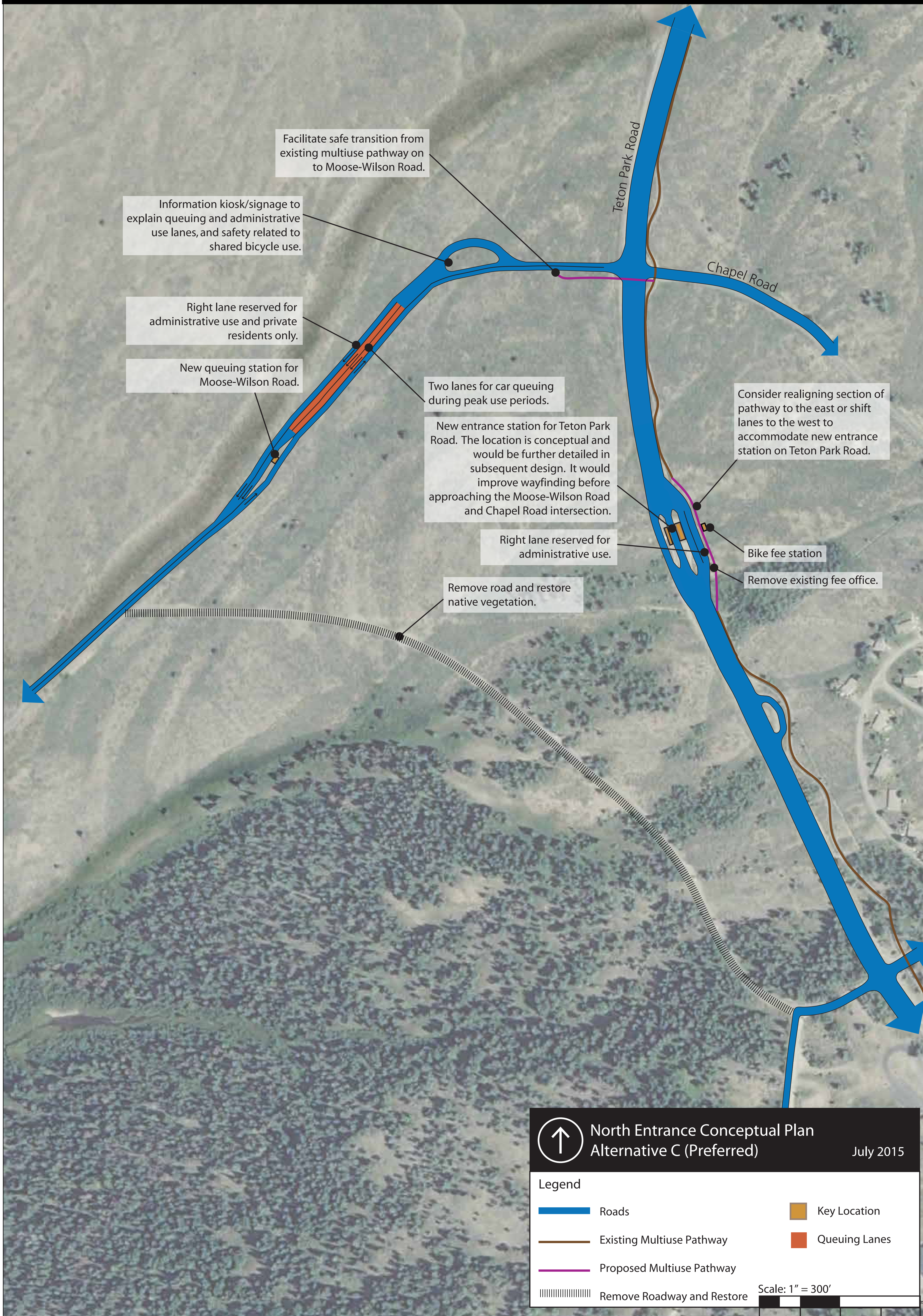

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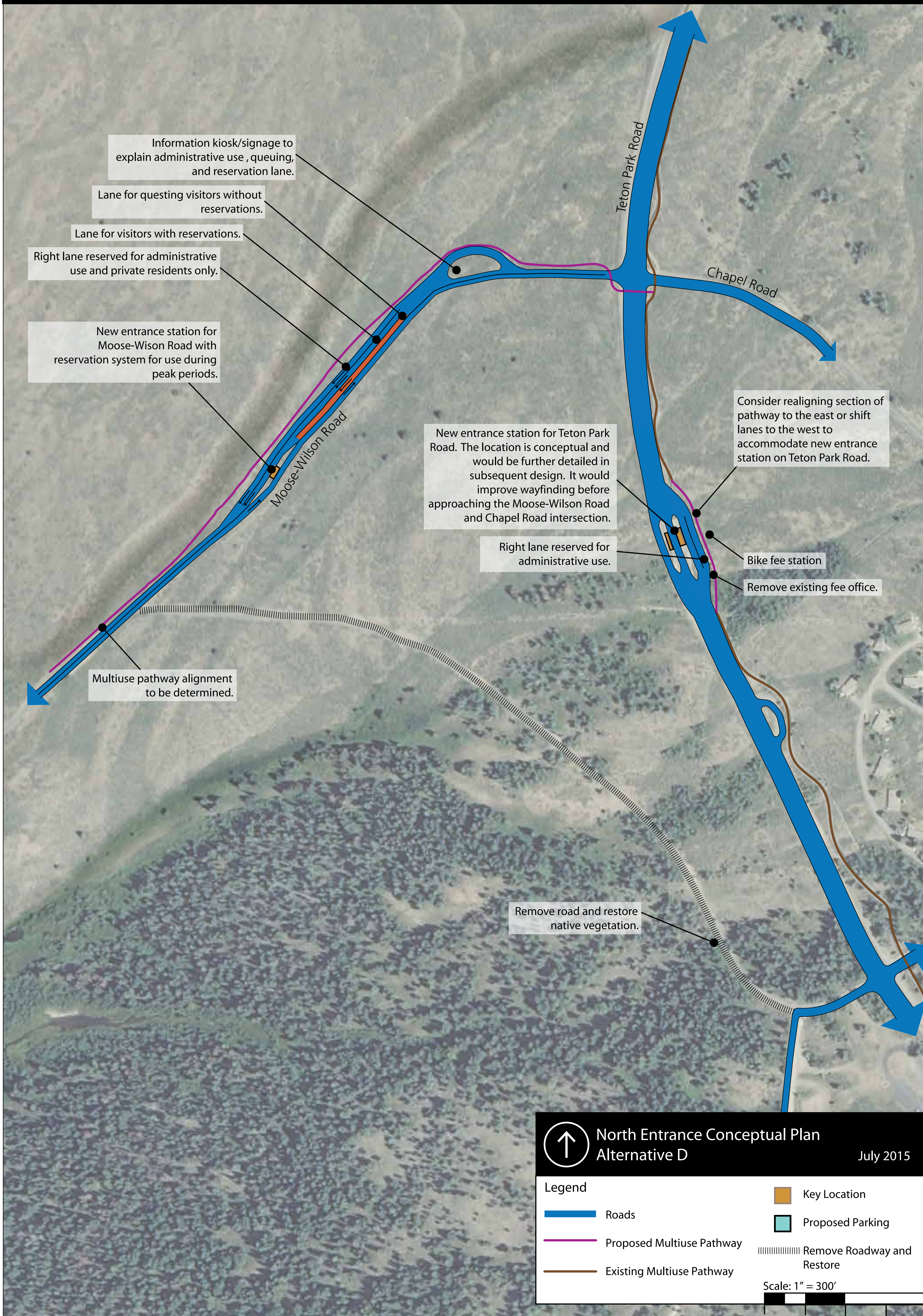

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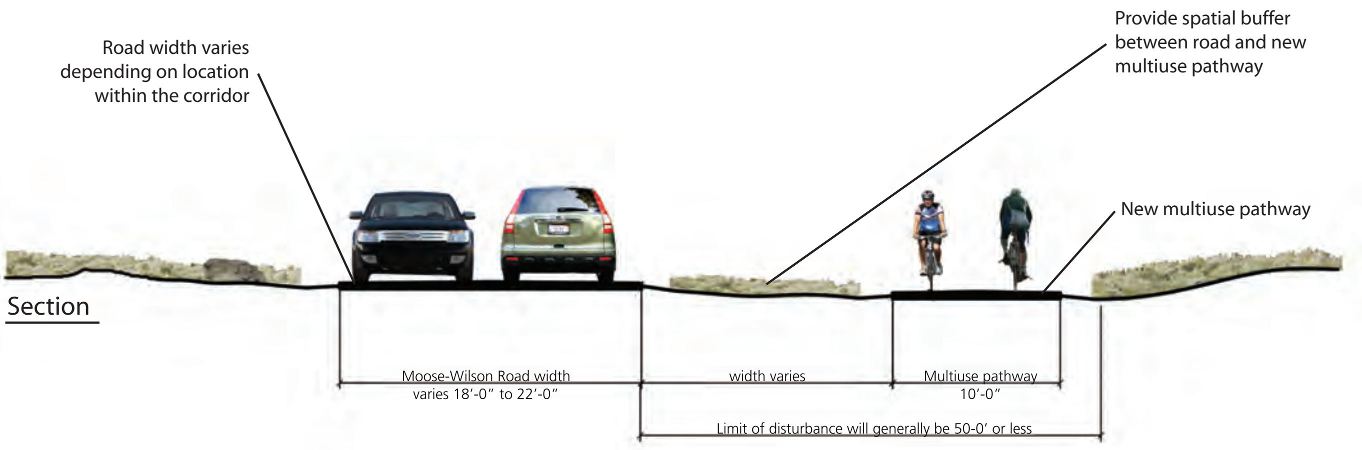
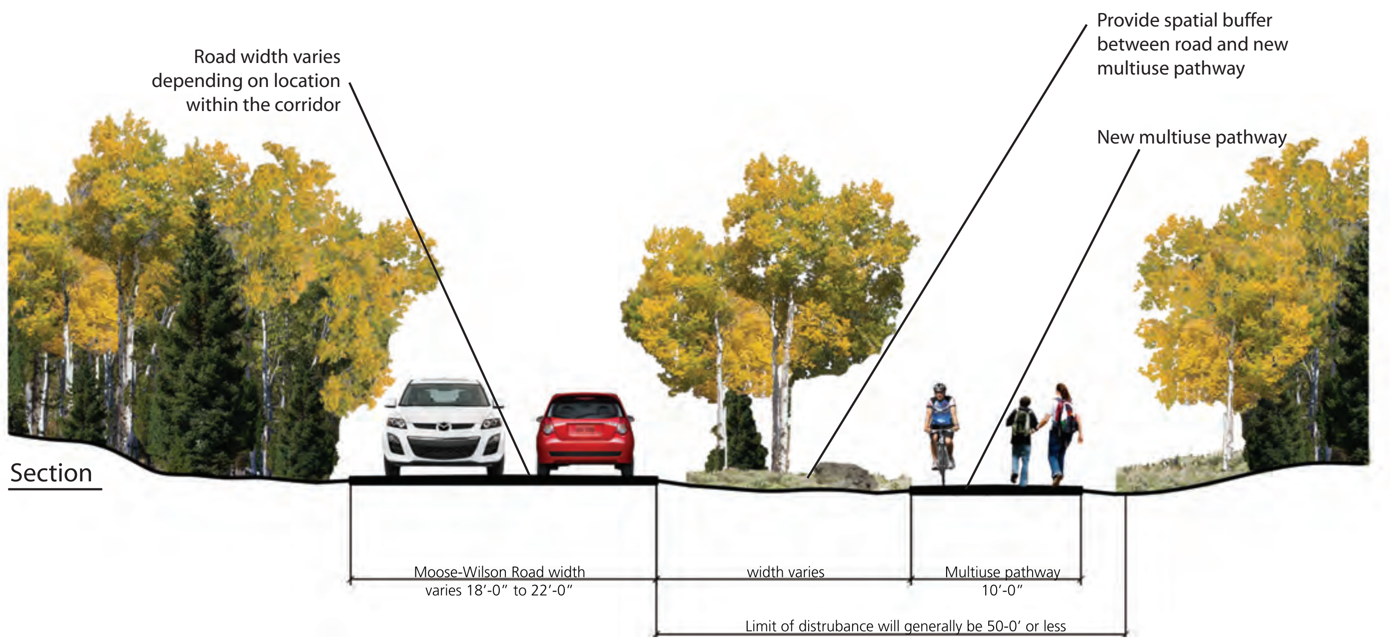


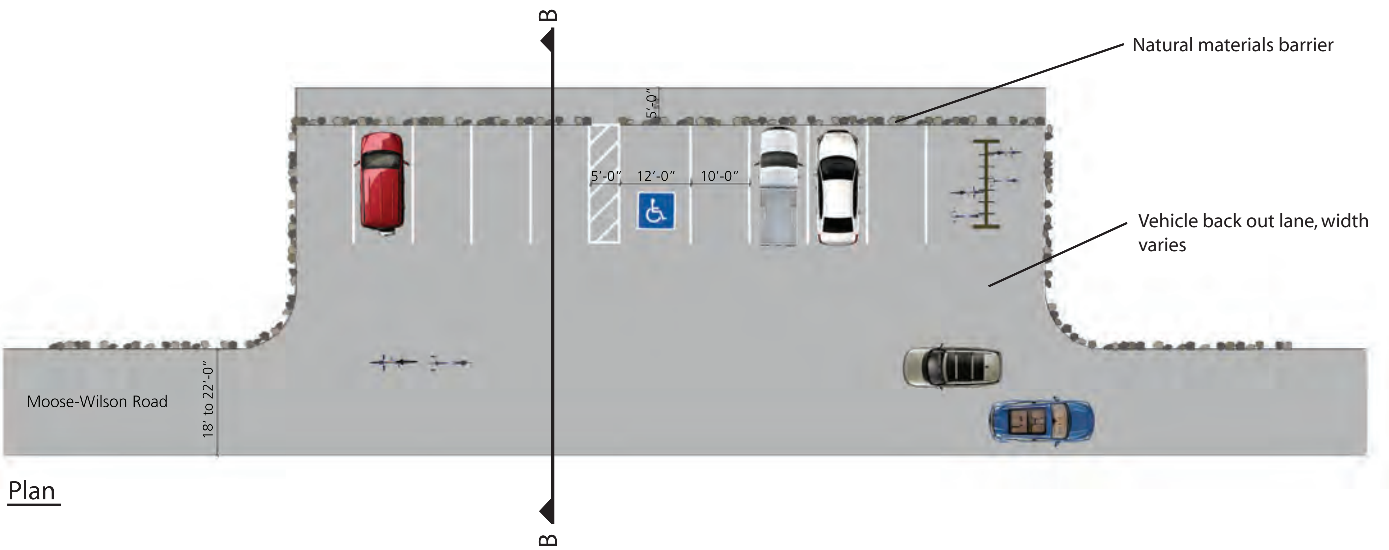
Moose-Wilson Corridor Management Plan
Typical Multiuse Pathway in Sage Road Segments
Alternative D

July 2015



Moose-Wilson Corridor Management Plan
Typical Multiuse Pathway in Forested Road Segments
Alternative D

July 2015



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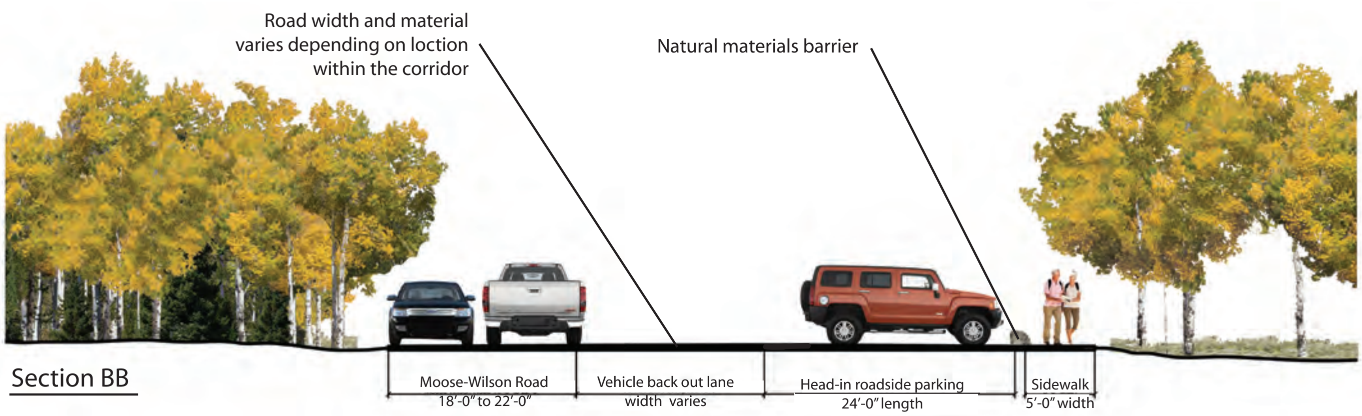
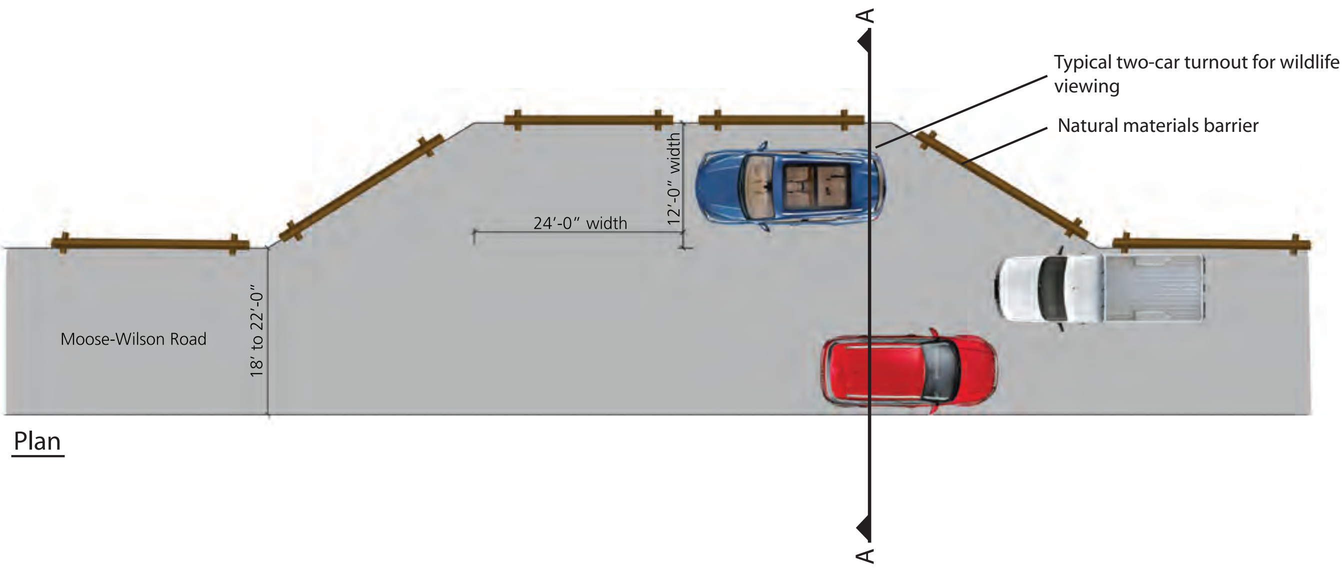


Section BB



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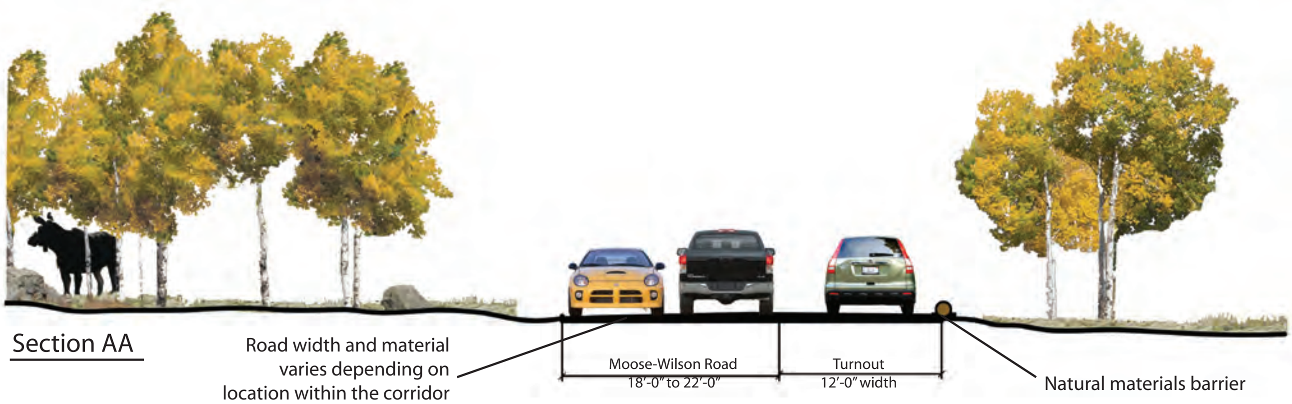


Section AA

COMMON TO ALL ACTION ALTERNATIVES

The following management directions are common to all action alternatives. These provide a practical approach to managing the Moose-Wilson corridor that does not vary by alternative. They include a visitor use management framework to sustain desired resource conditions and visitor experiences, best management practices to ensure continued protection of the park's fundamental resources and values, mitigation measures to avoid or minimize potential adverse impacts from implementation of the plan, monitoring guidelines to periodically check the status of the resources, and strategies to address climate change.

VISITOR USE MANAGEMENT FRAMEWORK

Introduction

Visitor use management is the proactive and adaptive process of planning for and managing characteristics of visitor use and its physical and social setting, using a variety of strategies and tools, to sustain desired resource conditions and visitor experiences. Visitor use management is important because NPS managers strive to maximize benefits for visitors while achieving and maintaining desired conditions for resources and visitor experiences in a particular area. Managing visitor access and use for visitor enjoyment and resource protection is inherently complex. It requires that managers analyze not only the number of visitors but also where they go, what they do, their impacts on resources and visitor experiences, and the underlying causes of those impacts. Managers must acknowledge the dynamic nature of visitor use, the vulnerabilities of natural and cultural resources, and the need to be responsive to changing conditions.

Proactively planning for visitor use maximizes the ability of agencies to encourage access and protect resources and values. Visitor use goes beyond the types of activities that people engage in at parks. In this framework, visitor use refers to human presence in an area for recreational purposes including education, interpretation, inspiration, and physical and mental health.

Visitor use also includes the amount, timing, and distribution of visitor activities and behaviors. The visitor use management framework provides a process within which visitor capacity should be addressed when necessary. Visitor capacity, a component of visitor use management, is the maximum amounts and types of visitor use that an area can accommodate while achieving and maintaining desired resource conditions and visitor experiences consistent with the purposes for which the area was established. Visitor capacities will vary from site to site depending on the desired conditions and issues of the specific area. The monitoring component of this visitor use management framework would test the effectiveness of management actions and provide a basis for informed adaptive management of visitor use.

The Planning Process

This plan uses the visitor use management framework to develop a long-term strategy for managing visitor use within the Moose-Wilson corridor of Grand Teton National Park. The general planning process used for the Moose-Wilson Corridor Comprehensive Management Plan / Environmental Impact Statement is outlined below. Please refer to figure 14 for an overview of the visitor use management planning process steps.

- Determine how the park's *purpose/significance* and the *fundamental resources and values* found within the corridor, along with guidance from previous park plans, outline desired resource conditions, visitor experience opportunities, and general levels of development for the Moose-Wilson corridor. See "Chapter 1, Foundation for Planning and Management."

- Determine what goals and objectives for visitor use management should exist within the corridor by assessing existing knowledge about visitor use within the Moose-Wilson corridor (e.g., patterns of use, timing of use, types of use, impacts on resources and visitor experiences caused by visitors, monitoring that is already being conducted). See "Goals and Desired Conditions" in this chapter. Understand key components of visitor use from recent and past data collection efforts. See "Chapter 3: Affected Environment," in the "Visitor Use and Experience" section for the explanation of existing visitor use and experience conditions.

- Identify the critical elements of desired visitor experiences and resource conditions that may serve as visitor use indicators. Prioritize the range of potential indicators, and determine the most feasible and important for inclusion in the plan. See below for more information on the development of indicators.

- Develop thresholds for each priority indicator. See below for more information on the establishment of thresholds.

- Identify a tool kit of management strategies that could be applied for each priority indicator to manage visitor use and achieve desired conditions over time. See below for more information on management strategies associated with indicators. An analysis of the impacts of proposed actions and management strategies are also discussed in "Chapter 4: Environmental Consequences," in the "Visitor Use and Experiences" section.

- Identify management strategies that necessitate visitor capacities. Understand the processes through which visitor capacities will be determined for those strategies. See below for more information on management strategies associated with visitor capacities. An analysis of the impacts of proposed actions and management strategies are also discussed in "Chapter 4: Environmental Consequences," in the "Visitor Use and Experiences" section.

Indicators and Thresholds

Indicators translate the broad description of desired conditions into measureable attributes (i.e., people at one time at key locations, number of user-created social trails) that could be tracked over time to evaluate change in resource or experiential conditions. The planning team considered many potential issues and related indicators that would identify impacts of concern, but those described below were considered the most significant, given the importance and vulnerability of the resource or visitor experience affected by visitor use. The planning team also reviewed the experiences

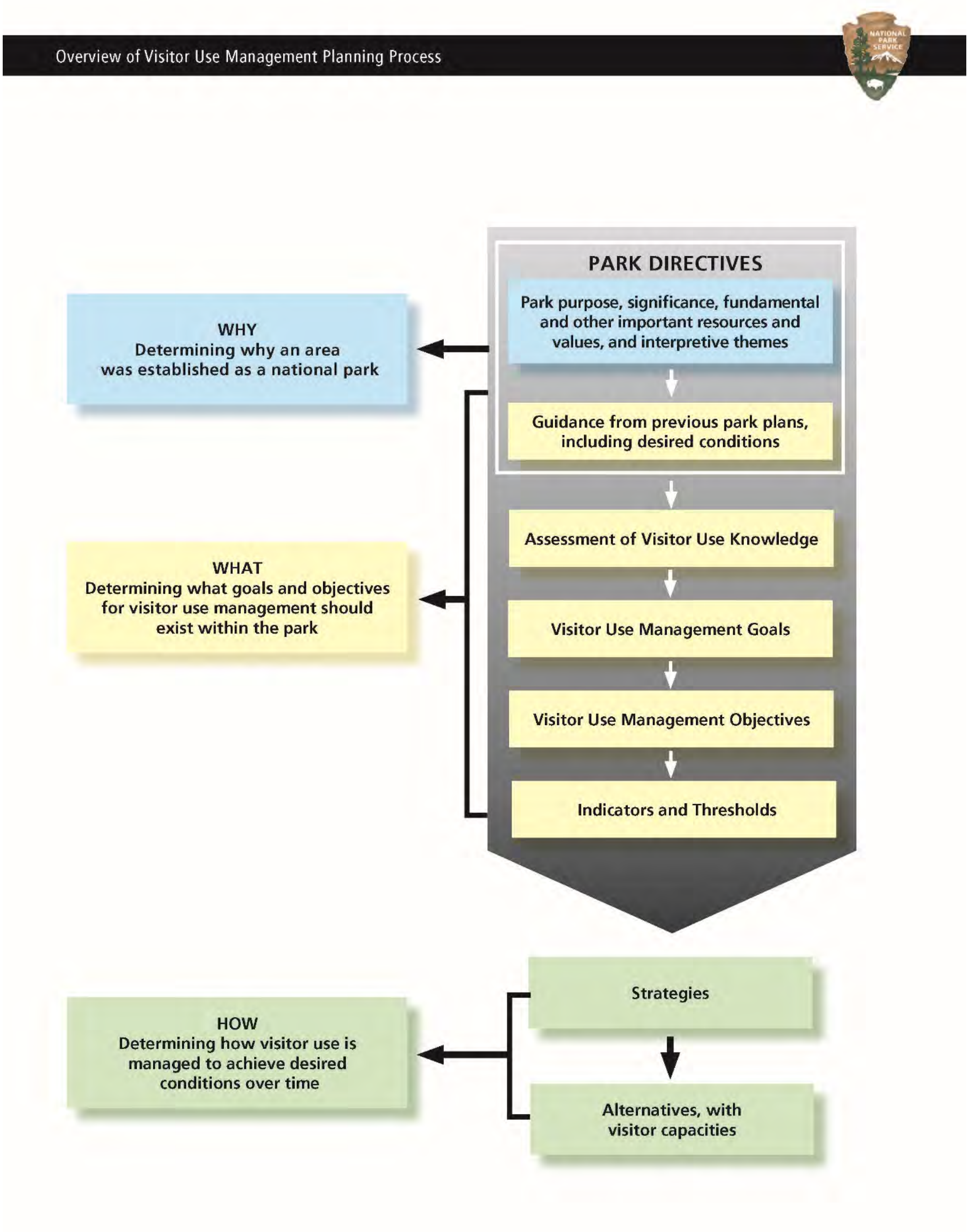


Figure 14. Overview of Visitor Use Management Planning Process

of other park units with similar issues to identify meaningful indicators. Thresholds that represent the minimum acceptable condition for each indicator were then assigned, taking into consideration the qualitative descriptions of the desired conditions, data on existing conditions, relevant research studies, staff management experience, and scoping on public preferences. Although defined as "minimally acceptable," thresholds still represent acceptable conditions. Also, establishing thresholds does not imply that no action will be taken prior to reaching the threshold. Managers strive to maintain conditions that are superior to the thresholds. However, if conditions deteriorate, thresholds define the point at which management is committed to take immediate, corrective action to ensure that conditions remain acceptable so desired conditions are achieved over time. Table 2 includes the indicators, thresholds, and associated potential management strategies that would be implemented as a result of this planning effort.

Some management strategies in table 2 vary across alternatives and would be implemented upon completion of the plan to ensure thresholds are maintained and desired conditions are achieved. Several of these strategies are currently in use in the Moose-Wilson corridor and may be increased in response to changing conditions. If new strategies are needed, an analysis would be prepared to identify the most effective and feasible action for implementation. Implementation of some of these management strategies and of new strategies in the future may require additional compliance and public involvement.

Some of the indicators and thresholds are more directly linked to addressing visitor capacity. These indicators include:

- **Vehicles-Free Viewscape.** Measuring this indicator helps protect the scenic driving experience by minimizing crowding along Moose-Wilson Road.
- **Peak Levels of Use on Trails.** Measuring this indicator helps promote solitude and minimize conflicts by addressing crowding along trails.
- **People at One Time at Key Destinations.** Measuring this indicator aids visitors in having a relaxed and uncongested experience by minimizing crowding at both frontcountry and backcountry locations to protect visitor experiences.
- **Amount of User-Created Overflow Parking.** Measuring this indicator helps protect resources and ensures that visitors have safe and easy access to key destinations by minimizing unauthorized parking.
- **Amount of User-Created Roadside Disturbance.** Measuring this indicator helps protect natural and cultural resources (historic character) by identifying visitor-caused areas of disturbance along Moose-Wilson Road.
- **Number of User-Created Trails.** Measuring this indicator helps protect natural and cultural resources by identifying visitor-caused areas of disturbance through creation of unauthorized trails.

Visitor use management is an iterative process in which management decisions are continuously informed and improved. Indicators are monitored, and adjustments are made as appropriate. As monitoring of conditions continues, managers may decide to modify or add indicators if better ways are found to measure important changes in resource and experiential conditions. Monitoring indicators helps NPS staff determine the most effective way to manage visitor use to attain desired visitor experiences and resource conditions. Information on the NPS monitoring efforts, related visitor use management actions, and any changes to the indicators and thresholds would be available to the public.

The following table ("Table 2. Indicators and Thresholds") contains all indicators and thresholds developed for the Moose-Wilson corridor. They appear in the following order:

- Vehicle-Free Viewscape
- Peak Levels of Use on Trails
- People at One Time at Key Destinations
- Amount of User-Created Overflow Parking
- Condition of Historic and Archeological Sites
- Illegal Activity at Historic and Archeological Sites
- Amount of User-Created Roadside Disturbances
- Number of User-Created Trails
- Percent Time Nonnatural Sounds Are Audible
- Number and Types of Undesirable Human-Wildlife Encounters

TABLE 2. INDICATORS AND THRESHOLDS

Vehicle-Free Viewscape
Measuring this indicator helps protect the scenic driving and bicycling experience by minimizing crowding along Moose-Wilson Road.
Rationale for Indicator and Threshold
This indicator provides a relationship between use levels and visitor experience. It would assist the park in protecting the desired visitor experience of scenic driving on Moose-Wilson Road. Desired conditions of this experience include an unhurried pace along a rustic "motor natural trail" without being surrounded by other vehicles or bicycles. This indicator would focus on levels of vehicular and bicycle use. This indicator would serve to manage Moose-Wilson Road as a destination for visitors rather than to serve regional transportation needs. This indicator serves to protect the historic rural character of the corridor and maintains the sense of discovery within the area. This indicator is intended to be applied to the general experience of traveling the road and is not intended to address incident-type congestion such as wildlife jams. The park would continue to manage incident-based congestion through separate management strategies. This indicator works in tandem with the percentage of time that destination parking lots are full since managing the amount of use in the corridor would influence demand for parking. This indicator serves to enhance opportunities for bicycling on Moose-Wilson Road by managing traffic levels on the road and is therefore directly related to the visitor capacity determination for the corridor. The number of vehicles and bicycles per viewscape observed in the corridor can be correlated to the rate of vehicles and bicycles traveling the road. Timed photographs of viewscapes along Moose-Wilson Road taken during the 2014 season have been correlated to traffic rates recorded at the same time. This correlation shows that when rates of traffic are lower, there is a higher likelihood that visitors will not observe other vehicles or bicycles in their viewscapes. In turn, when traffic rates per hour are higher, it is more likely that visitors will observe other vehicles or bicycles in their viewscapes. According to studies by Utah State University, an hourly rate of vehicles during peak use periods is on average 140 vehicles per hour. The correlation between photos of vehicles per viewscape and hourly vehicle rates indicates that at current use levels, there is a 70% chance that visitors will experience vehicle- and bicycle-free viewscapes as they travel the corridor. The threshold developed for this indicator would protect the scenic driving and riding experience for visitors. It would protect the desired conditions of an unhurried, rural, rustic, and slow-paced experience of the roadway. This threshold would allow park managers to effectively manage desired visitor experiences by combining visitor survey information, such as visitors' desired levels of crowding, with regular observation of the amount of vehicle and bicycle use on the road. This threshold would be linked to the amount of use in the corridor. The park would manage the amount of use to not exceed the desired vehicle- and bicycle-free viewsheds.

TABLE 2. INDICATORS AND THRESHOLDS

Vehicle-Free Viewscape
Threshold
Visitors would experience vehicle- and bicycle-free viewsheds 70% of the time as they travel along Moose-Wilson Road.
Potential Management Actions
Common to All Action Alternatives: ▪ Develop and implement a public information effort to inform local businesses and other information providers (e.g., guidebooks) about the desired experience in the corridor and actions the park is taking to achieve those experiences and how visitors can best experience the corridor. This information would be distributed through direct visitor contact, park publications, and wayside exhibits. The goal of the effort would be to have visitors self-disperse or to come at lower use times of the day or season to accommodate similar levels of vehicle use, but without concentrating that use during peak periods. *Alternative B:* ▪ Construct a gate and supplemental parking area midway through the corridor that would allow two-way traffic from both ends of Moose-Wilson Road as far as the LSR Preserve; but would not allow through-traffic along the road. ▪ Gate would be closed during days when use would otherwise be expected to exceed threshold levels and would be done as part of an adaptive management approach. – Dates would be determined using recent traffic counts to determine peak use periods and would be established to be simple for the public to understand such as the gate being closed from 11:00 a.m. to 3:00 p.m. on weekends during July and August. – The Granite Canyon Entrance Station would continue to serve as a visitor education and fee collection contact point. – A new Moose Entrance Station would serve as a visitor education and fee collection contact point. *Alternative C:* ▪ Build a new visitor education and queuing station at Moose to provide education and to manage levels of visitor use entering from the north end of the corridor. Use the Granite Canyon Entrance Station to manage levels of visitor use entering from the south end of the corridor. – Levels of use would be managed by controlling the number of vehicles allowed beyond the station. The amount of use allowed at one time would be consistent with the determined visitor capacity for the corridor. The visitor capacity is reflective of current use levels observed in the corridor. o These use levels would be managed through real-time counts of vehicle use in the corridor and time entry (sequencing) to ensure that crowding thresholds are not exceeded. *Alternative D:* ▪ Build a new visitor education and queuing station on the northern end of the road to provide education and to manage levels of visitor use per a reservation system. The Granite Canyon Entrance Station would continue to serve as a visitor education and fee collection contact point and would also be used to manage levels of visitor use. – Levels of use would be managed by controlling the number of vehicles allowed beyond the station. o These levels would be managed through a reservation system whereby visitors are allowed to enter the corridor within a certain hour of a certain day. A limited number of reservations would be issued to ensure that crowding thresholds are not exceeded. o Reservations would be issued in advance but with a number held back at the station to be issued for the current hour.
Monitoring Strategies
Data would be collected periodically to confirm that the thresholds are not being exceeded and that use levels are not being overly restricted beyond what is necessary to achieve the desired visitor experience. Observational data (traffic counts and timed photographs) would be conducted in tandem with social science research to facilitate linking crowding levels and volumes of vehicle and bicycle use.

TABLE 2. INDICATORS AND THRESHOLDS

Peak Levels of Use on Trails
Measuring this indicator helps promote solitude and minimize conflicts by addressing crowding along trails.
Rationale for Indicator and Thresholds
This indicator monitors the levels of use on trails. The objective of this indicator is to achieve the desired levels of solitude and high-quality visitor experience on corridor trails. By monitoring and managing use levels on trails, the amount of encounters between visitors is also influenced. This indicator is applicable to a variety of user types on the trails and would track visitor use patterns. In addition, it would ensure that desired conditions for wilderness and the Laurance S. Rockefeller Preserve are being maintained. Thresholds are established to achieve different experiences that are appropriate for each location. The established thresholds would protect the opportunity for solitude and diverse visitor experiences in the corridor with the following desired experiences by location. The desired experiences by location are described below. 1. The Valley Trail between Death Canyon Trailhead and the junction with Death Canyon Trail ▪ This trail provides the opportunity for short-duration hikes (approximately 2–3 miles round trip) to a particular destination, which are achievable by a wide range of user abilities. This segment also serves as a gateway to overnight backcountry wilderness use areas beyond the junction with Death Canyon Trail where crowding levels are expected to be lower than those at the overlook or the junction. 2. The Granite Canyon Trail between Granite Canyon Trailhead and the Valley Trail ▪ This segment of trail provides the opportunity for solitude with the most likely opportunity for solitude. The primary desired experience is of a longer duration and hiking distance, often to backcountry wilderness areas for overnight use or without a specific destination as an objective. 3. The Woodland and Lake Creek Trails between the LSR Preserve Center and the shore of Phelps Lake. ▪ These trails provide opportunities for relatively short hikes (approximately 2–3 miles) to the shore of Phelps Lake, with opportunities for longer hikes along the lakeshore or further into the backcountry. These trails are generally a day use hiking area. Managing to thresholds would provide an opportunity for personal connections to nature, contemplation, and solitude. By measuring peak levels of use at locations somewhat away from the trailheads, park managers can protect visitor experiences in areas outside the roadway itself. These thresholds protect visitor's abilities to experience solitude in a setting that is relatively easy to access. The established thresholds are based on observed use levels on trails during peak use times. By managing use on trail segments nearest trailheads, the more distant segments are also managed because use levels become lower and more dispersed as visitors travel farther from the trailhead. Minimal amounts of use were detected entering the corridor via trails. Almost all use (and therefore sufficient levels) can be effectively managed via the destination trailheads.

TABLE 2. INDICATORS AND THRESHOLDS

Peak Levels of Use on Trails
Thresholds
Threshold would vary by trail segment but not by alternative. The three trail segments to be managed are 1. The Valley Trail between Death Canyon Trailhead and Phelps Lake Overlook ▪ No more than 220 number of counts per day. 2. The Granite Canyon Trail between Granite Canyon Trailhead and the Valley Trail ▪ No more than 30 number of counts per day. 3. The Woodland and Lake Creek Trails between the LSR Preserve Center and the shore of Phelps Lake. ▪ No more than 375 number of counts per day.
Potential Management Actions
The potential management actions below would be implemented as part of an adaptive management strategy and would be implemented in a descending order if determined to be necessary. ▪ Develop and implement a public information effort to inform local businesses and other information providers (e.g., guidebooks) about the desired experience in the corridor and actions the park is taking to achieve those experiences and how visitors can best experience the corridor. This information would be distributed through direct visitor contact, park publications, and wayside exhibits. The goal would be to have visitors self-disperse or to come during lower use times of day or season to accommodate similar levels of hiker use but without concentrating that use during peak periods. ▪ Manage the amount of bicycles that can be parked in parking areas in a similar manner as vehicles are currently managed (i.e., three bicycles would represent one vehicle parking spot). ▪ Place physical barriers along roadsides so that visitors are not able to park on the roadside and then walk to trailheads. Formalize road edges where possible. ▪ Actively manage the Death Canyon Trailhead parking lot and other parking lots during peak periods to ensure that visitors only park in authorized spaces. ▪ Reduce the usable size of parking lots to reduce encounter rates on trails.
Monitoring Strategies
Use levels on trails would be monitored by placing trail counters at key locations along trail segments. The collected information would be compared over time to determine if adaptive management strategies need to be employed to ensure that desired experiences are being reached in the corridor.

TABLE 2. INDICATORS AND THRESHOLDS

People at One Time at Key Destinations
Measuring this indicator would aid visitors in having a relaxed and uncongested experience by minimizing crowding at both frontcountry and backcountry locations to protect visitor experiences.
Rationale for Indicator and Thresholds
This indicator would apply to both frontcountry and backcountry areas within the corridor. It distinguishes the Moose-Wilson corridor as a different experience within Grand Teton National Park and would promote a less crowded environment. This in turn protects a visitor's ability to experience the park in a rare uncrowded setting. The visitor experience goals outlined in the *Laurance S. Rockefeller Preserve Property Maintenance Plan* (2007) would be upheld by monitoring this indicator. The corridor is rich with stories of wilderness, preservation, and solitude. The small numbers of desired visitor congregations perpetuate the stories of the Murie and Rockefeller families. These stories ground and give meaning to the current visitor experience in the corridor.

TABLE 2. INDICATORS AND THRESHOLDS

People at One Time at Key Destinations
By monitoring and protecting visitor experiences at key destinations, park staff would be able to determine how alternative management strategies are working and if they need to be adjusted. These thresholds protect experiences beyond the roadway within the corridor. By managing for these thresholds, park staff can ensure that a variety of experiences are available within the corridor and elsewhere in the park. In this corridor, easily accessible but uncrowded experiences are possible. By providing areas of the corridor that are uncrowded, visitors are given the opportunity to experience a sense of solitude without having to be in backcountry areas. This tracks the influence that volumes of visitation along the roadways have on key destinations. As thresholds are exceeded, potential management strategies to stay within the threshold may focus on both vehicles and bicycles, as appropriate. The thresholds within the LSR Preserve were established in the 2007 LSR Preserve Property Maintenance Plan. The key destinations were designed to accommodate a target number of visitors. Once these target numbers are exceeded the desired visitor experience is compromised, which can be attributed to physical size constraints of the key destinations and the perception of crowding by visitors. The Grand Teton National Park Visitor Survey conducted by Idaho State University in 2009 shows that visitor perception of crowding at LSR Preserve was low overall—11% of visitors surveyed felt a little crowding at the LSR Preserve Center and 33% felt a little crowding on the trails, with 6% feeling moderate crowding. These findings support current thresholds established in the LSR Preserve Property Maintenance Plan to be continued as part of this plan. Both Phelps Lake Overlook and "jump rock" are within the 1978 potential wilderness. Thresholds of 10 people at one time at these locations support desired experiences for visitors to solitude and wilderness character in nearby areas. These thresholds also support the target for group size at the LSR Preserve of no more than 10 per group.
Thresholds
Key destinations include: Phelps Lake Overlook, "jump rock", Sawmill Ponds Overlook, White Grass Dude Ranch Historic District, and specific sites within the Laurance S. Rockefeller Preserve. This proposed threshold for each of these key destinations is as follows. Please see map 6 for the Laurance S. Rockefeller Preserve. *Alternatives B, C. and D:* ▪ Laurance S. Rockefeller Preserve – No more than 30 people at one time in the galleries at the Laurance S. Rockefeller Preserve Center (PMP pp18, 39). – No more than 16 people at one time in the Resource Room at the LSR Preserve Center (PMP p39). – No more than 10 people at one time at the Lakefront Overlook) and at rest areas 2 and 6 within the LSR Preserve (PMP pp29, 30, 53). – No more than 3 people at one time at rest area 3 within the LSR Preserve (PMP p31). – No more than 4 people at one time at rest areas 1, 4, and 5 within the LSR Preserve (PMP pp30, 31, 32). – No more than 10 people at one time leaving on the Lake Creek Trail (PMP p46). ▪ No more than 10 people at one time at the Phelps Lake Overlook. ▪ No more than 10 people at one time at "jump rock". ▪ No more than 25 people at one time at White Grass Dude Ranch Historic District. This number would be applied to general visitors beyond those who are participating in training or events at the Western Center for Historic Preservation or those attending park sanctioned special events. *Alternatives B and C:* No more than 25 people at one time at Sawmill Ponds Overlook. *Alternative D:* No more than 40 people at one time at established viewing areas along realigned portion of Moose-Wilson Road between Sawmill Ponds Overlook and Death Canyon Road junction.
Potential Management Actions
▪ Education, including how sound carries through the corridor so that visitors at sites such as "jump rock" understand how their actions may affect others. Education could include ranger roves and/or signage/waysides. ▪ Encourage hikers to take a certain route during peak use times. ▪ Provide information on other visitor destinations within the corridor. For instance, highlight Murie Ranch and White Grass Ranch to disperse use. Focus on destinations that typically have lower use levels and provide education on

TABLE 2. INDICATORS AND THRESHOLDS

People at One Time at Key Destinations
Valley Trail access. ▪ Increase maps and signage about various destinations within and outside developed areas of the corridor. ▪ Provide real-time parking lot status updates. Rangers at contact stations could relay this information to visitors before they reach that location. ▪ Limit group size to 10 individuals, similar to limits of the LSR Preserve's current management practices (2007 LSR Property Maintenance Plan. ▪ Manage bicycle use in a similar manner as vehicles if visitation to key destinations is directly tied to an increase in bicycle use in the corridor. ▪ Prohibit audio devices (amplified music or radios) at "jump rock" and other wilderness sites. If these devices are frequently used at such locations, wilderness character and soundscapes would be degraded. ▪ Manage commercial uses to ensure smaller group sizes and/or timing and places tour groups can visit. Enforce parking in authorized spaces for commercial groups. ▪ Manage parking lots to mimic the LSR Preserve parking lot management strategy. ▪ Implement a permit system for certain trails or trailheads.

Table 2. Indicators and Thresholds

Amount of User-Created Overflow Parking
Measuring this indicator would help protect resources and ensure that visitors have safe and easy access to key destinations by minimizing unauthorized parking.
Rationale for Indicator and Threshold
This indicator would protect resources by managing overflow parking areas that cause vegetation damage and soil erosion. By addressing visitor-caused impacts on resources at parking areas, connected opportunities such as hiking are not adversely affected. Beyond the resource impacts themselves, user-created overflow parking indicates that parking is often nearly full or full and that visitors are attempting to find additional areas to park their vehicles. This indicator directly informs the potential alternative management strategies related to regulating levels of visitor use entering the corridor such as rates of vehicle entry into the corridor. This threshold aids the park in reducing the amount of lost visitor opportunities and protects the ability of corridor visitors to leave their cars. The threshold for this indicator has been determined from current parking use levels at Death Canyon Trailhead, LSR Preserve, and Granite Canyon Trailhead. Other areas such as Sawmill Ponds, turnouts, and the overlook that would be added under alternative D are considered temporary stopping areas and are generally not managed as long-term parking. Related Indicators ▪ Peak Levels of Use on Trails: This indicator works in tandem with the volume of use on park trails. Overflow parking would have a negative influence on achieving the desired visitor experience on the trails. Overflow parking would result in more people on the trails causing more than the acceptable levels of crowding. ▪ Amount of User-Created Roadside Disturbance: This indicator works in tandem with user-created roadside disturbances as the presence of roadside disturbances would indicate that visitors are not able to find designated parking or temporary turnouts.
Threshold(s)
There would be no user-created overflow parking areas. Parking areas would not be more than 95% full more than one day a week during the peak use period. Parking areas include Death Canyon Trailhead, Granite Canyon Trailhead, and the LSR Preserve parking lot. Parking considerations for both bicycles and vehicles may be included as part of this indicator and threshold.
Potential Management Actions
▪ Provide education and information on parking availability through park entrance stations and visitor centers. Develop and implement a public information effort to inform local businesses and other information providers (e.g.,

Table 2. Indicators and Thresholds

Amount of User-Created Overflow Parking
guidebooks) about the desired experience in the corridor and actions the park is taking to achieve those experiences and how visitors can best experience the corridor. Set the expectation of how many opportunities there are to park at designated spaces in the corridor. Direct visitors to parking areas where adequate parking is available. ▪ Provide information on status of parking lots (when they tend to be full) so visitors can plan accordingly. ▪ Prevent overflow parking by installing barriers to parking in the vicinity of parking areas. ▪ Provide information on real-time parking availability to potential visitors before they reach the park. This information would be conveyed to visitors prior to and/or upon entry to the corridor to facilitate seeking alternative experiences including those outside the corridor. ▪ Manage bicycle use in a similar manner as vehicles if visitation to key destinations is directly tied to an increase in bicycle use in the corridor. ▪ Formalize turnouts along Moose-Wilson Road. ▪ Actively manage parking at Death and Granite Canyon Trailheads, in addition to efforts already underway at the LSR Preserve. ▪ Use active visitor use management strategies to manage the number of vehicles entering the corridor. These could include sequencing or a reservation system as proposed in alternatives C and D. These systems would both be managed using the determined visitor capacity for the corridor and would be implemented during peak use times.
Monitoring Strategy(s)
▪ Conduct observational study of parking lot use throughout the day during the operating season. – Hourly count of parking lot accumulation (including bicycles and vehicles. – Counts shall be throughout the day to determine the effectiveness of management strategies that attempt to diffuse use throughout the day; noting any change during peak hours. – Assessment of impacts on soils and vegetation from user-created parking noting area and level of impact. – This assessment can be performed informally by park staff on an annual basis.

TABLE 2. INDICATORS AND THRESHOLDS

Condition of Historic and Archeological Sites
Measuring this indicator protects cultural resources by identifying negative changes to those resources caused by visitors.
Rationale for Indicator and Threshold
Disturbance to historical and archeological sites can occur through both intentional and unintentional means. Both can cause impacts that influence the integrity of these resources (user-created trails, erosion, etc.). Monitoring the condition of historic and archeological sites in the Moose-Wilson corridor has been chosen as a meaningful and easily attainable method to assess natural and human threats at historic and archeological sites. Monitoring the condition of historic and archeological sites contributes to the protection of many outstanding cultural resources in the Moose-Wilson corridor. The condition of historic and archeological sites is indicative of the level of visitor use within an area and the accessibility of sites to visitors. Archeological sites are not static entities. Whether inadvertent or intentional, human-related impacts can be unpredictable. For instance, the intensity of human-related impacts may grow dramatically with enhanced accessibility or increased off-trail use (Versar, Inc. 2011:2). Public land managers are recognizing that proper stewardship of historic and archeological resources on public lands cannot rely on avoidance strategies alone, but rather must become more proactive. Public land managers must assess historic and archeological sites on a regular basis to observe the dynamic forces acting on a site if they hope to develop long-term strategies that will minimize or redirect these ever-changing impacts (Versar, Inc. 2011:2). There is also a persistent notion within federal land management agencies that natural and cultural resource management issues are separate and must be managed separately. This is certainly not the case. For example, maintaining intact ground cover can protect archeological sites by reducing erosion and minimizing the impact of people traveling across an area (Versar, Inc. 2011:3). Unfortunately, unlike natural resources that can potentially be restored, archeological resources are nonrenewable.

TABLE 2. INDICATORS AND THRESHOLDS

Condition of Historic and Archeological Sites
Threats to historic and archeological sites are divided into three categories: those related to natural activities (erosion, fire, tree falls, freeze/thaw cycles, etc.), those related to animal activities (burrowing, trampling, bison wallows, etc.), and those related to human activities (vandalism, looting, collecting, camping, development, social trails, etc.) (Versar, Inc. 2011:15). Regular visits to sites through a formal site monitoring program have proven an effective technique for preserving the integrity of archeological sites (Versar, Inc. 2011:3). Information on condition trends and changes in condition allows managers to make rational, efficient, fair, and consistent decisions so resources can be managed and conserved in the long term (Walton 2003:7). Many of the sites are meant to be enjoyed by visitors, but they are nonrenewable so their disturbance is unacceptable. The condition would not improve due to visitor use, but any visitor-caused degradation of condition would warrant management action. Historic and archeological resources are nonrenewable. This means sites cannot recover from natural and human-caused disturbance. Using condition levels to monitor natural and human impacts allows land managers to regularly track changes at sites. Changes in visitor access, construction, and recreational activities can expose historic and archeological sites to new risks, which in turn lowers the overall condition of a site. More sites are seriously damaged or destroyed by human actions than by natural processes. With consistent monitoring, the effects of environmental and human degradation are regularly observed and recorded, so land managers can understand the full extent of environmental impacts and human degradation. Consistent monitoring of human-related disturbance or destruction within sites allows managers to assess whether conditions are worsening and when to implement management action. Any observed disturbance and destruction within historic or archeological sites would lead to a record of the condition exceeding the threshold.
Threshold
Action Alternatives B, C, and D: Overall condition (good, fair, poor) does not change in any culturally significant area as the result of visitor activity.
Potential Management Actions
▪ Improved education regarding the sensitivity of cultural resources and the need to protect them. ▪ Designate trails or viewing areas in places where degrading social trailing is occurring. ▪ Provide deterrents to inappropriate visitor use near cultural sites (e.g., logs, rocks, etc.). ▪ Place signs directing visitors to stay on trails. ▪ Prioritize documentation of resources in high visitor use areas. ▪ Increased ranger presence/law enforcement patrol. – Revegetation of sites. – Area closure.
Monitoring Strategies
Monitoring the condition of historic and archeological sites consists of periodic visits and inspections to detect any changes in a site's condition from a previous visit (USACE 2009:A-1). A condition assessment schedule of three to five years would be in place for monitoring sites. Condition assessments may occur on a more frequent basis for sensitive sites. During each assessment, the site condition would be evaluated to determine if the threshold is being met or has been exceeded.

TABLE 2. INDICATORS AND THRESHOLDS

Illegal Activity at Historic and Archeological Sites
Measuring this indicator protects cultural resources by tracking and responding to illegal activity aimed at cultural resources.
Rationale for Indicator and Threshold
Damage to historical and archeological sites can occur through both intentional and unintentional means. Both can cause impacts that influence the integrity of these resources. (Archaeological Resources Protection Act [ARPA] violations, damage/theft of NPS property, etc.). Monitoring the extent and type of illegal activity at historic and archeological sites within the Moose-Wilson corridor has been chosen as a strong and easily attainable method to determine human-caused threats. Monitoring the illegal activity occurring at sites contributes to the protection of cultural resources in the Moose-Wilson corridor. The amount and type of illegal activity is indicative of the level of visitor use within an area and the accessibility of sites to visitors. Archeological sites are not static entities. Whether inadvertent or intentional, human-related impacts can be unpredictable. For instance, the intensity of human-related impacts may grow dramatically with enhanced accessibility or increased off-trail use (Versar, Inc. 2011:2). Public land managers are recognizing that proper stewardship of historic and archeological resources on public lands cannot rely on avoidance strategies alone, but rather must become more proactive. Public land managers must assess historic and archeological sites on a regular basis to observe the dynamic forces acting on a site if they hope to develop long-term strategies that will minimize or redirect these ever-changing impacts (Versar, Inc. 2011:2). Monitoring the extent and type of illegal activity (intentional or unintentional) at historic and archeological sites consists of periodic visits and inspections to detect any changes from a previous visit to a site (USACE 2009:A-1). Illegal activity at sites includes vandalism, looting, or collecting, or the unauthorized excavation, removal, damage, alteration, or defacement of historic or archeological resources. Regular visits to sites through a formal site monitoring program have proven an effective technique for preserving the integrity of archeological sites (Versar, Inc. 2011:3). Information on condition trends and changes in illegal activity allows managers to make rational, efficient, fair, and consistent decisions so resources can be managed and conserved in the long term (Walton 2003:7).
Threshold(s)
Action Alternatives B, C, and D: No incidences of illegal activity.
Potential Management Actions
▪ Improved education regarding the sensitivity of cultural resources and the need to protect them. ▪ Increased ranger presence/law enforcement patrol. ▪ Prioritize documentation of resources in high visitor use areas. ▪ Implement area closures. ▪ Remove artifacts from field as ultimate preservation/protection measures.
Monitoring Strategies
Monitoring incidents of illegal activity at historic and archeological sites consists of periodic visits and inspections to detect any activities. As incidents are reported by park staff or visitors, inspections and assessments will be conducted.

TABLE 2. INDICATORS AND THRESHOLDS

Amount of User-Created Roadside Disturbances
Measuring this indicator helps protect natural and cultural resources (historic character) by identifying visitor-caused areas of disturbance along Moose-Wilson Road and Death Canyon Road.
Rationale for Indicator and Threshold
This indicator tracks vegetation loss and soil compaction. It also serves as a proxy for the expansion of invasive species associated with vegetation disturbance and seed dispersal. It also tracks impacts on the historic character of the road and is an indication of visitor use levels and behavior in the corridor. The threshold is low because maintaining intact, high-quality habitat near roadways increases the historic character of the corridor and the likelihood of viewing wildlife, which are fundamental resources and values of the corridor. In addition, the low threshold is possible because of actions contained in the action alternatives: additional formal parking is provided along the road, which is equal to the amount of user-created parking that is currently occurring. In other words, more parking would be provided in formal spaces than is now being used in current informal, visitor-created parking mode. This increased formal parking availability is intended to be strategically placed to enable visitors to park safely at locations of interest and thus eliminate the need and desire on the part of visitors to create additional parking. All action alternatives formalize the current user-created parking into a similar number and distribution of approved parking spaces. All action alternatives include visitor information and education strategies designed to help visitors understand and maintain the features and values of the Moose-Wilson project area, including the natural and cultural resources and historic aspects of the roadway.
Threshold(s)
No more than one area of additional visitor-created disturbances along roadsides.
Potential Management Actions
▪ Increase on-site visitor education regarding the adverse effects of parking in undesignated areas. ▪ Improve signage. ▪ Create physical or visual barriers. ▪ Formalize visitor-created turnouts in strategic areas. ▪ Consider limiting traffic volumes.
Monitoring Strategies
During the time that the Moose-Wilson Road is open, the road will be surveyed once per month by park resource staff to determine if there is evidence of user-created parking developing. Evidence could include vehicles parked in undesignated areas, tire tracks in undesignated areas, movement of barrier logs, evidence of crushed vegetation or areas denuded of vegetation and showing newly bare soil. Sites may be blocked off immediately to prevent further damage, if feasible. Monitoring would include GPS locations and photo points of any new user-created parking areas. Documentation of locations with evidence of new user-created parking would be completed (Monz et al. 2015) and reviewed each October prior to season-ending snows.

TABLE 2. INDICATORS AND THRESHOLDS

Number of User-Created Trails
Measuring this indicator helps protect natural and cultural resources by identifying visitor-caused areas of disturbance through creation of unauthorized trails.
Rationale for Indicator and Threshold
User-created trails are tracks created by users that are noticeable to observers and generally not managed directly by park staff, as opposed to formal trails that are mapped, periodically assessed, and regularly maintained (Leung et al. 2002, 2011b). This indicator measures multiple issues, including vegetation trampling, soil compaction, spread of invasive

TABLE 2. INDICATORS AND THRESHOLDS

Number of User-Created Trails
species, habitat fragmentation, safety concerns, visitor experience, and degradation of cultural resources, wilderness character, and habitat for sensitive species. User-created trails have many deleterious ripple effects in natural systems. Research has demonstrated that trails can have sizeable impacts radiating from the trail's edge (within 1 to 3 meters of the informal trail) (Dawson et al. 1974; Dale and Weaver 1974; Leung et al. 2011c). Social trails may lead to fragmentation that further affects hydrology, habitat quality, and soil moisture, and creates conditions ideal for the introduction of nonnative species (Forman 1995; Leung et al. 2011c; Lindenmayer and Fischer 2006). Trail corridors have also been shown to pose barriers for small mammals and other wildlife (Knight 2000; Miller et al. 1998; Gaines et al. 2003).
Threshold(s)
No more than 100 feet of visitor-created trails per mile of designated trails and roadways in nonsensitive resource areas. No more than 50 feet of visitor-created trails per mile of designated trails and roadways in sensitive resource areas.
Potential Management Actions
▪ Rehabilitate visitor-created trails in a timely manner whenever possible. ▪ Educate visitors regarding the sensitivity of resources and the importance of staying on the trail. ▪ Improve trail identification and signage. ▪ Consider designating visitor-created trails in strategic locations, as appropriate. ▪ Survey visitor-created trails in proximity to roads, parking areas, and turnouts annually. All other areas would be surveyed every three years.
Monitoring Strategies
Conduct periodic assessments along major trail networks to identify and record visitor-created trails. Assessments should include trail length, width, and associated vegetation or soil degradation.

TABLE 2. INDICATORS AND THRESHOLDS

Percent Time Nonnatural Sounds Are Audible
Measuring this indicator protects natural resources and visitor experience by monitoring nonnatural sounds.
Rationale for Indicator and Threshold
This indicator informs management of changing levels and types of use and is related to the quality of the visitor experience. It indicates the degree to which wildlife may be impacted by noise from vehicles in the Moose-Wilson corridor. It also measures the ability of the corridor to provide natural quiet and the wilderness character opportunity for solitude. Noise refers to any sound that is extraneous or unwanted and that often masks or degrades the natural soundscape. Tracking this measure informs park managers of the opportunities available for visitors to experience solitude and to experience the natural soundscape without interfering noises. Monitoring the Moose-Wilson corridor soundscapes would estimate nonnatural sounds produced by vehicles in the Moose-Wilson corridor, in addition to aircraft and other motorized transportation-related noises. The same monitoring data can also be used to assess noise from visitors along trails and in the backcountry and wilderness. The range of thresholds is based on greater or lesser tolerance for noise related to Moose-Wilson corridor traffic, considering the alternative concept descriptions. The thresholds acknowledge that road traffic noise would be expected and appropriate adjacent to the roads, but would still allow natural sounds to be heard and enjoyed. The threshold in the backcountry and areas distant from Moose-Wilson Road and access roads sets a much lower limit to the traffic noise

TABLE 2. INDICATORS AND THRESHOLDS

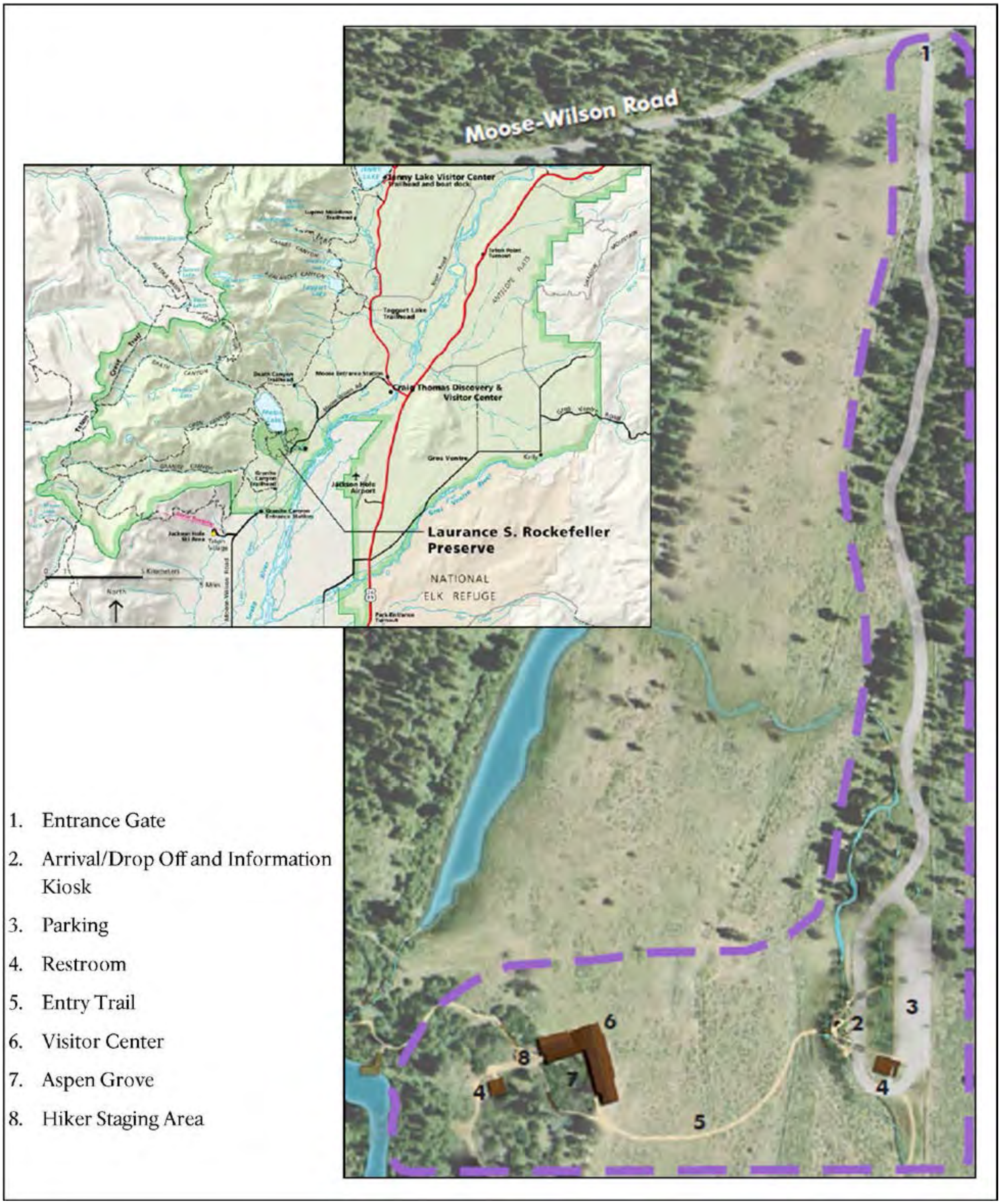
Percent Time Nonnatural Sounds Are Audible
allowable as would be appropriate for those areas. Calculations of average percent time audible of road traffic along Moose-Wilson Road from recent long-term acoustic monitoring is about 73% from 7:00 a.m. to 7:00 p.m. during the summer season, and 8% at White Grass Ranch. This compares to average percent time audible of 85% and higher for the main roads in Grand Teton and Yellowstone National Parks.
Threshold(s)
In Summer Months, 7:00 a.m.–7:00 p.m. *Action Alternatives B, C, and D:* Percent time audible of noise related to Moose-Wilson corridor at Phelps Lake Overlook locations does not exceed the maximum desired condition of 5%. *Alternative B:* Percent time audible of noise related to Moose-Wilson corridor traffic at specific sites along the road does not exceed the maximum desired condition of 70% along travel corridor. *Alternative C:* Percent time audible of noise related to Moose-Wilson corridor traffic at specific sites along the road does not exceed the maximum desired condition of 75% along travel corridor. *Alternative D:* Percent time audible of noise related to Moose-Wilson corridor traffic at specific sites along the road does not exceed the maximum desired condition of 80% along the travel corridor.
Potential Management Actions
▪ Adjust traffic volumes accordingly. ▪ Reduce speed limits near visitor destinations. ▪ Seek to regulate higher decibel vehicles. ▪ Through education efforts, encourage use of quieter vehicles by tour operators, concessioners, contractors, and park fleet. ▪ Discourage the use of loud vehicles and behaviors that create unnecessarily loud noises (i.e., revving engines, rapid acceleration, and use of horns, radios, and cell phones).
Monitoring Strategies
Sound monitoring protocols and equipment would be used at key locations along Moose-Wilson Road and at the Phelps Lake Overlook in to identify nonnatural audible sounds.

TABLE 2. INDICATORS AND THRESHOLDS

Number and Types of Undesirable Human-Wildlife Encounters
This indicator addresses human-caused impacts on wildlife and safety of humans by measuring undesirable human-wildlife encounters.
Rationale for Indicator and Threshold
The Moose-Wilson corridor lies in an area where high-quality habitats associated with the Snake River riparian corridor and high, productive habitats at the base of the Teton Range converge. As a result, wildlife is abundant, and human use in the corridor impacts distribution and behavior of many species. Visitor interactions with moose and black and grizzly bears occur most often. These interactions can result in disturbances to wildlife, especially sensitive species, disrupting activities such as foraging and breeding. In addition, animals may learn to ignore people (become habituated) or seek food from them (food conditioned), increasing the potential for physical interactions that cause injury to people and wildlife. This indicator addresses general levels of safety for both visitors and wildlife and informs management decisions needed to remedy issues associated with visitor and wildlife behavior.

TABLE 2. INDICATORS AND THRESHOLDS

Number and Types of Undesirable Human-Wildlife Encounters
The overarching purpose of this plan is to establish a long-term vision and comprehensive management strategies within the Moose-Wilson corridor of Grand Teton National Park to ensure protection of significant national park resources and values. This comprehensive plan presents several management options in the corridor that provide appropriate opportunities for visitors to use, experience, and enjoy the area while protecting park resources, which include wildlife and ecological communities. Therefore, desirable human-wildlife encounters as defined in this plan would be safe and appropriate for visitors and wildlife, minimizing human impacts on wildlife, mitigating safety concerns, while providing increased interpretation and education about the resources, values, and wilderness character along the Moose-Wilson corridor. Undesirable human-wildlife encounters are those that result in harm or the potential for harm to the human or the wildlife (e.g., wildlife consuming human food due to improper storage, wildlife being scared away from natural food sources due to the proximity of humans, or physical harm caused to a human by wildlife, or wildlife-vehicle collisions). During public comment periods, visitors supported these definitions of desirable and undesirable human-wildlife encounters. Many commenters believed efforts should be made to further protect wildlife in the corridor and minimize impacts from human-wildlife interactions. Continual monitoring of species involved, severity of interactions, and patterns of interactions in time and space would be required. This threshold is set at a low level due to the importance of safety for both visitors and wildlife.
Threshold
Every observation of an undesirable human-wildlife encounter would trigger an appropriate level of management response. Depending on the type and severity of the encounter, management actions may focus more on managing the people or the wildlife.
Potential Management Actions
Actions Directed Toward Humans: ▪ Increased education – Safe and appropriate wildlife viewing practices. – Understanding how human behavior can impact wildlife. – Wildlife habituation and food conditioning. ▪ Increased enforcement – Increase patrols when patterns of interaction suggest a significant increase in violation of regulations relating to wildlife. – Enforce fines for improper food storage/garbage disposal. ▪ Temporary signage and or barriers – Use as necessary to modify visitor use patterns in ways that mitigate human-wildlife interaction potential. Actions Directed Toward Wildlife: ▪ Temporary closures – Close segments of Moose-Wilson Road when grizzly bears forage along roadsides. – Close segments of Moose-Wilson Road when inadequate staff exists to manage black bear jams safely. – Close sensitive wildlife areas when necessary, such as nest sites, den sites, or feeding concentration areas. ▪ Wildlife hazing, relocations, or removals – Considered as a last resort and usually only when overly aggressive or food conditioned wildlife are present and represent a human safety concern.



6. LAURANCE S. ROCKEFELLER PRESERVE MAP

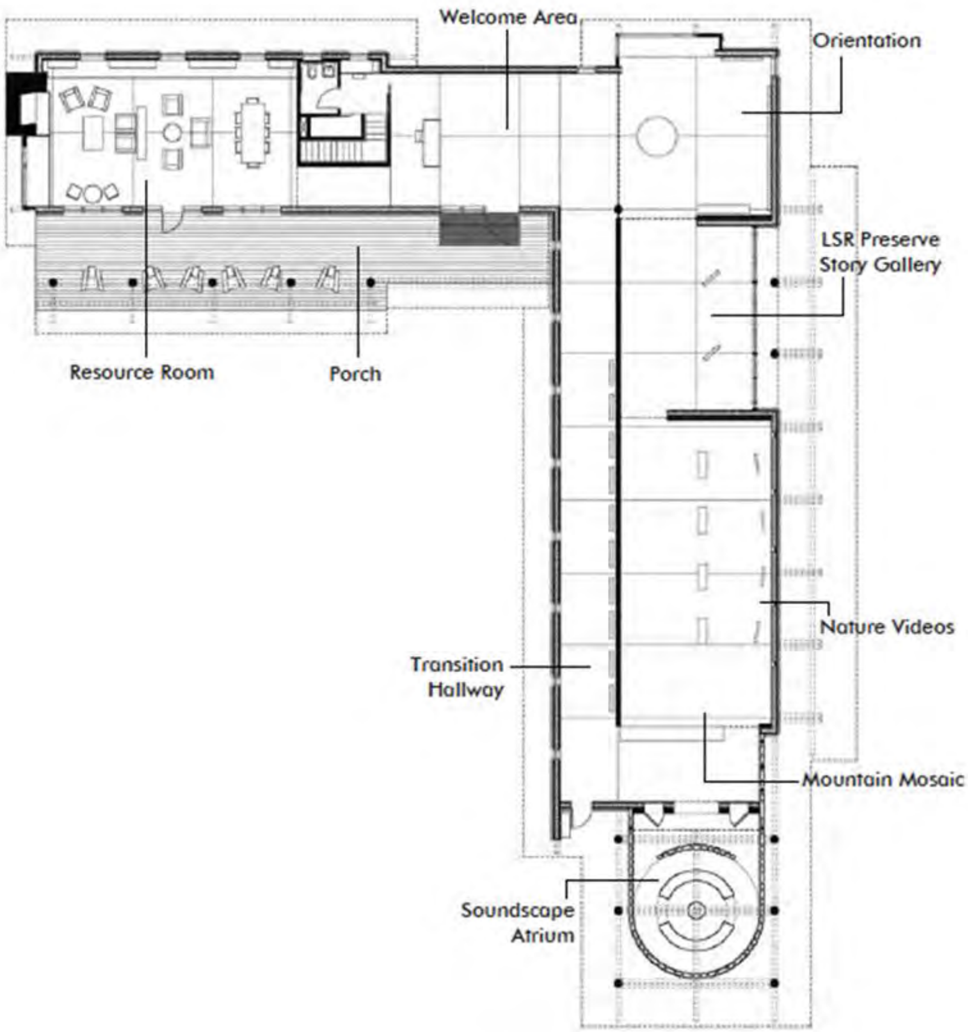


FIGURE 15. DESIGN DRAWING OF THE LSR PRESERVE CENTER

Visitor Capacity

Moose-Wilson Corridor Context. The amount, timing, distribution, and types of visitor use in the Moose-Wilson corridor influence both resource conditions and visitor experiences. Currently, there is high demand for and high levels of use in the corridor during peak summer months. The levels and patterns of visitation are causing some impacts and influencing the ability of the National Park Service to achieve desired conditions. A visitor capacity that defines the maximum amounts and types of use an area can accommodate is one tool to help the National Park Service to effectively implement some of the adaptive management strategies outlined in the plan that are bound to when and how visitors access the corridor. These strategies (seasonal gate at the Laurance S. Rockefeller Preserve, timed sequencing, and a reservation system) would allow an equitable distribution of opportunities while supporting desired conditions.

The corridor is primarily reached via personal vehicles. The experience of driving in the corridor is a sought after visitor experience and consistent with desired conditions of the corridor. For destinations within the corridor, desired resource and social conditions associated with each area determine the number of visitors that can be accommodated. The linear nature and patterns of use in the corridor make managing use levels at the entrances to the corridor most efficient. The visitor capacities for the corridor's primary destinations and Moose-Wilson Road have all been assessed based on best available information and consideration of the desired conditions and management strategies identified in this plan. The relationship of the destinations and road capacities has been assessed to develop an overall corridor capacity that can be used to manage visitation levels in the corridor whether visitors are reaching the corridor by personal vehicle or any other mode of transportation.

Process for Determining Visitor Capacity. Four key locations within the Moose-Wilson corridor that are integral to considering a corridorwide capacity were identified and discussed during the planning workshops: Death Canyon Trailhead, the Laurance S. Rockefeller Preserve, Granite Canyon Trailhead, and Moose-Wilson Road (see figure 16). For each of these locations, major contributing factors of how the sites are used by visitors were analyzed. Key datasets analyzed include vehicular traffic levels, vehicle stopping and parking behavior, parking accumulation, and pedestrian use levels. It is important that visitor capacity be focused on visitation levels (number of people), which relate more directly to desired conditions than number of parking spaces or vehicles. Vehicular-related datasets have, as mentioned, been used below to inform a visitor capacity due to their relevancy to current use levels as visitors most often access the corridor via personal vehicle. In the future, alternative transportation could be adopted in the corridor. To protect resources and meet desired conditions, the number of people using these sites would need to remain the same, regardless of how visitors reach those destinations (i.e., vehicle, bicycle, shuttle). If a shuttle or other system were implemented, increased numbers of visitors could be brought into this area, therefore causing unintentional consequences to resources and visitor experiences.

Rationale for Data Analysis. Data from the Utah State University is reported in both average and peak levels. For the purpose of visitor capacity, the highest reported average figures will be used. Maximum use levels observed are not being used as the highest use days or instances since these are not representative of typical use patterns within the corridor; they instead represent extreme conditions that occur occasionally. By using datasets reporting the average levels of use, and focusing on the highest of those averages, visitor capacity and therefore management strategies will be designed to address conditions in the corridor found most often. Numbers below have been approximated.

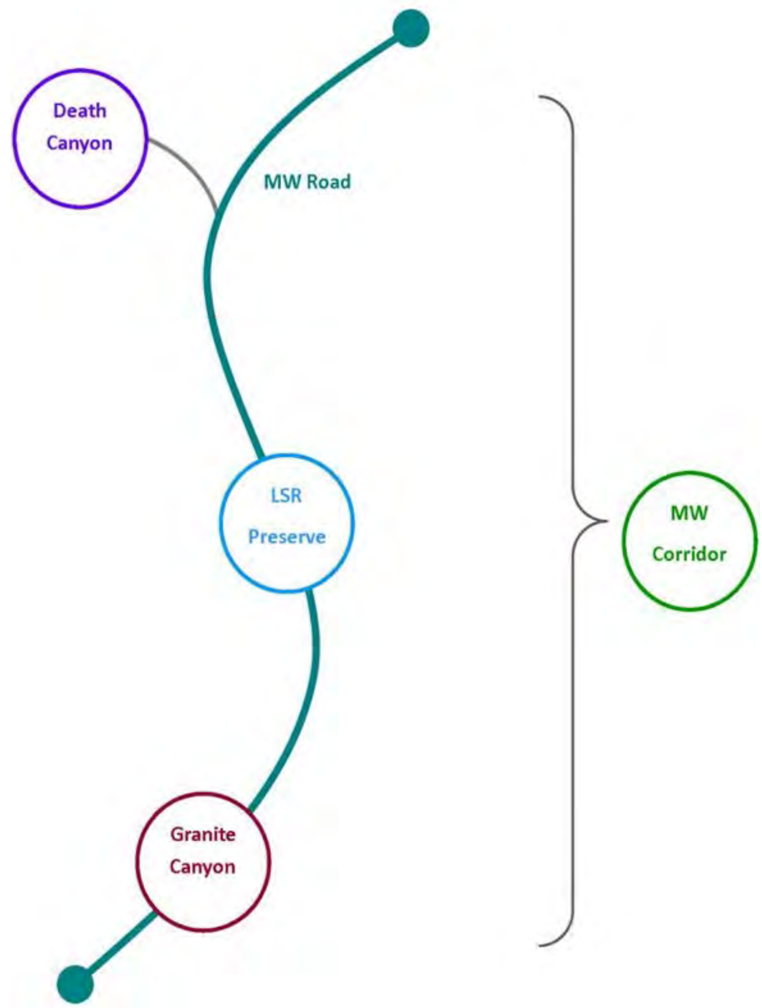


FIGURE 16. OVERVIEW OF KEY LOCATIONS ANALYZED

Visitor Capacity Determination. Summaries of the visitor capacity determined for the four key locations and the total corridor capacity are provided below. For a more detailed discussion on how these determinations were made, including desired conditions, overviews of visitor use issues, and descriptions of current use levels, please refer to appendix A. Figure 17 depicts an overview of the determined visitor capacity

Moose-Wilson Corridor Visitor Capacity— When all of the individual capacities below are combined, a final capacity of 550 people at one time (PAOT) is determined. This capacity supports current use levels within the corridor while also protecting the visitor experiences and resources with it.

Death Canyon— At this trailhead, 220 people can be accommodated at one time. Access to this trailhead is highly sought after. Large amounts of overflow parking occur during the summer. The capacity determination supports current use levels at Death Canyon Trailhead while also ensuring a high likelihood of access to the area and experiences of solitude while visitors hike on the associated trails

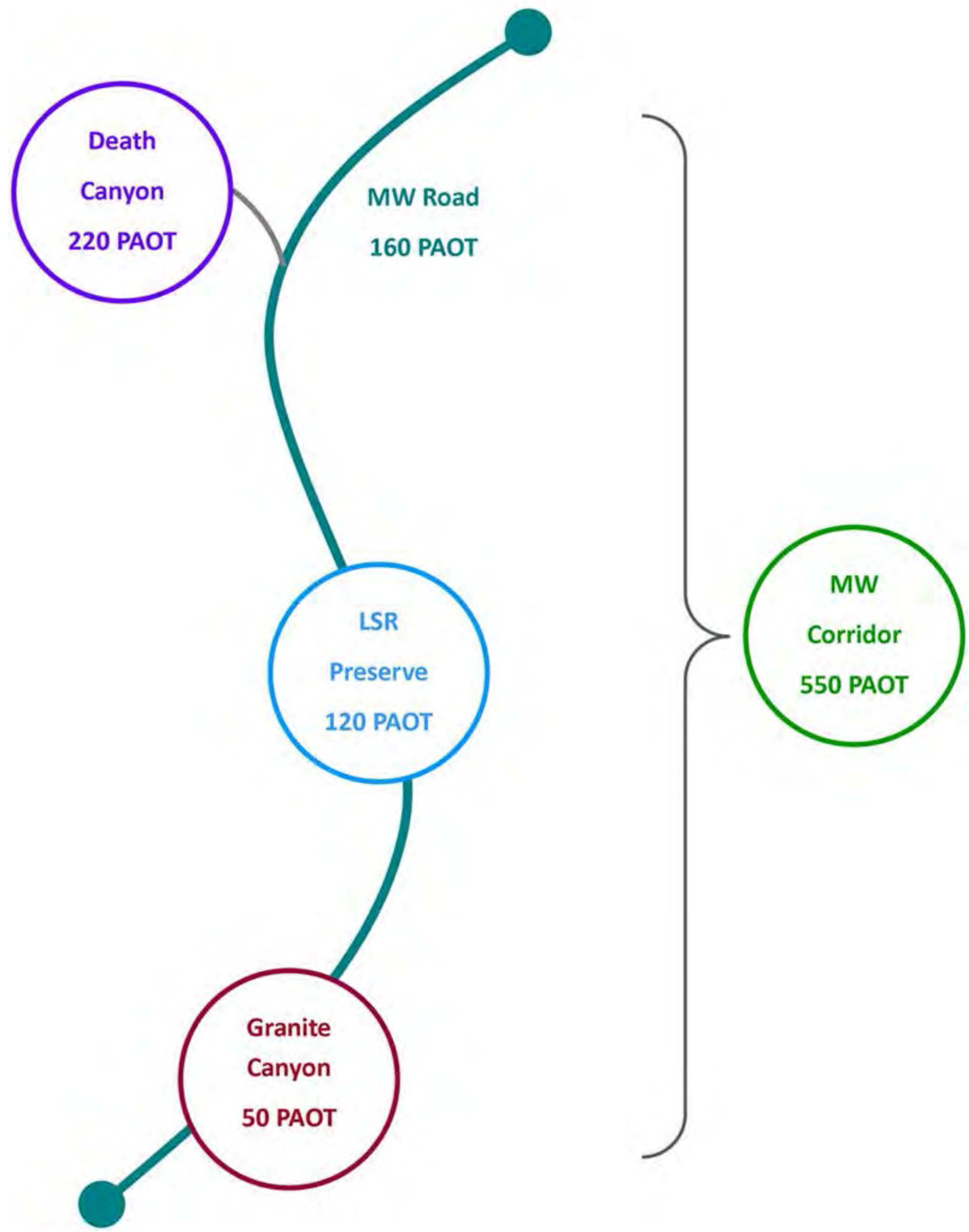


FIGURE 17. PEOPLE AT ONE TIME VISITOR CAPACITY OF THE MOOSE-WILSON CORRIDOR

Laurance S. Rockefeller Preserve— At this location, 120 people can be accommodated at one time. The LSR Preserve is one of the most popular destinations in the corridor. Current use levels support specific visitor capacities established during the creation of the Preserve. The capacity determination continues the current use levels at the LSR Preserve and on the trails associated with it while also ensuring that opportunities for contemplation and solitude remain.

Granite Canyon— At this location, 50 people can be accommodated at one time. Granite Canyon is a relatively lower use area in the corridor; however, winter recreation is popular at this trailhead. Current use levels support visitor opportunities to view scenic vistas and begin a variety of hikes from this location. The capacity determination continues the current use levels at Granite Canyon and on the trails associated with it.

Moose-Wilson Road— Along the roadway, 160 people can be accommodated at one time. Moose-Wilson Road itself is a destination for scenic driving as well as a way to access other destinations. The turnouts and viewing areas, such as Sawmill Ponds Overlook, associated with the road are temporary stopping areas where visitors can enjoy scenery and wildlife viewing. Current use levels support these opportunities. The capacity determination continues the current use levels along Moose-Wilson Road and at turnouts and viewing areas.

Long-Term Monitoring

Grand Teton National Park staff have been and would continue to monitor many different variables related to resources and visitors in the Moose-Wilson corridor. Items most commonly associated with visitors typically monitored by park staff include visitor use levels and patterns. In addition to current monitoring efforts, the park staff would monitor the indicators associated with visitor use discussed earlier in this section.

The intensity of monitoring indicators related to visitor use (e.g., frequency of monitoring cycles, amount of geographic area monitored) might vary considerably, depending on how close existing conditions are to the thresholds. The intensity of monitoring might be less if existing conditions are far from exceeding the thresholds, than if the existing conditions are close to or trending toward the thresholds.

Initial monitoring of indicators would determine if the indicators are accurately measuring the conditions of concern and if the thresholds truly represent the minimally acceptable condition of the indicator. Park staff might decide to modify the indicators or thresholds and revise the monitoring program if better ways are found to measure changes caused by visitor use. Most of these types of changes should be made within the first several years of monitoring. Some of these changes may require a plan amendment with appropriate level of environmental compliance.

After this testing period, adjustments should be needed less often. Frequent adjustments may lead to situations in which the indicators are no longer consistent with the desired conditions. In no case should an indicator or threshold be changed simply because a threshold has been exceeded or because the staff wants to postpone difficult decisions. If visitor use levels and patterns change appreciably, the park staff might need to identify new indicators to ensure that desired conditions are achieved and maintained. This iterative learning and refining process is a strength of the NPS visitor use management framework.

BEST MANAGEMENT PRACTICES

To ensure the protection of the park's fundamental resources and values within the corridor, the following set of best management practices would be implemented under all action alternatives. These best management practices are grounded in NPS *Management Policies 2006*, and they are intended to provide a practical approach to everyday management of the corridor. These best practices are different than mitigation measures described in the next section of this chapter, which are intended to avoid or minimize potential adverse impacts from implementing the management actions proposed in this plan.

Scenery

- Design, site, and construct developments to avoid or minimize visual intrusion.
- Strategically place signs within the corridor based on established design guidelines (i.e., rustic sign plan). When signs are necessary, position them in areas that minimize visual impacts.
- Use native vegetation treatments to screen and blend new structures with the natural and cultural landscapes, as appropriate.
- Emphasize the use of natural materials (e.g., vegetation, rocks, and wood) to maintain the natural appearance of the Moose-Wilson corridor. Design structures to minimize visual intrusions to the maximum extent possible.
- Remove or relocate unnecessary facilities to restore natural conditions and to enhance scenic quality.
- Maintain select vistas and other remarkable views (i.e., vegetation pruning) to allow visitors to experience a variety of scenic settings without disrupting the integrity of the natural ecosystem. Where possible, allow these viewpoints to be dynamic and subject to change due to natural processes (i.e., geologic, hydrologic, and vegetation changes).
- Maintain the natural canopy within the forested portions of the road corridor to preserve the intimate views unless impacted by natural processes such as fire.
- Manage appropriate visitor and administrative uses to minimize impacts on scenic qualities.
- Place future proposed utility lines underground within existing and/or new transportation corridors to minimize visual intrusions, except where such placement would cause significant damage to natural or cultural resources. Existing overhead utility lines would be placed underground to the extent possible to enhance scenic views.

Geologic Processes

- Design, site, and construct any new developments in compliance with building requirements for geologically active zones.
- Avoid placing structures in areas that obscure important geologic features.
- Implement best practices to prevent soil erosion. Mitigate potential impacts on adjacent water resources by implementing these techniques.
- Salvage topsoil whenever possible.
- Allow the natural geomorphic processes of the Snake River to continue to the greatest extent possible.
- Implement best practices related to native fill materials.
- Provide opportunities for visitors to understand and appreciate the significant geologic forces that continue to shape the landscape.

Ecological Communities and Wildlife

- Monitor human use areas (e.g., road corridor, trails, turnouts) for signs of native vegetation disturbance and manage visitor use to minimize or avoid vegetation disturbance and the spread of nonnative species (e.g., public education, erosion control, and barriers to control potential impacts on plants).
- Monitor populations and extent of various wildlife “indicator” species to assess for possible effects from visitor use.

- Conduct bird surveys to ensure compliance with the Migratory Bird Treaty Act.
- Identify species of concern and coordinate monitoring and protection activities among park units and other federal and state agencies.
- Implement temporary visitor use closures for areas with sensitive ecological values and/or areas in need of restoration, when appropriate (e.g., migration routes, breeding/nesting areas, important foraging areas, etc.).
- Minimize habitat fragmentation by concentrating areas of high visitor use and development while continuing to provide a range of visitor experiences within the Moose-Wilson corridor.
- Restore native species, ecological function, and habitat values to disturbed areas when possible.
- Accommodate fish passage with culverts and other similar techniques where possible. Implement these strategies when development or construction on the roadway occurs.
- Monitor and remove nonnative invasive plant species to the greatest extent possible. Where possible, use an early detection and rapid response strategy to remove invasive species before populations establish themselves and impact native species.
- Provide wildlife-resistant dumpsters and trash cans for garbage and other wildlife attractants where appropriate.
- Encourage and enforce, when possible, appropriate visitor behaviors toward wildlife in the Moose-Wilson corridor (e.g., separation distances and food storage requirements). Educate visitors on wildlife and how they can minimize negative encounters with and impacts on wildlife.
- Employ various techniques to reduce impacts on wildlife, including visitor education programs, temporary restrictions on visitor activities, and park ranger patrols to deter inappropriate visitor behaviors.
- Where appropriate, use facilities such as designated trails, boardwalks, and directional fencing to route visitors away from sensitive natural resources, while permitting access to important viewpoints or destinations.
- Promote “Leave No Trace” principles and other similar ideals by educating visitors about how to enjoy the corridor’s resources without negatively affecting these resources.
- Manage trail densities and campsites to minimize habitat loss and fragmentation by preventing development of new visitor-created social trails and restoring unnecessary visitor-created social trails.
- Develop and implement revegetation plans for disturbed areas. Revegetation plans would specify native seed/plant source and mixes, soil preparation, etc.
- Develop a fire management plan strategy to promote healthy ecosystems and to avoid damage to infrastructure when possible and appropriate.
- Implement best practices to ensure construction equipment and machinery entering the corridor are free of nonnative plant and aquatic invasive species.
- Employ various visitor education techniques and media to reduce visitor use impacts on general wildlife habitat, including
  - providing visitor education programs about appropriate behavior around wildlife in the Moose-Wilson corridor
  - installing temporary signs alerting motorists to the presence of migrating wildlife in important crossing areas

  - installing additional digital speed signs
  - posting notices at visitor centers, entry points, and in local newspapers during the spring/fall migrations, alerting the public to drive safely due to higher levels of wildlife movement
  - placing public service announcements on local radio regarding wildlife activity, particularly during spring/fall migrations
- Take measures to reduce the potential for undesirable human-bear encounters (e.g., property damage, food rewards, human injury/fatality, bear mortality) by
  - educating visitors on appropriate behavior when recreating in bear habitat
  - providing bear-resistant garbage containers in all developed areas
  - providing "bear aware" education to all personnel involved in development and maintenance projects
  - alerting visitors to properly store food and other attractants (e.g., food, drinks, garbage, cooking utensils, other odorous items) at all times and pack out all food materials, garbage, and other attractants on a daily basis if they cannot be stored in bear-resistant containers (for more details on proper food storage practices, see section 2.10(d) of the 2014 Superintendent's Compendium)
- Avoid overlapping areas where bears will be foraging for food and areas where human use is directed by design.

Aquatic Resources

- Conduct periodic monitoring of the chemical, physical, and biological properties of the water bodies and waterways in the Moose-Wilson corridor (including Phelps Lake, beaver ponds, the Snake River, and its various tributaries) to ensure water quality remains in good condition.
- Mitigate the effects of snow storage and stormwater runoff along park roads and at developed areas to avoid impacts on water quality of downstream water bodies.
- When possible, minimize snow plowing along corridor roads to reduce effects on riparian vegetation and adjacent water bodies, particularly in areas of the corridor where the road is adjacent to wetlands and streams.
- Where stream and river channels cross or flow along roads, trails, or other human-created features, seek solutions that allow the continuation of natural river processes while minimizing bank erosion.
- Implement best practices to reduce erosion, sedimentation, compaction, and to control surface runoff from parking areas, roads, stormwater sewer outfalls, and other ground-disturbing activities.
- Develop and implement revegetation plans and specifications for disturbed areas along and around water features. Revegetation plans would specify native seed/plant sources and mixes, soil preparation, erosion control, etc. Salvaged vegetation would be used to the extent possible.
- Monitor human use areas for signs of disturbance to water features and associated native vegetation and manage use to minimize or avoid vegetation disturbance and spread of nonnative species (e.g., public education, erosion control, and barriers to control potential impacts on plants from trail erosion or social trailing).

- Collaborate with the Wyoming Game and Fish Department to implement seasonal fishing and area closures to protect spawning fish, particularly sensitive or rare spawning fish species in the Moose-Wilson corridor.
- Avoid development of new visitor or administrative areas or trails adjacent to water features, and/or associated habitats.
- Accommodate wildlife and fish passage with road crossings, culverts, and other similar techniques.
- Coordinate with the Wyoming Game and Fish Department, as appropriate, to conduct periodic fisheries monitoring and creel surveys.
- Coordinate with the Wyoming Game and Fish Department and other agencies to remove and/or minimize the spread of invasive, nonnative aquatic plant and wildlife species; and restore native species populations.
- Identify aquatic species of concern and coordinate monitoring and protection activities among other federal and state agencies.
- Monitor populations and extent of aquatic species “indicator” species to assess for possible effects from visitor use.
- Work with water rights holders to maximize instream flows in the Snake River and all applicable tributaries. Promote and retain natural processes where possible, recognizing the human alterations that currently exist.
- Work with water rights holders to minimize adverse effects of water diversion structures and associated maintenance activities. Collaboration with water rights holders may become more vital as effects of climate change are identified.
- Delineate wetlands and apply protection measures before any ground disturbance (e.g., construction). Wetlands would be delineated by qualified NPS staff or certified wetland specialists and clearly marked before construction work. Perform construction activities in a careful manner to prevent damage caused by equipment, erosion, siltation, etc.

Cultural History and Resources

- As needed, park staff would continue to conduct cultural resource surveys/inventories and research regarding historic properties (i.e., archeological, historic, ethnographic resources, and cultural landscapes) to further document resources in the Moose-Wilson corridor and assist management. Identified sites would be evaluated for their eligibility for listing in the National Register of Historic Places, and preservation treatments would be recommended and implemented as appropriate. The results of these efforts would be incorporated into comprehensive planning and resource assessments, as well as site-specific planning, mitigation, and environmental analysis. Collected site information would be entered in appropriate cultural resource data bases (e.g., ASMIS, List of Classified Structures, Cultural Landscape Inventory).
- In accordance with section 106 of the National Historic Preservation Act, the National Park Service would consult with the Wyoming State Historic Preservation Office, American Indian tribes traditionally associated with park lands, and other concerned parties regarding proposed actions resulting from this plan. If adverse impacts on historic properties were unavoidable, strategies to mitigate such impacts would be developed through consultation with all interested parties.

- Where appropriate, the use of facilities such as designated trails, boardwalks, and directional fencing would route visitors away from sensitive cultural resources, while permitting access to important viewpoints or destinations.
- Continue to periodically monitor and record the condition of cultural resources within the Moose-Wilson corridor. Proposed actions to manage and protect cultural resources would require separate analyses and compliance requirements on a case-by-case basis.
- Continue to maintain and retain current levels of integrity of cultural resources to the maximum extent possible. Ongoing preservation and maintenance activities would employ techniques that are sensitive to the Moose-Wilson corridor to protect its character-defining qualities. All treatments of archeological resources, historic structures, cultural landscapes, or ethnographic resources shall be planned in consultation with the Wyoming SHPO, associated tribes, and other consulting groups. All restoration or rehabilitation activities on historic structures or cultural landscapes would be planned and conducted in accordance with NPS *Management Policies 2006*, "Chapter 5: Cultural Resources," Director's Order 28: *Cultural Resource Management*, "NPS 28: *Cultural Resource Management Guideline*," and following *The Secretary of the Interior's Standards and Guidelines for the Treatment of Historic Properties* (NPS 1995).
- Continue to manage ethnographic resources, including those involving American Indian traditional cultural uses, in consultation with traditionally associated tribes.
- Continue or expand visitor opportunities and education within historic and culturally related destinations in the corridor including the Laurance S. Rockefeller Preserve, Murie Ranch, and White Grass Ranch. Ensure that visitor uses remain appropriate to the conservation and historic aspects for which these areas were protected or established.
- NPS staff would continue to inform visitors and others of the importance of protecting and not disturbing archeological resources and other historic properties. Visitors would be informed (through NPS educational and interpretive programs and/or interpretive media products and ranger contacts) of the penalties for illegally collecting artifacts or otherwise causing resource damage.
- NPS staff would cooperate with partners, park neighbors, and other stakeholders to establish and enforce measures to prevent and reduce human impacts (such as vandalism and looting) on cultural resources.

Natural Soundscapes and Acoustic Resources

- Follow all applicable guidance and policy regarding natural soundscapes and acoustic resources, including Director's Order 47: *Soundscape Preservation and Noise Management* and NPS *Management Policies 2006*.
- Maximize noise-free intervals and limit the intensity and duration of noise intrusions.
- Collaborate with adjacent property owners; appropriate federal, state, and local agencies; and organizations to reduce noise. Continue working with the airport to reduce aircraft and related noise.
- Consider identifying and designating "quiet zone areas." These areas would be identified on maps, signs, and through interpretation.

- Consider a "Ride Respectfully" outreach campaign for motorcycles.
- Consider "no idling" signage or messaging.
- Apply quiet pavement to road surfaces.
- Lower speed limits.

*Note: Park hiking recommendations suggest that solo hikers should make bears aware of their presence and avoid surprising them by making loud noises. Management options that seek to reduce noise should align with these recommendations when bears have left their dens.

Visitor Experience in an Outstanding Natural Environment

- In general, provide a range of visitor experience opportunities.
- Periodically conduct visitor surveys and data collection to determine visitor satisfaction with park programs, services, and facilities.
- Use temporary area closures to prevent unacceptable visitor use impacts on resources and wildlife within the Moose-Wilson corridor.
- Further develop and provide educational and interpretive products, programs, and services for the Moose-Wilson corridor.
- Conduct community outreach and education about the Moose-Wilson corridor, providing collaborative and consistent messaging regarding appropriate visitor uses.
- Continue to support a visitor education program on wildlife safety (e.g., not feeding animals, trash disposal, bear-resistant containers) and appropriate behaviors toward wildlife (e.g., regulations on distance from wildlife and interactions).
- Continue to have NPS staff manage wildlife jams when possible to facilitate safe wildlife viewings and to maintain vehicle flow.
- Continue appropriate and strategic signage and wayfinding where needed.
- Educate visitors on Leave No Trace ethics to minimize resource impacts, as well as the wilderness character of backcountry areas of the corridor.
- Implement a visitor use management and monitoring program using indicators and thresholds to effectively manage visitor use and related impacts.

MITIGATION MEASURES

Congress has charged the National Park Service with managing the lands under its stewardship "in such manner and by such means as will leave them unimpaired for the enjoyment of future generations" (NPS Organic Act, USC 100101(b) et seq.). As a result, the National Park Service routinely evaluates and implements mitigation measures whenever conditions occur that could adversely affect the sustainability of national park system resources.

To ensure that implementation of the Draft CMP/EIS protects natural and cultural resources unimpaired for future generations and provides for a high quality visitor experience, a consistent set of mitigation measures would be applied to all management actions. The National Park Service would prepare appropriate environmental compliance reviews (i.e., those required by the National Environmental Policy Act, National Historic Preservation Act, Archaeological Resources Protection Act, Endangered Species Act, and other relevant legislation) for future proposed actions as needed. As part of the environmental review, the National Park Service would avoid, minimize, and mitigate adverse impacts. The National Park Service could consider implementing a compliance monitoring program that would apply these mitigation measures and also include reporting protocols.

The following mitigation measures would be applied to avoid or minimize potential adverse impacts from implementation of the comprehensive management plan.

General Construction Measures

- Locate staging and stockpiling areas in previously disturbed sites, away from visitor use areas to the extent possible, to minimize the amount of ground disturbance. All staging and stockpiling areas would be returned to pre-construction conditions and/or revegetated following construction. Parking areas for construction vehicles would be limited to these staging areas, existing roads, and identified previously disturbed areas.

- Identify and fence construction zones with construction fencing, silt fencing, or some similar material prior to any construction activity. The fencing would define the construction zone and confine activity to the minimum area required for construction. All protection measures would be clearly stated in the construction specifications and workers would be instructed to avoid conducting activities, including materials staging and storage, beyond the construction zone as defined by construction zone fencing.

- Place nonvegetation construction debris in refuse containers at least daily, and dispose of refuse at least weekly. No refuse burying or burning would be allowed inside the park.

- Comply with applicable federal and state regulations on the storage, handling, and disposal of all hazardous materials and waste. Provisions would be made for storage, containment, and disposal of hazardous materials used on-site. To minimize possible petrochemical leaks from construction equipment, all equipment would be monitored frequently to identify and repair any leaks and would be staged in designated areas suitable to contain leaking materials. Trained personnel would clean up and dispose of any leakage or spill from construction equipment such as hydraulic fluid, oil, or fuel. Fueling and fuel storage areas would be permitted only at approved locations and comply with park refueling guidelines.

Sustainable Development

- Design development projects (e.g., buildings, facilities, utilities, roads, bridges, trails, etc.) or reconstruction projects (e.g., road reconstruction, building rehabilitation, utility upgrade, etc.) to blend with the surroundings, including in areas prone to erosion. Projects would reduce, minimize, or eliminate air and water point and nonpoint source pollution. Projects would be sustainable whenever practicable by recycling and reusing materials, minimizing materials, minimizing energy consumption during the project, and minimizing energy consumption throughout the life span of the project.

- Implement compliance monitoring to ensure that the project remains within the parameters of NEPA and NHPA compliance documents. The National Park Service would apply for and comply with all federal and state permits required for construction-related activities, including, but not limited to, permits from the US Army Corps of Engineers (USACE).

- Develop and implement a comprehensive spill prevention and pollution control program that complies with federal and state regulations and addresses all aspects of spill prevention, notification, emergency spill response strategies for spills occurring on land and water, reporting requirements, monitoring requirements, personnel responsibilities, response equipment type and location, and drills and training requirements.

- Comply with all applicable regulations and policies during the removal and remediation of asbestos, lead paint, and polychlorinated biphenyls (PCBs), as applicable.

Wildlife and Wildlife Habitat

- Employ temporary or seasonal use restrictions or area closures to protect sensitive wildlife habitat and sensitive wildlife behavior or life stages.

- Implement standard construction measures to avoid or minimize wildlife impacts including
  - scheduling construction during seasons that are least disruptive to wildlife behavior
  - evaluating habitat for species likely to occur prior to construction activities, and take steps to minimize impacts on those species determined to be especially vulnerable
  - monitoring for adverse impacts on wildlife or wildlife habitat
  - installing and maintaining temporary fences or other barriers to protect sensitive resources adjacent to construction sites (as defined by wildlife-friendly fence specifications)
  - removing all food-related items to reduce or prevent bears from becoming food conditioned
  - alerting construction crews to follow contract stipulations related to food storage and bear aware policies
  - maintaining routes of escape for animals that might fall into excavated pits and trenches and covering post holes and other narrow cavities or crevices
  - ensuring construction crews working in grizzly bear habitat meet standards for personal safety, sanitation, attractant storage, and access to and from the construction site(s)
  - minimizing the potential for "taking" a nest or egg of a migratory bird species by (1) avoiding any activity that would destroy a nest or egg until after August 1 (a time frame outside the primary nesting season), or (2) conducting a survey for any nests in the project area prior to construction activities

- Take appropriate measures to reduce the potential for undesirable encounters between people and black bears. All contractors and employees would be trained and required to comply with the park's bear management plan and food storage regulations during construction and rehabilitation activities. All project staff, trainees, and other personnel would be briefed about food storage needs and bear safety protocols. Bear-resistant garbage containers would be required. Food, fuel, and other attractants would be stored and handled to minimize negative encounters (i.e., no food, garbage, drink, trash, or food and drink containers would be placed outside vehicles, trailers, or bear-resistant containers except during times when they are being attended; see section 2.10(d) of the 2014 Superintendent's Compendium for more details on proper food storage). Equipment, materials, and supplies in the staging area(s) would be secured by hard-sided storage containers. Work would be temporarily halted if bears approach within 100 yards of an unfenced work area. Workers would allow the bear(s) to pass through the work area before starting or resuming mobilization, construction, or demobilization activities. All bear sightings would be reported to resource management staff. Any undesirable human-bear encounter would be reported to Teton Dispatch immediately.

- Where appropriate, periodically brush or thin adjacent roadside ground vegetation, especially fruit-bearing shrubs, to minimize human-bear interactions.

- Use park staff and volunteers to inform visitors about the possible presence of black bears and control visitors to keep them from feeding the bears or approaching too close.

- Perform mitigation actions during normal park operations as well as before, during, and after construction to minimize immediate and long-term impacts on wildlife and wildlife habitat. These actions would vary depending on the type of project and its location. Many of the measures listed for vegetation would also benefit wildlife by preserving habitat.

- Minimize distance between existing road corridor(s) and any newly constructed developments to reduce overall wildlife displacement and habitat fragmentation.

- Clearly define boundaries of developed areas to confine human use and limit radiating impacts.

- Avoid use of roadway development, and maintenance features that would present a barrier or hindrance to wildlife movement and migration.

- Limit the effects of light and noise on adjacent habitat through control of sources during construction activities.

- Where possible, preserve natural features that are considered high wildlife value (e.g., tree snags).

Federal Listed and Candidate Wildlife Species

- The US Fish and Wildlife Service would be consulted on the frequency required for surveys prior to commencement of construction activities. Site and design facilities/actions would be applied to avoid adverse effects on rare, threatened, and endangered species. If avoidance is infeasible, adverse effects on rare, threatened, and endangered species would be minimized and compensated, as appropriate, and in consultation with the appropriate resource agencies.

- Develop and implement restoration and/or monitoring plans, as warranted. Plans should include methods for implementation, performance standards, monitoring criteria, and adaptive management techniques.

- Inform construction workers and supervisors of the potential for special status species within the work vicinity. Contract provisions would require the cessation of construction activities if a special status species was discovered in the project area, until park staff re-evaluates the project. This would allow modification of the contract for any measures determined necessary to protect the discovery.

- Take appropriate measures to reduce the potential for undesirable encounters between people and grizzly bears. All contractors and employees would be trained and required to comply with the park's bear management plan and food storage regulations during construction and rehabilitation activities. All project staff, trainees, and other personnel would be briefed about food storage needs and bear safety protocols. Bear-resistant garbage containers would be required. Food, fuel, and other attractants would be stored and handled to minimize negative encounters (i.e., no food, garbage, drink, trash, or food and drink containers would be placed outside vehicles, trailers, or bear-resistant containers except during times when they are being attended; see section 2.10(d) of the 2014 Superintendent's Compendium for more details on proper food storage). Equipment, materials, and supplies in the staging area(s) would be secured by hard-sided storage containers. Work would be temporarily halted if grizzly bears approach within 100 yards of an unfenced work area. Workers would allow the bear(s) to pass through the work area before starting or resuming mobilization, construction, or demobilization activities. All grizzly bear sightings would be reported to resource management staff. Any undesirable human/bear encounter would be reported to Teton Dispatch immediately.

- Limit daily construction activities within the Moose-Wilson corridor to 30 minutes after sunrise to 30 minutes prior to sunset.

- To the degree possible, construction work would be scheduled during the summer months when grizzly bears are less likely to be present along Moose-Wilson Road.

- Where appropriate, periodically brush adjacent roadside and pathway ground vegetation, especially fruit-bearing shrubs, to minimize human-grizzly bear interactions.

- As necessary, institute temporary closures of Moose-Wilson Road to public access, including pedestrians, bicycles, and vehicles, when grizzly bears are foraging along the road.

- Inform visitors about the possible presence of bears and manage visitor actions to prevent them from feeding the bears or approaching too close.

- All project activities would comply with the Superintendent's Compendium for the park (2014 and as updated) regarding closures in the vicinity of wolf den and rendezvous sites. Should a den or rendezvous site be found within the project area that was previously unknown, a 1.0-mile area closure would be implemented between April 15 and August 15.

Fisheries

- Employ techniques to reduce impacts on fisheries, including visitor education programs, restrictions on visitor activities, and park ranger patrols.
- Implement a natural resource protection program. Standard

measures would include biological monitoring, erosion and sediment control, removal of monofilament and other aquatic debris, and revegetation. This could include specific construction monitoring by resource specialists as well as treatment and reporting procedures.

- Accommodate fish passage with road/trail crossings by using adequately sized culverts and other similar improvements.

- Reduce fish entrainment in irrigation infrastructures and systems.

Vegetation

- Fence or clearly mark and enforce disturbance zones and construction and staging areas to prevent impacts on vegetation outside the approved construction limits.

- No vegetation would be damaged or removed without prior approval via the project documents or by park vegetation management staff.

- Provide construction workers and supervisors with tree pruning guidelines to minimize damage to trees during project implementation.

- To the extent possible, salvage and preserve existing native vegetation would be salvaged and preserved to the extent possible for use in revegetating disturbed areas. Existing trees would be preserved to the extent possible.

- Implement measures to ensure construction equipment and machinery entering the park are free of nonnative plant and aquatic invasive species. All construction equipment that has the potential to leave the road would be pressure washed before entering the park.

- Implement invasive weed control measures prior to construction and develop a management plan to monitor and mitigate impacts within the first three years of construction. An early detection and rapid response strategy would be followed to remove invasive species before populations establish themselves and impact native species.

- Develop a project revegetation plan that would address, among other things, the use of native genetically appropriate species, plant salvage potential, and nonnative vegetation / noxious weed management. Disturbed areas would be replanted with native vegetation. Revegetation efforts would include imitating the natural spacing, abundance, and diversity of native plant species. Natural groupings of vegetation, rocks, or other natural features would be used for screening, as appropriate. Local native species would be used; no irrigation would be needed except during plant establishment.

- Conduct pre- and post-project nonnative plant monitoring in the project area to ensure successful revegetation, maintain plantings, and replace plants that do not survive.

Hydrology and Water Quality

- Take measures to reduce erosion, sedimentation and compaction, and to control surface runoff and wastewater from parking lots and from ground-disturbing activities.

- Implement measures to minimize disturbance areas at the banks of drainages. One example includes placing limits on ground-disturbing activities in the vicinity of wetlands and drainage banks and clearly delineating boundaries with temporary fencing (as defined by wildlife-friendly fence specifications).

- Take action to keep waters free of turbidity that cause a nuisance or adversely affect aquatic resources and beneficial uses.

- To the extent possible, limit construction activities to periods of low precipitation to reduce the risk of accidental hydrocarbon leaks or spills reaching surface and/or groundwater.

- Inspect construction equipment for fluid leaks, including hydraulic and oil leaks prior to use on construction sites, and implement inspection schedules to prevent contamination of soil and water.

- Use absorbent pads, booms, and other materials on construction sites that involve heavy equipment to contain oil, hydraulic fluid, solvents, and hazardous material spills.

- Incorporate stormwater management and treatment into construction designs and contracting requirements, which would minimize soil erosion and degradation in the project area during both construction and use of the area.

- Enclose fueling and fuel storage areas with berms and lining to contain spills. Provisions would be made for the containment and disposal of oil-soaked or contaminated soils (clay or plastic liners). Construction equipment would be regularly inspected and maintained to prevent any fluid leaks. Contractors would promptly clean up any leaks or accidental spills from construction equipment such as hydraulic fluid, oil, fuel, or antifreeze.

- When construction is ended prior to a winter season, protect all disturbed areas and soil stockpiles from snowmelt run-off impacts.

Wetlands

- Conduct a wetland survey by qualified NPS staff or certified wetland specialists to certify wetlands within the Moose-Wilson corridor and to accurately identify locations of wetlands and open water habitat. Clearly mark delineated wetlands before construction work begins and apply protection measures before any ground disturbance.

- Through consultation with the NPS regional wetland ecologist, determine if a wetlands statement of findings is needed for any future implementation project that could affect wetlands and produce wetlands statement of findings documents where necessary.

- Perform construction activities in a careful manner to prevent damage caused by equipment, erosion, siltation, etc.

- As appropriate, protect wetland resources by
  - avoiding wetlands during construction, using bridge crossings or retaining walls wherever possible
  - exercising increased caution to protect wetland resources from damage caused by construction

equipment, erosion, siltation, and other activities with the potential to affect wetlands

- taking measures to keep construction materials from escaping work areas, especially near streams or natural drainages
- using elevated pathways over wetland sections where it is not feasible to avoid the wetland from trail construction

Soils

- To the extent possible, locate staging and stockpiling in previously disturbed areas to minimize the amount of ground disturbance. All staging and stockpiling areas would be returned to pre-construction conditions and/or revegetated following construction. Parking areas for construction vehicles would be limited to these staging areas, existing roads, and previously disturbed areas.

- Minimize soil erosion by limiting the time soil is left exposed and by applying other erosion control measures such as erosion matting, silt fencing, and sedimentation basins in construction areas to reduce soil erosion, surface scouring, and discharge to water bodies. Once work is completed, disturbed areas would be revegetated with native plants in a timely manner.

- Separate all soil stockpiles based on soil type. Topsoil materials would be stockpiled in a predetermined designated area away from excavations and future work sites without intermixing with subsoils. Stockpiles would then be graded and shaped to allow unimpeded surface water drainage. Stockpiles would be temporarily seeded and periodically treated to prevent wind from scattering topsoil and to prevent the introduction of nonnative plants.

- To ensure successful revegetation, screen Tineman and Taglake soil types that are excavated to remove material greater than 3 inches in size in the topsoil layer before being respread.

- Respread topsoil as near the original location as possible and supplement with scarification, mulching, seeding, and/or planting with species native to the immediate area. Conserving topsoil would minimize vegetation impacts and potential compaction and erosion of bare soils. The use of conserved topsoil would preserve microorganisms and seeds of native plants.

- Follow existing contours to the degree possible for constructed elements such as roads or paths. Locally excavated material would be used at fill locations.

- As appropriate, reuse excavated soil within the project area; store excess soil only in approved areas. Topsoil would be removed and returned to the same area once construction activities are completed. Live vegetation less than 3 feet in height and limbs less than 2 inches in diameter may be incorporated as topsoil in the stockpiles. Care would be taken to ensure that topsoil and fill material are not mixed and are stockpiled in separate areas (i.e., topsoil to the right of the trench and fill to the left).

- In an effort to avoid introduction of nonnative plant species, use only certified weed-free materials for erosion control. Any proposed materials would be reviewed on a case-by-case basis; allowable materials for erosion control would be weed-free purchased from a certified source, and materials that are identified as unlikely to draw wildlife to construction sites or roadsides such that wood excelsior fibers may be preferred over straw-filled waddles. This selection may be determined based on location, quantity, and duration of material use.

- Obtain any fill materials from a park-approved source, approved by the park ecologist. Borrow and aggregate materials from sources outside the park would be inspected to avoid importation of nonnative plants.

- When construction is ended prior to a winter season, protect all disturbed areas and soil stockpiles from snowmelt impacts by using erosion-control best management practices for subsoil, and soil conservation practices for topsoil.

Air Quality

- Implement a dust abatement program. Standard dust abatement measures may include the following elements: water spraying or otherwise stabilizing soils, covering haul trucks, employing speed limits on unpaved roads, minimizing vegetation clearing, and revegetating after construction.

- Reduce or eliminate idling of construction and public vehicles.

- Assure that all construction equipment comply with EPA emission standards in effect at the time of manufacture.

Night Skies

- Use artificial light only where needed and only at times when needed. Warmer color lighting would be used, while blue-white light would be avoided. Controls that automatically dim or switch outdoor lights may be used to mitigate environmental impacts and conserve energy.

- Select the most efficient lamps and fixtures that minimize negative impacts and use the minimum amount of light necessary.

- Shield and direct downward all artificial light.

Historic Structures, Sites, and Cultural Landscapes

- Design all new construction within or adjacent to historic sites, districts, and cultural landscapes to be compatible in terms of architectural elements, scale, massing, materials, and other character-defining features. To minimize the visual and auditory intrusions on cultural resources from new development, the National Park Service would use screening or other sensitive design measures that would be compatible with historic resources and cultural landscapes. If adverse impacts could not be avoided, impacts would be mitigated through consultation with all interested parties.

Archeological Resources

- Routinely monitor known archeological sites to assess and document the effects of natural processes and human activities on the resources. Archeological resources would be left undisturbed and preserved in a stable condition to prevent degradation and loss of research values unless intervention could be justified based on compelling research, interpretation, site protection, or park development needs. Recovered archeological materials and associated records would be treated in accordance with 36 CFR Part 79, NPS *Management Policies 2006*, and the NPS *Museum Handbook*. All identified sites would be entered in ASMIS and previous records would be updated.

- As appropriate, conduct archeological surveys or monitoring prior to any ground disturbance. Significant archeological resources would be avoided to the greatest extent possible during construction. If such resources could not be avoided, an appropriate mitigation strategy (e.g., the excavation, recordation, and mapping of cultural remains prior to disturbance) would be developed in consultation with the Wyoming SHPO and, as necessary, associated American Indian tribes. The mitigation strategy would ensure that important archeological data is recovered and documented.

- If, during construction, previously unknown archeological resources were discovered, halt all work in the immediate vicinity of the discovery until the resources could be identified and documented. If the resources could not be preserved in situ, an appropriate mitigation strategy would be developed in consultation with the Wyoming SHPO and, as necessary, associated American Indian tribes. Archeological sites would be fenced and/or appropriately marked by a NPS-approved archeologist. All project personnel would be briefed to stay out of areas with sensitive archeological resources.

- Follow site-specific planning and compliance procedures for all projects with the potential for ground disturbance. Adverse impacts on cultural resources would be avoided to the extent possible in accordance with *The Secretary of the Interior's Standards and Guidelines for Archeology and Historic Preservation*.

Ethnographic Resources

- Consult with associated American Indian tribes to ensure that project actions are conducted in a way that respects the beliefs, traditions, and other cultural values of the tribes who have ancestral ties to park lands. Sensitive, sacred, or traditional use areas would be protected to the greatest extent possible by avoiding or mitigating adverse impacts on ethnographic resources, retaining site confidentiality as appropriate, and continuing to provide tribal access to resources and places of cultural importance.

- Follow provisions outlined in the Native American Graves Protection and Repatriation Act of 1990 (25 USC 3001) in the event that human remains, funerary objects, sacred objects, or objects of cultural patrimony are discovered during construction. If non-Indian human remains were discovered, standard reporting procedures to notify appropriate authorities would be followed, as would all applicable federal, state, and local laws.

- Should project activities be underway and associated tribes subsequently identify the presence of ethnographic resources in project areas, appropriate measures would be undertaken to avoid, minimize, or mitigate project impacts in consultation with the associated tribes. The location of sensitive ethnographic sites and resources would not be made public.

Museum Collections

- The natural and cultural resources management activities discussed in this plan may result in the collection of specimens, artifacts, and resource management records that would be permanently retained in the park museum collections and archives. In accordance with all NPS policies and guidelines, collection items would be documented (accessioned and cataloged), preserved, and made accessible for future research and use as appropriate.

Visual Resources

- Fence off and consolidate construction areas and equipment to visually screen construction activity and materials when possible.

- Site and design trails to route people away from sensitive natural and cultural resources while still allowing access to important viewpoints. Use vegetation screening when appropriate.

- Subject viewshed-related projects to site-specific planning and compliance. Avoid adverse impacts through use of *The Secretary of the Interior's Standards and Guidelines for Archeology and Historic Preservation* to preserve historic scenic views and landscapes where scenic resources are an integral component of the cultural landscape (see cultural resource mitigation measures above). If adverse impacts could not be avoided, mitigate these impacts through a consultation process with all interested parties.

Soundscapes and Acoustical Resources

- Implement standard noise abatement measures during construction and for traffic. Standard noise abatement measures may include the following elements: a schedule that minimizes impacts on adjacent noise-sensitive uses, the use of best available noise control techniques wherever feasible, the use of hydraulically or electrically powered impact tools when feasible, the use of hand tools when feasible, the placement of stationary noise sources as far from sensitive uses as possible, and the use of noise-muffling, shielding, or fencing. Functioning mufflers would be installed and maintained on all motorized equipment. Engine idling would be reduced or eliminated.

- Consider the impact of all administrative actions, such as planning, maintenance, resource management, interpretation, and ranger activities, on natural sounds. Incorporate noise mitigation into these administrative actions.

- Design additional facilities with noise reduction in mind, including using quiet fans, shielding noise-producing utilities, and noise-dampening door mechanisms.

- Provide educational messages concerning natural soundscapes. Create interpretive materials that instill a culture of awareness of and respect for the value of natural soundscapes. Educate visitors and park staff about the growing impact of loud vehicles, motors, and other unnecessary noise disturbances.

Quality of the Visitor Experience

- Implement measures to reduce adverse effects of construction on visitor experience. Measures may include, but are not limited to, noise abatement, visual screening, and directional signs so visitors are able to avoid construction activities.

- Conduct construction work to avoid peak visitor use times (i.e., weekends, holidays) to the extent practicable to minimize inconveniences to visitors.

- If possible, provide alternative routes of reaching destinations within the corridor when areas are closed to construction activities. Alternative routes would not involve the construction of new trails, roads, or access routes.

- Make information public regarding implementation of projects in public areas.

- Continue to collect and use visitation data and other information to identify user conflicts.

- Implement an interpretation and education program to promote visitor understanding of the history and character of the corridor, changes being made to management of the corridor (e.g., access), appropriate uses of the corridor, and avoiding potential resource impacts.

- Improve directional signs and interpretive media at overlooks and historic sites.

Access and Opportunities

- Ensure the facilities, programs, and services of the National Park Service and its partners are accessible to and usable by all people, including those who are disabled. This policy is based on the commitment to provide access to the widest cross-section of the public and to ensure compliance with the Architectural Barriers Act (42 USC 4151 et seq.) and the Rehabilitation Act (29 USC 701 et seq.).

Health and Safety

- Implement measures to reduce adverse effects of construction on safety. Measures may include, but are not limited to, noise abatement, visual screening, and directional signs that aid visitors in avoiding construction activities.

- Develop an emergency notification plan that complies with park, federal, and state requirements and allows contractors to properly notify park, federal, and/or state personnel in the event of an emergency during construction activities. This plan would address notification requirements related to fire, personnel, and/or visitor injury, releases of spilled material, evacuation processes, etc. The emergency notification plan would be submitted to the park for review/approval prior to commencement of construction activities.

MONITORING GUIDELINES

The following monitoring guidelines have been developed for each of the fundamental resources and values identified within the Moose-Wilson corridor. These guidelines are intended for park managers to use to periodically check on the status of the fundamental resources and values to ensure their conditions are not being degraded. The following tables include general monitoring guidelines that are common to all action alternatives. For specific indicators and thresholds related to visitor use management, please refer to the visitor use management framework section of this chapter.

Monitoring Guidelines for Scenery
Key aspects
▪ Unique views of the iconic peaks of the Teton Range and high-elevation canyons, not readily found in other areas of the park. ▪ Stunning views of Phelps Lake and Death Canyon from the trails in the Laurance S. Rockefeller Preserve. ▪ Exceptional scenic landscapes, including the Snake River, forests, sagebrush flats, wet meadows, and wetlands.
Goal
▪ Preserve the exceptional variety of scenery and wildlife viewing opportunities within the Moose-Wilson corridor.
Rationale for adopting monitoring protocols
▪ Periodic monitoring of scenic vistas and viewsheds would ensure that their quality remains outstanding, while also protecting ecological and cultural values. ▪ Provide a diversity of appropriate uses for visitors to experience and have a direct connection to the corridor and its unique scenic value.
Past and ongoing monitoring strategies
▪ Periodic visitor surveys are distributed to compile visitor experience as related to scenic values. ▪ Project-related analyses related to scenery, including photos, aerial photography, visibility data, and air quality monitoring, are undertaken as needed. ▪ The Moose-Wilson Road Corridor Cultural Landscape Inventory may serve as a baseline for monitoring strategies.
Future monitoring objectives
▪ Individual projects would be analyzed on a case-by-case basis to ensure protection of the scenery. ▪ Visual surveys noting visual anomalies and recommended corrections would be performed at key vista points within the corridor. ▪ Long-term scenic integrity monitoring would be conducted through use of photo points at key areas within the corridor. Photos would be updated and reviewed as necessary.

Monitoring Guidelines for Geologic Processes
Key aspects
▪ The Moose-Wilson corridor lies within a geomorphically active zone where dynamic geologic processes continue to shape the landscape, including earthquakes, fault lifts, glaciation and snowmelt, alluvial soil deposition, and the constantly changing river/stream morphology. A wide variety of soil types and strata that resulted from the above geologic processes occur across the Moose-Wilson corridor.

Monitoring Guidelines for Geologic Processes
Goal
▪ Allow for natural geologic forces to continue to shape the dynamic landscapes of the Moose-Wilson corridor and protect existing geologic resources (e.g., soils) from erosion and compaction associated with development and visitor use impacts.
Rationale for adopting monitoring protocols
▪ Geologic monitoring identifies changes in unique features such as landslides, debris flows, alluvial depositions, and exposed geologic layering and ensures that natural processes are maintained. ▪ Soil monitoring identifies changes to surface soil conditions and substrata, such as soil compaction and erosion, which result from natural processes as well as human-induced effects.
Past and ongoing monitoring strategies
▪ Geologic maps of the area have been completed, detailing volcanic and seismic connections and the geomorphology of the Snake River below Jackson Lake Dam. Soil monitoring along the road corridor is conducted occasionally as disturbed locations are assessed for revegetation needs and potential restoration. When reported, landslide activity and associated soil disturbance is recorded and photographed.
Future monitoring objectives
▪ Periodic field observations would be performed. ▪ Site inspections of soil conditions (erosion, sedimentation, compaction, etc.) at/around roads, developed sites, concentrated visitor use areas, streams and stormwater facilities, and other permitted and unpermitted ground-disturbing activities, as needed. ▪ The National Park Service and other agencies would continue and possibly enhance the current ongoing monitoring programs in place by park staff and partners.

Monitoring Guidelines for Ecological Communities and Wildlife
Key aspects
▪ Geography, location, size, and connectivity of the Greater Yellowstone Ecosystem. ▪ Extreme topography in a small area that leads to diverse vegetation communities. ▪ Full complement of native birds and mammals—natural predator-prey interactions that reflect the health of the ecosystem. ▪ Natural disturbances—fire, landslides, flooding, drought, insect infestations—influence the landscape.
Goal
▪ Protect and maintain the natural function, diversity, complexity, and resiliency of the ecological systems and natural communities of the Moose-Wilson corridor; allow natural behaviors of wildlife individuals and species to continue; and maintain the unique habitat characteristics and conditions that result from the Snake River's distinctive proximity to the Teton Range. ▪ Minimize fragmentation and other human disturbance that degrades the ecological communities and alters native vegetation and wildlife population abundance, diversity, and distribution in the Moose-Wilson corridor.
Rationale for adopting monitoring protocols
▪ Ongoing monitoring related to visitor use and development impacts as they affect ecological and wildlife values would ensure the Moose-Wilson corridor remains outstanding and is not impaired. Ongoing research is also a central component to the development of restoration solutions to maintain native plant and wildlife communities and habitats. Monitoring would determine the efficacy of visitor use management actions and restoration efforts, and provide direction for future management.
Past and ongoing monitoring strategies
▪ Large mammals in general are monitored through annual counts and population trends. Specific monitoring

Monitoring Guidelines for Ecological Communities and Wildlife
efforts target wolves, black bears, grizzly bears, elk, beavers, swans, raptors, eagles, and osprey. Amphibians are monitored by the Greater Yellowstone Coordinating Committee Inventory and Monitoring Program. ▪ Rare plants, and invasive plant species are monitored regularly.
Future monitoring objectives
▪ The National Park Service would conduct regularly scheduled monitoring of key human use areas (e.g., road corridor, trails, turnoffs) to determine if visitation is affecting ecological communities, native vegetation, and wildlife. Populations of various wildlife "indicator" species would be monitored to assess possible effects of visitor use. Wildlife observations, human-wildlife interactions, wildlife jams, traffic incidents, and vegetation disturbance would be documented. Monitoring results would indicate if actions need to be taken to reduce or eliminate the impacts. ▪ Special monitoring for grizzly bear, wolf, and other identified species of interest; surveying new areas for occupancy; and reporting new activity would be performed. Trends in occupancy over time would be monitored. ▪ Periodic monitoring of key use areas would be conducted to determine if excessive trampling is occurring and social trails are forming. If this is the case, then measures such as formalizing trails, fencing, and revegetation efforts would be considered. The use of additional corridor vegetation monitoring methods would be considered to assess ecological health (e.g., using multiple indicator monitoring protocols). ▪ Evaluate the effectiveness of actions being taken to mitigate human impacts and restore native species, ecological functions, and habitat values in disturbed areas (e.g., effectiveness of temporary closures, visitor education programs, native plant revegetation efforts). ▪ Monitor the presence of nonnative invasive plant species to implement an early detection and rapid response strategy to remove invasive species before populations establish themselves and impact native species. ▪ Monitor the presence of hazard trees along roads, parking areas, and developed areas to determine if trees need to be removed.

Monitoring Guidelines for Aquatic Resources
Key aspects
▪ The Moose-Wilson corridor contains a portion of the designated wild and scenic Snake River; its associated outstandingly remarkable values, floodplain, and riparian areas; Phelps Lake; and a complex system of high-value wetlands, mountain seeps, springs, and streams. These hydrologic resources provide habitat for diverse aquatic communities.
Goal
▪ Protect and restore the natural hydrological features, processes, and functions within the Moose-Wilson corridor. Maintain and protect the diverse native aquatic communities and species that rely on the hydrological features within the corridor.
Rationale for adopting monitoring protocols
▪ Ongoing monitoring provides opportunities to study the influence of hydrological changes on the natural features, systems, processes, and aquatic species of the rivers and streams within the Moose-Wilson corridor. ▪ Natural geologic and geothermal forces, as well as artificial changes in stream flow due to human-made river impediments can affect the water quality of the rivers and streams within the corridor, including the Snake River. These and other natural and human influences can cause changes in temperature, dissolved oxygen, and other water quality characteristics. ▪ These variables are appropriate to monitor water quality because their levels can be tied to human activities and human contact with water. ▪ Fish habitat, population, and macroinvertebrate monitoring determines changes in fish and aquatic species variables and ensures that this river value remains outstandingly remarkable.

Monitoring Guidelines for Aquatic Resources
Past and ongoing monitoring strategies
▪ There has been an ongoing water quality monitoring effort by the National Water Quality Assessment Program. This program monitors phosphorus levels, total nitrates, turbidity, summer water temperatures, and contaminants. ▪ Greater Yellowstone Coordinating Committee Inventory and Monitoring Program began monitoring water chemistry, dissolved oxygen, specific conductivity, pH, temperature, and phosphorus content in 2006. Data indicate that water quality remains excellent and continues to meet or exceed EPA and state standards. ▪ Project-driven research studies monitoring pesticides and E. coli have been performed in the streams and corridors within the Moose-Wilson corridor and the larger park hydrologic system. ▪ Monitoring and research on floodplains and wetlands would continue to be encouraged, especially related to use of the road corridor. ▪ Annual cutthroat trout spawning surveys are conducted as well as trout population estimates in the Snake River within the corridor, and some movement studies and presence/absence monitoring have been conducted. ▪ Creel surveys have been conducted, such as the 1995 Snake River creel survey produced by the Wyoming Game and Fish Department; these population estimates and creel surveys give some indication of influence visitor use levels and other factors have on fish populations.
Future monitoring objectives
▪ The National Park Service would continue and possibly enhance the current ongoing monitoring programs in place by park staff and partners. ▪ Conduct periodic water quality monitoring of water bodies and waterways in the Moose-Wilson corridor (including, including but not limited to, Phelps Lake, Lake Creek, the Snake River and its various tributaries) to ensure water quality remains in good condition. ▪ While stream health and water quality currently meet desired conditions and do not appear to be at future risk, if baseline monitoring indicates otherwise, or ocular indicators show possible stream health or water quality issues may be occurring, a stream health assessment would be conducted. ▪ In addition to monitoring direct water quality attributes (e.g., dissolved nutrients, temperature, pH, bacteria, etc.), monitoring indirect indicators of water quality, such as health of aquatic invertebrate populations, would be considered. ▪ Fisheries monitoring and creel surveys would continue to be periodically conducted in collaboration with partners, including the Wyoming Game and Fish Department. ▪ Monitor human use areas for signs of disturbance to water features and associated native vegetation. ▪ Identify aquatic species of concern and coordinate monitoring and protection activities between other federal and state agencies. ▪ Monitor populations and extent of aquatic "indicator" species to assess for possible effects from visitor use.

Monitoring Guidelines for Cultural History and Resources
Key aspects
▪ Thousands of years of human use and settlement are documented along the Snake River and the Moose-Wilson corridor. The diversity of peoples and evidence of their cultural activities and adaptations to the area are reflected in archeological resources, historic structures/districts, cultural landscapes, and ethnographic resources.
Goal
▪ Protect and enhance the management of cultural resources importantly linked to the human history of the Moose-Wilson corridor. Ensure that the integrity and informational potential of important resources are preserved at desired conditions.
Rationale for adopting monitoring protocols
▪ Monitoring is an essential tool that provides cultural resource managers with the ability to assess resource conditions and to determine the extent to which long-term resource protection and preservation objectives are

Monitoring Guidelines for Cultural History and Resources
being achieved. In general, cultural resources are nonrenewable and their condition and integrity cannot be fully recovered if damaged or adversely impacted. NPS staff establishes baseline conditions for particular historic structures, cultural landscapes, archeological and ethnographic resources, and tracks changes in the condition of these resources over time. Site-specific threats and disturbances are identified and documented, and recommended management actions are undertaken as necessary to prevent future damage or degradation of resource conditions. ▪ NPS *Management Policies 2006* (chapter 5, section 5.3.1.6) directs park superintendents to set, enforce, and monitor carrying capacities to limit public visitation to or use of cultural resources that would be subject to adverse effects from unrestricted levels of visitation or use. ▪ NPS *Management Policies 2006* (chapter 5, section 5.3.5.1.1, Archeological Resources), direct that the condition of archeological resources be documented, regularly monitored, and evaluated against initial baseline data. Parks are encouraged to enlist concerned local citizens in site stewardship programs to patrol and monitor the condition of archeological resources.
Past and ongoing monitoring strategies
▪ NPS staff conducts surveys to identify cultural resources in accordance with NPS policies and the requirements of sections 106 and 110 of the National Historic Preservation Act. Identified cultural resources are assessed for their eligibility for listing in the National Register of Historic Places. ▪ As funding and staffing permits, NPS staff conducts ongoing monitoring at prescribed intervals to assess and document the condition of national register-listed or -eligible historic structures/districts, cultural landscapes, archeological and ethnographic resources. Potential impacts and threats to the integrity of significant resources are identified (e.g., weathering, erosion, social trails and other inadvertent visitor use impacts, and site looting). Monitoring data is used to inform strategies for resource protection or appropriate mitigation measures if adverse impacts cannot be avoided. ▪ Monitoring is commonly used by NPS staff during ground-disturbing construction or other project actions with the potential to affect unidentified archeological or other sensitive cultural resources. Construction is halted in the locations of cultural resource discoveries until the resources are assessed and appropriate avoidance or mitigation measures are carried out in consultation with the Wyoming SHPO, associated tribes, and other concerned parties in accordance with section 106 requirements.
Future monitoring objectives
▪ Monitoring would remain an important component of cultural resource stewardship. In accordance with user capacity strategies employing resource indicators and standards, particular standards for cultural resources could be developed that would signal when resources were approaching minimally acceptable desired conditions as a result of park/visitor use. ▪ Ongoing and future consultations with associated American Indian tribes and other culturally associated groups would assist park staff with efforts to identify and monitor the condition of places and resources having traditional cultural importance. Potential threats to resources or traditional access could be identified along with appropriate measures to protect resources and places, and avoid or mitigate adverse impacts. ▪ Park staff could partner with tribal members and others to assist with cultural resources monitoring. ▪ NPS staff could implement measures to enhance monitoring protocols, perhaps employing new technological methods (e.g., remote sensing) to assess resource conditions. As necessary, sensitive cultural sites (including those at heightened risk of disturbance) would be monitored more frequently to inform management decisions and protection strategies.

Monitoring Guidelines for Natural Soundscapes and Acoustic Resources
Key aspects
▪ Natural sounds have been identified as a fundamental resource and value within Grand Teton National Park. The Moose-Wilson corridor is composed of a full suite of biological sounds and sounds created through physical processes. Examples include running water, thunder, bird songs and calls, wind blowing, wolves howling, elk bugling, or beaver tails slapping, as well as the complete absence of all sounds. Cultural sounds within the Moose-Wilson corridor are place-specific and examples include quiet reflection at Murie Ranch, or

Monitoring Guidelines for Natural Soundscapes and Acoustic Resources
the sound of horseback activities that invoke the history of dude ranching at White Grass Dude Ranch and the STS Ranch (the dude ranch that predated the Murie Ranch). Visitors have the opportunity to appreciate both natural and cultural sounds. The audibility of sounds along the Moose-Wilson corridor varies across the landscape, with a variety of natural and unnatural audible sounds depending on location. For example, the sound levels of backcountry winter areas are sometimes close to the lower limit of human hearing (0 A-weighted decibels [dBA]), while vehicles on Moose-Wilson Road create loud (>70 dBA) nonnatural sounds that propagate into backcountry. Additionally, the Jackson Hole Airport is within Grand Teton National Park to the east of the Moose-Wilson corridor, and air traffic can be heard, sometimes at high levels, from within the corridor.
Goal
▪ Protect and enhance natural and cultural sounds within the Moose-Wilson corridor and visitor opportunities to experience those sounds.
Rationale for adopting monitoring protocols
▪ Acoustical monitoring provides a scientific basis for assessing the current status of acoustic resources within the Moose-Wilson corridor, identifying trends in resource conditions, quantifying impacts from other actions, assessing consistency with park management objectives and standards, and informing management decisions regarding desired future conditions. ▪ Visitor survey data allows park managers to better understand visitors' values, perceptions, and preferences relating to natural and cultural sounds in the Moose-Wilson corridor.
Past and ongoing monitoring strategies
▪ Since 2003, acoustical data collection has occurred in Moose-Wilson corridor in the following locations: (1) at Murie Ranch, (2) at White Grass Ranch, and (3) along Moose-Wilson Road at three different locations (near the Sawmill Ponds, between the Death Canyon Road and the LSR Preserve, and near Granite Canyon Trailhead parking area). Data were collected using automated acoustical monitors in all instances. ▪ A summer 2014 visitor survey will reveal visitor expectations for and the importance of enjoying natural quiet and sounds of nature when visiting the Moose-Wilson corridor. The survey will also reveal if visitors believe that the sounds of aircraft, vehicles, or other visitors were a problem during their visit to the corridor. ▪ Another survey that was recently conducted at LSR Preserve also provided information on visitor experiences related to the soundscapes. ▪ Additionally, a 2006 visitor survey was conducted in a heavily visited area outside of the Moose-Wilson corridor near the point where Cascade Creek flows into Jenny Lake in Grand Teton National Park; those findings could be considered when assessing similar soundscapes in the Moose-Wilson corridor.
Future monitoring objectives
▪ Continue monitoring in the Moose-Wilson corridor, especially in locations where baseline sound levels have the potential to change due to planning alternatives. ▪ Use established methodologies for collecting acoustical monitoring data and visitor survey data.

Monitoring Guidelines for Visitor Experience in an Outstanding Natural Environment
Key aspects
▪ Visitors may immerse themselves in the spectacular natural setting of the Teton Range. ▪ Visitors have extraordinary opportunities to observe wildlife, experience solitude, explore wilderness, appreciate dark night skies, and listen to natural quiet. ▪ Visitors can experience a multitude of recreational opportunities, including bicycling, winter use, and equestrian activities. ▪ Visitors to the Moose-Wilson corridor can become intimately involved in one of the most scenic and rustic road corridors found in any national park.

Monitoring Guidelines for Visitor Experience in an Outstanding Natural Environment
Goal
▪ Provide meaningful opportunities to experience and enjoy the rustic character and diverse ecosystems of the Moose-Wilson corridor.
Rationale for adopting monitoring protocols
▪ Monitoring types and levels of visitor use would ensure that visitor experiences in the corridor remain outstanding. ▪ Provide a diversity of appropriate uses for visitors to experience and have a direct connection to the corridor and its unique recreational value.
Past and ongoing monitoring strategies
▪ Visitation data are monitored through various methods such as visitor surveys, transportation data, backcountry permits, and concessioner data. ▪ At the LSR Preserve, visitor use level data has been collected since its opening in 2008. Data collected includes parking lot fill times, hourly parking lot counts, foot traffic from parking lot, and total number of visitors visiting the LSR Preserve Center.
Future monitoring objectives
▪ The park would use feedback from routine patrols and biological/wildlife monitoring programs to assure that recreational activities were not adversely affecting other fundamental resources and values. ▪ Condition surveys at developed recreation sites would be conducted as needed. ▪ The National Park Service would continue and possibly enhance the current ongoing monitoring programs in place by park staff and partners.

STRATEGIES TO ADDRESS CLIMATE CHANGE

Climate change has a high potential to adversely affect future conditions of the Greater Yellowstone Ecosystem, including the Moose-Wilson corridor of Grand Teton National Park. As global and regional climates continue to change, a management approach that enhances the protection and resilience of climate-sensitive resources is becoming increasingly important. The following outlines such a strategy that adapts to our growing understanding of climate change influences and the effectiveness of management to contend with them.

Climate change science is a rapidly advancing field and new information is continually being collected and released, yet the full extent of climate change impacts on resource conditions is unknown. As such, park managers and policy makers have not determined the most effective response mechanisms for minimizing impacts and adapting to change. Because of this, the following management strategies do not provide definitive solutions or directions; rather, they provide science-based and scholarship-based management principles to consider when implementing the broader management direction of the Moose-Wilson corridor.

The NPS Climate Change Response Program aims to prepare the agency and national park system units for the anticipated management needs resulting from climate change. To aid parks in coping with the uncertainty of future climate conditions, the Climate Change Response Program assists park managers in determining the extent to which they can and should act to protect current park resources while allowing park ecosystems to adapt to new conditions. Efforts of the NPS Climate Change Response Program focus on the following strategies:

Science

- Conduct scientific research and vulnerability assessments necessary to support NPS adaptation, mitigation, and communication efforts.
- Collaborate with scientific agencies and institutions to meet the specific needs of management when confronting the challenges of climate change.
- Learn from and apply the best available climate change science.

Mitigation

- Reduce the carbon footprint of the National Park Service.
- Promote energy efficient practices such as alternative transportation.
- Enhance carbon sequestration as one of many ecosystem services.
- Integrate mitigation into all business practices, planning, and NPS culture.

Adaptation

- Develop the adaptive capacity for managing natural and cultural resources and infrastructure under a changing climate.
- Inventory resources at risk and conduct vulnerability assessments.
- Prioritize and implement actions and monitor the results.
- Explore scenarios, associated risks, and possible management options.
- Integrate climate change impacts into facilities management.

Communication

- Provide effective communication about climate change and resulting impacts on the public.
- Train park staff and managers in the science of climate change and decision-making tools for coping with change.
- Lead by example.

With the guidance of the above strategies, Grand Teton National Park will use the following management approach to address climate change throughout implementation of this comprehensive management plan. Many of these specific management strategies are adopted from the publication, "Some Guidelines for Helping Natural Resources Adapt to Climate Change" (IHDP 2008). Further, elaboration and adaption of these strategies are anticipated as implementation of the plan proceeds.

- Identify key natural and cultural resources and processes that are at risk from climate change. Establish baseline conditions for these resources, identify their thresholds, and monitor for change. Increase reliance on adaptive management to minimize risks.

- Restore key ecosystem features and processes and protect cultural resources to increase their resilience to climate change.

- Use best management practices to reduce human-caused stresses (e.g., park infrastructure and visitor-related disturbances) that hinder the ability of species or ecosystems to withstand climatic events.

- Form partnerships with other resource management entities to maintain regional habitat connectivity and refugia that allow species dependent on resources within the Moose-Wilson corridor to better adapt to changing conditions.

- Reduce or mitigate greenhouse gas emissions associated with park operations and visitor use such as alternative transportation options (e.g., shuttles and low-emission vehicles for the park's fleet) and biofuels and other renewable energy sources for visitor center and administrative buildings.

- Use the fragile environments of the Moose-Wilson corridor as an opportunity to educate visitors about the effects of climate change on the resources they are enjoying. Inspire visitors to take action through leadership and education.

- Manage facilities and infrastructure (structures, trails, roads, etc.) within the Moose-Wilson corridor in a way that prepares for and adapts to the effects of climate change.

Finally, the action alternatives proposed in this plan include a range of facility enhancements to address a variety of visitor and resource issues. The National Park Service would evaluate proposed facility investments prior to project approvals using the best scientific information available and the climate change strategies described above to ensure the long-term sustainability of these investments. It is feasible that the National Park Service may conclude that such financial investments for facilities would be unwise and that other options would be considered or potentially the project would not be pursued or implemented.

FUTURE STUDIES AND IMPLEMENTATION PLANS NEEDED

The *Moose-Wilson Corridor Comprehensive Management Plan* is a long-term comprehensive plan, focused on overall management of the corridor. To fully implement this plan and avoid or minimize impacts on the area's natural and cultural resources and visitors, some additional site-specific plans would be needed.

Three specific plans would need to be prepared before the proposed construction in this plan can occur. These plans, as noted in the "Best Management Practices" and "Mitigation Measures" sections, include:

- A revegetation plan. This plan would provide direction for replanting disturbed areas resulting from construction actions in the Moose-Wilson corridor plan and for rehabilitating areas that would be closed and revegetated. The plan would include details on such items as native seed/plant sources and mixes, soil preparation, and erosion control.

- A spill prevention and pollution control plan. This plan would cover all aspects of spill prevention, notification and reporting requirements, response strategies for spills occurring on land and water, type of response equipment, location of equipment, etc.

- An emergency notification plan. This plan would enable contractors to properly notify park, federal, and/or state agencies in the event of an emergency during construction activities. This plan would address notification requirements related to fire, personnel, and/or visitor injury, releases of spilled materials (see above), evacuation processes, etc.

Ongoing studies would be completed during implementation of the plan to periodically check on the status of resource conditions and visitor experiences to ensure unanticipated changes are not degrading desired conditions over time. For example, monitoring would be needed to determine if invasive nonnative species are becoming established and spreading in the corridor. Likewise, periodic visitor surveys would be needed to determine visitor satisfaction with services and facilities in the corridor. Visitor numbers would also need to be monitored to determine if use levels are approaching or exceeding the visitor use capacity for the corridor. For more details on future monitoring needs, please refer to the previous "Visitor Use Management Framework," and "Monitoring Guidelines" sections in this chapter.

STAFFING AND COST ESTIMATES

National Park Service decision makers and the public must consider the costs and advantages of various alternatives, including the no-action alternative, to make a relevant comparison among the alternatives.

The costs presented here are estimates for comparison purposes only and are not to be used for budgetary purposes or implementation funding requests. If and when the actions are implemented, actual costs would vary. Specific costs would be determined in subsequent, more detailed planning and design efforts.

Presentation of costs in this plan does not guarantee future NPS funding. Project funding would not come all at once; it would likely take many years to secure, and some could be provided by partners, donations, or other nonfederal sources. Although Grand Teton National Park hopes to secure this funding and would prepare itself accordingly, the park might not receive enough funding to achieve all desired conditions within the time frame of the *Moose-Wilson Corridor Comprehensive Management Plan*, which is the next 10 or more years.

The estimates in this section include annual operating, staffing, deferred maintenance, one-time facility and nonfacility, and other costs. These are defined as follows:

- ***Annual Operating Costs*** are the total costs per year for operations and maintenance (O&M) associated with each alternative, including utilities, supplies, staff salaries and benefits, leasing, and other materials. Cost and staffing estimates assume that the alternative is fully implemented as described.
- ***Staffing*** is the total number of person-years of staff required to maintain the assets of the park at an acceptable level, provide visitor services, protect resources, and generally support park operations. The full-time equivalency (FTE) number indicates NPS staffing levels, not volunteer positions or positions funded by partners. Full-time equivalency salaries and benefits are included in the annual operating costs.
- ***One-Time Facility Costs*** include those for the design, construction, rehabilitation, upgrades, or adaptive reuse of visitor centers, campgrounds, picnic areas, roads, parking areas, administrative facilities, comfort stations, educational facilities, maintenance facilities, trails, and other visitor facilities.
- ***Deferred Maintenance Costs*** include costs related to maintenance that was not performed when it was scheduled and was put off or delayed. The primary reason for delays is lack of funds to address maintenance needs.
- ***One-Time Nonfacility Costs*** include actions for the preservation of cultural or natural resources not related to facilities, the development of visitor use or management tools, and other park management activities that would require substantial funding above annual operating costs.
- ***Other Costs*** are identified separately for projects that are wholly or partially funded from other sources.

Staffing and annual operating cost estimates for the action alternatives are calculated by adding the additional staffing and annual operating costs associated with the implementation of each action alternative to the staffing and annual operating costs under the no-action alternative.

Table 3 provides cost estimates and staffing (FTE) levels for the no-action alternative and implementing the three action alternatives.

TABLE 3. COST ESTIMATES AND STAFFING FOR FULL IMPLEMENTATION OF THE ACTION ALTERNATIVES

Cost Type	Alternative A (No Action)	Alternative B	Alternative C (NPS Preferred)	Alternative D
Staffing (FTE)	21.9	25.1	26.2	28.6
Annual Operating Costs*	$1,286,000	$ 1,525,000	$ 1,567,000	$ 1,815,000
NPS One-Time Facility Costs		$ 9,270,000	$ 9,089,000	$ 9,251,000
Federal Lands Highway / Other One-Time Facility Costs		$23,345,000	$15,302,000	$33,931,000
Total One-Time Facility Costs	$3,572,000	$32,615,000	$24,391,000	$43,182,000
Deferred Maintenance Addressed**	$3,572,000	$ 3,572,000	$ 3,572,000	$ 3,572,000
One-Time Nonfacility Costs		$ 35,000	$ 35,000	$ 55,000

*This number is derived from an inventory of the park FTE dedicated to activities in the corridor, plus an estimate for non-FTE operations and maintenance costs derived from Park Asset Management Plan data. Salaries and benefits for FTE assigned to the corridor are calculated from geography-specific federal salary and wage tables.
**Each alternative, including the no-action alternative, would address $3.6 million in deferred maintenance associated with road, parking, and bridge assets in the corridor.

STAFFING AND ANNUAL OPERATING COSTS

Staffing levels expressed as FTEs shown under the no-action alternative in table 4 indicate the actual number of positions funded in fiscal year 2014. There was a total of 21.9 FTE assigned to the corridor, of which 11.7 were permanent and 10.1 were seasonal. This number represents approximately 9% of the total park FTE level of 240 for fiscal year 2014, of which 141 were permanent and 99 were seasonal (each of the 197 seasonal staff count as 0.5 FTE), which is within the authorized number of FTE for the park in that year. The park also employed 11 term employees in fiscal year 2014. Salaries and benefits of these staff account for the majority of the annual operating costs for the corridor; the remainder consists of O&M expenditures for assets within the corridor.

Table 4 shows the total number of proposed additional staff required above the 2014 funded staffing levels to implement the management strategies described under alternatives B, C, and D. The 2014 staffing levels are identified for the no-action alternative and serve as a baseline for comparison against the action alternatives. The increase in annual operating costs above the no-action alternative is due in part to the increased number of staff proposed to fully implement each action alternative. For this plan, the cost of an additional FTE is based on a General Schedule Grade 9 permanent level position with the "Rest of U.S." locality adjustment, a geographically based percentage adjustment for salaries appropriate for the park location. In addition, there is a small increase in O&M expenditures for new and rehabilitated roads, parking, and structures.

Volunteers and partners would continue to be key contributors to NPS operations under all of the alternatives. In FY 2013, there were 1,656 Volunteers-in-Parks (VIPs) who worked a total of 37,305 volunteer hours throughout the park, equivalent to 17.9 FTE. In the Moose-Wilson corridor, there were 34 VIPs, of which 15 worked at the LSR Preserve and 19 assist with wildlife management activities. These volunteers contributed a total of about 6,025 hours, which is equivalent to 2.9 FTE. Volunteers and future partners would continue to be an important part of ongoing management and a vital component of the park's efforts to implement any of the action alternatives.

Alternative A (No Action)

The NPS staffing level in the corridor under this alternative would remain at 21.9 FTE based on the 2014 allocation of Operation of the National Park System (ONPS) funding.

TABLE 4. ESTIMATED STAFFING LEVELS TO IMPLEMENT THE ALTERNATIVES

Division	No Action	Alternative B		Alternative C (NPS Preferred)		Alternative D	
	Funded	New FTE	Total FTE	New FTE	Total FTE	New FTE	Total FTE
Business Administration	0.3	0.5	0.8	0.3	0.6	0.7	1.0
Facility Management	4.4	1.0	5.4	1.3	5.6	1.3	5.6
Visitor and Resource Protection	11.6	0.3	11.8	2.0	13.6	3.3	14.8
Interpretation and Partnerships	3.1	0.8	3.9	0.0	3.1	0.0	3.1
Science and Resource Management	2.6	0.8	3.3	0.8	3.4	1.5	4.1
Total	**21.9**	**3.2**	**25.1**	**4.3**	**26.2**	**6.7**	**28.6**

*Note: Numbers may not sum due to rounding.

Alternative B

Alternative B would add a total of 3.2 FTE in the Business Administration, Facility Management, Visitor and Resource Protection, Interpretation and Partnerships, and Science and Resource Management Divisions. Added Business Management staff would provide oversight of expanded commercial services activities. Added facility management staff would perform custodial and maintenance activities for the new access road and split parking area at the Laurance S. Rockefeller Preserve Center, expanded parking area at the Death Canyon Trailhead, and new road bridges on Moose-Wilson Road near the Sawmill Ponds associated with the road realignment. Added Visitor and Resource Protection staff would operate components of the new traffic control system. Added interpretive staff would provide capacity to manage the expanded parking at the LSR Preserve Center and increase the number of visitor contacts. Added Science and Resource Management staff would manage natural resources, including wildlife, fisheries, vegetation, and cultural resources in the corridor.

Alternative C (NPS Preferred)

Alternative C would add a total of 4.3 FTE in the Business Administration, Facility Management, Science and Resource Management, and Visitor and Resource Protection Divisions. Added Business Management staff would provide oversight of expanded commercial services activities. Added facility management staff would perform custodial and maintenance activities for the additional culverts installed underneath Moose-Wilson Road near Sawmill Ponds, the new queuing station at the north end of Moose-Wilson Road, expanded parking area at Death Canyon Trailhead, and new vault toilets installed at multiple sites. Added visitor and resource protection staff would operate the new queuing system and the new queueing station at the north end of Moose-Wilson Road, as well as manage queueing and traffic flow at the existing Granite Canyon Entrance. Added Science and Resource Management staff would manage natural resources, including wildlife, fisheries, vegetation, and cultural resources within the corridor.

Alternative D

Alternative D would add a total of 6.7 FTE in the Business Administration, Facility Management, Visitor and Resource Protection, and Science and Resource Management Divisions. Added facility management staff would perform custodial and maintenance activities for the new reservation and queuing station at the north end of Moose-Wilson Road, expanded parking area at Death Canyon Trailhead, the new 7-mile multiuse pathway, and two new vault toilets in the corridor between Death Canyon Road junction and the north end of Moose-Wilson Road. Added visitor and resource protection staff would patrol the multiuse pathway, operate the new reservation queuing station at the Moose Entrance, and manage the new reservation system for visitor entry into the corridor. Added Science and Resource Management staff would be required for control of invasive plants and management of social trails that could develop adjacent to the new pathway, as well as provide more general management of natural resources, including wildlife, fisheries, vegetation, and cultural resources in the corridor.

ONE-TIME COSTS

One-Time Facility Costs

One-time NPS facility costs for each action alternative are detailed in table 5, followed by a detailed description of the alternative components. Alternative A includes the deferred maintenance backlog for the road, parking, and bridge assets in the corridor that would be repaired or rehabilitated under the current management strategy.

The National Park Service would likely need to seek funding from external sources to complete some of these projects. Funding for road construction and rehabilitation could come from the Federal Highway Administration (FHWA), including the Federal Lands Transportation Program (FLTP) and the Federal Lands Access Program (FLAP). FLAP, state funds, and private donations could be used to fund the construction costs of the multiuse pathway proposed in alternative D.

TABLE 5. ESTIMATED ONE-TIME FACILITY COSTS TO IMPLEMENT THE ALTERNATIVES

Item	Alternative A	Alternative B	Alternative C (NPS Preferred)	Alternative D
Road Realignment		$14,438,000	$ 7,028,000	$17,748,000
Road Repair and Rehabilitation	$3,499,000	$10,054,000	$ 8,845,000	$10,313,000
Multiuse Pathway		$0	$0	$ 7,320,000
Parking and Turnouts	$ 56,000	$ 4,169,000	$ 2,558,000	$ 2,597,000
Traffic Management Infrastructure		$ 3,719,000	$ 5,724,000	$ 4,902,000
Other	$ 17,000*	$ 235,000	$ 235,000	$ 303,000
TOTAL	**$3,572,000**	**$32,615,000**	**$24,391,000**	**$43,182,000**
Construction Mobilization		$ 3,019,000	$ 2,933,000	$ 4,016,000

*Repairs to Lake Creek Bridge

Sequencing of Construction Projects

The rehabilitation and realignment of Moose-Wilson Road would be completed over the course of several construction seasons, each of which lasts approximately from May through November and would be sequenced to prevent construction hauling over newly constructed or rehabilitated pavement. The phased construction approach would apply to all plan alternatives, including the no-action alternative, and would also apply to all other construction activity described in this plan that is connected to the particular road segment under construction.

Construction staging would be confined to previously impacted areas. These areas could include larger parking areas within the corridor and other parking areas outside the corridor but within the park boundary. Another possibility is to use the sites of structures in the corridor slated for demolition. Before the sites are restored to natural conditions, they could be used for staging purposes.

During a particular phase of construction, access to the targeted segment of Moose-Wilson Road would be restricted. Residents of in-holdings within the corridor who use that segment for access would have scheduled access to the road. Contractors would be required to provide access for emergency vehicles. There may be construction delays due to wildlife activity; the emphasis would be on careful monitoring of construction activities to avoid impacts on wildlife and minimize these delays as much as possible.

A key park management goal is to keep the LSR Preserve Center and all other recreation sites in the corridor accessible during all phases of construction. However, there is a possibility that access to the center and other sites may need to be closed or have visitor access restricted during specific phases of construction.

Alternative A (No Action)

Under the current management strategy for the corridor, the entire length of Moose-Wilson Road would be rehabilitated, which would include the repair, restoration, and resurfacing of the pavement surface. These treatments would also be applied to the paved portion of Death Canyon Road and the LSR Preserve entrance road. Other construction activity that would occur under this alternative includes repairs to the unpaved segment of Death Canyon Road, the LSR Preserve Loop parking lot, Granite Canyon Trailhead parking area, Sawmill Ponds parking area, and Lake Creek Bridge. These activities would address the deferred maintenance backlog for these road, bridge, and parking assets in the corridor and are described in more detail in table 6.

Alternative B

Alternative B would realign two segments of Moose-Wilson Road. The northern section of the road would be realigned to intersect with Teton Park Road at the Chapel of the Transfiguration Road junction. The segment between Sawmill Ponds and Death Canyon Road would be realigned to the southeast. The old road segments would be removed and native vegetation restored. The remaining segments of the road would be rehabilitated, which would include repair, restoration, resurfacing, and improved drainage features. The unpaved segment of the road would be paved and the traditional width of the road would be restored where needed.

Turnouts with capacity for 120 vehicles would be constructed along the road, with strategically placed barriers to reduce shoulder parking along the road. The existing Moose Entrance Station would be removed and a new one constructed on Teton Park Road. Low-impact interpretive signage would be strategically placed in the corridor.

An additional parking area and connector road would be constructed to provide parking access at the LSR Preserve from both directions, with approximately 25 spaces in each lot. Two gates would be installed on Moose-Wilson Road at the LSR Preserve turnoff to prevent through-traffic during peak use periods, and a pair of traffic circles would facilitate turn-arounds when the gates are closed to block through-traffic.

The Death Canyon Trailhead would be moved slightly to the south near White Grass Ranch. Death Canyon Road would be improved to a single-lane, gravel, two-way road with staggered passing turnouts, and the paved segment would be rehabilitated. A 60-car gravel parking area would be constructed and the vault toilet relocated to the new trailhead. The abandoned road segment and parking area would be rehabilitated. White Grass Road would be gated to limit vehicle access for administrative use only. Parking at the south end of Death Canyon Road would be formalized.

Parking for horse trailers at Poker Flats would be improved and designated only for six vehicles with horse trailers.

Alternative C (NPS Preferred)

Alternative C would realign the northernmost segment of Moose-Wilson Road to intersect with Teton Park Road at the Chapel of the Transfiguration Road junction. The road segment between Sawmill Ponds and Death Canyon Road would undergo a major rehabilitation within its existing alignment to address drainage issues. The remaining segments of the road would be rehabilitated, which would include repair, restoration, resurfacing, and improved drainage features. The unpaved segment of the road would be paved, and the traditional width of the road would be restored where needed.

Turnouts with the capacity for 120 vehicles would be constructed along the road, with strategically placed barriers to reduce shoulder parking along the road.

Traffic metering devices would be installed at both ends of Moose-Wilson Road to monitor the number of vehicles in the corridor at a given time. Queuing areas would be constructed at both entrances to accommodate waiting vehicles. The existing Moose Entrance Station would be removed and a new one constructed on Teton Park Road. A queuing station would also be constructed at the north end of the Moose-Wilson Road as part of the sequenced corridor entry system.

The Death Canyon Trailhead would be relocated to the White Grass Road junction, and the unpaved Death Canyon roadbed would be restored and repurposed as a hiking trail. The paved segment of Death Canyon Road would be rehabilitated. An 80- to 90-car gravel parking area would be constructed and the vault toilet relocated to the new trailhead. Access to White Grass Road would be gated to limit vehicle use for administrative purposes only. Parking at the south end of Death Canyon Road would be formalized.

Parking for horse trailers at Poker Flats would be improved and designated only for six vehicles with horse trailers. A vault toilet would be installed at the Granite Canyon Trailhead.

Alternative C would not construct a separate multiuse pathway. The existing Moose-Wilson Road would be designated as shared use.

Alternative D

Alternative D would realign two segments of Moose-Wilson Road as in alternative B. The northern section of the road would be realigned to intersect with Teton Park Road at the Chapel of the Transfiguration Road junction. The segment between Sawmill Ponds and Death Canyon Road would be realigned to the southeast. The old roadway segments would be removed and rehabilitated to natural conditions. The remaining paved segments of the road would be rehabilitated, which would include repair, restoration, resurfacing, and improved drainage features. The current grade of the unpaved road segment would be built up to repair extensive rutting and erosion along its length. The traditional width of the road would be restored where needed.

Turnouts with a capacity for 120 vehicles would be constructed along the road, with strategically placed barriers to reduce shoulder parking. The existing Moose Entrance Station would be removed and a new one constructed on Teton Park Road. Two observation areas with associated parking areas would be constructed along the realigned road segment, and low-impact interpretive signage would be strategically placed in the corridor.

To support the new reservation system for peak use periods, a new reservation and queuing station would be constructed at the north end of Moose-Wilson Road, and queuing areas would be constructed at the north and south ends of the road to accommodate waiting vehicles.

Parking at the Death Canyon Road junction would be improved, and restrooms would be installed. The unpaved portion of White Grass Road would be converted to a single-lane, gravel two-way road with staggered passing turnouts to provide access to the existing Death Canyon Trailhead. The unpaved section of Death Canyon Road would be removed and restored to natural conditions. A 100-car gravel parking area would be constructed at the trailhead, and connected to White Grass Road with a new road segment.

Parking for horse trailers at Poker Flats would be improved and designated only for six vehicles with horse trailers. A vault toilet would be installed at the Granite Canyon Trailhead.

Alternative D would construct a new multiuse pathway that would connect an existing pathway that terminates at the Granite Canyon Entrance Station with the pathway that lies adjacent to Teton Park Road at Moose, Wyoming. The pathway would roughly parallel the entire length of Moose-Wilson Road, with a narrow and serpentine alignment, and would follow part of Levee Road around the LSR Preserve.

Deferred Maintenance

The deferred maintenance backlog is the same for all the action alternatives. There is a total of $8.4 million of deferred maintenance for assets within the corridor. For the road, bridge, and parking assets specifically targeted by this plan, the backlog is $3.6 million. This number is included in table 6, and would be addressed by each of the action alternatives. Table 6 shows the composition of the deferred maintenance for these assets in detail.

TABLE 6. DEFERRED MAINTENANCE FOR MOOSE-WILSON CORRIDOR TRANSPORTATION ASSETS

NPS Asset Identification Number	Description	Deferred Maintenance*	DM Addressed by Plan Alternatives			
			Alt. A	Alt. B	Alt. C (NPS Preferred)	Alt. D
4330	Moose-Wilson Road	$2,846,797	$2,846,797	$2,846,797	$2,846,797	$2,846,797
35920	Death Canyon Road (Paved)	$ 250,533	$ 250,533	$ 250,533	$ 250,533	$ 250,533
35920	Death Canyon Road (Unpaved)	$ 252,623	$ 252,623	$ 252,623	$ 252,623	$ 252,623
110768	LSR Entrance Road	$ 149,363	$ 149,363	$ 149,363	$ 149,363	$ 149,363
110769	LSR Loop Parking Lot, Unpaved	$ 12,470	$ 12,470	$ 12,470	$ 12,470	$ 12,470
36067	Granite Canyon Trailhead Parking, Unpaved	$ 20,783	$ 20,783	$ 20,783	$ 20,783	$ 20,783
36567	Sawmill Ponds Parking, Unpaved	$ 22,445	$ 22,445	$ 22,445	$ 22,445	$ 22,445
4374	R – Lake Creek Bridge, RT 013P	$ 16,973	$ 16,973	$ 16,973	$ 16,973	$ 16,973
TOTAL		**$3,571,987**	**$3,571,987**	**$3,571,987**	**$3,571,987**	**$3,571,987**

*The deferred maintenance estimate for corridor transportation assets was developed via the Roads Portal on 12/9/2014. The Roads Portal acts as a bridge between road condition data developed by FHWA and the FMSS used by the National Park Service for asset management, identifying maintenance needs for NPS roads inspected by FHWA.

One-Time Nonfacility Costs

One-time nonfacility costs common to alternatives B, C, and D include $35,000 for visitor use monitoring equipment. Alternative D includes $20,000 for additional computer and telecommunications equipment required to operate the online reservation system.

ENVIRONMENTALLY PREFERABLE ALTERNATIVE

Guidance from the Council on Environmental Quality defines the environmentally preferable alternative as the alternative that causes the least damage to the biological and physical environment; it also means the alternative that best protects, preserves, and enhances historical, cultural, and natural resources" (46 *Federal Register* 18026, Q6a). It should be noted there is no requirement that the environmentally preferable alternative and the NPS preferred alternative be the same.

The National Park Service has identified alternative C as the environmentally preferable alternative. When looked at collectively across all resources, alternative C overall would best protect the corridor's natural and cultural resources by limiting new development and disturbances in the corridor, reducing the existing development footprint, providing some restoration of natural hydrological processes, and carefully managing traffic levels. Although alternative C does not include the realignment of Moose-Wilson Road from Sawmill Ponds to the Death Canyon Road junction, which under alternatives B and D would improve conditions for wildlife (including grizzly bears), hydrology, and wetlands, alternative C would avoid significant adverse impacts on major archeological resources in the Moose-Wilson corridor. Alternative D would provide for more recreational amenities yet place less emphasis on natural and cultural resource protection than alternatives B and C as a result of constructing a separate multiuse pathway. All of the action alternatives would provide a more comprehensive approach than the no-action alternative in protecting resources and addressing resource impacts, including impacts due to increasing levels of traffic, off-road vehicle parking, parking outside designated parking areas, and the physical characteristics and location of the existing Moose-Wilson Road.

Alternative C would result in some resource impacts in a few localized areas such as the loss of vegetation due to construction of the new northern road alignment and the new Death Canyon parking area and reconstruction of the road between Sawmill Ponds and the Death Canyon Road junction. The alternative would substantially reduce negative impacts on natural and cultural resources in several ways. The sequenced traffic management system would limit the potential increase in traffic and visitor use volumes that would likely otherwise occur, reducing potential impacts on soils, vegetation, wetlands, and wildlife, including grizzly bears and other listed species. Reducing traffic volume and congestion would also preserve the rustic and rural character of the historic road and its cultural landscape. The reduction in traffic speeds would reduce the potential for wildlife-vehicle collisions. Paving the unpaved portion of Moose-Wilson Road would eliminate impacts from dust and magnesium chloride applications on roadside vegetation. Realigning the northernmost segment of Moose-Wilson Road would reduce habitat fragmentation and create a more intact wildlife corridor near Moose. Reconstruction of parts of the road alignment south of the Sawmill Ponds to Death Canyon Road would improve drainage and the hydrology of this area and improve conditions of the large wetland complex downstream from the road. Installing officially designated roadside turnouts and design solutions to reduce off-road parking would reduce roadside soil, vegetation, and cultural resource impacts, and may lessen wildlife impacts. Relocating the Death Canyon Trailhead parking area would eliminate damage to adjacent vegetation due to extensive off-road parking, though it would result in vegetation removal to construct the new parking lot. Relocating this parking area and converting one mile of the existing Death Canyon Road to a trail also would result in the restoration of some native vegetation and reduce overall habitat fragmentation in the corridor, which would benefit wildlife.

CONSISTENCY OF THE ALTERNATIVES WITH THE NATIONAL ENVIRONMENTAL POLICY ACT SECTION 101(B)

The National Environmental Policy Act of 1969, as amended, requires an analysis of how each alternative meets or achieves the purposes of the act, as stated in section 101(b). Each alternative analyzed in a NEPA document must be assessed as to how it meets the following purposes:

1. Fulfill the responsibilities of each generation as trustee of the environment for succeeding generations.
2. Assure for all Americans safe, healthful, productive, and aesthetically and culturally pleasing surroundings.
3. Attain the widest range of beneficial uses of the environment without degradation, risk to health or safety, or other undesirable and unintended consequences.
4. Preserve important historic, cultural, and natural aspects of our national heritage, and maintain, wherever possible, an environment that supports diversity and variety of individual choice.
5. Achieve a balance between population and resource use that would permit high standards of living and a wide sharing of life's amenities.
6. Enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources.

The Council on Environmental Quality has promulgated regulations for implementation of the National Environmental Policy Act (40 CFR Parts 1500–1508) by federal agencies. Section 1500.2 states that federal agencies shall, to the fullest extent possible, interpret and administer the policies, regulations, and public laws of the United States in accordance with the policies set forth in the act (sections 101(b) and 102(1)); therefore, other acts and NPS *Management Policies 2006* are referenced, where applicable, in the following discussion.

CRITERION 1: FULFILL THE RESPONSIBILITIES OF EACH GENERATION AS TRUSTEE OF THE ENVIRONMENT FOR SUCCEEDING GENERATIONS

The four alternatives meet this criterion to varying degrees. Under alternative A, the no-action alternative, increasing traffic and use levels would be expected. Increased impacts on both natural resources (e.g., vegetation, soils, grizzly bears and other wildlife) and cultural resources (e.g., archeological resources) would likely occur. Although park managers would take management actions to mitigate these impacts, the potential for resources to be damaged or lost would be higher in this alternative. Thus, alternative A would not meet criterion 1 as well as the other action alternatives over time.

Alternative B would take several actions to address continuing resource impacts in the corridor. Instituting such actions as paving the unpaved section of Moose-Wilson Road, rerouting two portions of Moose-Wilson Road, establishing turnoffs, and limiting the potential increase in traffic would beneficially affect many of the corridor's natural resources, including hydrology, wetlands, grizzly bears, and other wildlife. These resources would receive greater protection over the long term than they do now. But the new developments in the alternative, primarily the rerouting of the two segments of Moose-Wilson Road, would also result in the permanent loss and alteration of soil and natural vegetation. In addition, even with mitigation, the road realignments and the new developments in the LSR Preserve in alternative B would result in an adverse impact to archeological and ethnographic resources, as well as a loss in integrity of the historic Moose-Wilson Road alignment. Thus, alternative B would fulfil criterion 1 for some resources, but not for others.

Of all the alternatives, alternative C would best meet this criterion. Under alternative C actions such as paving the unpaved section of Moose-Wilson Road, rerouting the northern portion and reconstructing part of Moose-Wilson Road, establishing turnoffs, and limiting the potential increase in traffic, would beneficially affect many of the corridor's natural resources, reducing adverse impacts on soil, vegetation, hydrology, and wildlife (although not to the same degree for resources like hydrology, grizzly bears, and other wildlife as would occur under alternative B). Most importantly, alternative C would not result in adverse impacts on important cultural and ethnographic resources in the corridor and in fewer impacts on the integrity of the historic road than the other action alternatives.

Alternative D would have many of the same beneficial and adverse impacts as alternative B. However, the development and use of the multiuse pathway would result in additional long-term adverse natural and cultural resource impacts, including adverse impacts on soils, vegetation, wildlife, and grizzly bears. Consequently, although alternative D would fulfil criterion 1 for some resources in the corridor, it also would have the potential to result in more resource damage and degradation than alternative B.

CRITERION 2: ASSURE FOR ALL AMERICANS SAFE, HEALTHFUL, PRODUCTIVE, AND AESTHETICALLY AND CULTURALLY PLEASING SURROUNDINGS

Under all alternatives, including the no-action alternative, the National Park Service would strive to provide for safe, healthful, productive, and aesthetically and culturally pleasing surroundings. It is important to note that judgment about whether or not surroundings are "aesthetically and culturally pleasing" is subjective. As such, surroundings that are pleasing to one person may not be pleasing to another person. Therefore, park managers aim to provide appropriate experiences that can effectively meet a broad spectrum of visitor interests and expectations (that is, for "all Americans") without adversely affecting the corridor's fundamental and other important resources and values.

Under all of the alternatives, visitors would continue to be able to pursue a variety of recreational activities. Many opportunities would continue to be provided for visitors to enjoy the corridor and its resources. All of the proposed developments in alternatives B, C, and D would be designed so they are aesthetically pleasing. Additional information would be provided to visitors before they come to the corridor to increase their awareness of what to expect in the area and to provide opportunities for self-discovery. Although the three action alternatives would manage the volume of traffic entering the corridor in differing ways, there still would be opportunities for visitors to enter the corridor at different times. In addition, these alternatives would reduce congestion and alleviate crowding during peak times, which would reduce user conflicts and provide a better overall experience for visitors.

CRITERION 3: ATTAIN THE WIDEST RANGE OF BENEFICIAL USES OF THE ENVIRONMENT WITHOUT DEGRADATION, RISK TO HEALTH OR SAFETY, OR OTHER UNDESIRABLE AND UNINTENDED CONSEQUENCES

All of the alternatives would provide a wide range of high-quality recreation opportunities while also providing resource protection. Under all of the alternatives, monitoring the road would ensure visitor safety and avoid undesirable and unintended consequences.

The use of road closures when grizzly bears are present and continuing use of the park staff to manage visitors would avoid potential safety risks under all of the alternatives. However, some potential would remain in all of the alternatives to have human-wildlife interactions that pose a risk to human health and safety.

Alternative A would pose a higher risk to visitor health and safety than the other alternatives. Under alternative A, increased numbers of vehicles would intensify congestion on the road, posing higher safety risks for visitors due to the increased potential for vehicle accidents. There would also continue to be the potential for bicycle-vehicle incidents along the road.

Several actions in alternatives B, C, and D would improve visitor safety. A reduction in road congestion by use of the different traffic management strategies and the designation of official turnouts under the three alternatives would improve safety conditions, decreasing the potential for vehicle accidents. Providing visitors with increased information before they enter the corridor would increase awareness of potential risk factors for visitors, and thus reduce the potential for safety issues occurring. Reductions in speed limits in alternatives B and C would make wildlife-vehicle collisions less likely and improve safety for vehicles and bicyclists. Adding a “safety edge” to the road in alternatives B and C would provide a minor improvement to safety for bicyclists. The new road alignment from Sawmill Ponds to Death Canyon Road in alternatives B and D would also decrease the likelihood of visitor-wildlife interactions and improve sight lines for drivers, thus improving visitor safety. The multiuse pathway in alternative D would both benefit and increase safety risks for visitors: the multiuse pathway would separate bicyclists from vehicles (except at road crossings), largely eliminating the potential for bicycle-vehicle collisions, and thus increasing safety for both bicyclists and motor vehicles. But the pathway would also increase the potential for wildlife-bicyclist interactions, such as with grizzly bears, which would increase the risk of injury to visitors.

CRITERION 4: PRESERVE IMPORTANT HISTORIC, CULTURAL, AND NATURAL ASPECTS OF OUR NATIONAL HERITAGE; AND MAINTAIN, WHEREVER POSSIBLE, AN ENVIRONMENT THAT SUPPORTS DIVERSITY AND A VARIETY OF INDIVIDUAL CHOICES

All of the alternatives support a diversity and variety of individual choices and opportunities, providing a mix of recreational activities, both self-directed and guided, in summer and winter. Although alternatives B, C, and D would increase management of traffic flows during peak use periods, there would continue to be a variety of opportunities for visitors to enjoy the corridor at different times during the year.

Under all of the alternatives, park managers would strive to continue to protect important historic, cultural, and natural resources in the corridor as required by law and NPS policy. In addition, mitigation measures common to all action alternatives would be implemented to minimize adverse effects to resources. Differing actions in the alternatives, such as realignment of portions of Moose-Wilson Road in alternatives B, C, and D, and establishment of designated turnouts along the road, would improve natural resource protection. All the alternatives to varying degrees would still result in the localized loss or disturbance of natural and cultural resources in the corridor. In addition, as noted under criterion 1, the road realignments and the new developments in the LSR Preserve under alternatives B and D would result in adverse impacts on important archeological and ethnographic resources, as well as a loss of integrity in the historic Moose-Wilson Road alignment.

CRITERION 5: ACHIEVE A BALANCE BETWEEN POPULATION AND RESOURCE USE THAT WOULD PERMIT HIGH STANDARDS OF LIVING AND A WIDE SHARING OF LIFE'S AMENITIES

All of the alternatives provide a balance between providing opportunities for recreational use of the Moose-Wilson corridor while also protecting resources. Visitors in all of the alternatives would be able to find high-quality recreational opportunities in the corridor, but in different areas and at different times depending on the alternative, which would contribute to a high standard of living.

CRITERION 6: ENHANCE THE QUALITY OF RENEWABLE RESOURCES AND APPROACH THE MAXIMUM ATTAINABLE RECYCLING OF DEPLETABLE RESOURCES

In accordance with NPS *Management Policies 2006*, all action alternatives incorporate measures to ensure actions are conducted in an environmentally responsible and sustainable manner. Conservation and recycling of resources is encouraged throughout the National Park Service and, therefore, would be implemented under any alternative.

ALTERNATIVES CONSIDERED BUT DISMISSED FROM FURTHER ANALYSIS

While developing each alternative, it became evident that certain alternative concepts or strategies were not appropriate to fully analyze in the environmental impact statement. Certain alternatives can sometimes be considered but eliminated from further study for a variety of reasons. Eliminated alternatives should be limited to those that were initially thought to be viable or suggested by the public, but later dismissed. According to the NPS Director's Order 12 Handbook, reasons to eliminate alternatives include:

- technical or economic infeasibility
- inability to meet project objectives or resolve need
- duplication with other, less environmentally damaging or less expensive alternatives
- conflict with an up-to-date and valid park plan, statement of purpose and significance, or other policy, such that a major change in the plan or policy would need to be implemented
- too great an environmental impact

Table 7 provides a brief description of alternative strategies that were considered but dismissed from detailed analysis, along with the applicable Director's Order 12 criteria and rationale.

TABLE 7. ALTERNATIVES CONSIDERED BUT DISMISSED FROM FURTHER ANALYSIS

Description of Alternative or Action	Applicable DO 12 Criteria	Rationale for Dismissal
Some commenters suggested a one-way traffic option be considered to reduce traffic congestion on Moose-Wilson Road.	Duplication with other, less environmentally damaging or less expensive alternatives Inability to meet project objectives or resolve need	A one-way traffic option was included in the park's 2007 Transportation Management Plan. This adaptive management approach was considered technically feasible with the stipulation that two-way traffic would be maintained from Moose to the LSR Preserve and from the Granite Canyon Entrance Station to the Granite Canyon Trailhead and considerations for emergency and in-holder traffic would be developed. A one-way traffic option was dismissed from further analysis because it is duplicative with similar traffic management strategies described in the action alternatives. However, unlike the one-way option, these other traffic management strategies are designed to maintain traffic volumes at or near current condition to ensure high-quality visitor experiences in the future. A one-way option would not manage the number of vehicles in the corridor, only the direction they travel. One-way traffic would also limit access from park headquarters to or from the corridor, resulting in slower response times during emergency situations. If one-way traffic was established from south to north through the corridor, it would require traveling

TABLE 7. ALTERNATIVES CONSIDERED BUT DISMISSED FROM FURTHER ANALYSIS

Description of Alternative or Action	Applicable DO 12 Criteria	Rationale for Dismissal
		25 miles from park headquarters to reach the Granite Canyon Entrance (via Spring Gulch Road). When compared to traveling 7 miles directly from park headquarters to the Granite Canyon Entrance via Moose-Wilson Road, this would add an additional 18 miles to the trip. In a life-threatening emergency, this additional travel time would be prohibitive. Due to the narrow, winding nature of Moose-Wilson Road, it would be difficult for emergency vehicles to effectively travel against the grain of one-way traffic to reach a destination within the corridor. A one-way traffic option would affect the park's ability to meet the project's objective associated with providing a safe visitor experience within the corridor.
Some commenters suggested bike lanes on Moose-Wilson Road be considered to enhance biking opportunities and visitor safety.	Inability to meet project objectives or resolve need	Bike lanes would require extensive widening and striping of Moose-Wilson Road, which would affect the rustic, narrow, winding, slow driving experience and the historic character of the road. These changes would affect the park's ability to meet the project's objective associated with preserving the historic character of the corridor.
Some commenters suggested retaining the old roadbed for public use if Moose-Wilson Road is realigned.	Too great of an environmental impact	The purpose of realigning the road is to address undesirable human-wildlife encounters, restore wetland functions, and improve wildlife habitat connectivity in an area of the corridor that receives high concentrations of wildlife use. Without restoring the old roadway to natural conditions, the benefits of realigning the road would be lost.
Some commenters suggested realigning the entire Moose-Wilson Road in the sage flats to the east to improve traffic flow and avoid sensitive habitats. Other commenters suggested realigning the northern portion of Moose-Wilson Road on the higher bench to the west through the forested area.	Too great of an environmental impact Inability to meet project objectives or resolve need	Realigning the entire road would result in a substantial loss of the road's historic character, which would be too great of an environmental impact. This change would affect the park's ability to meet the project's objectives associated with preserving the historic character of the corridor. A partial realignment of the road is considered in the range of alternatives because the degree of change is more localized and is designed to reduce ongoing impacts on other significant park resources within the corridor, specifically rare ecological communities and wildlife in the vicinity of the beaver ponds. A partial realignment of Moose-Wilson Road on the higher bench to the west was dismissed from further analysis because the new road development and resulting motorized use would adversely impact the park's recommended wilderness area.

TABLE 7. ALTERNATIVES CONSIDERED BUT DISMISSED FROM FURTHER ANALYSIS

Description of Alternative or Action	Applicable DO 12 Criteria	Rationale for Dismissal
Commenters suggested a variety of different options for either temporarily or permanently closing Moose-Wilson Road to vehicles. Some commenters suggested closing the road entirely to vehicles to create a nonmotorized path out of the old road; closing the road at the Granite Entrance Station with a turnaround; closing the middle section of the road from Death Canyon to Sawmill Ponds; or closing the road at night to avoid wildlife disturbances. Others suggested converting the entire road to gravel or charging a Moose-Wilson-specific toll to reduce commuting traffic.	Duplication with other, less environmentally damaging or less expensive alternatives Inability to meet project objectives or resolve need	The planning team considered a range of ideas suggested by the public for improving traffic management along Moose-Wilson Road. In the end, the team chose to carry forward a variety of practical traffic management options that would be the least intrusive to park visitors. Traffic management ideas that were not carried forward were dismissed because they are variations to many of the traffic management options presented in the range of alternatives, yet they would likely result in greater disruption to most visitors (such as permanently closing the entire road or a portion of the road to vehicles). Closing the road at night to avoid wildlife disturbances was dismissed because it would not resolve a need identified in the plan. Traffic volumes are generally low at nighttime and not considered to be an issue affecting wildlife that the plan needs to address. Converting the entire Moose-Wilson Road to gravel was dismissed as an option to reduce commuting traffic, because a portion of the road is currently gravel and it has not had the effect of reducing commuting traffic. In fact, traffic in general has increased notably in recent years despite the existing gravel portion of the road. Charging a Moose-Wilson-specific toll to reduce commuting traffic was dismissed because a toll for commuters would not fulfill the stated purpose of the park. Rather, it may be perceived as formalizing a use for which the park was not established.

SUMMARY TABLES

SUMMARY OF KEY DIFFERENCES AMONG THE ALTERNATIVES

Table 8 provides a summary of key differences among the alternatives. The table is organized by the following management topics:

- Concept Statement
- Key Elements
- Traffic Management Along Moose-Wilson Road
- Physical Characteristics of Moose-Wilson Road
- Moose-Wilson Road Realignments
- Turnouts and Parking
- Bicycle Use
- Commercial Activity
- Death Canyon
- Winter Access and Use
- Visitor Use and Experience / Education and Interpretation
- Horse Use

TABLE 8. SUMMARY OF KEY DIFFERENCES AMONG THE ALTERNATIVES

	Alternative A (No Action)	Alternative B	Alternative C (NPS Preferred Alternative)	Alternative D
Concept	This alternative represents the continuation of current management practices related to natural and cultural resources, visitor use, traffic and transportation, operations, and maintenance of roads, trails, and facilities within the Moose-Wilson corridor.	This concept emphasizes the corridor as a visitor destination. Reduced crowding on Moose-Wilson Road and at destinations within the corridor would provide visitors an opportunity for self-discovery. Existing developed areas and facilities would be maintained where appropriate and removed or relocated in some areas to protect natural and cultural resources.	The emphasis of this concept is to be a model for the balance of preservation and public use and enjoyment by exemplifying the conservation legacies within the corridor. The alternative would manage the intensity and timing of visitor use to effectively provide high-quality visitor opportunities. Development within the corridor would generally be maintained within the existing development footprint. The sense of discovery would predominate in this outstanding and diverse natural ecosystem and cultural history area.	The emphasis of this concept is to integrate the Moose-Wilson area with the broader park experience and link it to the region's larger recreational network. Park management would focus on ways to connect people with resources and promote understanding, enjoyment, preservation, and health. To enhance the recreational scenic driving experience, strategies would be used to reduce traffic congestion. Visitors would be provided with opportunities to leave their vehicles and experience the outstanding natural and cultural landscapes. Additional developments and concentrated visitor use in the corridor would be located in focused areas.
Key Elements	1. Please note the following description of the no-action alternative is only a subset of current management practices. It is used to compare specific management strategies that are proposed in the action alternatives.	1. Realign two segments of the northern portion of Moose-Wilson Road to address congestion associated with the presence of wildlife, wildlife habitat connectivity, and operational issues. 2. Reconstruct and pave the existing, unpaved portion of Moose-Wilson Road, but retain the current road alignment. The width of this newly paved segment would be narrowed to be consistent with other existing paved portions of the road. 3. Address increases in traffic and volume-related congestion by restricting through-traffic in either direction beyond the LSR Preserve Center during peak use periods. This would be accomplished by reconfiguring access to and parking at the LSR Preserve and installing a gate to prevent through-traffic at certain established peak hours during the peak season, thereby encouraging use of the road only as a means for visiting destinations within the corridor at those times. Through-travel by bicycles would not be affected, and the road would continue to be open to motor vehicle through-traffic at all other times.	1. Realign the northernmost 0.6-mile section of Moose-Wilson Road to address wildlife habitat connectivity and operational issues. The segment between Sawmill Ponds Overlook and the Death Canyon Road junction would be retained in its existing alignment. The portion of the road adjacent to wetlands would be reconstructed to correct drainage issues and improve road conditions. Wildlife safety mitigation measures would be included in the design of the road reconstruction. 2. Reconstruct and pave the existing, unpaved portion of Moose-Wilson Road, but retain the current road alignment. The width of this newly paved road segment would be narrowed to be consistent with other existing paved portions of the road. 3. Address increases in traffic and volume-related congestion on Moose-Wilson Road by limiting the number of vehicles entering the corridor at any one time during peak use periods through timed sequencing techniques. Provide queuing lanes on the north and south ends of the corridor, as needed. If additional traffic management measures are needed in the future, a corridor reservation system or transit system may be considered.	1. Realign two segments of the northern portion of Moose-Wilson Road to address congestion associated with the presence of wildlife, wildlife habitat connectivity, and operational issues. 2. Construct a multiuse pathway parallel to Moose-Wilson Road between Moose and the Granite Canyon Entrance (please refer to map for general alignment). 3. Address increases in traffic and volume-related congestion on Moose-Wilson Road by establishing a reservation system during peak use periods. Visitors without reservations would be accommodated on a space available, first-come, first-served basis.
Traffic Management Along Moose-Wilson Road	The road would continue to provide two-way travel between the Moose and Granite Canyon Entrances in the same manner as the existing conditions. Moose-Wilson Road would be open to motor vehicle use from early/mid-May through October 31.	Provide traveler alerts before entrances to inform visitors of potential traffic congestion, full parking lots, and wait times, and give them the opportunity to choose an alternate route before entering the corridor. These alerts would be planned and coordinated with the Wyoming Department of Transportation and other stakeholder agencies as appropriate. Moose-Wilson Road would be open to motor vehicles on or about May 15 through October 31. Reduce the speed limit along Moose-Wilson Road to 20 mph to improve safety for motor vehicles, bicyclists, and wildlife. This would be achieved through management actions such as proactive education at entrances, signage, and enforcement techniques. *Adaptive Strategy:* Address increases in traffic and volume-related congestion by restricting through-traffic in either direction beyond the LSR Preserve Center during peak use periods. This would be accomplished by reconfiguring access to and parking at the LSR Preserve, and installing a gate to prevent through-traffic at certain established peak hours during the peak season, thereby encouraging use of the road only as a means for visiting destinations within the corridor at those times. Through-travel by bicycles would not be affected, and the road would continue to be open to motor vehicle through-traffic at all other times.	Provide traveler alerts before entrances to inform visitors of potential traffic congestion, full parking lots, and wait times, and give them the opportunity to choose an alternate route before entering the corridor. These alerts would be planned and coordinated with the Wyoming Department of Transportation and other stakeholder agencies as appropriate. Moose-Wilson Road would be open to motor vehicles on or about May 15 through October 31. Reduce speed limit along Moose-Wilson Road to 20 mph to improve safety for motor vehicles, bicyclists, and wildlife. This would be achieved through management actions such as proactive education at entrances, signage, and enforcement techniques. *Adaptive Strategy:* Address increases in traffic and volume-related congestion on Moose-Wilson Road by limiting the number of vehicles entering the corridor at any one time during peak use periods using timed sequencing techniques. Provide queuing lanes on the north and south ends of the corridor. If additional traffic management measures are needed in the future, a corridor reservation system or transit system may be considered. Bicycle use currently represents a small percentage of visitation to the corridor and would therefore be permitted to bypass the queuing lanes. If monitoring associated with indicators and thresholds demonstrates an increase in impacts on visitor experience or resources in the corridor due to bicycle use, management actions would be taken to manage the number of bicycles entering the corridor in a similar manner to vehicles.	Provide traveler alerts before entrances to inform visitors of potential traffic congestion, full parking lots, and wait times, and give them the opportunity to choose an alternate route before entering the corridor. These alerts would be planned and coordinated with the Wyoming Department of Transportation and other stakeholder agencies as appropriate. Moose-Wilson Road would be open to motor vehicles on or about May 15 through October 31. *Adaptive Strategy:* Address increases in traffic and volume-related congestion on Moose-Wilson Road by establishing a reservation system during peak use periods. Visitors without reservations would be accommodated on a space available, first-come, first-served basis. Bicycle use currently represents a small percentage of visitation to the corridor and would therefore be permitted to bypass the reservation lanes. If monitoring associated with indicators and thresholds demonstrates an increase in impacts on visitor experience or resources in the corridor due to bicycle use, management actions would be taken to manage the number of bicycles entering the corridor in a similar manner to vehicles.

TABLE 8. SUMMARY OF KEY DIFFERENCES AMONG THE ALTERNATIVES

	Alternative A (No Action)	Alternative B	Alternative C (NPS Preferred Alternative)	Alternative D
Physical Characteristics of Moose-Wilson Road	The unpaved portion of the road would remain unpaved.	Reconstruct and pave the existing, unpaved portion of Moose-Wilson Road, but retain the approximate current road alignment. The width of this newly paved segment would be narrowed to be consistent with other existing paved portions of the road. Repair and resurface existing paved portions of Moose-Wilson Road. Develop Moose-Wilson corridor design standards and apply to design and maintenance of roads, parking areas, turnouts, etc., in the corridor (also see "Turnouts and Parking"). Address road drop-off by incorporating a "safety edge" to improve the edge of the pavement and allow errant vehicles (motorized and nonmotorized) to safely return to the road.	Reconstruct and pave the existing, unpaved portion of Moose-Wilson Road, but retain the approximate current road alignment. The width of this newly paved segment would be narrowed to be consistent with other existing paved portions of the road. Repair and resurface existing paved portions of Moose-Wilson Road. Develop Moose-Wilson corridor design standards and apply to design and maintenance of roads, parking areas, turnouts, etc., in the corridor (also see "Turnouts and Parking"). Address road drop-off by incorporating a "safety edge" to improve the edge of the pavement and allow errant vehicles (motorized and nonmotorized) to safely return to the road.	Repair and resurface the paved and gravel portions of Moose-Wilson Road. The unpaved section of the road would remain unpaved and would be graded and treated for dust abatement several times per year. Develop Moose-Wilson corridor design standards and apply to design and maintenance of roads, parking areas, turnouts, etc., in the corridor (also see "Turnouts and Parking").
Moose-Wilson Road Realignments	The road would be retained in its existing alignment and width.	Two segments of the northern portion of Moose-Wilson Road would be realigned to address congestion associated with the presence of wildlife, wildlife habitat connectivity, and operational issues. The new road segments would be constructed to emulate the slow-speed, narrow, winding character of the road corridor. • The 0.6-mile section of roadway between Murie Ranch Road and the base of the hill near Sawmill Ponds would be abandoned and a new segment would be constructed to intersect with Teton Park Road at its junction with Chapel of the Transfiguration Road. • The segment between Sawmill Ponds Overlook and the Death Canyon Road junction would be realigned to the east of the beaver ponds to restore wetland functions and habitat connectivity. The old roadway would be removed and restored to natural conditions.	The northernmost segment of Moose-Wilson Road would be realigned to address wildlife habitat connectivity and operational issues. The 0.6-mile section of roadway between Murie Ranch Road and the base of the hill near Sawmill Ponds would be abandoned and restored to natural conditions. A new road segment would be constructed to intersect with Teton Park Road at its junction with Chapel of the Transfiguration Road. The new road segment would be constructed to emulate the slow-speed, narrow, winding character of the road corridor. The segment between Sawmill Ponds Overlook and the Death Canyon Road junction would be mostly retained in its existing alignment. The portion of the road adjacent to wetlands would be reconstructed to correct drainage issues and improve road conditions. Some minor alignment changes may be necessary to accommodate the wetlands, wildlife, and vegetation concerns. Wildlife safety mitigation measures would be included in the design of the road reconstruction. This may include slight modifications to road alignment, visibility, and vegetation setbacks (without creating conditions that would encourage drivers to accelerate through the area). All available and emerging management techniques would be used to reduce undesirable human-wildlife encounters, particularly during wildlife high-use periods (September through October). This may include the need for additional temporary road closures and increased use of the park's Wildlife Brigade staffing.	Two segments of the northern portion of Moose-Wilson Road would be realigned to address congestion associated with the presence of wildlife, wildlife habitat connectivity, and operational issues. The new road segments would be constructed to emulate the slow-speed, narrow, winding character of the road. • The 0.6-mile section of roadway between Murie Ranch Road and the base of the hill near Sawmill Ponds would be abandoned and a new segment constructed to intersect with Teton Park Road at its junction with the Chapel of the Transfiguration Road. • The segment between Sawmill Ponds Overlook and the Death Canyon Road junction would be realigned to the east of the beaver ponds to restore wetland functions and habitat connectivity. The old roadway would be removed and restored to natural conditions.
Turnouts and Parking	Parking lots and visitor-created roadside turnouts would generally remain their current size and the same locations. Changes would be addressed on a case-by-case basis.	Apply design solutions to roadside parking that would reduce resource impacts from unofficial off-road parking. Signage, physical barriers, or other means would be strategically placed along the corridor to deter visitors from parking in undesignated areas. Install officially designated parking turnouts along Moose-Wilson Road that are strategically placed and clearly defined to accommodate up to 120 vehicles (similar to the current condition of parking demand). Each turnout would be designed and sized to accommodate between one and three vehicles. Develop Moose-Wilson corridor design standards and apply to design and maintenance of roads, parking areas, turnouts, etc., in the corridor (also see "Physical Characteristics of Moose-Wilson Road"). Increase the use of park staff and volunteers to assist in maintaining traffic flow and parking management during wildlife activity periods. Reconfigure the access and parking at LSR Preserve to prevent through-traffic at certain peak periods when necessary to alleviate congestion.	Apply design solutions to roadside parking that would reduce resource impacts from unofficial off-road parking. Signage, physical barriers, or other means would be strategically placed along the corridor to deter visitors from parking in undesignated areas. Install officially designated parking turnouts along Moose-Wilson Road that are strategically placed and clearly defined to accommodate up to 120 vehicles (similar to the current condition of parking demand). Each turnout would be designed and sized to accommodate between one and three vehicles. Develop Moose-Wilson corridor design standards and apply to design and maintenance of roads, parking areas, turnouts, etc., in the corridor (also see "Physical Characteristics of Moose-Wilson Road"). Increase the use of park staff and volunteers to assist in maintaining traffic flow and parking management during wildlife activity periods. Install vault toilet at Granite Canyon Trailhead within the existing disturbed area. Additional vault toilets may be installed at both the north and south corridor entrances, as needed.	Apply design solutions to roadside parking that would reduce resource impacts from unofficial off-road parking. Signage, physical barriers, or other means would be strategically placed along the corridor to deter visitors from parking in undesignated areas. Install officially designated parking turnouts along Moose-Wilson Road that are strategically placed and clearly defined to accommodate up to 120 vehicles (similar to the current condition of parking demand). Each turnout would be designed and sized to accommodate between one and three vehicles. Develop Moose-Wilson corridor design standards and apply to design and maintenance of roads, parking areas, turnouts, etc., in the corridor (also see "Physical Characteristics of Moose-Wilson Road"). Increase the use of park staff and volunteers to assist in maintaining traffic flow and parking management during wildlife activity periods. Install vault toilet at Sawmill Ponds Overlook and Granite Canyon Trailhead within the existing disturbed area.

TABLE 8. SUMMARY OF KEY DIFFERENCES AMONG THE ALTERNATIVES

	Alternative A (No Action)	Alternative B	Alternative C (NPS Preferred Alternative)	Alternative D
Bicycle Use	Bicycles would continue to be allowed on roads and parking areas and not allowed on trails. During seasonal periods when the road is closed to motor vehicles, bicycles would continue to be permitted to use the road when it is free of snow and ice.	During seasonal periods when the road is closed to motor vehicles, bicycles would be permitted to use the road when it is free of snow and ice. Bicycles would continue to share Moose-Wilson Road with motor vehicles. The restriction on through-traffic that would apply to motor vehicles during peak use periods would not apply to bicycles. Facilitate the transition from the existing multiuse pathways on the south and north ends of the corridor. Reduce speed limit along Moose-Wilson Road to 20 mph to improve bicyclist safety (also see "Traffic Management"). Provide road markers and/or signage that orient and safely guide bicyclists through the corridor. Provide an appropriate number of bike racks at destination points in the corridor.	During seasonal periods when the road is closed to motor vehicles, bicycles would be permitted to use the road when it is free of snow and ice. Bicycles would continue to share Moose-Wilson Road with motor vehicles. If monitoring associated with indicators and thresholds demonstrates an increase in impacts on visitor experience or resources in the corridor due to bicycle use, the number of bicycles entering the corridor would be managed in a similar manner as vehicles through timed sequencing techniques. Pave unpaved portion of Moose-Wilson Road to improve biking safety and enhance visitor experience in this segment (also see "Physical Characteristics of Moose-Wilson Road"). Facilitate the transition from the existing multiuse pathways on the south and north ends of the corridor. Reduce speed limit along Moose-Wilson Road to 20 mph to improve bicyclist safety (also see Traffic Management). Provide road markers and/or signage that orient and safely guide bicyclists through the corridor. Provide an appropriate number of bike racks at destination points in the corridor.	Construct a multiuse pathway parallel to Moose-Wilson Road between Moose and the Granite Canyon Entrance (please refer to map for general alignment). If monitoring associated with indicators and thresholds demonstrates an increase in impacts on visitor experience or resources in the corridor due to bicycle use, the number of bicycles entering the corridor would be managed in a similar manner as vehicles through a reservation system. Provide signage that orients bicyclists to the corridor. Provide an appropriate number of bike racks at destination points in the corridor. During the winter, bicycles would only be permitted to use the pathway when it is free of snow and ice. The multiuse pathway would be closed from sunset to sunrise (or provide specific hours) daily and during wildlife-related temporary closures. No special events would be permitted on the pathway.
Commercial Activity	Current commercial visitor services within the corridor would continue to be permitted. Park-authorized road-based tours and photography workshops would continue. Guided horseback riding in the Moose-Wilson corridor would continue at current use levels and on currently authorized trails. Guided skiing and snowshoeing would continue under current use limits.	Commercial visitor services in the corridor would include: A limited number of resource-focused, corridor-specific, road-based tours (limited either by the number of operators or the number of trips) would be permitted within the corridor. Corridor-specific, resource-based interpretation would be required. Learning-focused commercial visitor activities, such as photography workshops, could be permitted. Limit group size according to current Moose-Wilson Road vehicle size restrictions. Caravans would not be allowed. Tours would continue to operate when the gate is closed at the LSR Preserve, with the same travel limits that apply to noncommercial visitors. Guided horseback riding in the Moose-Wilson corridor would continue at current use levels on designated horse trails. Guided skiing and snowshoeing would continue at current use levels (a five-year average taken from 2012–16) and would be limited to locations deemed appropriate.	Commercial visitor services in the corridor would include: Road-based tours would be permitted within the corridor. These tours would not be limited in number, but would be subjected to the same corridor capacity limit during peak use periods that apply to noncommercial visitors. Tours would include a broad array of interpretive topics. Learning-focused commercial visitor activities, such as photography workshops, could be permitted but limited to numbers based on current corridor capacity. Limit group size according to current Moose-Wilson Road vehicle size restrictions. Caravans would not be allowed. Guided horseback riding in the Moose-Wilson corridor would continue at current use levels on designated horse trails. Guided skiing and snowshoeing would continue at current use levels (a five-year average taken from 2012–16) and would be limited to locations deemed appropriate.	Commercial visitor services in the corridor would include: Road-based tours would be permitted through a limited number of operators. These trips would have an allocation should a reservation system be implemented. Interpretation would be required, but could include a broad array of interpretive topics. Additional activity or learning-focused commercial visitor activities, such as photography workshops, could be permitted but limited to numbers based on current corridor capacity. Road-based tours would be given priority access (an allocation within the reservation system) and would be required to provide trips in a manner that promotes access of the road to the greatest number of visitors; this may occur through higher occupancy vehicles, trips that avoid crowded destinations in the corridor, or other configurations. Limit group size according to current Moose-Wilson Road vehicle size restrictions. Caravans would not be allowed. Guided horseback riding in the Moose-Wilson corridor would continue at current use levels on designated horse trails. Additional guided ski and snowshoe tours on the groomed road would be considered. Guided skiing and snowshoeing could be increased above current use levels (a five-year average taken from 2012–16) and would be limited to locations deemed appropriate. Guided bicycle tours on the new pathway would be considered.

TABLE 8. SUMMARY OF KEY DIFFERENCES AMONG THE ALTERNATIVES

	Alternative A (No Action)	Alternative B	Alternative C (NPS Preferred Alternative)	Alternative D
		Taxis and all other nonpark-dependent commercial traffic would be prohibited in the corridor. Shuttle services could be authorized by park management provided that the number of visitors accessing the corridor via shuttles is allocated based on current corridor capacity. Other Activities: Special events, such as bike events and site-specific special events, would be prohibited in the corridor, with the exception of park-administered events.	Taxis and all other nonpark-dependent commercial traffic would be prohibited in the corridor. Shuttle services could be authorized by park management provided that the number of visitors accessing the corridor via shuttles is allocated based on current corridor capacity. Other Activities: Special events, such as bike events and site-specific special events, would be prohibited in the corridor, with the exception of park-administered events.	Taxis would be allowed to provide transportation service to and from locations in the corridor with appropriate permits. All other nonpark-dependent commercial traffic would be prohibited. Shuttle services could be authorized by park management provided that the number of visitors accessing the corridor via shuttles is allocated based on current corridor capacity. Other Activities: Special events, such as bike events and site-specific special events, would typically be prohibited in the corridor, with the exception of park-administered events.
Death Canyon	The unpaved section of the road would be maintained to current standards. The road would continue to be signed as four-wheel-drive recommended. The trailhead parking area would be maintained in its current configuration. Visitors would continue to be allowed to park in user-created parking areas along the unpaved portion of the road.	Death Canyon Trailhead would be relocated to a site near White Grass Ranch, approximately 0.4 mile from its current location. A parking lot would be provided for up to 60 vehicles (approximately 20 vehicles less than the current condition of parking demand), serving both the trailhead and visitors to White Grass Ranch. The abandoned section of the trailhead access road would be converted to a trail. The remaining unpaved portion of Death Canyon Road would be improved to a single lane, gravel surface with turnouts for passing.	Death Canyon Trailhead would be relocated to the current end of pavement on the existing access road (i.e., the junction with White Grass Road). Parking would be provided for approximately 80–90 vehicles (similar to the current condition of parking demand). The existing 1.0-mile unpaved portion of the trailhead access road (no longer necessary for vehicular traffic) would be converted to a trail. The restroom would be relocated to the new trailhead location. White Grass Ranger Station would become a backcountry cabin (no vehicular access).	The Death Canyon Trailhead parking area would be reconfigured and expanded in its current location to accommodate up to 100 vehicles (approximately 20 vehicles more than the current condition of parking demand). The 0.4-mile segment of Death Canyon Road between the trailhead and White Grass Ranch would be improved. A new road segment between Death Canyon Road and White Grass Road would be constructed. White Grass Road would be improved to allow one-lane traffic with staggered turnouts. The remaining portion of Death Canyon Road would be removed and the area restored to natural conditions.
Winter Access and Use	The unplowed section of Moose-Wilson Road would continue to extend from the Death Canyon Road junction to Granite Canyon Trailhead. The unplowed portion of the road would be available for cross-country skiing and snowshoeing, but would not be groomed. Northern winter parking would occur at an unimproved parking area north of the Death Canyon Road junction.	The unplowed portion of Moose-Wilson Road would extend from the Murie Ranch Road junction and Granite Canyon Trailhead. The unplowed portion of the road would be available for cross-country skiing and snowshoeing, but would not be groomed. Winter recreational activities would use the old road alignment for skiing/snowshoeing and tie into the existing road at the base of the hill leading to Sawmill Ponds Overlook. Winter parking at the north end of the corridor would occur at plowed visitor parking areas in Moose.	The unplowed section of Moose-Wilson Road would continue to extend from the Death Canyon Road junction to Granite Canyon Trailhead. The unplowed portion of the road would be available for cross-country skiing and snowshoeing, but would not be groomed. Northern winter parking would occur at an unimproved parking area north of the Death Canyon Road junction.	The unplowed section of Moose-Wilson Road would extend from the Sawmill Ponds Overlook to Granite Canyon Trailhead. Enhance winter recreational opportunities (i.e., cross-country skiing) by improving parking and seeking a partner to groom the unplowed section of Moose-Wilson Road. Northern winter parking would occur at the Sawmill Ponds Overlook.

TABLE 8. SUMMARY OF KEY DIFFERENCES AMONG THE ALTERNATIVES

	Alternative A (No Action)	Alternative B	Alternative C (NPS Preferred Alternative)	Alternative D
Visitor Use and Experience / Education and Interpretation	Visitor services such as staffed interpretation at the LSR Preserve, interpretive waysides, interpretive publications, ranger programs, and education programs would continue to be provided. Park staff would continue to actively manage visitor use and congestion associated with the presence of wildlife. A variety of backcountry-oriented activities would continue to be available in the corridor, including camping, hiking, climbing, swimming, boating, rafting, floating, cross-country skiing, backcountry skiing, snowshoeing, horseback riding, and fishing. Backcountry patrols would continue to monitor hiker and backpacker compliance with regulations and visitor use counters would monitor use at trailheads.	Visitor services such as staffed interpretation at the LSR Preserve, interpretive waysides, interpretive publications, ranger programs, and education programs would continue to be provided. Park staff would continue to actively manage visitor use and congestion associated with the presence of wildlife. A variety of backcountry-oriented activities would continue to be available in the corridor, including camping, hiking, climbing, swimming, boating, rafting, floating, cross-country skiing, backcountry skiing, snowshoeing, horseback riding, and fishing. Backcountry patrols would continue to monitor hiker and backpacker compliance with regulations and visitor use counters would monitor use at trailheads. In keeping with the goal of self-discovery within the corridor, minimal low-impact interpretive media would be provided. Messaging would focus on the nationally significant natural and cultural resources of the corridor, as identified and studied during this planning process. Provide a sense of arrival experience that cues the visitor that they are entering a unique natural and cultural setting that is protected. The focus of interpretive media would be on pre-visit information and electronic media to prepare visitors for self-discovery prior to entering the corridor.	Visitor services such as staffed interpretation at the LSR Preserve, interpretive waysides, interpretive publications, ranger programs, and education programs would continue to be provided. Park staff would continue to actively manage visitor use and congestion associated with the presence of wildlife. A variety of backcountry-oriented activities would continue to be available in the corridor, including camping, hiking, climbing, swimming, boating, rafting, floating, cross-country skiing, backcountry skiing, snowshoeing, horseback riding, and fishing. Backcountry patrols would continue to monitor hiker and backpacker compliance with regulations and visitor use counters would monitor use at trailheads. In keeping with the goal of self-discovery within the corridor, minimal low-impact interpretive media would be provided. Messaging would focus on the nationally significant natural and cultural resources of the corridor, as identified and studied during this planning process. Provide a sense of arrival experience that cues the visitor that they are entering a unique natural and cultural setting that is protected. Few interpretive signs and structures would be installed on the landscape. Pre-visit information and electronic media to prepare visitors for self-discovery prior to entering the corridor would be the focus.	Visitor services such as staffed interpretation at the LSR Preserve, interpretive waysides, interpretive publications, ranger programs, and education programs would continue to be provided. Park staff would continue to actively manage visitor use and congestion associated with the presence of wildlife. A variety of backcountry-oriented activities would continue to be available in the corridor, including camping, hiking, climbing, swimming, boating, rafting, floating, cross-country skiing, backcountry skiing, snowshoeing, horseback riding, and fishing. Backcountry patrols would continue to monitor hiker and backpacker compliance with regulations and visitor use counters would monitor use at trailheads. In keeping with the goal of self-discovery within the corridor, minimal low-impact interpretive media would be provided. Messaging would focus on the nationally significant natural and cultural resources of the corridor, as identified and studied during this planning process. Provide a sense of arrival experience that cues the visitor that they are entering a unique natural and cultural setting that is protected. Establish viewing areas to allow visitors to appreciate vista points. Use viewing areas to concentrate use. Provide short nature trails and interpretive materials to enhance visitor experience.
Horse Use	Horse use would continue to only be allowed on official designated horse trails per the Superintendent's Compendium. Management of the Poker Flats horse trails would continue as approved through previous environmental compliance. Outside Poker Flats, use of horse trails would continue as illustrated on the Alternative A Map. Trail Crossings: Use of existing trail crossings over Moose-Wilson Road would continue as illustrated on the Alternative A Map. Parking and trailheads: Horse trailer parking would continue to take place at Sawmill Ponds (from the north), Death Canyon Road junction (from the north), Granite Canyon Trailhead (from the south), and Poker Flats (from the south). Trailer through-traffic restrictions would continue for public and commercial users.	Horse use would continue to only be allowed on official designated horse trails per the Superintendent's Compendium. Management of the Poker Flats horse trails would continue as approved through previous environmental compliance. Outside Poker Flats, trails that cannot be sustained would be removed and/or re-routed. Trails that have been identified by horse users as no longer being used due to redundancy or impacts on resources would be removed; horse routes (e.g., two-tracks, roads, powerline rights-of-way) would be designated for horse use to ensure consistent access throughout the corridor (e.g., connects Poker Flats trails with north corridor trails). Trail Crossings: Delineate (signage) minimum number of horse crossings over Moose-Wilson Road (based on trail locations). Parking and trailheads: Horse trailer parking and trailhead access would continue to occur at Death Canyon Road junction (from the north) and Poker Flats (from the south). These parking areas would be improved for trailer parking. *Note: No horse trailer parking would occur at Sawmill Ponds Overlook and Granite Canyon Trailhead.* Trailer through-traffic restrictions would continue for public and commercial users.	Horse use would continue to only be allowed on official designated horse trails per the Superintendent's Compendium. Management of the Poker Flats horse trails would continue as approved through previous environmental compliance. Outside Poker Flats, trails that cannot be sustained would be removed and/or re-routed. Trails that have been identified by horse users as no longer being used due to redundancy or impacts on resources would be removed; horse routes (e.g., two-tracks, roads, powerline rights-of-way) would be designated for horse use to ensure consistent access throughout corridor (e.g., connects Poker Flats trails with north corridor trails). Trail Crossings: Delineate (signage) minimum number of horse crossings over Moose-Wilson Road (based on trail locations). Parking and trailheads: Horse trailer parking and trailhead access would continue to occur at Sawmill Ponds (from the north), Death Canyon Road junction (from the north), and Poker Flats (from the south). These parking areas would be improved for trailer parking. *Note: No horse trailer parking would occur at the Granite Canyon Trailhead.* Trailer through-traffic restrictions would continue for public and commercial users.	Horse use would continue to only be allowed on official designated horse trails per the Superintendent's Compendium. Management of the Poker Flats horse trails would continue as approved through previous environmental compliance. Outside Poker Flats, trails that cannot be sustained would be removed and/or re-routed. Trails that have been identified by horse users as no longer being used due to redundancy or impacts on resources would be removed; horse routes (e.g., two-tracks, roads, powerline rights-of-way) would be designated for horse use to ensure consistent access throughout corridor (e.g., connects Poker Flats trails with north corridor trails). Trail Crossings: Delineate (signage) minimum number of horse crossings over Moose-Wilson Road (based on trail locations). Parking and trailheads: Horse trailer parking would continue to take place at Sawmill Ponds (from the north), Death Canyon Road junction (from the north), Granite Canyon Trailhead (from the south), and Poker Flats (from the south). Trailer through-traffic restrictions would continue for public and commercial users.

SUMMARY OF IMPACTS OF THE ALTERNATIVES

Table 9 provides a summary of the impacts of the alternatives. The table is intended to provide a concise, high-level comparison of the impacts by alternative. Please refer to "Chapter 4: Environmental Consequences," for a detailed description of the cause and effect relationship between the alternatives and each impact topic.

TABLE 9. SUMMARY OF THE IMPACTS OF THE ALTERNATIVES

	Alternative A (No Action)	Alternative B	Alternative C (Preferred)	Alternative D
Wildlife and Wildlife Habitat	**The most notable continuing adverse effect of alternative A would involve the continued use of the existing Moose-Wilson Road alignment, because:.** ▪ Traffic and use along this alignment would continue to fragment the wetland and shrub habitat between Sawmill Ponds Overlook and Death Canyon Road from montane forest habitat to the west. ▪ This continued fragmentation and disturbance would continue to adversely alter the Ecological Communities and Wildlife fundamental resource and value. Other adverse effects from alternative A would include: ▪ increasing disturbances and habitat impacts from unmanaged traffic and visitor use volumes in the corridor (as traffic/visitation continues to increase) ▪ unmanaged and dispersed roadside parking, ▪ ongoing winter use/vehicle traffic ▪ a Death Canyon Trailhead that is over a mile away from the main corridor of human activity (along Moose-Wilson Road) **Overall, alternative A would result in a considerable, long-term, adverse effect on wildlife and wildlife habitat, particularly in areas between Death Canyon Road and Sawmill Ponds Overlook and adjacent wetland and shrub habitat. However, because the most notable adverse effects to wildlife would be limited to a relatively localized portion of the corridor, the adverse impacts on wildlife and wildlife habitat would not likely be significant.**	**The most substantial beneficial impact from alternative B would relate to the two realignments of Moose-Wilson Road that would substantially reduce habitat fragmentation, reduce human disturbances to wildlife behavior, and substantially improve habitat quality between Sawmill Ponds Overlook and Death Canyon Road and along the Snake River riparian corridor.** Despite having some adverse effects to sagebrush habitat (as noted below), these realignment actions would greatly benefit the Ecological Communities and Wildlife fundamental resource and value. Other beneficial effects of alternative B would include reductions in wildlife disturbances and habitat fragmentation from: ▪ the elimination of through-traffic in the corridor during peak periods (gate) ▪ moving the Death Canyon Trailhead (and its high-use activity) 0.4 mile closer to the Moose-Wilson high-use corridor ▪ closing two equestrian parking areas ▪ lengthening the unplowed road segment in winter ▪ better control of roadside parking **The most notable adverse effects of alternative B would include likely increases in vehicle and visitor use disturbances to crepuscular wildlife behavior in the mornings and evenings (i.e., pre/post-gate closures) and sagebrush habitat fragmentation for the two road realignments.** Other adverse effects of alternative B would include: ▪ by providing several designated turnouts, visitors driving through may actually be encouraged to stop if they see wildlife (as opposed to driving through slowly), which could increase behavioral disturbances ▪ construction activity disturbances to wildlife behavior for the various development projects and road paving **Overall and relative to other alternatives, alternative B would offer the greatest benefit to wildlife and habitat, primarily due to the two realignments and the fact that it does not include the substantial adverse effects of other large development expansions such as the multiuse pathway. Although alternative B would have some adverse impacts on wildlife and wildlife habitat, the adverse impacts would not likely be significant because of the relatively localized and intermittent**	**The most substantial beneficial impacts from alternative C would relate to the improved traffic and visitor use volume management, the northern realignment of Moose-Wilson Road, and the relocation of the Death Canyon Trailhead, because:** ▪ During peak visitation periods, the vehicle sequencing would likely limit disturbances to wildlife behavior and habitat conditions from traffic and visitor activities. ▪ The northern realignment would remove the road and its high visitor use/traffic from the Snake River riparian corridor. ▪ The Death Canyon Trailhead relocation would notably reduce habitat fragmentation by moving high levels of human use disturbances around the trailhead much closer to the main visitor use corridor (Moose-Wilson Road). Other beneficial effects of alternative C would include reductions in disturbances to wildlife behavior and habitat condition from: ▪ reconstructing the road segment between Death Canyon Road and Sawmill Ponds Overlook to improve drainage, which would also improve downstream wetland hydrology ▪ closing one equestrian parking area and controlling roadside parking ▪ better control of roadside parking **The most notable adverse effect of alternative C would involve the continued use of the existing Moose-Wilson Road alignment that fragments the high-use wetland and shrub habitat between Sawmill Ponds Overlook and Death Canyon Road from montane forest habitat to the west.** ▪ This use along the existing alignment would continue to adversely alter the Ecological Communities and Wildlife fundamental resource and value. ▪ The traffic management system could also result in increases in vehicle and visitor use disturbances to crepuscular wildlife behavior in the mornings and evenings (i.e., if local visitors learn the traffic control system and adjust travel/visit times). Other adverse effects of alternative C would include: ▪ providing several designated turnouts, visitors driving through may actually be encouraged to stop if they see wildlife (as opposed to driving through slowly), which could increase behavioral disturbances. ▪ construction activity disturbances to wildlife behavior	**The most substantial beneficial impact from alternative D would relate to the two realignments of Moose-Wilson Road that would substantially reduce habitat fragmentation, reduce human disturbances to wildlife behavior, and substantially improve habitat quality between Sawmill Ponds Overlook and Death Canyon Road and along the Snake River riparian corridor.** Despite having some adverse effects to sagebrush habitat (as noted below), these realignments would greatly benefit the Ecological Communities and Wildlife fundamental resource and value. Other beneficial effects of alternative D would include reductions in disturbances to wildlife behavior and habitat condition from: ▪ better managed traffic/visitor volumes during peak periods (via a reservation system) ▪ lengthening the unplowed segment in winter ▪ better control of roadside parking **However, the most notable adverse effects of alternative D would be the significant net increases (relative to existing levels of wildlife habitat disturbances and fragmentation in the corridor) in wildlife disturbances, habitat loss, and fragmentation in the corridor from introducing a second primary human use corridor through the length of the project area, the multiuse pathway.** This effect would notably diminish the quality and integrity of the Ecological Communities and Wildlife fundamental resource and value. Other notable adverse effects of alternative D include: ▪ The expansion of the Death Canyon Trailhead/parking area in its existing location, resulting in continuing and increased habitat fragmentation a relatively long distance from the main visitor use corridor (Moose-Wilson Road). ▪ The traffic management strategy (reservation system) could also increase vehicle and visitor use disturbances to crepuscular wildlife behavior in the mornings and evenings (i.e., pre/post peak reservation periods). ▪ By providing several designated turnouts, visitors driving through may actually be encouraged to stop if they see wildlife (as opposed to driving through slowly), which could increase behavioral disturbances. ▪ Short-term construction activity disturbances to wildlife for several large construction projects, and fragmentation of sagebrush habitat from the two

TABLE 9. SUMMARY OF THE IMPACTS OF THE ALTERNATIVES

	Alternative A (No Action)	Alternative B	Alternative C (Preferred)	Alternative D
		nature of the effects in the corridor.	for the various development projects and road paving. **Overall, alternative C would not offer as much benefit to wildlife and habitat as alternative B (mainly due to the lack of the southern road realignment). However, alternative C would have substantially less adverse effects on wildlife and habitat than alternative D due to the fact that it does not include the adverse effects of other large development expansions such as the multiuse pathway. Also, because the most notable adverse effects to wildlife from alternative C would be limited to a relatively localized portion of the corridor (generally between Sawmill Ponds Overlook and Death Canyon Road), these adverse impacts would not likely be significant.**	road realignments. **Overall, although alternative D would offer a substantial benefit to wildlife habitat (due to the road realignments), alternative D would likely have the greatest adverse effect on wildlife and habitat relative to other alternatives, primarily due to the substantial net increase in habitat fragmentation and wildlife disturbance from the multiuse pathway through the extent of the corridor. These adverse effects on wildlife and wildlife habitat from alternative D would likely be significant.**
Federally Listed and Candidate Species (grizzly bear, Canada lynx, gray wolf, greater sage-grouse)	▪ **Grizzly Bear** – No significant impacts, with no ongoing or new substantial changes in the bears or habitat in the project area. No significant changes in the number, distribution, use of the area, or reproduction of bears would be expected. But because there would continue to be a risk that one or more bears may be lost, alternative A may affect, and is likely to adversely affect grizzly bears in the project area. ▪ **Other Species** – No significant impacts, on Canada lynx, gray wolf, or greater sage-grouse, with no ongoing or new actions that would affect the numbers, distribution, use, or habitat of these species in the project area. But because there would continue to be a risk that one of these animals may be lost under alternative A, the alternative may affect, and is likely to adversely affect, the lynx, gray wolf, and greater sage-grouse in the project area.	▪ **Grizzly Bear** – Alternative B would result in the loss of some grizzly bear habitat and affect the behavior of the bears, including possible temporary or permanent displacement of bears. There also would be several beneficial effects, reducing human-bear interactions and potential disturbance of bears due to realigning part of the road away from important foraging areas, placing limits on the increase in the number of vehicles, reducing vehicle speeds, and periodic thinning of roadside vegetation. With no substantial changes in use of the corridor by grizzly bears, or substantial changes in bear numbers, distribution, or reproduction, alternative B would not result in significant impacts on the grizzly bears in the project area. ▪ **Other Species** – No significant impacts, with no new actions that would substantially affect the numbers, distribution, or reproduction of Canada lynx, gray wolf, and greater sage-grouse in the project area. Although the behavior of individual animals may be temporarily affected by noise from construction and the presence of people and vehicles, alternative B would not be expected to result in a significant long-term change in the use of the project area by the three species. None of the actions in alternative B would affect known occupied sage-grouse leks, or known key foraging, breeding, or denning areas for lynx and wolves. The location of the new Death Canyon parking area would increase human use in an area used by wolves as a rendezvous site, but the implementation of a seasonal closure around this site would substantially reduce the likelihood of this potential impact. There would be a net loss of ~1.85 acres of core sage-grouse habitat due to the northernmost road realignment. There also would be a slight increase in suitable lynx forage habitat as a result of the alternative. **Overall, alternative B would have a lower risk than alternative C of adversely affecting the grizzly bear (due largely to the realignment of the northern segment of the**	▪ **Grizzly Bear** – Alternative C would result in the loss of a small amount of grizzly bear habitat and affect the behavior of bears, including possible temporary or permanent displacement along the existing Moose-Wilson Road between Sawmill Ponds Overlook and Death Canyon Road. But the alternative also would have several beneficial effects. Realigning the northernmost segment of the road would decrease habitat fragmentation, while limiting the increase in numbers of vehicles traveling the road during peak use periods, reducing vehicle speeds, and periodic thinning of roadside vegetation would reduce potential human-bear interactions and disturbance of bears. With no substantial changes in use of the corridor by grizzly bears or substantial changes in bear numbers, distribution, reproduction, or habitat, alternative C would not result in significant impacts on grizzly bears in the project area. ▪ **Other Species** – No significant impacts, with no new actions that would substantially affect the numbers, distribution, or reproduction, of Canada lynx, gray wolf, or greater sage-grouse in the project area. Although the behavior of individual animals may be temporarily affected by noise from construction and the presence of people and vehicles, alternative C would not be expected to result in a significant long-term change in the use of the project area by the three species. None of the actions in alternative C would affect known occupied sage-grouse leks, or known key foraging, breeding, or denning areas for lynx and wolves. There would be a net loss of ~1.85 acres of core sage-grouse habitat due to the northernmost road realignment. There also would be a slight decrease (~1.1 acres) in suitable lynx forage habitat as a result of the alternative. **Overall, alternative C would have a slightly higher risk than alternative B of adversely affecting the grizzly bear (due to the potential for continuing human-bear encounters on the northern segment of the**	▪ **Grizzly Bear –** Alternative D would have some beneficial effects on grizzly bears due to the two proposed road realignments, limiting the increase in numbers of vehicles driving the road during peak use periods, reducing vehicle speeds, and periodic thinning of roadside vegetation. But alternative D could result in a significant adverse impact on grizzly bears in the project area due to increased habitat fragmentation from construction and use of the pathway, loss of foraging habitat, and possible spatial and/or temporal displacement of bears in the corridor, and the increased potential for human-bear encounters that would in turn increase the potential for bears being removed, injured, or killed. ▪ **Other Species** – No significant impacts, with no new actions that would substantially affect numbers, distribution, or reproduction of Canada lynx, gray wolf, or greater sage-grouse in the project area. Although the behavior of individual animals may be temporarily affected by noise from construction and the presence of people and vehicles, alternative D would not be expected to result in a substantial long-term change in the use of the project area by the three species. None of the actions in alternative D would affect known occupied sage-grouse leks, or known key foraging, breeding, or denning areas for lynx and wolves. There would be a net loss of ~5.9 acres of core sage-grouse habitat due to the northernmost road realignment and the pathway. There also would be a slight decrease (~2.8 acres) in suitable lynx forage habitat as a result of the alternative. . ▪ **Overall, alternative D would have the highest risk of all the alternatives of adversely affecting the grizzly bear (due to the construction and use of the multiuse pathway), a lower risk than alternative B and about the same risk as alternative C of adversely affecting the gray wolf (due to the location of the Death Canyon parking area), and a slightly higher level of risk than alternatives B and C of adversely affecting**

TABLE 9. SUMMARY OF THE IMPACTS OF THE ALTERNATIVES

	Alternative A (No Action)	Alternative B	Alternative C (Preferred)	Alternative D
		road), a much lower risk than alternative D of adversely affecting the grizzly bear (due to the multiuse pathway), a greater risk than alternatives C and D of adversely affecting the gray wolf (due to the new Death Canyon parking area), and the same level of risk as alternative C and a slightly lower risk than alternative D of adversely affecting the greater sage-grouse and its core habitat. Alternative B also would have the same low risk as the other alternatives of adversely affecting the Canada lynx. Because there would be a risk that a grizzly bear, lynx, wolf, or sage-grouse may be lost under alternative B, the alternative may affect, and is likely to adversely affect, these species in the project area.	**road), a much lower risk than alternative D of adversely affecting the grizzly bear (due to the multiuse pathway), a lower risk than alternative B, and about the same risk as alternative D of adversely affecting the gray wolf (due to the location of the Death Canyon parking area), and the same level of risk as alternative B and a slightly lower risk than alternative D of adversely affecting the greater sage-grouse and its core habitat. Alternative C also would have the same low risk as the other alternatives of adversely affecting the Canada lynx. Because there would be a risk that a grizzly bear, lynx, wolf, or sage-grouse may be lost under alternative C, the alternative may affect, and is likely to adversely affect, these species in the project area.**	**the greater sage-grouse and its core habitat. Alternative D also would have the same low risk as the other alternatives of adversely affecting the Canada lynx. Because there would be a risk that a grizzly bear, lynx, wolf, or sage-grouse may be lost under alternative D, the alternative may affect, and is likely to adversely affect, these species in the project area.**
Wetlands	**The most notable continuing adverse effect of alternative A would involve the continued use and maintenance of the existing Moose-Wilson Road alignment that bisects the corridor's largest and most sensitive wetland complex and the upstream Reserve Creek and Stewart Draw drainages that feed it (between Death Canyon Road and Sawmill Ponds Overlook).** The road would continue to have substantial effects on wetland hydrology and high levels of human activity along the road would continue to alter the adjacent wetland habitat and vegetation conditions. Other adverse effects from alternative A would include: ▪ increasing threats from vehicle-generated pollutants on wetland water quality ▪ wetland vegetation impacts from unmanaged roadside parking and use ▪ sediment loading and winter wetland habitat disturbance from winter road plowing **Overall, alternative A would result in a considerable, long-term, adverse effect on wetlands, particularly in the large wetland complex between Death Canyon Road and Sawmill Ponds Overlook. Alternative A would likely have the greatest overall adverse effect on wetlands compared to the other three alternatives. However, given the somewhat localized nature of these effects relative to the project area's overall hydrological regime and wetland complexes, the continuing adverse impacts on wetlands under alternative A would not likely be significant.**	**The most substantial impact from alternative B would relate to the two realignments of Moose-Wilson Road that would help improve wetland hydrology, wetland habitat, water quality, and other important wetland functions between Sawmill Ponds Overlook and Death Canyon Road and along the Snake River riparian zone.** ▪ The southern realignment would have the greatest beneficial effect of the two, as it would eliminate these existing impacts from the largest and most sensitive wetland complex in the project area and thus would greatly benefit the Aquatic Resources fundamental resource and value. Other beneficial effects would include improved wetland water quality and wetland vegetation conditions from: ▪ closing two equestrian parking areas ▪ paving the unpaved road segment ▪ improved traffic management ▪ lengthening the unplowed segment in winter ▪ controlling roadside parking **The most notable adverse effect of alternative B would involve localized wetland impacts or loss associated with the southern road realignment (particularly at the north and south ends of the realignment).** Other adverse effects from alternative B would include potential threats to wetland water quality and native wetland plant communities from ground disturbances associated with various construction projects, most notably the two road realignments. **Overall, alternative B would offer the greatest benefit to wetlands relative to other alternatives, primarily due to the realignment around the large wetland complex. Also, the most notable adverse effects on wetlands under this alternative (from the southern road realignment) would not likely be significant due to the relatively localized nature of the effects on wetlands.**	**The most substantial change and beneficial impact from alternative C would relate to the northern realignment that would relocate Moose-Wilson Road farther away from Snake River riparian wetlands and the reconstruction of Moose-Wilson Road between Death Canyon Road and Sawmill Ponds Overlook to improve hydrological connectivity between upstream drainages (Reserve Creek and Stewart Draw drainages) and the large wetland complex in that area.** Other beneficial effects would include improved wetland water quality and wetland vegetation conditions from: ▪ closing one equestrian parking area ▪ paving the unpaved road segment ▪ improved traffic management ▪ controlling roadside parking **The most notable adverse effect of alternative C would involve the continuation of routing high levels of vehicle traffic and associated visitor use immediately along the large, sensitive wetland complex, which would continue impacts such as wetland vegetation trampling, degraded wetland plant communities, disturbed wetland habitat, and potential threats of nonnative plants.** Other adverse effects from alternative C would result from ground disturbances associated with various construction projects, as well as the continuation of current winter use impacts. In addition, the drainage improvements between Death Canyon Road and Sawmill Ponds Overlook could increase some short- and long-term sedimentation to downstream wetlands if hillside excavation is needed to accommodate the improvements. **Overall, across all beneficial and adverse effects, alternative C would offer an appreciable improvement to wetland conditions relative to alternative A. However, this alternative would not accomplish as much overall beneficial effect on wetlands as alternative B because it**	**The most substantial impact from alternative D would relate to the two realignments of Moose-Wilson Road that would improve wetland hydrology, wetland habitat, water quality, and other important wetland functions between Sawmill Ponds Overlook and Death Canyon Road and along the Snake River riparian zone.** ▪ The southern realignment would have the greatest beneficial effect of the two because it would eliminate these existing impacts from the largest and most sensitive wetland complex in the project area and thus would greatly benefit the Aquatic Resources fundamental resource and value. Other beneficial effects would include improved wetland water quality and wetland vegetation conditions resulting from: ▪ improved traffic management ▪ lengthening the unplowed road segment in winter ▪ controlling roadside parking **The most notable adverse effects of alternative D would involve a substantial increase in hydrological disturbance from a second primary disturbance corridor (multiuse pathway) and localized wetland impacts and loss associated with the southern road realignment and pathway (in the vicinity of the north and south ends of the realignment).** Other adverse effects from alternative D would include potential threats to wetland water quality and native wetland plant communities from the new wildlife viewing area developments and ground disturbances associated with other construction projects in previously undisturbed areas. **Overall, alternative D would offer a considerable benefit to wetlands, primarily due to the realignment around the large wetland complex. However, the overall benefit would not be as great as alternative B, namely due to the considerable adverse effects associated with the multiuse pathway. The considerable adverse effects on**

TABLE 9. SUMMARY OF THE IMPACTS OF THE ALTERNATIVES

	Alternative A (No Action)	Alternative B	Alternative C (Preferred)	Alternative D
			lacks the southern road realignment. Although the most notable adverse effects to wetlands under alternative C would continue to be considerable in the area between Sawmill Ponds Overlook and Death Canyon Road, given the relatively localized nature of these effects, these adverse impacts on wetlands would not likely be significant.	**wetlands from the southern road realignment and hydrological alterations from the multiuse pathway would not likely be significant due to the relatively localized nature of the effects on wetlands.**
Hydrology	Alternative A would continue to have ongoing, long-term adverse effects on hydrology**. However, although the most notable adverse effects on hydrology would continue to be substantial in the area between Sawmill Ponds Overlook and Death Canyon Road, given the somewhat localized nature of these effects relative to the project area's overall hydrological regime, the continuing adverse impacts on hydrology under alternative A would not likely be significant.** ▪ The most notable adverse effect would continue to be the effect of Moose-Wilson Road on the natural flow patterns because the road generally runs perpendicular to the natural northwest to southeast surface flow patterns in the corridor. ▪ The most affected local hydrology in the project area would be the drainage and wetland connectivity between Sawmill Ponds Overlook and Death Canyon Road (Reserve Creek and Stewart Draw drainages).	**Alternative B would offer the greatest benefit to hydrology relative to other alternatives, primarily due to the southern road realignment. The most notable effects on hydrology under this alternative (from increases of impervious surfaces and alterations to natural flow patterns in previously undisturbed areas where parking and roads are developed) would not likely be significant due to the relatively localized nature of the effects on hydrology (i.e., in the area immediately surrounding the two realignments of Moose-Wilson Road, the Death Canyon parking area, and adjacent areas).** The most notable beneficial effects would involve: ▪ The southern Moose-Wilson Road realignment, which would remove a major impediment to the natural hydrological system in the vicinity of the wetland complex between the Sawmill Ponds Overlook and Death Canyon Road. The natural hydrological connectivity of this wetland complex with the uplands to the west (Reserve Creek and Steward Draw drainages) would be restored; surface and groundwater flow patterns would be restored, and wetland functions and aquatic systems to the east of the existing road alignment would benefit. ▪ The restoration of approximately 0.4 mile of Death Canyon Road. Adverse impacts would primarily result from: ▪ Increased impervious surfaces caused by paving road surfaces and alterations to natural flow patterns in previously undisturbed areas where parking and roads are developed (most notably the two realignments of Moose-Wilson Road and Death Canyon Trailhead area). ▪ Short-term, adverse impacts on local hydrology would also result from construction activities associated with these developments.	**Across all beneficial and adverse effects, alternative C would offer an appreciable improvement to hydrology relative to alternative A. However, this alternative would not accomplish as much overall beneficial effect on hydrology as alternative B because it lacks the southern road realignment. The most notable effects on hydrology under this alternative (from increases of impervious surfaces and alterations to natural flow patterns in previously undisturbed areas where parking and roads are developed) would not likely be significant due to the relatively localized nature of the effects on hydrology (i.e., in the area immediately surrounding the northern realignment of Moose-Wilson Road, the Death Canyon parking area, and adjacent areas).** The most notable beneficial effects would result from: ▪ Reconstruction of Moose-Wilson Road between Sawmill Ponds Overlook and Death Canyon Road would improve drainage conditions and restore some aspects of hydrological connectivity between the Reserve Creek and Stewart Draw drainages and downstream wetlands. This action would also benefit the wetland hydrology downstream (to the east) of the road alignment. ▪ The restoration of approximately 1.0 mile of Death Canyon Road. Adverse impacts would primarily result from: ▪ Increases of impervious (paved) road surfaces and alterations to local surface hydrology and natural flow patterns in previously undisturbed areas where road and parking development occurs (e.g., northern realignment, Death Canyon parking area). ▪ Short-term impacts as a result of construction activities.	**Alternative D would offer a considerable benefit to hydrology, primarily due to the southern road realignment. However, the overall benefit would not be as great as alternative B, namely due to the considerable adverse effects associated with the multiuse pathway**. **However, the adverse effects on wetlands from the southern road realignment and pathway would not likely be significant due to the relatively isolated and localized nature of the effects on hydrology (i.e., in the area immediately surrounding the two realignments of Moose-Wilson Road, the multiuse pathway, road improvements in the Death Canyon Trailhead area, and adjacent areas).** The most notable beneficial effects would result from: ▪ The southern Moose-Wilson Road realignment, which would remove a major impediment to the natural hydrological system in the vicinity of the wetland complex between the Sawmill Ponds Overlook and Death Canyon Road. The natural hydrological connectivity of this wetland complex to the western uplands (Reserve Creek and Steward Draw drainages) would be restored, surface and groundwater flow patterns would be restored, and wetland functions and aquatic systems to the east of the existing road alignment would benefit. ▪ The restoration of a large segment of Death Canyon Road. Adverse impacts would primarily result from: ▪ The development of a second transportation corridor through the project area (i.e., the multiuse pathway), having a substantial, long-term adverse effect on the local hydrological system by introducing a second impediment to natural surface flows for the length of the corridor (e.g., converting sheetflows to channelized flows). ▪ Increased impervious road surfaces and other alterations to natural flow patterns in previously undisturbed areas where parking and roads are developed (most notably the two realignments of Moose-Wilson Road and the road improvements in the Death Canyon Trailhead area). ▪ Short-term, adverse impacts on local hydrology would also result from construction activities associated with these developments.

TABLE 9. SUMMARY OF THE IMPACTS OF THE ALTERNATIVES

	Alternative A (No Action)	Alternative B	Alternative C (Preferred)	Alternative D
Water Quality	**Alternative A would continue to result in notable long-term adverse effects on water quality throughout the corridor. However, although the most notable adverse effects to water quality would continue to be substantial in the area between Sawmill Ponds Overlook and Death Canyon Road, as well as along the unpaved segment of Moose-Wilson Road, given the somewhat localized nature of these effects relative to the project area's overall hydrological regime, the continuing adverse impacts on water quality under alternative A would not likely be significant.** Adverse effects would primarily relate to: ▪ Increasing threats from vehicle-generated pollution from the increased traffic volumes in the corridor (particularly along the wetland area between Sawmill Ponds Overlook and Death Canyon Road). ▪ Continued dust abatement and MgCl migration from the unpaved segment of Moose-Wilson Road. ▪ Sediment loading impacts from unmanaged roadside parking and high-use area parking. ▪ Sediment loading from winter snow plowing and snow storage. ▪ Horse manure in high equestrian use areas.	**Alternative B would offer the greatest benefit to water quality relative to other alternatives, primarily due to the southern road realignment and the paving of the unpaved road segment of Moose-Wilson Road. These adverse effects on water quality under this alternative would not likely be significant due to the relatively localized nature of the effects on water quality (i.e., in the area immediately surrounding the two realignments of Moose-Wilson Road, the Death Canyon parking area, and adjacent areas).** The most notable beneficial effects would primarily be realized by: ▪ Substantial reductions in vehicle pollution and sediment threats in a major wetland complex due to the southern road realignment. ▪ Reduced sediment loading and elimination of MgCl migration by paving the unpaved road segment. ▪ Establishing designated roadside turnouts. ▪ Reducing sediment loading from snow storage areas (due to more unplowed road segments). ▪ Restoring a 0.4-mile segment of Death Canyon Road. ▪ A reduction in nutrient and sediment loading from equestrian use in multiple localized areas mainly due to the elimination of two horse trailer parking areas. Adverse impacts would primarily result from: ▪ Continued vehicle-related pollution migration and sediment loading from several newly disturbed areas. ▪ Construction activities associated with new developments within the corridor (two road realignments, Death Canyon parking area, etc.).	**Across all beneficial and adverse effects, alternative C would offer an appreciable improvement to water quality relative to alternative A. However, this alternative would not accomplish as much overall beneficial effect to water quality as alternative B because it lacks the southern road realignment. These adverse effects on water quality under this alternative would not likely be significant due to the relatively localized nature of the effects on water quality (i.e., in the area immediately surrounding the northern realignment of Moose-Wilson Road, the Death Canyon parking area, and adjacent areas).** The most notable beneficial effects would primarily be realized through: ▪ Some reductions in sediment loading threats due to the improved drainage infrastructure between Sawmill Ponds Overlook and Death Canyon Road. ▪ Reduced sediment loading and elimination of MgCl migration by paving the unpaved road segment. ▪ Establishing designated roadside turnouts restoring a 1.0-mile segment of Death Canyon Road. ▪ A reduction in nutrient and sediment loading from equestrian use in the vicinity of the Granite Canyon Trailhead and associated trails mainly due to the elimination of a horse trailer parking area. Adverse impacts would primarily result from: ▪ Continued vehicle-related pollution migration within the corridor. ▪ Vehicle pollutants introduced into previously undisturbed areas (northern realignment, Death Canyon parking area). ▪ Sediment loading from multiple newly disturbed areas and construction activities associated with new developments within the corridor.	**Across all beneficial and adverse effects, alternative D would offer an appreciable improvement to water quality relative to alternative A. However, this alternative would not accomplish as much overall beneficial effect to water quality as alternative B because it lacks the paving of the unpaved road segment of Moose-Wilson Road. However, the adverse effects on water quality as a result of these actions would not likely be significant due to the relatively isolated and localized nature of the effects on water quality (i.e., in the area immediately surrounding the two realignments of Moose-Wilson Road, the multiuse pathway, road improvements in the Death Canyon Trailhead area, and adjacent areas).** The most notable beneficial effects would primarily be realized through: ▪ Substantial reductions in vehicle pollution and sediment threats in a major wetland complex due to the southern road realignment. ▪ Establishing designated roadside turnouts that reduce erosion and sedimentation caused by undesignated roadside parking. ▪ A reduction in sediment loading from snow storage areas (due to more unplowed areas). ▪ Larger parking capacity at Death Canyon and closure of a large segment of Death Canyon Road. Adverse impacts would primarily result from: ▪ Continued vehicle-related pollution migration within the corridor. ▪ Continued long-term sediment loading and MgCl migration from the 1.4-mile unpaved road segment. ▪ Human waste in newly disturbed areas along the multiuse pathway. ▪ Considerable short-term sediment loading from several newly disturbed areas and construction activities associated with new developments within the corridor (two road realignments, multiuse pathway, larger Death Canyon parking area, wildlife viewing areas, etc.).
Vegetation	▪ Under alternative A vegetation would continue to be lost or altered in small, localized areas, primarily along the roads, parking areas, and trails, due to drivers parking off the road, outside of designated turnouts and parking areas, and due to the creation and use of unofficial hiker and horse trails. ▪ Nonnative plants would likely continue to be introduced and spread by visitors. With visitor use likely to increase in the future, this impact would likely increase. **Overall, alternative A would not likely result in significant impacts because no major new vegetation disturbance would occur and there would not be a substantial alteration or loss of vegetation communities or a major change in the distribution and abundance of native plant species in the project area.**	▪ Alternative B would result in both adverse and beneficial impacts on vegetation along the Moose-Wilson and Death Canyon Roads. ▪ Long-term adverse impacts would result from the loss of vegetation due to the construction of two new road alignments, the new Death Canyon parking area, and new turnouts along Moose-Wilson Road. Short-term disturbance of vegetation would occur due to construction activities, and although these areas would be revegetated it would be unlikely they would be restored to pre-construction condition. ▪ There would be a substantial long-term increase in the potential for the spread of nonnative species due to new ground disturbance in localized areas. ▪ Beneficial effects would result from the eventual revegetation of two road segments and the existing	▪ Alternative C would result in both adverse and beneficial impacts on vegetation along Moose-Wilson and Death Canyon Roads. ▪ Long-term adverse impacts would result from the loss of vegetation due to the construction of one new road alignment, the new Death Canyon parking area, and new turnouts along Moose-Wilson Road. ▪ Short-term disturbance of vegetation would occur due to construction activities, and although these areas would be revegetated it would be unlikely they would be restored to pre-construction condition. ▪ There would be a long-term increase in the potential for the spread of nonnative species due to new ground disturbance in localized areas. ▪ Beneficial effects would result from the eventual revegetation of one road segment and the existing Death Canyon parking area, a reduction in	▪ Alternative D would result in both adverse and beneficial impacts on vegetation along Moose-Wilson and Death Canyon Roads. ▪ Long-term adverse impacts would result from the loss of vegetation due to the construction of two new road alignments, the expansion of the existing Death Canyon parking area, a new road link between Death Canyon and White Grass Roads, new turnouts along Moose-Wilson Road, and two new parking/wildlife viewing areas and associated nature trails. ▪ Short-term disturbance of vegetation would occur due to construction activities, and although these areas would be revegetated it would be unlikely they would be restored to pre-construction condition. ▪ There would be a substantial long-term increase in the potential for the spread of nonnative species due

TABLE 9. SUMMARY OF THE IMPACTS OF THE ALTERNATIVES

	Alternative A (No Action)	Alternative B	Alternative C (Preferred)	Alternative D
		Death Canyon parking area, a reduction in disturbance of roadside vegetation due to the paving of the unpaved portion of Moose-Wilson Road, and a reduction in visitors parking in nondesignated areas (due to the developments of turnouts and a new Death Canyon parking area). ▪ Relative to the project area, a small area of native vegetation would be permanently lost or altered. However, this disturbed area would be large relative to the limited disturbance that has occurred in the corridor. **Collectively, while alternative B would reduce some existing adverse impacts on vegetation, it would have a much greater adverse effect on vegetation than alternative C (due to the two Moose-Wilson Road realignments) and lower degree of adverse effect than alternative D (because alternative B does not include other large development expansions). These adverse vegetation impacts would diminish the quality and integrity of the Ecological Communities and Wildlife fundamental resource and value. Although the above noted adverse effects would be considerable, there would not be a substantial alteration or loss of vegetation communities or a major change in the distribution and abundance of native plant species in the project area. Thus, overall alternative B would not likely have a significant adverse effect on vegetation in the project area.**	disturbance of roadside vegetation due to the paving of the unpaved portion of Moose-Wilson Road, and a reduction in visitor parking in nondesignated areas (due to the developments of turnouts and the new Death Canyon parking area). ▪ Relative to the project area, a small area of native vegetation would be permanently lost or altered. However, this disturbed area would be large relative to the limited disturbance that has occurred in the corridor. **Collectively, alternative C would address various existing adverse effects on vegetation (relative to alternative A) and would have the least overall adverse effect on vegetation from proposed developments when compared to alternatives B and D. Alternative C would not result in a substantial alteration or loss of vegetation communities or a major change in the distribution and abundance of native plant species in the project area. Thus, alternative C would not likely have a significant adverse effect on vegetation in the project area.**	to new ground disturbance in localized areas. ▪ Beneficial effects would result from the eventual revegetation of two road segments, and a reduction in visitors parking in nondesignated areas (due to the developments of turnouts and an expanded Death Canyon parking area). ▪ Relative to the project area, a small area of native vegetation would be permanently lost or altered. However, this disturbed area would be large relative to the limited disturbance that has occurred in the corridor. **Collectively, while alternative D would address various existing adverse effects on vegetation, it would by far involve the greatest degree of adverse impacts on vegetation relative to all other alternatives mainly due to the multiuse pathway and two road realignment developments. These adverse vegetation impacts would substantially diminish the quality and integrity of the Ecological Communities and Wildlife fundamental resource and value. Although the above noted adverse effects would be considerable, there would not be a substantial alteration or loss of vegetation communities or a major change in the distribution and abundance of native plant species in the project area. Thus, overall, alternative D would not likely have a significant adverse effect on vegetation in the project area.**
Soils	▪ Alternative A would result in the continued degradation of soils in small, localized areas in the corridor due to vehicles widening the unpaved portion of Moose-Wilson Road, parking off roads and outside of parking areas, and the creation and use of unofficial hiking and equestrian trails. These impacts would be ongoing, primarily affecting topsoils. The projected increased use levels in the corridor would exacerbate these impacts. No major new soil erosion would be expected as a result of alternative A. **Overall, alternative A would not likely result in significant adverse soil impacts because no major new soil disturbance or soil erosion would occur. Soil disturbance that would occur would be localized in small areas along the corridor.**	▪ Alternative B would result in both short- and long-term, adverse and beneficial effects to soils, primarily along Moose-Wilson Road (existing and new alignments) and Death Canyon Road. ▪ Long-term adverse impacts would occur due to the permanent loss or alteration of soil from the development of two new road segments, a new Death Canyon parking area, and turnouts. Some additional long-term topsoil erosion would occur due to surface runoff and ditch channelization primarily due to the two new road alignments. Additional short-term disturbance of soils would occur due to construction activities. ▪ Beneficial effects, including the restoration of soil, and a reduction in soil compaction, erosion, and soil alteration, would result from the removal of two road segments and the Death Canyon parking area, paving the unpaved part of the Moose-Wilson Road, and a reduction in visitors parking in nondesignated areas (due to the developments of turnouts and a new Death Canyon parking area). ▪ Relative to the project area, a small area of topsoil would be permanently lost. However, this disturbed area would be large relative to the limited disturbance that has occurred in the corridor. **Overall, alternative B would not likely result in significant adverse soil impacts because no actions are being proposed that would result in major new soil disturbance or soil erosion in the project area. Although**	▪ Alternative C would result in both short- and long-term, adverse and beneficial effects to soils, primarily along Moose-Wilson Road (existing and new alignments) and Death Canyon Road. ▪ Long-term adverse impacts would occur due to the permanent loss or alteration of soil from the development of a new road segment, a new Death Canyon parking area, and new turnouts. Some additional long-term topsoil erosion would occur due to surface runoff and ditch channelization primarily due to the two new road alignments. Additional short-term disturbance of soils would occur due to construction activities. ▪ Beneficial effects, including the restoration of soil, and a reduction in soil compaction, erosion and soil alteration, would result from the removal of a road segment and the Death Canyon parking area, paving the unpaved part of Moose-Wilson Road, and a reduction in visitors parking in nondesignated areas (due to the developments of turnouts and a new Death Canyon parking area). ▪ Relative to the project area, a small area of topsoil would be permanently lost. However, this disturbed area would be large relative to the limited disturbance that has occurred in the corridor. **Overall, alternative C would not likely result in significant adverse soil impacts because no actions are being proposed that would result in major new soil disturbance or soil erosion in the project area. Although**	▪ Alternative D would result in both short- and long-term, adverse and beneficial effects to soils, primarily along Moose-Wilson Road (existing and new alignments), the Death Canyon Road, and the multiuse pathway. ▪ Long-term adverse impacts would occur due to the permanent loss or alteration of soil from the development of two new road segments, the multiuse pathway, the expansion of the existing Death Canyon parking area, and new turnouts. Some additional long-term topsoil erosion would occur due to surface runoff and ditch channelization primarily due to the two new road alignments and pathway. Additional short-term disturbance of soils would occur due to construction activities. ▪ Beneficial effects, including the restoration of soil, and a reduction in soil compaction, erosion and soil alteration, would result from the removal of two road segments, and a reduction in visitors parking in nondesignated areas (due to the developments of turnouts and an expanded Death Canyon parking area). ▪ Relative to the project area, a small area of topsoil would be permanently lost. However, this disturbed area would be large relative to the limited disturbance that has occurred in the corridor. **Overall, alternative D would result in a considerable loss and alteration of soil in the corridor due primarily to the road relocations and pathway. These impacts would be**

TABLE 9. SUMMARY OF THE IMPACTS OF THE ALTERNATIVES

	Alternative A (No Action)	Alternative B	Alternative C (Preferred)	Alternative D
		there would be some soil loss and alteration, these impacts would be localized in small areas along the corridor. Collectively, alternative B would remedy various ongoing adverse effects on soils (under alternative A), but would have a much greater adverse effect on soils than alternative C (due to the two Moose-Wilson Road realignments) and lower degree of adverse effect than alternative D (because alternative B does not include other large development expansions).	**there would be some soil loss and alteration, these impacts would be localized in small areas along the corridor. Collectively, alternative C would remedy various ongoing adverse effects on soils (under alternative A) and would have the least overall adverse effect on soils from proposed developments when compared to alternatives B and D.**	**concentrated in several areas along the corridor. However, from a project area standpoint alternative D would not likely result in significant adverse impacts because no actions are being proposed that would result in major new soil disturbance or soil erosion in the project area as a whole. Collectively, while alternative D would remedy various continuing adverse effects on soils (under alternative A), it would also involve the greatest degree of adverse impacts on soils relative to all other alternatives mainly due to the multiuse pathway and two road realignment developments.**
Historic Structures, Sites, and Cultural Landscapes	No substantial changes to the Moose-Wilson corridor are anticipated under the no-action alternative. The historic character and integrity of the corridor and its associated cultural landscape would be preserved and there would be little potential for impacts on the road as a national register-eligible historic structure. The White Grass / Death Canyon Road would also remain unaltered and its historic alignment preserved. Continuation of the current NPS management approach for Moose-Wilson Road and White Grass / Death Canyon Road corridors would generally have long-term beneficial impacts on the historic character of these roads and their associated cultural landscapes, as well as associated historic sites along the corridor.	Proposed relocation of Moose-Wilson Road segments and restoring existing segments to natural conditions would result in significant adverse impacts on the historic character and cultural landscape integrity of the road corridor. Reconfiguration of access and parking near the LSR Preserve would also adversely affect the historic character of the road by altering its historic design and materials. Removal of a portion of the Death Canyon Road past its intersection with the White Grass Road would adversely affect the character and use of that historic road segment. These actions would variously result in long-term adverse impacts on the historic character of Moose-Wilson Road and Death Canyon / White Grass Roads and their associated cultural landscapes. Long-term beneficial impacts would also result from measures to develop and implement road corridor design standards regarding the appropriate location and configuration of turnouts, parking areas, and other features in efforts to maintain design consistency and discourage unplanned or random vehicle turnouts in undesignated areas. This alternative would entail substantial loss of the historic character of the road corridor's cultural landscape and contributing features primarily as a result of road realignment.	Primarily long-term beneficial impacts would result from retention of Moose-Wilson Road in its present alignment and instituting road corridor design standards and visitor education measures to protect cultural resources. Long-term beneficial impacts would result from measures to develop and implement road corridor design standards regarding the appropriate location and configuration of turnouts, parking areas, and other features in efforts to maintain design consistency and discourage unplanned or random vehicle turnouts in undesignated areas. Strategies to limit the number of vehicles entering Moose-Wilson Road during peak use periods would also help preserve the feeling and integrity of the road's cultural landscape. Limited adverse impacts would result from drainage improvements and reconstruction of a segment of Moose-Wilson Road near Sawmill Ponds. Other adverse impacts on the historic character of the road corridor would result from removal of a portion of Death Canyon Road past its intersection with White Grass Road and construction of a new parking area at the junction of the White Grass and Death Canyon Roads. This alternative would best protect the historic character of the road corridor and contributing historic properties.	Proposed relocation of Moose-Wilson Road segments and restoring existing segments to natural conditions would result in significant adverse impacts on the historic character and cultural landscape integrity of the road corridor. Construction of a multiuse pathway parallel to Moose-Wilson Road would further diminish the road's historic character, particularly if placed adjacent or close to the roadway. Substantial modifications to White Grass / Death Canyon Roads would be undertaken including relocating a portion of Death Canyon Road to the existing alignment of the White Grass Road, restoring the abandoned section to natural conditions, and constructing a new connector road to the Death Canyon Trailhead. These actions would adversely impact the historic character of Moose-Wilson Road and Death Canyon / White Grass Road corridors and their associated cultural landscapes. Long-term beneficial impacts would result from measures to develop and implement road corridor design standards regarding the appropriate location and configuration of turnouts, parking areas, and other features in efforts to maintain design consistency and discourage unplanned or random vehicle turnouts in undesignated areas. This alternative would have the greatest adverse impact on the historic character of the road corridor and contributing features of the cultural landscape primarily as a result of road realignments and construction of the multiuse pathway.
Archeological Resources	Little potential for impacts on archeological resources is anticipated because no substantial ground-disturbing construction or development actions would occur. Nevertheless, long-term or permanent, localized, minimal adverse impacts on the park's prehistoric and historic archeological resources along the Moose-Wilson corridor could occur from natural erosion, visitor use, ongoing NPS maintenance operations, and other factors. Long-term beneficial impacts would also result from continued NPS management, monitoring, and protection of archeological resources in accordance with NPS policies and guidelines.	Proposed realignment of a segment of Moose-Wilson Road near Sawmill Ponds would result in significant and irreversible adverse impacts on archeological site 48TE498 and would destroy the site's current ability to yield important archeological information in a largely undisturbed context. A newly identified archeological site along Moose-Wilson Road near the LSR Preserve would also be adversely impacted by ground disturbance associated with parking and access improvements. Other new parking areas and improvements have the potential to adversely affect archeological resources that may exist in project areas. Long-term or permanent, localized adverse impacts on archeological resources would potentially occur from proposed construction and development, natural erosion, visitor use, ongoing NPS maintenance operations, and other factors. Limited long-term beneficial impacts would also result from continued NPS management, monitoring, and protection of archeological resources in accordance with NPS policies and guidelines as well as visitor outreach measures to expand protection	Retention of the Moose-Wilson Road segment near Sawmill Ponds would achieve avoidance of archeological site 48TE498 although monitoring would likely be required because of the need to reconstruct and improve the road segment. Development of new or improved parking areas would be designed to avoid the archeological site near the LSR Preserve and site 48TE1197 along White Grass / Death Canyon Roads. Long-term or permanent, localized, minimal adverse impacts on archeological resources would potentially occur from proposed construction and development, natural erosion, visitor use, ongoing NPS maintenance operations, and other factors. Long-term beneficial impacts would also result from continued NPS management, monitoring, and protection of archeological resources in accordance with NPS policies and guidelines as well as visitor outreach measures to expand protection awareness. Outside the no-action alternative, alternative C would result in the greatest degree of protection for archeological resources	Proposed realignment of a segment of Moose-Wilson Road near Sawmill Ponds would result in significant and irreversible adverse impacts on archeological site 48TE498. Development of a multiuse pathway would further adversely impact 48TE498, the site near the LSR Preserve, and potentially other unidentified archeological resources because the pathway would require additional ground disturbance. Construction of a spur road connecting the Death Canyon Trailhead and the White Grass / Death Canyon Roads would also result in significant impacts on archeological site 48TE1197. Long-term or permanent, localized, adverse impacts on archeological resources would potentially occur from proposed construction and development, natural erosion, visitor use, ongoing NPS maintenance operations, and other factors. Limited long-term beneficial impacts would also result from continued NPS management, monitoring, and protection of archeological resources in accordance with NPS policies and guidelines as well as visitor outreach measures to expand protection awareness.

TABLE 9. SUMMARY OF THE IMPACTS OF THE ALTERNATIVES

	Alternative A (No Action)	Alternative B	Alternative C (Preferred)	Alternative D
		awareness. Compared to the other alternatives, alternative B would result in substantial disturbance and loss of important archeological resources primarily as a result of ground disturbing road realignment and development actions.	by retaining existing conditions to a large extent and retaining existing road alignments.	Compared to the other alternatives, alternative D would result in the greatest damage and loss of archeological resources from the combined impacts of ground-disturbing road realignment and multiuse pathway construction.
Ethnographic Resources	Little potential for impacts on ethnographic resources is expected because no substantial ground-disturbing construction or development actions would occur. Nevertheless, long-term or permanent, localized, minimal adverse impacts on ethnographic resources along the Moose-Wilson corridor could occur from natural erosion, visitor use, ongoing NPS maintenance operations, and other factors. Long-term beneficial impacts would also result from continued NPS management, monitoring, and protection of ethnographic resources in accordance with NPS policies and guidelines.	Proposed realignment of a segment of Moose-Wilson Road near Sawmill Ponds would result in significant and irreversible adverse impacts on archeological site 48TE498. A newly identified archeological site along Moose-Wilson Road near the LSR Preserve could also be adversely affected by ground disturbance associated with parking and access improvements. Both sites possess ongoing cultural and ethnographic importance for associated tribes. Other new parking areas and improvements have the potential to adversely affect ethnographic resources that may exist in project areas. Long-term or permanent, localized, adverse impacts on ethnographic resources would potentially occur from proposed construction and development, natural erosion, visitor use, ongoing NPS maintenance operations, and other factors. Compared to the other alternatives, this alternative would result in substantial disturbance and loss of important ethnographic resources primarily as a result of ground disturbing road realignment and development actions.	Retention of the Moose-Wilson Road segment near Sawmill Ponds would help achieve avoidance of archeological site 48TE498, although monitoring would likely be required because of the need to reconstruct and improve the road segment. Development of new or improved parking areas would be designed to avoid the archeological site near the LSR Preserve and site 48TE1197 along White Grass / Death Canyon Roads. These sites possess ongoing cultural and ethnographic importance for associated tribes. Long-term or permanent, localized, minimal adverse impacts on ethnographic resources would potentially occur from proposed construction and development, natural erosion, visitor use, ongoing NPS maintenance operations, and other factors. Long-term beneficial impacts would also result from continued NPS management, monitoring, and protection of ethnographic resources in accordance with NPS policies and guidelines as well as visitor outreach measures to expand protection awareness. Compared to the other alternatives, alternative C would result in the greatest degree of protection for ethnographic resources by retaining existing conditions to a large extent and retaining existing road alignments.	Proposed realignment of a segment of Moose-Wilson Road near Sawmill Ponds has the potential to result in significant and irreversible adverse impacts on archeological site 48TE498. Development of a multiuse pathway would further adversely impact 48TE498, the site near the LSR Preserve, and potentially other unidentified archeological resources because the pathway would require additional ground disturbance. Construction of a spur road connecting the Death Canyon Trailhead and White Grass / Death Canyon Roads would also result in significant impacts on archeological site 48TE1197. These sites possess ongoing cultural and ethnographic importance for associated tribes. Long-term or permanent, localized, adverse impacts on ethnographic resources would potentially occur from proposed construction and development, natural erosion, visitor use, ongoing NPS maintenance operations, and other factors. Compared to the other alternatives, alternative D would result in the greatest damage and loss of ethnographic resources from the combined impacts of ground disturbing road realignment and multiuse pathway construction.
Visual Resources	Under alternative A, the corridor would continue to provide outstanding scenery and visual quality, both along Moose-Wilson Road and elsewhere. There would be some slight adverse impacts on the scenery and visual resources of the Moose-Wilson corridor under alternative A. Adverse effects on the visual quality of the area would continue to occur in certain places, especially along Moose-Wilson and Death Canyon Roads due to the degraded condition of the roadside, haphazard and unorganized parking on eroded user-created turnouts, and congestion. Additionally, aircraft from Jackson Hole Airport would continue to cause long-term adverse impacts on visual resources in the corridor.	Alternative B would result in modest beneficial and slight adverse impacts on the visual resources of the Moose-Wilson corridor, but overall, the actions proposed in this alternative would not result in significant adverse impacts. Beneficial impacts would result from reduced congestion along the roadway due to the placement of a gate near the LSR Preserve during peak use times and the addition of turnouts along the roadway resulting in less damaged vegetation and visible congestion of vehicles. Realignment of two sections of the road would overall provide new opportunities for visitors to experience scenic vistas not currently accessed from the roadway; however, this would result in the loss of intimate views as experienced in the current alignments. Consolidating parking at the new Death Canyon Trailhead would improve visual resources along Death Canyon Road and at the trailhead itself. While views of the White Grass Dude Ranch Historic District from the improved Death Canyon Road would result in slight beneficial impacts, scenic views from the historic district would be slight but not significant adverse impacts by the new parking area. Additionally, aircraft from Jackson Hole Airport would continue to cause long-term adverse impacts on the visual resources in the corridor.	Alternative C would result in substantial beneficial and slight adverse impacts on the visual resources of the Moose-Wilson corridor, but overall, the actions proposed in this alternative would not result in significant adverse impacts. Beneficial impacts would result from reduced congestion along the roadway due to timed entry of vehicles. Compared to alternatives A and B, the congestion would be significantly reduced within this alternative as use levels are directly managed. The queuing lanes would result in slight adverse impacts from Moose-Wilson Road as visitors travel along this road segment; however, those impacts would be localized to that portion of the road. Consolidation and relocation of parking at the new Death Canyon Trailhead would improve visual resources from White Grass Dude Ranch Historic District and would bring additional visual resources along the new 1.0-mile stretch of trail. These changes result in moderate beneficial impacts on visual resources along Death Canyon Road compared to those resulting from alternative B and substantial beneficial impacts compared to alternative D as an active roadway is removed from the White Grass Dude Ranch Historic District and new scenic views are added with a new trail segment. Slight and localized adverse impacts would result from development of the new Death Canyon Trailhead. Additionally, aircraft from Jackson Hole Airport would continue to cause long-term adverse impacts on the visual resources in the corridor.	Overall, alternative D would result in significant adverse impacts on the visual character and quality of the Moose-Wilson corridor. Development of a multiuse pathway, especially along portions of Moose-Wilson Road that remain in their current alignment, would significantly alter the historic and rustic character of the area. These impacts could be somewhat mitigated by constructing the pathway farther from the road, rather than adjacent to it, although such an alignment would result in habitat fragmentation and an increased risk of surprise encounters between pathway users and wildlife, including grizzly bears (see chapter 4, "Wildlife," "Threatened and Endangered Species"). Realignment of the road between Sawmill Ponds Overlook and the Death Canyon Road junction would change the perspective from which visitors view the scenery of the corridor, which could be considered both beneficial and adverse. Actions regarding Death Canyon Road and trailhead parking would have both beneficial and adverse impacts. Overall, the impacts of alternative D on visual quality would be greater than in the other alternatives. Additionally, aircraft from Jackson Hole Airport would continue to cause long-term adverse impacts on the visual resources in the corridor.

TABLE 9. SUMMARY OF THE IMPACTS OF THE ALTERNATIVES

	Alternative A (No Action)	Alternative B	Alternative C (Preferred)	Alternative D
Acoustic Resources and Soundscapes	Because no new management strategies are being proposed under alternative A, there would be few if any impacts on the current condition of soundscapes and the acoustic resources. However, possible increases in traffic volumes and lack of management tools to regulate increases in traffic could lead to increased vehicle noise, and therefore, would allow adverse changes in the percentage of time that vehicles are audible, thereby affecting the condition of the soundscapes or acoustic resources over time. In particular: ▪ The lack of management to regulate possible increases in use at the Death Canyon area could lead to adverse changes in the condition of the soundscapes or acoustic resources near wilderness. ▪ Noise impacts would continue several times per year when the unpaved section of Moose-Wilson Road is graded and treated for dust abatement.	Under alternative B, there would be beneficial and adverse effects to soundscapes and the acoustic resources: ▪ Most notably, reducing speed limits and implementing traffic management would reduce sound levels of road vehicles and the percent time audibility of vehicle noise. ▪ Converting 0.4 mile of unpaved road to trail would lessen the audibility of vehicle and human noise from the newly placed Death Canyon Trailhead toward Death Canyon. ▪ Improving the condition of the gravel road near Death Canyon would also decrease the audibility of vehicles noises in that area, and likely reduce the average noise levels from vehicles on the roadway. ▪ Ending winter maintenance of Moose–Wilson Road at the Murie Ranch Road junction would reduce vehicle access to this area in the winter and decrease the percent time audibility of vehicle noise, and would likely reduce the average noise levels in the area of the trail conversion. This would improve the condition of soundscapes for visitors and the acoustic resources for wildlife. ▪ There would also be short-term adverse effects for the duration of construction under this alternative.	Under alternative C, there would be beneficial and adverse effects to soundscapes and the acoustic resources: ▪ Most notably, reducing speed limits and implementing traffic management would reduce sound levels of road vehicles and the percent time audibility of vehicle noise. ▪ Converting 1.0 mile of unpaved road to trail would lessen the audibility of vehicle and human noise from the newly placed Death Canyon Trailhead toward Death Canyon. ▪ Improving the condition of the gravel road near Death Canyon would also decrease the audibility of vehicle noise in that area, and likely reduce the average noise levels from vehicles on the roadway. ▪ There would also be short-term adverse effects during the duration of construction under this alternative. ▪ Creating additional parking spaces along Moose-Wilson Road may also have adverse effects due to an increase in the percentage of time that human-caused noise is audible in the locations where increased use occurs.	Under alternative D, there would be beneficial and adverse effects to soundscapes. ▪ Most notably, reducing speed limits and implementing traffic management would reduce sound levels of road vehicles and the percent time audibility of vehicle noise. ▪ Ending winter maintenance of Moose–Wilson Road at Sawmill Ponds Overlook would reduce vehicle access to this area in the winter and decrease the percent time audibility of vehicle noise. This would improve the condition of soundscapes for visitors and the acoustic environment for wildlife. ▪ There would also be short-term adverse effects during the duration of construction under this alternative. ▪ Creating additional parking spaces along Moose-Wilson Road may also have adverse effects due to an increase the percentage of time that human-caused noise is audible in the locations where increased use occurs. ▪ There would continue to be noise impacts several times per year when the unpaved section of Moose-Wilson Road is being graded and treated for dust abatement. ▪ Bicycle use on a multiuse pathway could have an adverse impact on the acoustic resources. For example, it is important for bears to hear approaching humans to prevent undesirable human-wildlife encounters. Bears may not hear bikers moving at quiet high speeds.
Wilderness	Under alternative A, there may be a small number of slight adverse impacts on wilderness character, including: ▪ Social trailing and vegetation impacts affecting the natural quality of wilderness character. ▪ Impacts on solitude may also occur as a result of increasing visitor use trends that would likely continue under alternative A. These impacts are relevant to the Death Canyon area because it serves as a gateway to proposed and recommended wilderness.	Under alternative B, there would be beneficial effects to wilderness. ▪ Most notably, managing for up to 60 vehicles by developing a defined parking lot and implementing traffic management would equate to an overall decrease in use of the area, which may lead to increased opportunities for *solitude* on trails within potential wilderness areas. ▪ Reduced use of the wilderness may decrease impacts on the natural quality of the wilderness caused by social trailing and vegetation trampling.	Under alternative C, there would be beneficial effects to wilderness. ▪ Most notably, conversion of the 1.0-mile unpaved portion of the trailhead access road to trail would lead to increased opportunities for *solitude* on trails within the potential wilderness areas by dispersing use over a greater amount of space and time. ▪ Managing for up to 80–90 vehicles by developing a defined parking lot and implementing traffic management would maintain current use of the area. ▪ Alternative C places a limit on the number of people/vehicles at one time in the corridor, which over time will prevent unrestricted growth, providing better protection of solitude and wilderness values into the future than alternative A.	Under alternative D, there would be mostly adverse effects to wilderness. ▪ Most notably, managing for up to 100 vehicles by developing a defined parking lot and implementing traffic management would equate to an overall increase in use of the wilderness accessed from this parking area, which may lead to decreased opportunities for *solitude* on trails within potential wilderness.
Visitor Use and Experience	Alternative A would contribute a few beneficial impacts along with relatively larger adverse impacts on visitor use and experience in the Moose-Wilson corridor. Overall, alternative A would result in significant adverse impacts on visitor use and experience as the demand for opportunities in the corridor increase over time and visitation to the area rises. These adverse impacts would be significant because increasing traffic and visitation would continue to cause crowding at destinations along the road and at parking areas. The ability for visitors to experience the corridor in an unhurried, relaxed	Alternative B would result in both beneficial and adverse impacts on visitor use and experience, but overall, the actions proposed in this alternative would result in significant adverse impacts on visitor use and experience. The proposed action that would have the largest adverse impact on visitor use and experience is the potential gate closure at the LSR Preserve. Realignment of sections of Moose-Wilson Road would have the largest potential benefit to visitor use and experience. The gate closure at the LSR Preserve during peak visitation times would reduce crowding and congestion throughout the	Alternative C would result in both beneficial and adverse impacts on visitor use and experience, but overall the actions proposed in this alternative would result in substantial beneficial impacts on visitor use and experience. This alternative would increase the types of opportunities available for visitors within the corridor while maintaining current average peak visitation levels. The proposed actions that would have the largest beneficial impacts on visitor use and experience are the proposed sequenced entry system and road improvements.	Alternative D would result in both beneficial and adverse impacts on visitor use and experience, but overall the actions proposed in this alternative would result in great benefit to visitor use and experience. This alternative would increase the types of opportunities available for visitors within the corridor while maintaining current average peak visitation levels. The two proposed actions that would have the greatest potential long-term beneficial impacts on visitor use and experience are the addition of the multiuse pathway and a reservation system. The multiuse pathway would

TABLE 9. SUMMARY OF THE IMPACTS OF THE ALTERNATIVES

	Alternative A (No Action)	Alternative B	Alternative C (Preferred)	Alternative D
	and rustic manner characteristic of this part of the park would be less likely over time. Congested parking lots would result in visitors feeling frustrated by not being able to reach an intended destination and recreation opportunity. ▪ Limited management tools to regulate these changes could lead to unsafe incidents between visitors, adversely affecting visitor safety and visitor experience over time as visitation continues to grow. Visitors would continue to be able to access the diversity of opportunities in the corridor from both north and south, including the LSR Preserve, providing some ongoing beneficial impacts on visitor use and experience.	corridor, providing some short-term benefits to visitor use and experience as a substantial portion of users wishing to use the corridor as a commuting route between Teton Village and Moose would instead drive on county roads. However, as visitation to the area and the corridor increases over time the gate would not directly manage the volume or timing of visitation within the corridor. The inability to drive from one end of the corridor in either direction at all times would cause substantial adverse impacts on visitor use and experience. Gate closures would greatly reduce the number of destinations visitors could realistically reach due to the need to travel to the opposite end of the corridor to visit the other section they could not access first. Some visitors may need to add additional driving time to their itinerary, depending on what destinations within the corridor they are seeking. While the gate is open, visitors would be able to access all destinations within the corridor. Overall, the gate closure at the LSR Preserve would result in significant adverse impacts on visitor use and experience due to greatly reduced access. ▪ Realigning segments of Moose-Wilson Road, including additional turnouts and paving the unpaved road segment, would reduce wildlife jams and chances of road closures due to grizzly bear presence on the road, improve visitor safety, and improve scenic viewing opportunities for many visitors, providing substantial beneficial long term impacts for most visitors. Visitors would be able to experience the corridor in a relaxed and unhurried manner while being able to participate in activities that exemplify the uniqueness of the corridor, such as scenic driving and wildlife viewing. However, the road realignments would also diminish wildlife viewing opportunities for those visitors who prize viewing wildlife close-up, adversely affecting this portion of visitors. Overall road realignments and associated road improvements would result in substantial beneficial impacts on visitor use and experience.	By managing use levels over time through a sequenced entry system, visitors who enter the corridor would have the opportunity to experience the corridor in an uncongested and relaxed manner compared to average current peak levels. By managing the amount and timing of visitor use in the corridor and implementing other strategies in the alternative that aim to keep crowding and congestion relatively stable over the long term, visitors would be able to reach their intended destinations within the corridor as they would not need to compete for parking spaces and room on the road. Visitors would not need to plan ahead to use the sequenced entry system, but some visitors may plan on visiting the corridor during a time when visitation levels are low to avoid waiting in line. Visitors would experience some adverse impacts from the sequencing system because the need to wait during high-use periods could frustrate some visitors and may deter some from visiting the corridor. Over the long term, a sequenced entry system would result in substantial benefit to visitor use and experience by keeping crowding and congestion relatively stable within the corridor. ▪ Proposed road improvements, including paving the unpaved road segment, correcting drainage issues, vegetation setbacks, and adding turnouts would reduce congestion and visitor conflict by improving traffic flow and increasing visibility for drivers. Increased use of park staff and volunteers would also improve traffic flow around wildlife jams by controlling and directing traffic and increasing visitor education on appropriate behavior around wildlife. Overall, these actions may result in slight beneficial impacts on visitor use and experience by improving traffic flow compared to current conditions.	accommodate a wider variety of user types and skill levels therefore increasing the types of activities visitors could choose while in the corridor. The multiuse pathway would also improve real and perceived safety for cyclists, pedestrians, and drivers by separating bicycles and pedestrians from vehicles on the narrow roadway and helping visitors feel more at ease and lowering the chance of vehicle-bicycle and vehicle-pedestrian collisions. However, the multiuse pathway would likely increase the potential for undesirable human-wildlife encounters. Encounters with grizzly bears are of particular concern, since cyclists and pedestrians would be closer to prime wildlife habitat than on the road and could easily surprise bears, given the quiet nature of the recreation activity. Though the magnitude of the increase in potential undesirable human-wildlife encounters is unknown, the loss of even one human life would be a substantial adverse impact. As with any activity, the potential for risk along the multiuse pathway exists and each visitor would have to assess their own comfort level and willingness to accept those risks. Overall, the multiuse pathway would result in substantial beneficial impacts on visitor use and experience. By managing use levels over time through a reservation system, visitors who enter the corridor would have the opportunity to experience it in an uncongested and relaxed manner compared to average current peak levels. By managing the amount and timing of visitor use in the corridor and implementing other strategies in the alternative that intend to keep crowding and congestion relatively stable over the long term, visitors would be able to reach their intended destinations within the corridor as they would not have to compete for parking spaces and room on the road. The need to make a reservation before entering the corridor would require substantial trip planning on behalf of visitors, which could frustrate some visitors and have an adverse impact on their experience. This adverse impact would not be significant because the impact would diminish over time as visitors become familiar with the reservation system and the need for trip planning. Over the long term, the reservation system would result in substantial beneficial impacts on visitor use and experience.
Traffic and Transportation	Alternative A would provide no management solutions to address expected increases in visitation to the corridor. Overall, this alternative would have substantial and sustained adverse impacts on traffic and transportation over time, with no anticipated long-term beneficial impacts. This is significant because existing challenges, such as congestion and inadequate parking, would amplify as vehicular and bicycle traffic continues to grow in the county (see "Cumulative Impacts" above for more details on county growth), and no mitigation measures would be implemented to manage this growth. More congestion would increase risks to visitor safety, as the potential for accidents for both vehicles and bicyclists increases when more users and inappropriately parked vehicles are present on the road.	Alternative B would provide a variety of design and management strategies that would address expected increases in visitation to the corridor. Overall, this alternative would have minor beneficial impacts regarding traffic flow and safety. This is primarily because the implementation of gate closures during peak use periods would deter through-traffic and reduce traffic volumes, which would be beneficial for traffic flow and minimize the potential for safety-related incidents. Traffic flow would also be improved through formalized parking/turnouts along the road and realignment of the road away from the wetland area and into the open sage, reducing the potential for inappropriately parked vehicles, which can act as obstacles to other vehicles and bicycles. Navigation may still be a challenge at Death Canyon because the parking configuration may not be adequate during peak visitation.	Alternative C would provide a variety of design and management strategies that would address expected increases in visitation to the corridor. Overall, this alternative would have moderate beneficial impacts regarding traffic flow and safety. This is primarily because implementation of the timed sequencing strategy during peak use periods would deter through-traffic and reduce traffic volumes, which would be beneficial for traffic flow and minimize the potential for safety-related incidents. Traffic flow would also be improved through formalized parking/turnouts along the road, reducing the potential for inappropriately parked vehicles, which can act as obstacles to other vehicles and bicycles. The road, however, would not be realigned out of the wetland area in this alternative, which could continue to pose challenges to navigability, congestion, and safety, but some of these issues	Alternative D would provide a variety of design and management strategies that would address expected increases in visitation to both the corridor and the county. Overall, this alternative would have substantial beneficial effects regarding traffic flow and safety for both motor vehicles and cyclists. This is primarily because the implementation of the reservation system during peak use periods would limit vehicular access and prevent increased traffic volumes, which would be beneficial for traffic flow and minimize the potential for safety-related incidents. Traffic flow would be improved through formalized parking/turnouts along the road and at Death Canyon, as well as realignment of the road away from the wetland area and into the open sage. These strategies would reduce the potential for inappropriately parked vehicles along the road and at Death Canyon, which can act as obstacles to

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	Alternative A (No Action)	Alternative B	Alternative C (Preferred)	Alternative D
		Bicycles would share the road with motorists in this alternative, so there may be adverse effects to cyclists with regard to real or perceived safety, especially with the expected expansion of the regional bicycle network, which may bring more cyclists to the area. This would not be significant because some of these impacts would be mitigated by design solutions that would improve sightlines, provide an improved road surface, and create a "safety edge." However, with more cyclists sharing the road with vehicles, there would still be an increase in the potential for safety incidents. There may also be some minor adverse impacts on adjacent roadways associated with expected growth near Teton Village and diverted through-traffic from Moose-Wilson Road. The magnitude of this impact is unknown because it is difficult to determine the amount of traffic that will be diverted given changes in visitation patterns.	may be mitigated through active management techniques targeted at improving conditions in this area. Navigation would be greatly improved at Death Canyon because the road changes and parking improvements would accommodate parking demand. Bicycles would share the road in this alternative, so there may be adverse effects to cyclists in regard to real or perceived safety, especially with the expected expansion of the regional bicycle network, which may bring more cyclists to the area. This would not be significant because some of these impacts would be mitigated by design solutions that would provide an improved road surface and create a "safety edge." However, with more cyclists sharing the road with vehicles, there would still be an increase in the potential for safety incidents. There may also be some minor adverse impacts on adjacent roadways associated with expected growth near Teton Village and diverted through-traffic from Moose-Wilson Road. The magnitude of this impact is unknown because it is difficult to determine the amount of traffic that will be diverted given changes in visitation patterns.	other vehicles and bicycles. Bicyclists would have a dedicated multiuse pathway in this alternative, which would greatly improve both real and perceived safety along the roadway and would also improve traffic flow for motor vehicles. There may also be some minor adverse impacts on adjacent roadways associated with expected growth near Teton Village and diverted traffic from Moose-Wilson Road. The magnitude of this impact is unknown because it is difficult to determine the amount of traffic that will be diverted given changes in visitation patterns.
Socioeconomics	Increased future visitation along with lodging capacities and congestion would potentially broaden the length of the peak season to the entire summer season as use levels increase during shoulder seasons. The corridor is anticipated to become more congested in the future, and diminished visitor experience is likely to cause some visitors to avoid visiting the corridor because there is no traffic management strategy under alternative A. ▪ The economic benefits to local economies are anticipated to increase under alternative A. As visitation increases in the future, relative to existing conditions. ▪ Compared to existing conditions, visitation, visitor spending, and sales and use tax receipts are all anticipated to increase over the planning horizon under alternative A, with more noticeable increases, and therefore benefits, in the communities of Moose and Teton Village in the summer. However, visitor spending is likely to be negligible in terms of Teton County's overall economy. Construction and facility costs (approximately $3.6 million) and continued NPS staffing would continue to benefit the county's economy, although these benefits are negligible in the context of the region's current jobs, income, and sales. ▪ Traffic management under alternative A would not adversely affect traffic congestion because unrestricted travel along Moose-Wilson Road would provide an alternative route of travel in the area. ▪ Taxis would continue to travel the Moose-Wilson corridor between Teton Village and the airport, bypassing traffic in the town of Jackson, providing convenience for those traveling to the airport.	The current level of travel, visitation, visitor spending, and fiscal benefits to proximate communities in the corridor is expected to continue in the short term because the corridor visitation would be consistent with the current levels of use. ▪ In the longer term, alternative B may reduce restaurant and retail spending in Teton Village and increase spending in the town of Jackson. Potential increased visitation in the long term in the corridor is anticipated under alternative B in the off-peak times (e.g., morning) and shoulder months compared to existing conditions because visitors would avoid congested peak times to travel the corridor. ▪ Because lodging is constrained and overcapacity issues occur during peak summer periods, traffic management of the corridor would not affect lodging choices and receipts, which would limit the adverse impacts on Teton Village. ▪ In the long term, any increases in visitor spending that could occur in the town of Jackson would be comparably small. Because alternative B does not actively limit travel in the corridor, it may lead to additional visitation to the corridor when compared to the other action alternatives. Construction activities, anticipated to cost approximately $32.6 million, and increased NPS staffing would benefit local economies, but be minimal in the context of the region's current jobs, income, and sales. ▪ Under alternative B, there would be more diverted vehicle travel in the future that, in most cases, would travel via the town of Jackson, causing congestion, traffic, and decreased quality of life in the Jackson area during peak visitation periods in the long term.	The current level of travel, visitation, visitor spending, and fiscal benefits to proximate communities in the corridor is expected to continue in the short term because the corridor capacity would be set at current levels of use. ▪ Increased visitation in the long term in the corridor is anticipated under alternative C in the off-peak times (e.g., morning) and shoulder months compared to existing conditions because visitors would avoid congested peak times where they would have to wait to travel the corridor. ▪ Alternative C may reduce restaurant and retail spending in Teton Village and increase spending in Jackson compared to alternative A, due to timed sequencing restrictions; however, increases in visitation to the corridor during off-peak times and seasons may offset this. However, potential increases in visitation to the corridor during off-peak times and seasons may off-set this decrease. ▪ Because lodging is constrained during peak summer periods, traffic management of the corridor would not affect lodging choices and receipts, which would also limit the adverse impacts on Teton Village. ▪ Traffic management under alternative C would provide negligible impacts on Teton County's economy. Construction activities, anticipated to cost approximately $24.4 million, and increased NPS staffing would benefit local economies, but be minimal in the context of the region's current jobs, income, and sales. ▪ There would be more diverted vehicle travel in the future that would cause congestion, traffic, and decreased quality of life in the Jackson area during	▪ In the long term, increased visitation in the corridor is anticipated under alternative D in the off-peak times and shoulder months, compared to existing conditions and alternative A because visitors would make a reservation and avoid congested peak times. Because the current visitor and vehicle capacity during the peak periods would be maintained, restaurant and recreational spending in the short term in Teton Village and Moose would remain at current levels. ▪ Alternative D may reduce long-term restaurant and retail spending in Teton Village and increase spending in the town of Jackson compared to alternative A because it limits through-traffic during peak periods, with potential long-term adverse impacts on visitor spending within Teton Village. Potential increases in visitation to the corridor during off-peak times and shoulder seasons may off-set this decrease. ▪ Because lodging is constrained during peak summer periods, traffic management of the corridor would not affect lodging choices and receipts, which would also limit the adverse impacts on Teton Village. ▪ The pathway amenity is likely to draw bicycle visitors to the corridor, with increased economic benefits to proximate communities, although these benefits are likely to be small relative to the current level of visitation and tourism spending in the region. ▪ Alternative D would have negligible impacts on Teton County's economy. Construction activities, anticipated to cost approximately $43.2 million, and increased NPS staffing would benefit local economies, but be minimal in the context of the region's

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	Alternative A (No Action)	Alternative B	Alternative C (Preferred)	Alternative D
	▪ Public services would not be affected under alternative A.	▪ The contribution to traffic in the Jackson area would be minimal in the short-term, but could be more noticeable in the future as travel and traffic increase across the area and more vehicles are diverted off Moose-Wilson Road. ▪ Alternative B would prohibit taxi use on the road, increasing the distance for travel to the airport from Teton Village. ▪ Administrative use of the road would still be allowed through the gate when it is closed, allowing emergency and fire vehicles to access (and pass through) the corridor during emergency situations. ▪ Construction activities under alternative B would not affect public services or schools because the workforce would already be residing within the county.	peak visitation periods in the long term although these impacts would be small relative to alternative A and less adverse than alternative B. ▪ Alternative C would prohibit taxi use on the road, increasing the distance for travel to the airport from Teton Village. The current management of the road to accommodate emergency and fire access would continue, and construction activities under alternative C would not affect public services or schools because the workforce would already be residing within the county.	current jobs, income, and sales. ▪ There would be more diverted vehicle travel in the future that would cause congestion, traffic, and decreased quality of life in the Jackson area during peak visitation periods in the long term, although these impacts would be small relative to alternative A and less adverse than alternative B. ▪ Alternative D would prohibit taxi use on the road, increasing the distance for travel to the airport from Teton Village. ▪ The current management of the road to accommodate emergency and fire access would continue, and construction activities under alternative D would not affect public services or schools because the workforce would already be residing within the county.
Park Operations	There would be continued adverse impacts on park operations resulting from growing visitation, congestion, and conflict that require staff intervention and accelerate deterioration of roads and trails in the corridor. The continued configuration of Moose-Wilson Road would require frequent repairs to hydrology-induced damage at Sawmill Ponds and dust abatement treatments for the unpaved segment. Insufficient parking capacity would require staff management and result in pavement damage from shoulder parking. There would be a beneficial impact from the currently programmed need to resurface Moose-Wilson Road, which would improve pavement condition.	Alternative B would result in both adverse and beneficial impacts on park operations. The barrier gate at the LSR Preserve would reduce congestion during peak use periods, reducing visitor conflict. Realigning segments of Moose-Wilson Road and paving the unpaved segment would reduce wildlife jams, reduce hydrology-induced pavement damage, and eliminate dust abatement needs. Added turnouts along Moose-Wilson Road and expanded parking at Death Canyon Trailhead would reduce staff management of parking issues and pavement damage. New bridges at Sawmill Ponds would require significant additional maintenance. The loss of White Grass Ranger Station as a station and reduced winter plowing would increase emergency response times. Proposed construction projects would require supervision.	Alternative C would result in both adverse and beneficial impacts on park operations. The sequenced entry system would reduce congestion to a greater extent than in alternative B, further reducing visitor use conflicts. Realigning the northern segment of Moose-Wilson Road, paving the unpaved segment, and enhancing drainage on the segment near Sawmill Ponds would reduce wildlife jams, reduce hydrology-induced pavement damage, and eliminate dust abatement needs. Added turnouts along Moose-Wilson Road and expanded parking at Death Canyon Trailhead would reduce staff management of parking issues and pavement damage. The loss of White Grass Ranger Station as a station would increase emergency response times. Proposed construction projects would require supervision.	Alternative D would result in both adverse and beneficial impacts on park operations. The reservation system would reduce congestion to a greater extent than in alternative B, and comparable to that of alternative C, reducing visitor use conflicts. Realigning segments of Moose-Wilson Road would reduce wildlife jams and reduce hydrology-induced pavement damage. Added turnouts along Moose-Wilson Road and expanded parking at Death Canyon Trailhead would reduce staff management of parking issues and pavement damage. The multiuse pathway would present a sizeable increase in operational requirements, including patrolling, clearing debris, closing for wildlife activities, and pavement maintenance. New bridges at Sawmill Ponds would require more maintenance than those in alternative B because they must accommodate the added width of the pathway. Reduced winter plowing of Moose-Wilson Road would lengthen emergency response times. Proposed construction projects would require supervision.

3 Affected Environment

INTRODUCTION

This chapter describes the environment of the Moose-Wilson corridor that is being analyzed in this environmental impact statement. It focuses on the natural and cultural resources, scenery, the acoustic resources and soundscapes, wilderness, visitor use and experience, traffic and transportation, socioeconomics, and park operations that may be affected by actions proposed in the alternatives. Please refer to the impact topics section in chapter 1 for a list of the impact topics that have been retained and thus are addressed in this chapter.

Chapter 3 does not provide an exhaustive description of the impact topics, but rather enough detail to understand the impacts of implementing the alternatives. The following description of the corridor environment establishes the basis for the impact analysis in "Chapter 4: Environmental Consequences." The effects of climate change on the corridor environment are also included as part of the introduction of this chapter.

For more details on the Moose-Wilson corridor, including reports on visitor use data, a road safety audit conducted by the Western Federal Lands Highway Division of the Department of Transportation, and a virtual tour of the corridor, see the park's website: http://www.nps.gov/grte/learn/management/mwccmp.htm.

CLIMATE CHANGE

To understand future trends in the condition of the Moose-Wilson corridor and its resources and values, a synopsis of projected regional climate changes and their potential influences on the area's natural and cultural resources and visitor experience is provided in this section.

Various climate change modeling efforts (and associated impact identification studies) are currently being conducted and refined across all regions of the National Park Service. Important information on potential future changes to park resources and values can be gleaned from this modeling and impact analysis. A number of reports have recently been published on climate change and possible impacts on the Greater Yellowstone Ecosystem through the 21st century (Chang and Hansen 2014; NPS 2013; Gonzalez 2012; Ashton 2010). Information from these reports can clarify what might be expected to occur throughout the Moose-Wilson corridor.

The effects of climate change have already been documented in the Greater Yellowstone Ecosystem region (Gonzalez 2012; Chang and Hansen 2014), including:

- Mean annual temperature has increased across the Rocky Mountains and in the area that includes the Greater Yellowstone Ecosystem from 1901 to 2002. Although the temperature trend for Yellowstone National Park and Grand Teton National Park is not statistically significant, temperature did show a statistically significant increase at the weather station at Yellowstone National Park headquarters from 1942–2011.
- Total annual precipitation has increased across the Rocky Mountains from 1901–2002, but not enough to offset temperatures. Consequently, aridity has increased.
- Analyses of data from weather stations and snow courses across the western United States have detected statistically significant changes in the 20th century and attributed these to climate change. These changes include

increased winter temperatures, decreased snowpack, decreased ratio of snow to rain, and earlier spring streamflow during the second half of the 20th century.

- Analyses of snow course and tree ring data from sites across the Rocky Mountains, including in the Greater Yellowstone Ecosystem, have detected snowpack melting in the 20th century greater than any time since AD 1200 and attributed the melting to climate change.
- The ratio of snow to rain has decreased and spring flows are starting earlier—attributed to a documented shift in spring warmth (10 days early for the Yellowstone region during the second half of the 20th century).
- Changes in climate have favored insect outbreaks resulting in increased mortality in conifer forests. Several tree species are particularly vulnerable to range contractions due to climate change, including the dominant subalpine species in Grand Teton National Park: Engelmann spruce (*Picea engelmannii*), subalpine fir (*Abies lasiocarpa*), and whitebark pine (*Pinus albicaulis*).

Looking ahead through the 21st century, climate modeling conducted by the Intergovernmental Panel on Climate Change factors in multiple possible scenarios for greenhouse gas emissions. For three emission scenarios that were analyzed with projected low, moderate, and high increases in carbon dioxide, the modeling shows (Gonzalez 2012; Chang and Hansen 2014):

- Mean annual temperatures in the region are projected to rise 5.8 degrees Fahrenheit (°F) to 10.8° (3.2° to 5.6° Celsius) by 2100, with temperatures rising at similar rates across all seasons.
- The Greater Yellowstone Ecosystem is projected to be largely snow-free on April 1 by 2075 under the highest emission scenario as a result of warming temperatures and a declining snow water equivalent.
- Mean annual precipitation is projected to increase an average 5% +/- 8% by 2100, with precipitation increasing most rapidly in the spring and decreasing slightly in the summer.
- The aridity of the region is projected to increase between 7% and 18% by 2100. While mean annual precipitation is projected to rise, these increases will not be adequate to offset increases in potential evapotranspiration that will result from increases in temperature; therefore, aridity is projected to increased.
- The mean annual runoff is projected to increase, with pronounced increases in the spring runoff, more extreme spring peak runoff volumes, and decreases in the summer.

In addition to potential increases in precipitation and mean annual temperature, other climatic changes will likely occur. Modeling under the higher emissions scenario indicates potential changes in the frequency of extreme precipitation and temperature periods (lower frequency of extreme cold days and higher frequency of high precipitation events and low precipitation periods) (Gonzalez 2012).

These types of projected climate changes are important because climate is a dominant factor affecting the physical and ecological processes of the region, which in turn affects vegetation and wildlife. For example, with warming temperatures, the length of the growing season for the Greater Yellowstone Ecosystem would be expected to increase. Increased spring and summer temperatures and an earlier spring melt have been associated with higher large-wildfire frequency, longer wildfire durations, and longer wildfire seasons (Westerling et al. 2006), potentially resulting in major changes to vegetation. Changes in temperature and precipitation levels (and the frequency and severity of extreme weather events/ conditions) could lead to notable shifts in wildlife ranges, as well as the migration of native plant communities (grassland, temperate conifer forest, and boreal conifer forest biomes) northward and upslope environs (Gonzalez 2012). Likewise, some species of plants and animals are less resilient to changes in climate conditions. Thus, considerable changes in species distributions, natural community biodiversity, and ecological systems (e.g., food chain) could occur. For example, the land area with a suitable climate for subalpine conifer forest is projected to decrease in the Greater Yellowstone Ecosystem, and the land area with a suitable climate for Great Basin montane scrub is projected to increase. It is possible that with the projected change in climate, there may be a shift from conifer forests to shrub steppe vegetation types now found in central Wyoming (Chang and Hansen 2014).

The general prediction for wildfire in the western United States calls for more intense fires, similar to those of 1988. However, the charcoal in lake sediment cores is telling a different story in the Greater Yellowstone Ecosystem. These records extend back 17,000 years and were taken from Cygnet Lake on the Central Plateau. Charcoal from 8,000 years ago, when temperature increases equal what we are now experiencing, shows more frequent but smaller fires than today. Fuels, along with fire weather, determine fire size and severity: the stand-replacing fires of today open up the forests where stands have been burned, limiting fuels for the next fire. As a result, areas with frequent fires also tend to have small fires (NPS 2013).

Changes in climate are expected to further alter fire regimes and increase invasive species in sagebrush steppe and low-elevation woodlands (NPS 2013). Wetlands in the region may decrease due to warming temperatures, a decreasing snowpack, and less precipitation in the summer. Sedges, rushes, and other mesic plants may lose habitat, as well as amphibians and birds that rely on this habitat (Ashton 2010; NPS 2013).

Climate change may affect the impact of nonnative species through direct effects on habitat suitability and indirect effects on nutrient availability and fire and other disturbances. Although invasive plants are also likely to continue to shift in range and competitiveness along with native species, they will differ in their response to climate change from native species insofar as they possess traits such as broad climatic tolerances and resilient dispersal mechanisms that enable them to better adapt to changing conditions (Ashton 2010). Depending on the species and geographic location, climate change may result in range movement, expansion, or contraction.

Climate change is also expected to affect wildlife in the area. In addition to changes in habitat and vegetation that species rely on, the following changes are expected to species in the Greater Yellowstone Ecosystem (NPS 2013):

- Climate change is predicted to cause birds to shift their range, migratory patterns, and timing, and interfere with reproduction.
- The current trend of grizzly bear males to den later would continue.
- Impacts on amphibians could include earlier breeding, resulting in more frequent exposure to killing frosts and a longer larval period because water temperatures warm more slowly in early spring, leading to higher larval mortality.

In addition to a wide variety of potential effects to natural processes and natural communities, changes in climate conditions are anticipated to alter cultural resources along the Moose-Wilson corridor. Archeological and ethnographic resources, particularly those along steep slopes or stream/river courses, could be at heightened risk of disturbance from erosion occurring during periods of more frequent and severe storm events. Archeological and ethnographic sites may become revealed or more visible, and therefore more vulnerable as a result of wildfires or reduction forest overstory. Increased intensity of spring runoff could also contribute to erosion and destabilization of archeological sites. Historic structures (primarily those of log and wood construction) and cultural landscape features may also be subject to damage or loss from severe storms as well as wildfires. Rising temperatures and decreasing precipitation have resulted in large areas of conifer forest die-off associated with insect infestations, increasing fuel loads, and the wildfire threat to historic structures and districts in proximity to forested areas.

Climate change is anticipated to alter visitor experiences within the Moose-Wilson corridor. Changes in climate may alter the kinds, amounts, and patterns of visitor use in the Moose-Wilson corridor. The most notable of these changes would be increased visitation trends in the shoulder seasons due to warmer temperatures. Heavy snow conditions during winter months provide opportunities for winter uses in the corridor. As large amounts of snow are present for shorter periods of time, opportunities for winter recreation (i.e., snowshoeing or backcountry skiing) would be lessened. In turn, recreation traditionally possible during the spring, summer, and fall could be available to visitors for additional weeks or months. This may put additional pressure on park staff to maintain infrastructure in the corridor to support nonwinter uses. In addition, as both natural and cultural resources are altered by climate change, the ability of a visitor to experience and learn about these resources would be affected.

NATURAL RESOURCES

INTRODUCTION

This section describes the natural resource components of the Moose-Wilson corridor's environment that would be affected by implementing the alternatives. It presents only enough detail to understand the effects of the alternatives and is not an encyclopedic description. These descriptions are concise summaries organized by the resource topics, which relate directly to those analyzed in "Chapter 4: Environmental Consequences."

Information about each resource topic corresponds to the type of impacts being analyzed in chapter 4. Descriptions of these resources are primarily at the corridorwide level; however, some site-specific information on resources is provided for areas that might be notably affected by implementation of various alternative strategies. In some cases, additional site-specific resource information is also included as part of the analysis in chapter 4. The natural resource topics discussed in this chapter are as follows:

- Wildlife and Wildlife Habitat
- Federally Listed and Candidate Wildlife Species
- Wetlands
- Hydrology
- Water Quality
- Vegetation
- Soils

WILDLIFE AND WILDLIFE HABITAT

Background

The project area in Grand Teton National Park sits amidst the large, diverse, and thriving ecosystem of the Greater Yellowstone Area. This broader, regional ecosystem consists of 28,000 square miles of landscape and is considered one of the largest intact temperate zone ecosystems on earth (NPS 2013). This large, intact ecosystem possesses some of the highest levels of biodiversity in North America, both in the number of species and in the abundance of each particular species. The Greater Yellowstone Area ecosystem is home to one of the largest elk herds in North America, the largest free-roaming, wild herd of bison in the United States, and one of the few populations of grizzly bears in the lower 48 states of the United States. Various rare wildlife species, such as the wolverine and Canada lynx, are also present. Equally important, the Greater Yellowstone Area appears to retain its full historical assemblage of native, vertebrate wildlife species. This characteristic is extremely rare in the lower 48 states (NPS 2013).

The richness of the wildlife community in the Greater Yellowstone Area ecosystem is a result of both the protected habitat condition (on a mosaic of federal lands) and the wide variety of habitats found in the region, which include sagebrush flats, deciduous and coniferous forests, grassy meadows, large wetland complexes, multiple riparian corridors along streams and rivers, and high alpine habitat to name a few (NPS 2013). All of these habitats are interconnected in one way or another by the many stream and river corridors. Most wildlife species depend on multiple habitat types from day to day, season to season, and/or life stage to life stage. Thus, minimizing habitat fragmentation and preserving habitat linkages and continuity are critical to the health of the overall, regional ecosystem. Likewise, as it relates to this plan, it is important to consider the value and functionality of the wildlife and wildlife habitat within the geographic boundary of the Moose-Wilson corridor as well as its contribution to the regional Greater Yellowstone Area ecosystem.

At a more local level, the Moose-Wilson corridor project area possesses a diverse array of wildlife habitat, including riparian corridors, wetlands, sagebrush steppe, montane woodlands, and forests. This habitat diversity results from the Snake River's extensive riparian habitats being closer to the Teton Range in the Moose-Wilson corridor than at any other location in the park. In addition to notable elevation changes, the vegetation, hydrology, and geology also changes rather abruptly as one moves from the riverbed of the Snake River to the mountainous areas at the western edge of the project area. Thus, in a relatively small geographic area (i.e., the project area), most of the park's major ecological communities are represented. Given this diversity of habitat, a wide variety of wildlife species inhabit the project area and depend on this unique ecological system. Furthermore, this natural constriction between the Snake River and the Teton Range functions as an important wildlife corridor within the broader park ecosystem, particularly for north-south movement along and above the Snake River floodplain. Prominent wildlife species within the corridor include grizzly and black bears, wolves, elk, moose, beavers, and a wide variety of migratory birds (Cain, pers. comm. 2014). Many of these species are "crepuscular," meaning they are most active in the morning and evening.

Included in this wide variety of wildlife species are various federally listed or candidate species (threatened or endangered) that warrant special consideration and protection. These federal special status species are described in the "Federally Listed and Candidate Wildlife Species" section.

Common Wildlife Habitat Types in Project Area

The following are the most predominant habitat types in the project area (Dewey, pers. comm. 2014):

Riparian Woodland Habitat. The riparian woodland habitat in the project area is associated with the wooded corridors along the Snake River and various stretches of the Snake River tributaries, primarily east of Moose-Wilson Road. This habitat type includes cottonwood riparian woodlands, spruce riparian woodlands, and mixed deciduous/coniferous riparian woodlands. The dominant tree species of this habitat type varies from stream/river segment to segment. Because of its relative rarity on the regional landscape, this habitat type is of great importance to wildlife. These woodlands provide nesting and foraging habitat for forest-dwelling raptors (accipiters such as northern goshawks) and other migratory birds. Ungulates also use these areas as protective cover. Both small and large carnivores use riparian woodlands for hunting, denning, and resting. The riparian woodland habitat areas serve as important wildlife movement corridors on a daily and seasonal basis (north-south movement along the Snake River, and generally east-west movement along the tributaries). Typical wildlife use of this habitat includes raptors (nesting bald eagles, osprey, various accipiters, red-tailed hawks, etc.); great blue herons; large nursery groups of elk; various large carnivores (black bear, grizzly bear, mountain lion, wolf); mid-size and small carnivores (weasel, fox, coyote, pine marten, wolverine); moose; beaver; and migratory birds.

Wetland Habitat. Most of the wetland habitat in the project area exists in the northern sections of the project area (near Sawmill Ponds and to the east toward Murie Ranch). Refer to "Affected Environment" in the "Wetlands" section for more information. Generally, most of the wetland extents in the northern portion of the project area relate to past and present beaver ponds. Although riverine and lacustrine wetlands also exist throughout the project area (e.g., near Phelps Lake and along the Snake River and its tributaries). Beyond the open water of beaver ponds, lakes, and streams, wetland vegetation in the project area consists of a mosaic of various sedges, rushes, and hydrophytic grasses, with a variety of willow species and other shrubs along wetland edges. These wetland conditions provide valuable foraging and breeding/nesting habitat for a wide variety of wildlife, including small and large mammals, birds, amphibians, and other aquatic species. For example, moose are common foragers in the beaver pond complexes and migratory birds nest and forage in vegetation adjacent to the wetlands. Also, a unique diversity of amphibian breeding populations (relative to other wetlands throughout the park) exists in the wetland complex around Sawmill Ponds, indicating the quality and importance of these wetlands (Ray et al. 2014). Due to the constantly changing and relocating beaver activity in the area, the wetland habitat conditions and locations of the project area are also in constant flux. Typical wildlife use of this habitat includes beavers, moose, amphibians, waterfowl, and migratory birds.

Shrub Habitat. Shrub habitat in the project area includes small and large areas of berry-producing shrubs (e.g., common chokecherry, hawthorn, etc.). Shrub habitat is relatively prevalent along the Moose-Wilson corridor south of Sawmill Ponds to the LSR Preserve, and along Lake Creek. The shrub habitat is mainly known for being a strong attractant to herbivores and omnivores when the berries are ripe in the fall. Typical wildlife use of this habitat includes black bears and grizzly bears (when berries are ripe), foxes, coyotes, and several bird species that feed on berries.

Sagebrush Habitat. Sagebrush habitat is found on the lower slopes and valley floor throughout the project area. During the homesteading era, sagebrush was cleared and replaced with pasture and hayfields in many locations, including west of Moose-Wilson Road at White Grass Ranch, parts of the LSR Preserve, and Poker Flats areas, and east of Moose-Wilson Road north of the Death Canyon Road junction and south of the LSR Preserve. These areas fragment the sagebrush habitat, but are also used by a variety of wildlife species The largest extents of sagebrush habitat are now found in the northern portion of the project area along the base of the ridge to the west of the northern corridor entrance and in the southern portion of the project area, both east and west of Moose-Wilson Road. Most notably, sagebrush habitat in the Moose-Wilson corridor area provides transitional (spring/fall) and summer range for elk. In the fall, groups of elk congregate in the larger sagebrush meadows and grasslands for the rut (e.g., around White Grass Ranch area, southwest of Sawmill Ponds, around LSR Preserve, etc.). Pronghorn have also been known to use the sagebrush habitat southwest of Sawmill Ponds Overlook and the open meadows in the White Grass Ranch area. Sage-grouse use sagebrush habitat to the west of Teton Park Road and north of Moose-Wilson Road at the base of the ridge along the northern corridor entrance throughout the year. Typical wildlife use of this habitat includes elk, various sagebrush-dependent bird species, occasional pronghorn, occasional moose (especially if bitterbrush is present), and various small mammals such as Uinta ground squirrel and deer mouse.

Coniferous Forest Habitat. Most of the coniferous forest habitat in the project area lies west of Moose-Wilson Road. This habitat includes areas of homogeneous lodgepole pine and other areas of mixed conifers (e.g., Douglas-fir, subalpine fir, and lodgepole pine). The dominant tree species and forest composition of the coniferous forest habitat varies with soil type, topography, and successional stage. For example, the ridge to the west of the road (west of northern corridor entrance and Sawmill Ponds Overlook) has mixed coniferous forest which transitions into homogeneous lodgepole forest east of White Grass Ranch. To the south, this forest then transitions back to mixed coniferous forest along Death Canyon

Road and then back again to homogeneous lodgepole pine. The plentiful coniferous forest habitat in the project area provides secure habitat for wildlife movement, shelter/protection, and nesting (for forest-dwelling raptors and other migratory birds). Various ungulates typically bed down in these forest areas during the day, especially in places that are adjacent to meadows/sagebrush openings or wetlands (e.g., moose). Also, large, mid-sized, and small carnivores hunt, den, rest, and travel in coniferous forests. Typical wildlife use of this habitat includes ungulates (elk, mule deer, moose); forest-dwelling birds and migratory species, including raptors (e.g., goshawks, great gray owls, great horned owls, etc.); large carnivores (black bears, grizzly bears, mountain lions, wolves); mid-sized and small carnivores (weasels, fox, coyote, pine marten, wolverine); and small mammals (marmot, Uinta ground squirrel, deer mice, etc.).

Open Water Habitat. In addition to the riparian habitat provided along the Snake River corridor (see above), the Snake River also provides an abundance of open water and gravel bar habitat that serves a different purpose than riparian habitat. Although portions of the Snake River corridor are confined by a levee, various stretches of wide and braided channels in the project area provide ample foraging habitat for a wide variety of waterfowl, shorebirds, and other migratory birds, including trumpeter swans. Ungulates, such as elk, use the open water habitat for drinking or even protection from predators. Farther to the west, Phelps Lake provides open water lake habitat. Both the open, deeper water of the lake and the shallow, open water habitat of the lake perimeter are important for a wide variety of species. Typical wildlife use of these riverine and lacustrine open water habitats include amphibians, waterfowl, shorebirds, and ungulates.

Description of Habitat Along Moose-Wilson Road Corridor

As Moose-Wilson Road meanders through the project area from north to south, it crosses through many of the above-described habitat types. Thus, the road fragments some of these habitats and human use of the road has notable effects on wildlife behavior. It is important to note that human activity along the road corridor affects the behavior of some wildlife species more significantly than others. The following descriptions along the road corridor were provided by the park's senior wildlife biologist (Cain, pers. comm. 2014).

From Moose Junction to the Sawmill Ponds Overlook, the road first crosses an important, narrow wildlife travel corridor (less than 0.25 mile in width) through coniferous forest habitat and open sagebrush habitat. Moose, elk, mule deer, and black bear are commonly observed in the area. This movement corridor is important for wildlife traveling north-south along and above the Snake River floodplain. The road corridor eventually approaches and overlooks Sawmill Ponds where moose and waterfowl are commonly found using ample beaver pond wetland habitat. In this segment of the road corridor, visitors frequently stop their cars to view elk, moose, mule deer, and bears along the road.

From Sawmill Ponds Overlook to Death Canyon Road, the road corridor passes, and effectively constrains, the relatively large acreage of beaver-created wetlands on the east side of the road. Moose, waterfowl, migratory birds, and amphibians are common in this area. The narrow, winding road fragments this valuable wetland habitat from the adjacent steep hillsides covered with fruit-bearing trees and shrubs on the west side of the road (an area where black bears and grizzly bears commonly forage in summer and fall). The road also limits beaver activity in this area, as beaver pond water levels are currently managed by park staff to minimize road flooding. This segment of the road corridor provides quality habitat for black bear, grizzly bear, moose, elk, beaver, and owls, and possesses some of the most diverse wildlife habitat in the entire corridor.

From Death Canyon Road to the LSR Preserve, the Moose-Wilson corridor winds through a flat, semi-open cottonwood and aspen forest, with some mixed coniferous forest. Steep hillsides lie to the west of the road. The east side of the corridor is more heavily forested than the west side. In addition to deciduous and coniferous forest habitat, some fruit-bearing shrub habitat is also present, but is farther from the road edge.

When the road corridor passes through the LSR Preserve, it climbs steeply and then descends a hillside as it proceeds southward. This is the only section of the road corridor that leaves/ascends the sagebrush habitat bench above the Snake River floodplain. This slightly elevated area is heavily forested with coniferous forest habitat. Near the south end of the LSR Preserve, the road crosses Lake Creek and its adjacent riparian habitat area.

The unpaved segment of Moose-Wilson Road (to the south of LSR Preserve) crosses through a large, semi-open cottonwood-aspen and spruce-fir forest. After passing through the forest habitat, the road corridor enters a large, open sagebrush flat to the south. Elk and bears are common along this segment. Also, this unpaved section of the road is where the road prism is the widest.

Lastly, from Poker Flats to the Granite Canyon Entrance at the park's southern boundary, the road bisects the large, open sagebrush flat. Elk are a common inhabitant of this large expanse of sagebrush habitat.

Common Wildlife Species in the Project Area

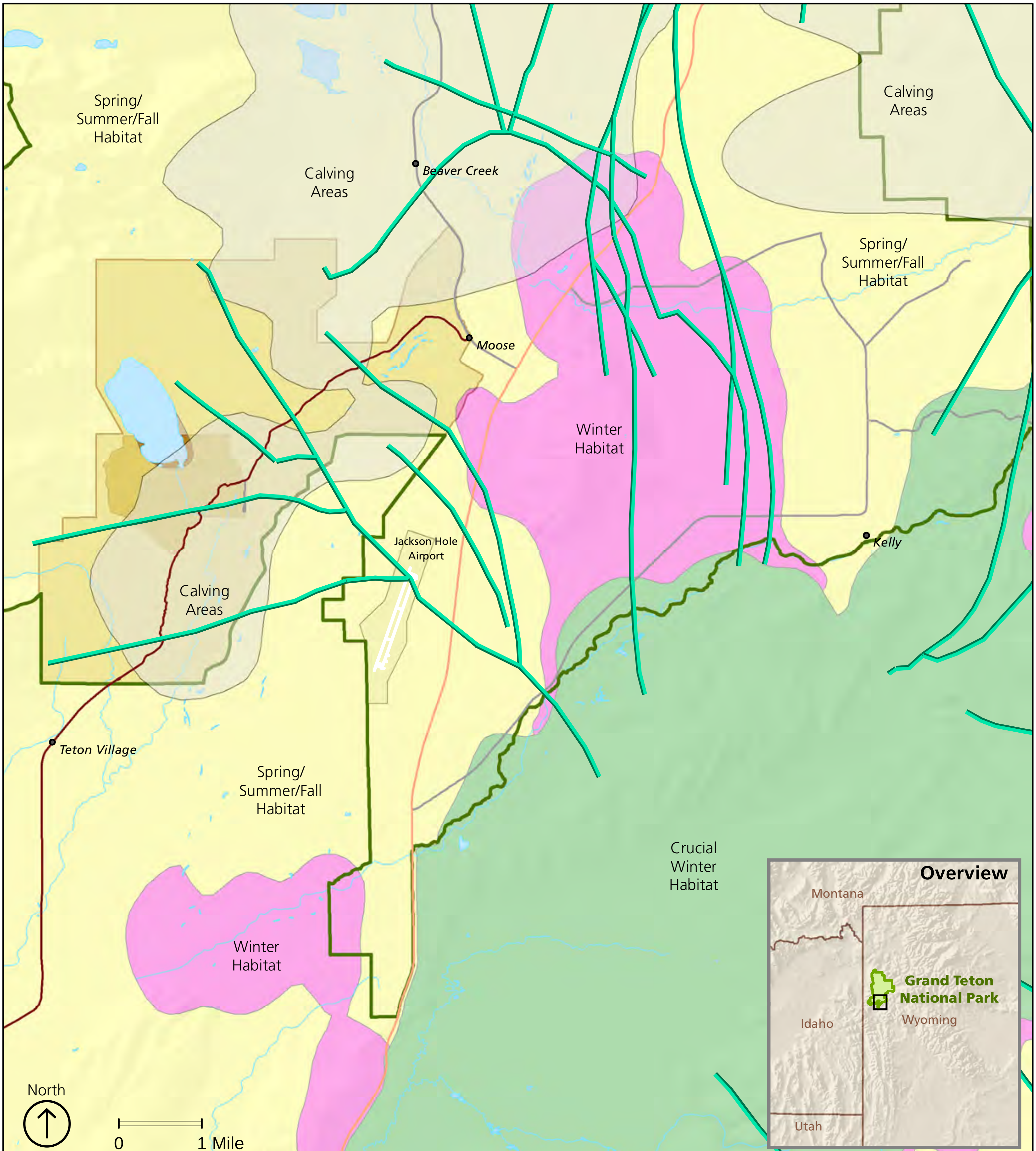
The following subsections describe some of the prominent wildlife species that are common in the project area. The focus on the following species does not imply that other wildlife species are not present.

Ungulates.

Rocky Mountain Elk— The Greater Yellowstone Area supports several of the largest Rocky Mountain elk herds in North America. Elk are the most prevalent ungulate in Grand Teton National Park. The elk that live in the park belong to the Jackson elk herd, which is one of the largest elk herds in North America (Dewey, pers. comm. 2014). Elk are relatively common throughout the project area for much of the year, residing in both lower and higher elevation habitats. However, their distribution and group size varies seasonally. The Moose-Wilson corridor receives extensive elk use in the summer and fall, particularly along the Snake River riparian areas (Cain, pers. comm. 2014). The lower-elevation woodlands and the Snake River riparian areas also provide habitat for spring elk calving (NPS 2006). Please refer to map 7 for elk seasonal ranges in the area.

In addition to seasonally resident elk, large numbers of elk move through the project area each spring and fall, migrating between their summer range in the park, Bridger Teton National Forest, and Yellowstone National Park and their winter range (mainly the National Elk Refuge near Jackson). Migration from summer to winter ranges may occur during a few days or span several weeks depending on the weather, snow accumulations, hunting seasons, and distance traveled (NPS 2006).

During the autumn mating season (or rut), which generally runs from late August through November, elk are particularly active and visible in the project area. At this time of year, in the early mornings and evenings, elk activity frequently occurs in the sagebrush meadows east of the Moose-Wilson corridor (Cain, pers. comm. 2014). Elk are also often visible in the vicinity of White Grass Ranch, along the ridge to the west of the road near the northern corridor entrance, and the meadows near Beaver Creek during the rut (Cain, pers. comm. 2014).



Legend

- Laurance S. Rockefeller Preserve
- Project Area Boundary
- Moose-Wilson Road
- Highway
- Other Roads
- Elk Migration Routes
- Crucial Winter Habitat
- Spring/Summer/Fall Habitat
- Winter Habitat
- Calving Areas

Elk Seasonal Range and Migration Routes

Wyoming Game and Fish Department, 2014

Grand Teton National Park, Wyoming

National Park Service/U.S. Department of the Interior

Produced by Denver Service Center Planning Division, June 2015.

Moose— Moose are common throughout the year in the project area and often occupy willow thickets and sagebrush habitats in winter and early spring where they browse on bitterbrush. However, as winter progresses, moose often use dense coniferous forest habitat where snow depths are less (NPS 2006; Saether et al. 1989). The riparian habitat along the Snake River and its tributaries is considered part of moose "winter-yearlong" or "crucial moose winter range" (NPS 2006; WGFD, unpublished data). Please refer to map 8 for seasonal moose ranges in the area.

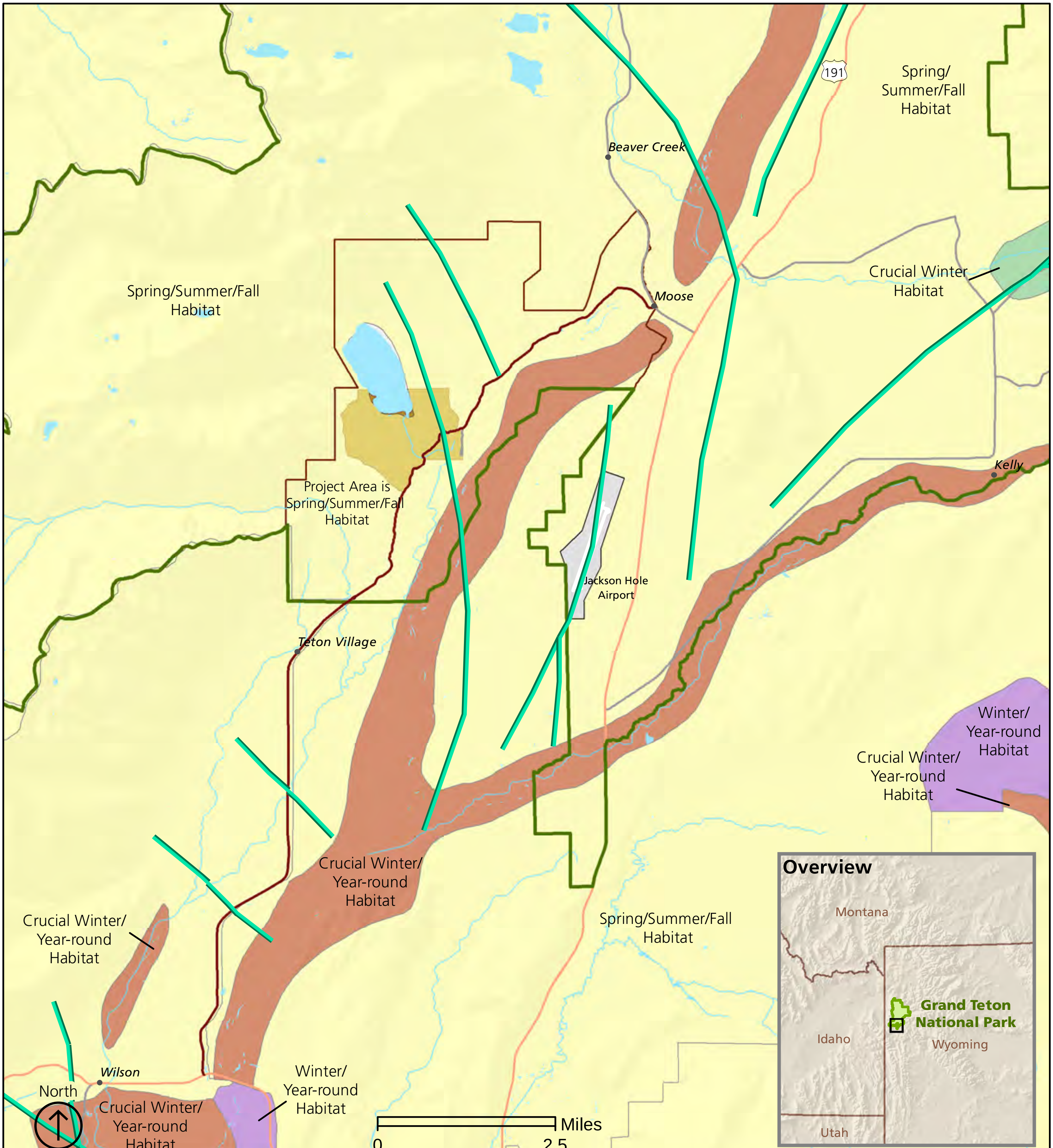
In warmer months, moose are common in the beaver pond wetland areas and surrounding forests in the project area. Moose activity is common in the Sawmill Ponds area along the Moose-Wilson corridor during summer months where they feed on aquatic vegetation. The Snake River riparian area and the lower elevations of the surrounding mountains are also considered important reproductive and maintenance habitat to the Jackson Hole moose population (NPS 2006; WGFD, unpublished data). Within the project area, riparian areas along the Snake River are important calving areas for moose.

Mule Deer— Mule deer are common in the project area, particularly during nonwinter months. The project area and its vicinity are considered spring-summer-fall mule deer habitat. Primary mule deer summer range is on mountainous slopes in the western portions of the project area, but mule deer can also be found along the Snake River floodplain during summer months. However, mule deer are most common along the Snake River floodplain in spring and fall months on their way to and from their winter range in the south. The Snake River riparian corridor serves as a primary seasonal migration route for mule deer. Some deer are known to irregularly winter along the Snake River, depending on the severity of the winter and/or the availability of artificial foods intentionally or unintentionally provided by humans outside the park (NPS 2006). Please refer to map 9 for seasonal mule deer ranges in the area.

Bears.

Black Bear— Black bears are prevalent in the project area and are most frequently seen during late summer and early fall. Black bears use the habitat in the project area for feeding, resting, breeding, and movement/traveling (Dewey, pers. comm. 2014). They most commonly occupy forest habitats and avoid open, meadow habitats that lack cover. Thus, dense forested stands, such as the lodgepole pine and spruce-fir forests of the project area, are important to black bears. These habitat types provide ample forage, adequate cover, and bedding areas. However, it is also possible to see black bears in some open areas in the project area.

Typically, female black bears are the first to enter dens in October, whereas males enter the dens a few weeks later, with most adult males in hibernation dens by the end of November. Conversely, adult males are the first to leave dens in March or early April. Female black bears with newborn cubs are typically the last to leave the dens later in April and into May (WGFD 2007). Upon emerging from the dens, black bears typically consume spring forbs and grasses. As summer nears and the weather warms, the bears gradually migrate to higher elevations containing green vegetation. During this time, black bears typically rely on insects and insect larvae as protein sources, along with occasional elk calves in late spring and early summer (WGFD 2007). In late summer and early fall, black bears in the project area focus much of their foraging on the abundant seasonal fruit crop in hawthorn and chokecherry shrubland along the Moose-Wilson corridor. When the fruit crop is healthy, it is not uncommon to see multiple black bears and family groups using the shrubland habitat (Dewey, pers. comm. 2014).



Project Area
Laurance S. Rockefeller

Moose-Wilson

Other
Moose Migration

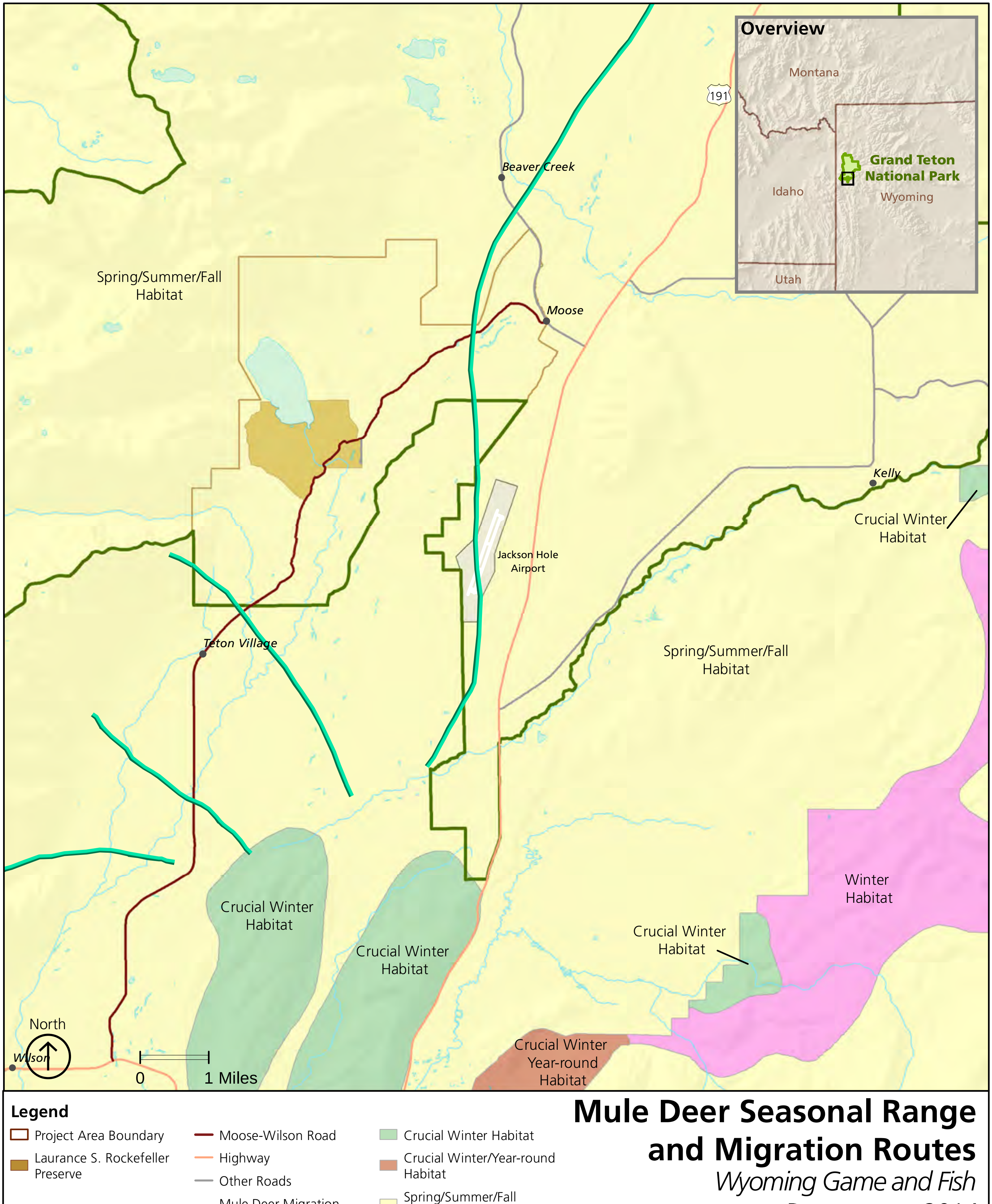
Crucial Winter Habitat
Crucial Winter/Year-round Habitat
Spring/Summer/Fall Habitat
Winter Year-round Habitat

Moose Seasonal Range and Migration Routes

Wyoming Game and Fish Department, 2014

Grand Teton National Park, Wyoming
National Park Service/U.S. Department of the Interior

Produced by Denver Service Center Planning Division, June 2015.



Mule Deer Seasonal Range and Migration Routes

Wyoming Game and Fish Department, 2014

Grand Teton National Park, Wyoming
National Park Service/U.S. Department of the Interior

Produced by Denver Service Center Planning Division, November 2013.

Grizzly bears occupy much of the same habitat in the project area as black bears. In such areas that are common to both bear species, research has indicated that black bears tend to be more active during the day. Whereas, male grizzly bears tend to be more active at dawn, dusk, and night, and female grizzly bears tend to be more active at dawn, during the daytime, and at dusk (Schwartz et al. 2010). These different activity patterns generally allow both species to use common areas concurrently. In areas within 0.62 mile (1.0 kilometer [km]) from human activity, such as roads or developments, research shows that both species tend to be more night-active and less day-active. Although human developments and activity have impacts on both bear species, black bears have a higher tolerance for human disturbances than grizzly bears and black bears may actually benefit from areas where human disturbances impact high-quality grizzly habitat (Schwartz et al. 2010). Given the competition between bear species and because grizzly bears tend to be aggressive toward black bears, such human-use areas could be safer for black bears due to fewer grizzly bears.

Grizzly Bear— Please refer to the section on grizzly bears in the "Affected Environment" section under "Federally Listed and Candidate Wildlife Species."

Gray Wolf. Please refer to the section on the gray wolf under "Affected Environment" in the "Federally Listed and Candidate Wildlife Species" section.

Other Mammals. Aside from the above-described bears and ungulates, the project area is also used by a diverse variety of other small, mid-sized, and large mammals. Beavers are common in portions of the project area, particularly in the Sawmill Ponds area, where they have established a large complex of beaver ponds and associated wetlands. In addition to beaver, several other small herbivore mammals are common in the project area and include Uinta ground squirrel, mice, vole, shrew, chipmunk, tree squirrel, raccoon, porcupine, marmot, muskrat, northern pocket gopher, and snowshoe hare (NPS 2006).

In addition to the black bear, grizzly bear, and wolf, other predatory mammals that occupy the project area include mountain lion, coyote, bobcat, badger, wolverine, long-tailed weasel, short-tailed weasel, mink, river otter, red fox, pine marten, skunk, and various species of bats.

Although less common and much more isolated in the project area, bison and pronghorn are occasionally found. Larger numbers of pronghorn are often found beyond the project area boundary in the sagebrush habitat to the northeast of the Moose Entrance Station (Cain, pers. comm. 2014; Dewey, pers. comm. 2014).

Canada Lynx— Please refer to the section on Canada lynx under "Affected Environment" in the "Federally Listed and Candidate Wildlife Species" section.

Birds. Neotropical migratory birds that occur in the project area include a variety of raptors, passerines (i.e., songbirds), waterfowl, and shorebirds that breed in North America but migrate to Mexico and Central and South America for the winter. Neotropical migratory birds play a critical role in ecological systems by consuming insects, dispersing seeds, and pollinating flowers (NPS 2006; Robinson 1997). In the state of Wyoming, 162 bird species are considered neotropical migrants (NPS 2006; Cerovski et al. 2000). Some neotropical migratory birds that occur in the project area include, but are not limited to osprey, chipping sparrow, ruby-crowned kinglet, yellow warbler, yellow-rumped warbler, white-crowned sparrow, western tanager, western meadowlark, green-tailed towhee, Lincoln's sparrow, and savannah sparrow. Neotropical migratory birds typically migrate from their wintering grounds to the project area or farther north between April and early June and return to their winter habitat from September through early

October. The species that nest in the project area begin breeding between early May and mid-June and may brood young into August (NPS 2006).

Greater Sage-Grouse— Please refer to the section on greater sage-grouse under “Affected Environment” in the “Federally Listed and Candidate Wildlife Species” section.

Reptiles and Amphibians. Amphibians are found in large abundance and high diversity in portions of the project area. Boreal toad, Columbia spotted frog, boreal chorus frog, and barred tiger salamander are known to have breeding populations in various wetlands of the project area (Patla and Legg 2014). The majority of these species commonly inhabit low-lying wet areas within riparian zones of the Snake River and the Snake River’s perennial tributaries, as well as around beaver pond wetlands and Phelps Lake. The Sawmill Ponds area is the only catchment known in the park to contain all four species of extant native amphibians. The uniqueness of this breeding species diversity at Sawmill Ponds is an indication of the importance of this wetland complex in supporting native amphibian diversity (Patla and Legg 2014; Ray et al. 2014; Bennetts et al. 2013). In 2012, new beaver impoundments began developing at the south end of the Sawmill Ponds catchment, evidently expanding from the lodge/colony near Moose-Wilson Road. By 2013, large areas of new wetlands were rapidly colonized by all four amphibian species, including the relatively rare boreal toad (Patla and Legg 2014). Boreal toads breed in slow-moving water along the Snake River, in willow marshes and beaver ponds, aspen or spruce-fir stands, and in foothill mesic areas. Boreal toads may move considerable distances away from water while foraging and use nonriparian habitats, including forested and sagebrush habitats (NPS 2006; Baxter and Stone 1980; Koch and Peterson 1995). In recent years, a higher elevation catchment in the Death Canyon area was also found to contain a breeding population of boreal toad (Bennetts et al. 2013; Ray et al. 2014).

Overall, the project area includes wetlands that are important for native amphibian breeding and these wetlands support some of the most diverse amphibian breeding assemblages present in wetlands monitored across the Greater Yellowstone Area. Although wetland drying and altered wetland hydrology is often a threat to such assemblages given the hydrological connectivity of these wetlands with the Snake River system and the prevalence of beaver pond activity, these high quality amphibian habitats in the project area have a lesser chance of drying up relative to some other amphibian-diverse catchment areas in the Greater Yellowstone Area (Ray et al. 2014). Also, identified in the next section, some of these amphibians also have special conservation status in the State of Wyoming.

In addition to the above-noted amphibians, two reptile species (wandering garter snake and rubber boa) also occur in the project area (Stephenson, pers. comm. 2014).

Wyoming Wildlife Species of Greatest Conservation Need

Several wildlife species in the corridor are classified with special listings by the State of Wyoming (including and in addition to some of the species noted above). The Wyoming Game and Fish Department (WGFD) maintains a list of Wyoming’s Species of Greatest Conservation Need (SGCN), as documented in Wyoming’s 2010 State Wildlife Action Plan. As noted in the plan, each of these SGCN species has an assigned Native Species Status (NSS), which provides insight on the species status and identifies priorities for management. The NSS status ratings range from “1” to “4,” and include “U” for unknown (with an NSS1 status being most critical). The status ratings also include a trend rating that more specifically describes the species population status and the severity of limiting factors. The population status rating ranges from “A” through “D,” with “A” indicating an imperiled population status and “D” indicating an expanding status. The limiting factor rating ranges from "a" through "d," with "a" being extreme and "d" being minimal (WGFD 2010).

Table 10 lists the state NSS 1, 2, 3, and U species that occur or are likely to occur in the project area. Because some SGCN species found in the Greater Yellowstone Area may not occur in the project area, professional judgment of park staff and other subject matter experts was used to determine which listed species occur within the project area based on past observations and/or available habitat types (as described earlier in this section).

TABLE 10. LIST OF WYOMING WILDLIFE SPECIES OF GREATEST CONSERVATION NEED IN THE PROJECT AREA

Common Name	Scientific Name	Federal Status	State Status
Birds			
American bittern	*Botaurus lentiginosus*		NSS3 (Bb)
American three-toed woodpecker	*Picoides dorsalis*		NSSU (U)
Ash-throated flycatcher	*Myiarchus cinerascens*		NSS3 (Bb)
Bald eagle	*Haliaeetus leucocephalus*	Delisted	NSS2 (Ba)
Barrow's goldeneye	*Bucephala islandica*		NSS3 (Bb)
Black rosy-finch	*Leucosticte atrata*		NSSU (U)
Black tern	*Chlidonias niger*		NSS3 (Bb)
Black-backed woodpecker	*Picoides arcticus*		NSSU (U)
Boreal owl	*Aegolius funereus*		NSS3 (Bb)
Brown-capped rosy-finch	*Leucosticte australis*		NSSU (U)
Canvasback	*Aythya valisineria*		NSS3 (Bb)
Clark's grebe	*Aechmophorus clarkii*		NSSU (U)
Common loon	*Gavia immer*		NSS1 (Aa)
Forster's tern	*Sterna forsteri*		NSS3 (Bb)
Franklin's gull	*Larus pipixcan*		NSS3 (Bb)
Great gray owl	*Strix nebulosa*		NSSU (U)
Greater sage-grouse	*Centrocercus urophasianus*	Candidate	NSS2 (Ba)
Lesser scaup	*Aythya affinis*		NSS3 (Bb)
Lewis's woodpecker	*Melanerpes lewis*		NSSU (U)
Long-billed curlew	*Numenius americanus*		NSS3 (Bb)
Merlin	*Falco columbarius*		NSSU (U)
Northern goshawk	*Accipiter gentilis*		NSSU (U)
Northern pintail	*Anas acuta*		NSS3 (Bb)
Northern pygmy-owl	*Glaucidium gnoma*		NSSU (U)
Peregrine falcon	*Falco peregrinus*		NSS3 (Bb)
Redhead	*Aythya americana*		NSS3 (Bb)
Swainson's hawk	*Buteo swainsoni*		NSSU (U)
Trumpeter swan	*Cygnus buccinator*		NSS2 (Ba)

TABLE 10. LIST OF WYOMING WILDLIFE SPECIES OF GREATEST CONSERVATION NEED IN THE PROJECT AREA

Common Name	Scientific Name	Federal Status	State Status
Virginia rail	*Rallus limicola*		NSS3 (Bb)
Mammals			
American pika	*Ochotona princeps*		NSSU (U)
Canada lynx	*Lynx canadensis*		NSS1 (Aa)
Dwarf shrew	*Sorex nanus*		NSS3 (Bb)
Least weasel	*Mustela nivalis*		NSSU (U)
Long-eared myotis	*Myotis evotis*		NSS3 (Bb)
Long-legged myotis	*Myotis volans*		NSS3 (Bb)
North American wolverine	*Gulo gulo luscus*		NSS3 (Bb)
Northern river otter	*Lontra canadensis*		NSSU (U)
Townsend's big-eared bat	*Corynorhinus townsendii*		NSS2 (Ba)
Water vole	*Microtus richardsoni*		NSS3 (Bb)
Wyoming pocket gopher	*Thomomys clusius*		NSS3 (Bb)
Fish			
Bluehead sucker	*Catostomus discobolus*		NSS1 (Aa)
Yellowstone cutthroat trout	*Oncorhynchus clarkii bouvieri*		NSS2 (Ba)
Amphibians			
Boreal toad	*Anaxyrus boreas boreas*		NSS1 (Aa)
Columbia spotted frog	*Rana luteiventris*		NSS3 (Bb)
Northern leopard frog	*Lithobates pipiens*		NSSU (U)
Reptiles			
Northern rubber boa	*Charina bottae*		NSS3 (Bb)
Valley gartersnake	*Thamnophis sirtalis fitchi*		NSSU (U)

Note: The State of Wyoming Native Species Status ratings are derived from the 2010 Wyoming State Wildlife Action Plan. Ratings range from 1 to 4, with "NSS1" being most critical at a state level and "U" indicating an unknown status). The population status rating ranges from "A" through "D," with "A" indicating an imperiled population status and "D" indicating an expanding status. The limiting factor rating ranges from "a" through "d," with "a" being extreme and "d" being minimal (WGFD 2010).

Wildlife and Wildlife Habitat Condition

This subsection briefly describes the existing activities that affect wildlife and wildlife habitat in the project area and some of the resulting conditions. This background information provides some context for understanding the effects on wildlife from the alternatives analyzed in chapter 4. Additional action-specific or site-specific effects on wildlife are found in chapter 4 as well. If the park continues to manage the corridor as it does currently (i.e., no-action alternative) these conditions would likely continue (or worsen) as described below.

The above-described habitat types and wildlife that depend on them are affected by a variety of past and ongoing human activities and developments in and around the project area (both inside and outside the park boundary). In most cases, many of these disturbances result in at least some level of habitat loss and/or fragmentation. Some wildlife species are more sensitive to human disturbances than others. Also, individuals of some species more easily adapt or habituate to human activity by modifying their behavioral patterns, and some even become conditioned and attracted to human presence. Whereas, other individuals and species may tend to avoid the areas of human disturbances altogether. Similarly, the degree of the effect on functional habitat values is often dependent on the timing, duration, location, and degree of the disturbance. For example, a particular human activity in one specific area may have a minimal effect on a particular species for most of the year. However, if the disturbance occurs during a critical migration period or during a sensitive nesting/breeding period, the same disturbance could have substantial negative effects on the species (Cain, pers. comm., 2014).

Park staff have noted that the following developments, trends, and activities have directly or indirectly contributed to the loss, degradation, or fragmentation of functional habitat in or near the project area (Cain, pers. comm., 2014).

Visitor Disturbances. The Moose-Wilson corridor, and the project area as a whole, receives large volumes of visitation and use during spring, summer, and fall months. These uses may contribute to behavioral wildlife disturbances, direct habitat loss or degradation, as well as impediments to habitat accessibility and connectivity. The spatial and temporal nature of this visitation and use compounds the wildlife impacts. First, the corridor's primary visitation season coincides with various important wildlife activities (e.g., ungulate calving and bear cub activity in spring and early summer, bear foraging for ripe berries in late summer, bird nesting in spring and summer, etc.). Secondly, wildlife viewing is one of the most popular visitor activities along the Moose-Wilson corridor. Thus, visitors tend to seek and follow the wildlife activity, resulting in further pressures on the habitat and on individual animals. Human activity can result in a wide range of disturbances to wildlife, including the alteration of daily or seasonal wildlife movement patterns, the disruption of foraging and hunting activities or timing, and the loss or degradation of important breeding or nesting grounds.

Although a large percentage of visitation (and thus wildlife disturbances) in the project area is concentrated along the designated thoroughfares (e.g., vehicle traffic, cyclists, pedestrians), some dispersed recreation also contributes to wildlife disturbance and impediments to habitat accessibility and connectivity. Social trail development from off-trail hiking and equestrian use is one example of how dispersed use can cause incremental disruptions to habitat use and connectivity. Park staff have observed the following park visitation threats to wildlife and wildlife habitat condition in the project area (Cain, pers. comm. 2014):

- individuals approaching wildlife along roads, in open fields, and near wetlands
- shouting and other acoustic disturbances from park visitors
- social trail development (i.e., unofficial trails) from pedestrian and equestrian use
- heavy vehicle traffic on Moose-Wilson Road
- bicycle use along roadways
- equestrian use affecting wildlife behavior and movement on and off trails
- unauthorized uses by park visitors (e.g., off-leash dog walking)
- inappropriate food storage by park visitors (attracting wildlife)
- human waste from park visitors
- high concentrations of park visitors in one area

- undesignated parking along paved and unpaved portions of Moose-Wilson Road

Increasing Visitation Trends. Given the trend of increasing park visitation throughout the project area, the negative effects of visitor use on wildlife and wildlife habitat (noted above) have the potential to worsen in the future if impact mitigation and visitor use management isn't effectively implemented. Park studies have documented increasing levels of visitor activity and recreation (concentrated and dispersed) along Moose-Wilson Road and at adjacent destinations within the project area. They have also noted an increase in wildlife viewing and photography as primary visitor activities (which increases the likelihood of human-wildlife interactions). Lastly, even if visitors remain in their vehicles, staff have documented a trend of increasing levels of vehicular traffic on Moose-Wilson Road and side roads. All of these trends have the potential to compound and increase the already-documented wildlife disturbances and habitat fragmentation.

Park Operations and Maintenance Activities. To manage visitor use and maintain park facilities (e.g., roads, trails, and the Laurance S. Rockefeller Preserve Center) in a safe and functional condition, park staff must carry out a variety of operations that can affect wildlife or wildlife habitat. For example, to protect against road flooding and erosion along Moose-Wilson Road, park staff have to artificially manipulate water levels on beaver ponds adjacent to the road. Aside from direct effects on individual beavers, this type of maintenance also modifies local hydrology that can have secondary effects on downstream wetland habitat. And the presence of park staff (performing operations and other management activities) in the project area can cause direct disturbances on wildlife and wildlife habitat.

External/Regional Development and Tourism. Beyond the project area and park boundary, the continued tourism, commercial activity, and residential development to the south of the Moose-Wilson corridor in and around Teton Village and Jackson Hole Mountain Resort contribute to direct and indirect effects on wildlife and wildlife habitat in the corridor. In addition to direct loss of habitat used by wildlife in the area, the development and uses on lands to the south of the Moose-Wilson corridor contribute to regional habitat fragmentation; alter wildlife migration routes; and disrupt foraging, roosting, and breeding behaviors for various species that also occupy the project area. The lights, noises, and activities associated with the Jackson Hole Airport to the southeast of the project area also contribute to these external disturbances to wildlife and wildlife habitat.

FEDERALLY LISTED AND CANDIDATE WILDLIFE SPECIES

Background

The Endangered Species Act of 1973, as amended, requires that federal agencies consult with the US Fish and Wildlife Service before taking any action that could jeopardize the continued existence of any federally listed threatened or endangered species. As a result, the National Park Service must consider potential effects that any proposed action may have on these species. The analysis in this environmental impact statement also addresses species that have been identified as candidate species for federal listing. NPS policy requires the protection of state listed threatened and endangered species. The State of Wyoming does not maintain a list of threatened and endangered species. However, the Wyoming Game and Fish Department maintains a status list for species of greatest conservation need. Please refer to the above section titled "Wildlife and Wildlife Habitat" for a brief explanation of SGCN species and a list of SGCN that may occur in the project area).

The US Fish and Wildlife Service was consulted by the National Park Service regarding federally listed and candidate species that may occur in the project area (see the "Consultation and Coordination" chapter). A US Fish and Wildlife Service website identifies federally listed species in Teton County, including species that may exist in this area of Grand Teton National Park. This information was used to help frame the impact analysis in chapter 4 for threatened and endangered species.

Table 11 lists federally listed species that are likely to occur in the project area based on a synthesis of existing inventories and a comparison of the general habitat types found in the project area and the habitat requirements of these species.

A detailed description and regulatory profile of all federally listed species can be found at http://www.fws.gov/species/#endangered.

Grizzly Bear. Grizzly bears (*Ursus arctos horribilis*) once ranged over most of western North America, from the Arctic Ocean to central Mexico. Although still abundant throughout much of Canada and Alaska, the range of grizzly bears in the lower 48 states is confined to six separate areas in Wyoming, Montana, Idaho, and Washington, covering less than 1% of its historic range in the United States (USFWS 1993). Grand Teton National Park, part of the Greater Yellowstone Ecosystem, is one of the areas grizzly bears still currently inhabit. In 1975, the grizzly bear was listed as a threatened species in the lower 48 states under the Endangered Species Act because of the frequency of human-caused grizzly bear mortalities, loss of habitat, and geographic isolation from other grizzly bear populations.

The life history of the grizzly bear is well-documented. Craighead and Mitchell (1982) characterized essential grizzly bear habitat as space, isolation, sanitation, food, denning sites, vegetation types, and safety. Grizzly bears require large home ranges (50 to 300 square miles for females; 200 to 500 square miles or more for males), encompassing diverse forests interspersed with moist meadows and grasslands in or near mountains. The life-time range of a male grizzly bear in greater Yellowstone covers approximately 800–2,000 square miles; for females, 300–550 square miles (Blanchard and Knight 1991). Although grizzly bears make substantial use of forested areas, they make more use of large, unforested meadows and valleys than do black bears.

In the spring, bears usually appear at lower elevations but can be found at a wide elevational range throughout the nondenning period. Typical den sites are situated on high, remote mountain slopes where deep snow functions as insulation and persists until spring (Podruzny et al. 2002). Grizzly bears often dig beneath the roots of large trees to create hibernacula.

TABLE 11. FEDERALLY THREATENED, ENDANGERED, OR CANDIDATE SPECIES IN THE PROJECT AREA

Common Name	Scientific Name	Federal Status
Grizzly bear	*Ursus arctos horribilis*	Threatened
Canada lynx	*Lynx canadensis*	Threatened
Gray wolf	*Canis lupus*	Nonessential experimental population (Treated as Threatened in NPS units)()()
Greater sage-grouse	*Centrocercus urophasianus*	Candidate

Grizzly bears are opportunistic omnivores and spend most of their time feeding. Their food habits are strongly influenced by seasonal variation in food availability. In general, whitebark pine nuts, army cutworm moths, and ungulates are the most important foods in the grizzly bear's diet in the Greater Yellowstone Ecosystem, but fish, small mammals, herbaceous vegetation, tubers, fruit, and insects also comprise a portion of their diet (Gunther et al.2014; Mattson and Knight 1991; NPS 2010). Ungulate carcasses are an important high-quality food source for bears (Mattson 1997) and will often attract and hold bears in localized areas for periods of several days to a week or more. They will also eat human food and garbage when available.

Bears are generally solitary, although they may tolerate other bears when food is plentiful. Mating season occurs from mid-May to mid-July. A mother grizzly will usually keep her cubs with her for two winters following their birth, after which time she (or a prospective suitor) chases the subadult bears away so she can mate again. Female cubs frequently establish their home range in the vicinity of their mother, but male cubs usually must disperse farther in search of a home.

Grizzly bears have a social hierarchy that determines which bears have access to the best habitats and food sources; typically adult male bears have priority followed by mature females with cubs, then by other single adult bears. Subadult bears, who are just learning to live on their own away from mother's protection, are most likely to be living in poor-quality habitat or in areas that are in proximity to roads and other development. Thus, young adult bears are most vulnerable to danger from humans and other bears and to being conditioned to human food (NPS 2013).

Grizzly bears usually enter their winter dens between mid-October and early December. They locate or excavate dens on densely vegetated, north-facing slopes between 6,562 and 10,000 feet (NPS 2015). Although grizzly bears are considered super hibernators, they do sometimes awaken and leave their dens during the winter. Bears emerge from their dens when temperatures warm up and food is available in the form of winter-killed ungulates or early spring vegetation. Greater Yellowstone grizzly bears begin to emerge from their den in early February, and most bears have left their dens by early May.

Occurrence in Project Area— The Moose-Wilson corridor project area is within occupied grizzly bear habitat (Bjornlie et al. 2013, figure 18), although it is outside the grizzly bear recovery zone (also referred to as the primary conservation area). The road corridor includes areas that are good grizzly bear forage habitat. Important grizzly bear feeding areas, including those associated with hawthorn, chokecherry, and serviceberry shrubs, occur mostly in low-lying areas with moderate moisture levels. Several areas in the corridor, including the area between the Sawmill Ponds Overlook and Death Canyon Road, provide abundant shrubs and are important forage areas when berries are plentiful in late summer and fall (NPS 2011; MacHutchon 2014). Other important foods found in the corridor include a variety of forbs (e.g., clover [*Trifolium* spp.]), horsetail [*Equisetum* spp.], dandelion [*Taraxcum officinale*]), graminoids (e.g., bluegrass [*Poa* spp.], bluejoint reedgrass [*Calamagrostis canadensis*], sedge [*Carex* spp.]), ants, and elk (MacHutchon 2014).

Other portions of the road corridor are not used or have low value for foraging. Approximately 37% of the Moose-Wilson corridor is considered to be unused or low value habitat for grizzly bears. An additional area of dense canopy coniferous forest in the corridor also has low forage potential for grizzly bears (MacHutchon 2014).

From 1998 to 2003, the Greater Yellowstone Ecosystem grizzly bear population increased at an annual rate of 4% to 7% and expanded its range by nearly 50% (Schwartz et al. 2006). Grizzly bear occurrence in Grand Teton National Park has increased during the past 20 years, most likely in response to increases in bear densities throughout the Greater Yellowstone Ecosystem (Pyare et al. 2004; Schwartz et al. 2002) and they have expanded their distribution to reoccupy portions of their former range (figure 18), including the project area. Since 2007, grizzly bears have been regularly observed in the project area throughout the nondenning period. At least one grizzly bear denned in the corridor in the winter of 2014/2015. Whether other grizzly bears also den in the project area is not known, but is possible.

The grizzly bear's extensive movements and reclusive habits make population estimates difficult. No specific population data or estimates exist for the project area or the Moose-Wilson corridor. However, based on park staff observations, grizzly bears are now considered residents (including breeding females) and are seen occasionally along the road in the spring, as early as April, with the starting dates being dependent on available food resources/snow levels in a given year. In the summer and fall, grizzly bears are seen more regularly. They can show up as early as August and stay as late as mid-November, again depending on food availability. For several weeks in the fall when several types of ephemeral berries are available, grizzly bears may be present on an almost daily basis along portions of the road. There were 31,16, and 15 reported sightings of grizzly bears in the project area, in 2011, 2012, and 2013, respectively (park unpublished data; MacHutchon 2014). The majority of grizzly bear observations in the project area between 2009 and 2013 were between Moose Junction and Death Canyon Road. Important bear forage also occurs throughout the corridor in areas away from the road. Consequently, the number of documented grizzly bear observations may under-represent bear use in the corridor since a lack of reports may reflect visibility rather than presence. Given the presence of an important seasonal food source for bears, there is a high likelihood of occurrence in the project area, especially in the fall.

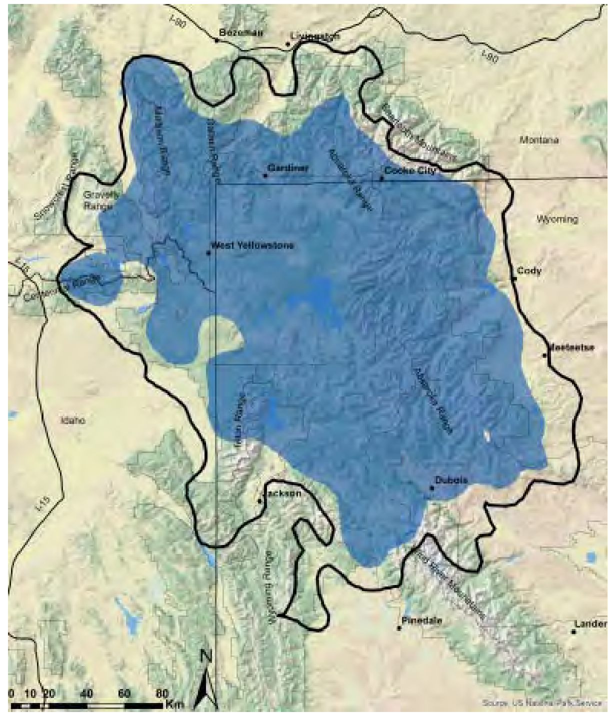


FIGURE 18. GRIZZLY BEAR DISTRIBUTION IN GREATER YELLOWSTONE ECOSYSTEM, 1990–2010

The blue shaded area represents the 1990–2004 distribution. The dark line represents the 1990–2010 distribution.
Source: Bjornlie et al. 2013.

Threats and Management of Bears in the Project Area— The greatest threat to grizzly bears is human-caused mortality. More than 80% of the grizzly bear mortalities in the Greater Yellowstone Ecosystem result from human causes, including collisions with vehicles, bears shot in defense of life and property, and illegal shootings. Bear mortalities in the region vary from year to year. Based on the Interagency Grizzly Bear Study Team mortality database, in 2013, of the 29 documented grizzly mortalities in the Greater Yellow Ecosystem, 19 were known or probable human-caused, including 6 management removals and 2 road kills. In 2012, of the 55 documented grizzly mortalities, 32 were known or probable human-caused, including 14 management removals and 2 road kills (http://www.nrmsc.usgs.gov/science/igbst/mort). , Grand Teton National Park has documented 5 grizzly bears hit and killed by vehicles since 2005, with an additional mortality likely caused by a vehicle strike but not confirmed. .In addition, since 2000, 11 bears of unknown species have been hit by vehicles but were able to run away from the road and therefore the species could not be confirmed. To date, no grizzly bears have been killed or injured on the two-lane, low speed Moose-Wilson Road. Likewise, no grizzly bears have been killed in defense of life and property in the project area.

Food conditioning and habituation are two potential threats for grizzly bears in Grand Teton National Park. Grizzly bears can become conditioned to humans because of improperly stored human food, garbage, and livestock feed. Unsecured attractants often lead to negative interactions between people and bears, and the most common outcome is that the bear is ultimately killed. Human food conditioning has not yet been an issue along Moose-Wilson Road.

The term “habituated bear” typically refers to the loss of avoidance or escape responses by a bear (Smith et al. 2005). The number of human-habituated (but not food-conditioned) grizzly bears in the park overall has increased. Several habituated bears have frequented Moose-Wilson Road. These bears go about their daily routines in proximity to humans and traffic on roads. Habituation without food conditioning is not necessarily detrimental to bears or people (Herrero et al. 2005), although it may place them at greater risk of mortality because they are not afraid to forage along roads, where they may be more vulnerable to vehicle strikes. In addition, habituation of bears raises the chances that park visitors might approach, feed, or otherwise behave inappropriately around bears, especially when park rangers are not present (Gunther and Wyman 2008). Finally, habituation may increase the cumulative likelihood of human–bear encounters and therefore of human injury due to bears (Herrero et al. 2005).

There is one record of a human-grizzly bear incident occurring in the Moose-Wilson corridor project area. In 2008, a grizzly “shadowed” a skier along the Death Canyon Road for about 20 minutes. A subsequent investigation revealed a mostly consumed moose carcass within 55 yards of the incident (Kate Wilmot, Grand Teton National Park, pers. comm., 2/11/14).

The presence of grizzly bears is a large draw for visitors who want to watch bears in their natural habitat and photograph them. When black or grizzly bears are present along a road they can cause traffic jams. In 2012, there were at least 170 “grizzly bear jams” in Grand Teton National Park (Wilmot and Cain 2013). Bear jams occur when habituated, nonfood-conditioned bears frequent roadsides and the outskirts of other developments, and draw crowds of onlookers. A significant amount of staff time is spent managing habituated bears, the traffic associated with the bear jams, and the visitors that stop to view and photograph the bears. However, in the case of Moose-Wilson Road, there are few records of grizzly bear jams occurring. This is because when grizzly bears forage for berries along Moose-Wilson Road, park staff close the road (see below).

To date, management of grizzly bears in Grand Teton National Park, including the project area, has been highly successful in promoting grizzly bear recovery and reducing undesirable human-bear encounters (e.g., property damage, human-food rewards, bear-inflicted human injuries) and human-caused bear mortalities. Roads and human activities in the park are managed in a manner that minimizes the potential for human-caused grizzly bear mortalities. The park employs a Wildlife Brigade composed of paid and volunteer staff, to manage bear jams on park roads, among other duties. The park staff also has an active program designed to identify appropriate mitigation measures for lowering the number of wildlife-vehicle collisions. Park managers assess trends and patterns in wildlife-vehicle collisions to inform management actions and strategies aimed at making park roads safer for humans and wildlife. For example, bears that are typically wary of humans will often tolerate people at close distances when roadside carcasses are available due to the high-quality of this bear food. Carcasses on or along roads may create large "bear jams" and potentially pose a hazard to bears that could be hit by vehicles while approaching carcasses to scavenge. To reduce these risks, road-killed carcasses of large animals on or along roads are dragged farther away from the road area or are loaded into trucks and hauled away from visitor proximity.

In addition, the park staff temporarily close roads to public entry for resource protection when necessary. Temporary road closures have periodically been instituted on Moose-Wilson Road. In 2011, the road north of the Laurance S. Rockefeller Preserve was closed from early October into mid-November due to the presence of grizzly bears foraging along the road. In 2012, the road north of the LSR Preserve was closed for approximately seven days in August when a grizzly bear and her cubs arrived to forage on the hawthorn and chokecherry shrubs along the road. In 2013, there were no road closures because no grizzly bears were foraging along the road. In September 2014, the road was temporarily closed for approximately 15 days due to a grizzly feeding on chokecherries in the area.

The park staff addresses grizzly bear conservation and safety issues along Moose-Wilson Road in the same way it does throughout the park and parkway. Management of bears along Moose-Wilson Road is particularly challenging due to limited sight distances (due to the narrow winding road, uneven terrain, and roadside vegetation) and the roadside food sources (berries). All of these conditions make it difficult to safely manage grizzly bears and visitors along the road (NPS 2012).

Canada Lynx. The Canada lynx (*Lynx canadensis*) is listed as a federally threatened species (65 *Federal Register* 16051). The State of Wyoming classifies the lynx as a Native Species Status 1 (NSS1), which indicates that habitat is limited and populations are greatly restricted or declining—extirpation appears possible and there is an ongoing significant loss of habitat (WGFD 2005). Lynx are considered rare in the Greater Yellowstone Area and are known to use boreal and montane forests.

Lynx are solitary carnivores and naturally occur at low densities in boreal forest habitats, with their distribution and abundance closely tied to their primary prey, the snowshoe hare (*Lepus americanus*). However, this relationship may be muted or absent in more southern populations (Halfpenny et al. 1982). Individual lynx maintain large home ranges generally between 12 to 83 square miles. The size of lynx home ranges varies depending on abundance of prey, the animal's gender and age, the season, and the density of lynx populations.

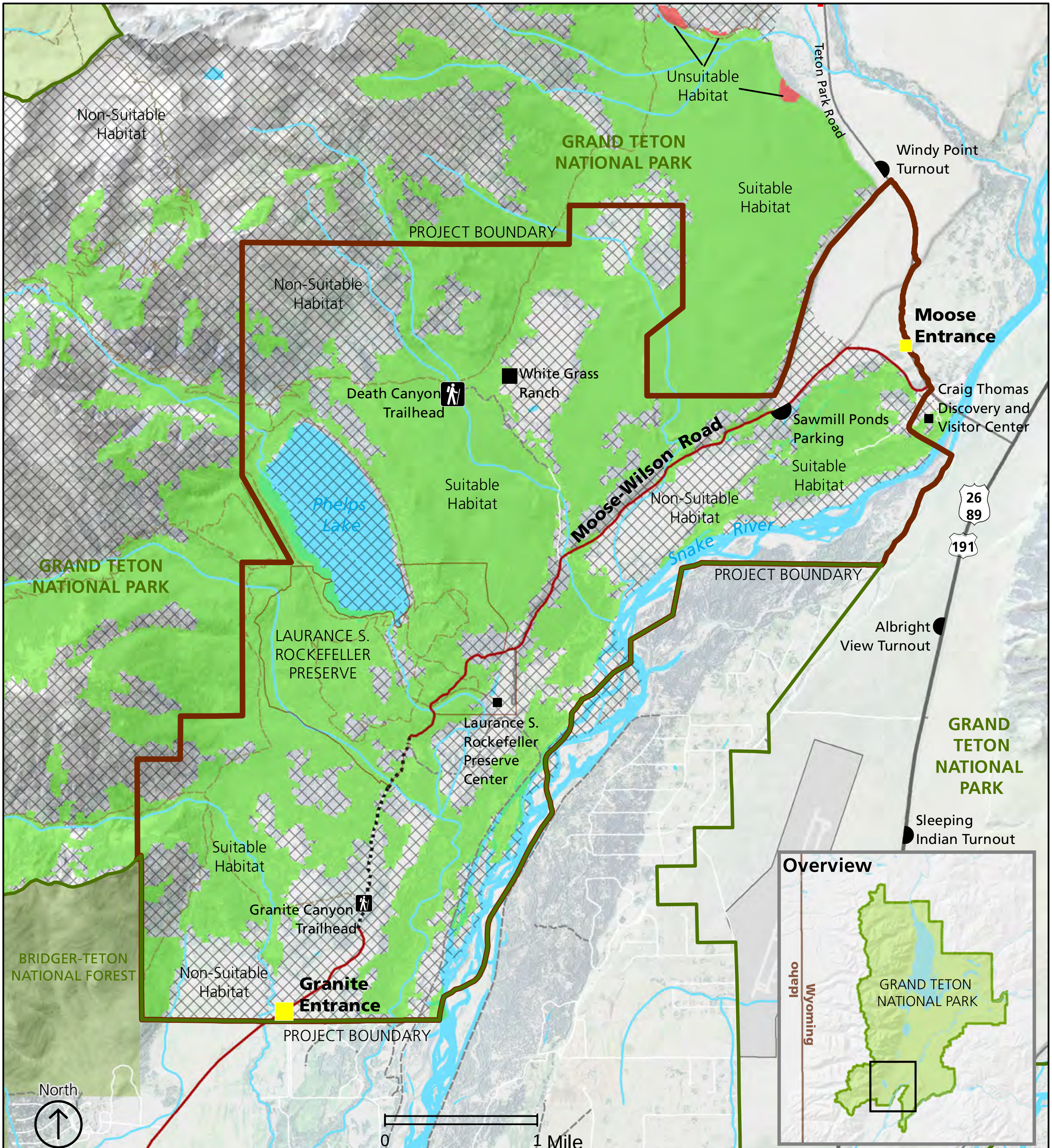
In Wyoming, Canada lynx occur primarily in spruce-fir and lodgepole pine forests with slopes of 8 to 12 degrees and at elevations from 7,995 feet to 9,636 feet (2,437 m to 2,937 m) (Ruediger et al. 2000). Densely regenerating coniferous forests and regenerating burned areas in mixed species forests provide excellent habitat for snowshoe hares and, therefore, are also important habitat for lynx. Aspen intermixed with spruce, fir, or lodgepole pine (with extensive shrub growth and woody debris) also provides high-quality habitat for hares. Sagebrush grasslands, dense willow thickets, and beaver pond complexes may provide foraging opportunities for alternative prey such as white-tailed jackrabbits, mountain cottontails, and ground squirrels. Lynx denning habitat consists of late successional spruce-fir forests on north-facing slopes with relatively high densities of large-diameter woody debris. Dispersal corridors, principally continuous conifer forests several miles in width, are critical for lynx travel and dispersal (Tanimoto 1998). Lynx travel corridors may be found in any conifer-covered landscape.

Potential Canada lynx habitat areas for Grand Teton National Park have been identified based on the above general habitat preferences. Five lynx management areas, called lynx analysis units (Ruediger et al. 2000), have been identified in the park. Mapping of lynx analysis units in the park was based primarily on vegetation characteristics. In September 2014, the US Fish and Wildlife Service released a final rule designating critical habitat for lynx in the contiguous United States (*Federal Register* 79 (177): 54782 - 54846). However, no lynx critical habitat occurs in the project area.

Information on lynx abundance and distribution within Grand Teton National Park is limited. Historical locations of lynx have been documented within the park (Reeve et al. 1986; McKelvey et al. 2000). More recent sightings of tracks and DNA detections have confirmed the continued occurrence of lynx in and adjacent to the park (Squires and Laurion 2000; Squires and Oakleaf 2005; Murphy et al. 2006; Holmes and Berg 2009; N. Berg, Utah State University, pers. comm., 2010). Since 1940, 16 observations of lynx have occurred in the park. Whether any of these lynx are residents or transients, or if lynx currently reside in Grand Teton National Park, is unknown.

Of the 10,294 acres in the Moose-Wilson project area, 9,405 acres lie within the Granite Lynx Analysis Unit. Of those 9,405 acres, approximately 5,503 acres are considered suitable habitat for lynx, and 3,902 acres are not considered habitat for lynx (see map 10). The project area also may serve as an important travel corridor for lynx. However, low densities of snowshoe hares may mean that Canada lynx would also occur at low densities and are probably transients moving through the area (S. Cain, NPS park wildlife biologist, pers. comm., 2014). There have been two documented sightings of lynx along the road corridor—on June 27, 1984, near Sawmill Ponds and on December 11, 1992, at Murie Ranch.

Timber harvesting, recreation, and their related activities are the predominant land uses affecting lynx habitat. The primary factor that caused the lynx to be listed was the lack of guidance for the conservation of lynx and snowshoe hare habitat in plans for federally managed lands (USFWS 2014). Other anthropogenic influences of greatest concern to the conservation of lynx and their snowshoe hare prey are climate change, vegetation management, wildland fire management, and fragmentation of habitat (Interagency Lynx Biology Team 2013). Lynx movements may be negatively affected by high traffic volumes on roads that bisect suitable lynx habitat; in some areas mortalities due to road kill are high. No known mortalities have occurred yet on Moose-Wilson Road. Fire suppression and reduction of heavy fuels has the potential to affect snowshoe hare habitat (USFWS 2005). Climate change and warming temperatures also are likely to negatively affect the climatic conditions that create and maintain the boreal forest ecosystem for which lynx are highly adapted (USFWS 2005; Interagency Lynx Biology Team 2013). Recreational activities may affect specific habitats. In the summer there is the potential for lynx to avoid habitat around human travel corridors, including roads and trails, during daylight hours. Human use is greatly reduced in the project area during winter, and no impacts are known to be occurring to lynx (S. Cain, park biologist, pers. comm., 02/07/14).



Legend

Entrance	**Moose-Wilson Road**	**Other Roads**	**Lynx Habitat**
Trailhead	Paved	Heavy-duty	Non-Habitat
Turnout	Unpaved	Medium-duty	Suitable
Point of Interest	Trails	Light-duty	Unsuitable
		Unimproved dirt	

Lynx Habitat

Wyoming Game and Fish Department, 2014

Grand Teton National Park, Wyoming

National Park Service/U.S. Department of the Interior

Produced by Denver Service Center Planning Division, July 2015.

Gray Wolf. Gray wolves (*Canis lupus*) were reintroduced into Yellowstone National Park and central Idaho in 1995 and 1996 as an "experimental nonessential" population. In national parks they are currently treated as a threatened species and all provisions of the Endangered Species Act apply. There is no critical habitat designated for gray wolves (USFWS 1994). Human-caused mortality and availability of prey are the two most limiting factors for wolf populations (Mech 1970). To date, most human-caused mortality of wolves in the Greater Yellowstone Area has resulted from management removals (mostly related to livestock depredations), illegal kills (from poaching), legal harvest, and by collisions with vehicles.

Gray wolves prey primarily on ungulates. Elk, the principal prey species of wolves in the area, are abundant in the park. Wolves travel widely and are relatively tolerant of human presence, except while raising young near den and rendezvous sites. Wolf pups are born in mid-April to May, and packs use rendezvous sites into the fall.

Much of Grand Teton National Park serves as suitable habitat for gray wolves. A variety of habitats and vegetation cover types are used. Wolf distribution varies depending on prey abundance. As of December 2014, at least 44 wolves in 7 packs had territories in and adjacent to Grand Teton National Park (J. Stephenson, Grand Teton National Park, pers. com., 5/18/15). The wolf population in the area and adjacent to the park has been stable for the last several years: over 40 wolves have been present since 2007.

The project area is in the home range of the Lower Gros Ventre wolf pack. Wolves use the project area to hunt and for denning, as well as a travel corridor. In 2012 and 2014, the pack had a den and rendezvous site within the project area (Cain, pers. comm. 2014; Dewey, pers. comm., 2014).

Greater Sage-Grouse. The greater sage-grouse (*Centrocercus urophasianus*) is a large, chicken-like, ground-dwelling upland bird found at elevations ranging from 4,000 to over 9,000 feet. Sagebrush habitat is essential for sage-grouse survival—they are highly dependent on sagebrush for cover and food and require large areas of contiguous sagebrush (USFWS n.d.; USRBSGLWG 2008). Sage-grouse nest on the ground, primarily under sagebrush, and feed on sagebrush, broad-leafed flowering plants (forbs), and insects. During the winter, their diet is composed almost entirely of sagebrush. Suitable habitat consists of plant communities dominated by sagebrush and a diverse native grass and forb understory. Holloran and Anderson (2004 as cited in NPS 2012) found sage-grouse in Grand Teton National Park used stands that averaged 21.4 inches in height with 27.9% total shrub canopy cover, 16.3% live sagebrush canopy cover, and 2.7% dead sagebrush canopy cover. Suitable seasonal habitats occur in a patchwork or mosaic across the landscape. Both the quantity and quality of the sagebrush environment determines suitability and productivity of sage-grouse.

Breeding activity begins in March when male sage-grouse gather together to perform courtship displays and then mate with females on areas called leks. Lek sites are generally in open areas such as meadows, low sagebrush zones, ridgetops, and old lake beds surrounded by denser sagebrush cover. Soon after breeding, females disperse to nesting areas characterized by relatively dense, tall, mature sagebrush stands (Holloran and Anderson 2004; Connelly et al. 2000). In Grand Teton National Park, known nests average 2.0 miles (3.2 km) and range from 1.5 to 6.0 miles (2.4 km to 9.6 km) from active leks (Holloran and Anderson 2004).

Early brood-rearing habitat is typically close to nesting sites (Gates 1985) in dense, mature sagebrush stands (Holloran and Anderson 2004). Brood-rearing occurs from June to mid-July. As the summer progresses, hens and their young will also use relatively open sagebrush stands that have good grass and forb cover (Lyon 2000). As sagebrush habitats desiccate, grouse usually move to more mesic sites (Connelly et al. 1988; Gates 1985).

Winter habitat is a critical and possibly a limiting habitat component for sage-grouse populations in the Jackson area (USRBSGLWG 2008). Sage-grouse use dense, tall stands of mature sagebrush during the winter for both food and cover. Low sagebrush stands on open windswept knolls are also used as feeding sites. Sage-grouse widely disperse over wintering areas during mild weather but concentrate in areas with exposed sagebrush as snow depth increases. In Grand Teton National Park, major wintering concentration areas include relatively flat south- to west-facing slopes.

Sage-grouse exhibit strong site fidelity (loyalty to a particular area even when the area is no longer of value) to seasonal habitats, which includes breeding, nesting, brood rearing, and wintering areas. Adult birds rarely switch between these habitats once they have been selected, limiting their adaptability to change and movement into unfamiliar areas (USFWS n.d.).

The project area is within the area used by the Jackson Hole population, which is a small, resident, nonmigratory population that is geographically isolated due to surrounding topography and limited habitat (Holloran and Anderson 2004; USFWS 2013). The sagebrush section north of Sawmill Ponds Overlook lies within the state designated core area (Wyoming Executive Order 2011-5), while the sagebrush section south of Sawmill Ponds Overlook, between Moose-Wilson Road and the Snake River, is within sage-grouse occupied habitat. There is documented nesting and use throughout the year, including the winter, in the sagebrush section north of Sawmill Ponds Overlook (Bedrosian et al. 2010). The project area does not contain an active lek. However, there are three occupied leks within 4 miles of the project area, Moulton (east and west activity centers), Airport, and Airport Pit, and a fourth occupied lek just outside 4 miles (Timbered Island) of the project area.

Greater sage-grouse populations throughout the West, including Wyoming, have declined by an average 33% since 1985 (Braun 1998). More recent information indicates that the greater sage-grouse population fell by 56% across its range between 2007–13 based on high counts of males on leks (Garton et al. 2015). Evidence suggests that habitat fragmentation and loss across much of the species' range is the primary cause of the decline (USFWS 2013). The US Fish and Wildlife Service concluded that the species warranted protection under the Endangered Species Act, but was precluded because of the need to take action on other species facing more immediate and severe extinction threats. As a result, in March 2010, the greater sage-grouse was placed on the list of species that are candidates for listing as threatened and endangered species (*Federal Register* 75(55): 13910–14014). The US Fish and Wildlife Service will complete a status review of the species by September 2015.

Despite an overall declining trend of the number of males counted on leks, the Jackson Hole population has increased over the past 15 years from a low count of only 33 males in 2001 to 174 in 2015 (J. Stephenson, wildlife biologist, pers. com., 5/29/15). Threats to the Jackson Hole population, including the park population, include internal habitat fragmentation resulting from wildfires, predation, weather events (e.g., drought or late spring storms), infectious diseases, spread of invasive nonnative plants, infrastructure development, and recreation (USRBSGLWG 2008; USFWS 2013). Roads may also affect the birds. Vehicle-caused sage-grouse mortalities have occurred in Grand Teton National Park, although they are probably infrequently reported (NPS 2006). No such mortalities have been reported on Moose-Wilson Road. Other recreational impacts on sage-grouse populations include potential disturbance of breeding and nesting activities due to hiking and horseback riding, and habitat fragmentation due to use resulting from motorized and nonmotorized recreation. There are also the potential effects of road noise on sage-grouse, including masking sounds that influence courtship, grouping, and escape behavior (USRBSGLWG 2008). The Upper Snake River Basin Sage-Grouse Local Working Group (2008) noted that the construction of the bike pathway system in Grand Teton National Park may have some unintended impacts on important sage-grouse nesting habitat.

WETLANDS

Background

The Moose-Wilson project area possesses both a large quantity and a high-quality of wetlands. The varying terrain, coupled with the abundance of lake-fed and snowmelt-fed tributaries, beaver pond activity, and the Snake River floodplain provide the necessary natural conditions for wetland development. In addition to the small and large pockets of wetlands that exist throughout the project area, Moose-Wilson Road also meanders along and through multiple wetland complexes. The interconnected wetlands and beaver ponds in the Sawmill Ponds area is the most notable wetland complex in the project area. Given the large size and diversity of this wetland complex, and its proximity to Moose-Wilson Road, these wetlands attract a large number and wide variety of wildlife as well as a large volume of park visitors (for wildlife viewing). Aside from the wetlands in the vicinity of Sawmill Ponds, the wetlands associated with the Snake River and its floodplain are the next most prominent wetland features in the project area. However, because many of these wetlands are farther east of Moose-Wilson Road, they are not as apparent to park visitors.

A notable characteristic of many wetlands in the project area is their dynamic nature due to the effect of beaver activity. The prevalence of beaver activity in various portions of the project area contributes to constantly changing hydrology, which in turn results in continually changing wetland conditions. As local hydrology shifts from this damming and ponding, new wetlands may develop in previous upland areas and old wetlands may dry up into wetland remnants. Likewise, the presence of a network of irrigation ditches throughout the project area (particularly east of Moose-Wilson Road) also modifies the local hydrology in areas, which also alters the evolution of wetland conditions. Please refer to the “Hydrology” section for additional information on irrigation facilities and associated map.

Wetland Values

Wetlands play a vital role in ecological systems and hydrological processes. These natural systems and processes associated with wetlands provide a variety of environmental maintenance functions on local, regional, and global scales. Disruption or removal of wetland functions can alter these broader processes and ultimately inhibit many of these ecological and hydrological values.

Some of the major functions of wetlands include (Larson et al. 1989):

- **Discharge and recharge of groundwater**. Discharging and recharging groundwater to and from the surface supports local and regional surface hydrology and aquatic habitat values. All of the wetlands in the project area play a role in the area’s hydrological system.

- **Flood control or moderation.** Wetlands in proximity to streams and rivers provide area and volume capacity for floodwater, which diminishes flow velocities, stores excess water, and lessens downstream flood surges and volumes. Reducing flow velocities can also limit scouring of waterways and erosion of streambanks. Wetlands in the project area provide this value for the Snake

River channel and the river's tributary streams that run through the project area.

- **Water quality control, stabilization of sediments, and retention of nutrients.** Many wetlands work as "filters" for surface water by retaining or transforming nutrients in the water and removing sediments from the water. For example, many of the wetlands in the project area filter waters that are tributary to the Snake River, thus improving Snake River water quality. These wetlands retain important nutrients from runoff and stream water, which contributes to flora and fauna productivity.

- **Fish and wildlife habitat.** Wetlands with open water can provide aquatic habitat for fish, foraging mammals and birds, amphibians, and other aquatic organisms. Most other wetlands provide habitat for a wide variety of fauna, as most birds and animals directly or indirectly rely on riparian or wetland habitat for survival. All of the wetlands in the project area provide some level of wildlife habitat for waterfowl, shorebirds, songbirds, moose, grizzly bear, and a variety of small mammals like beavers.

- **Biomass production and export.** Biomass (biological material derived from living or recently living organisms) is a key contributor to flora and fauna productivity in an ecosystem. Through leaching, flushing, or erosion, wetlands export biomass to adjacent areas in the form of dissolved or particulate organic carbon. Biomass may also be exported from wetlands via the aquatic and terrestrial food web.

In terms of social or human values, wetlands also provide benefits such as aesthetic open space and places for recreational activities such as birding, wildlife viewing, photography, and nature appreciation. The wetlands along the Moose-Wilson corridor provide a high level of these social values given their proximity to a popular park visitation area.

Because wetlands are protected by various laws, the boundary of the protected wetland is important to determine before any development or construction is approved by various governmental agencies. Wetland delineation establishes the existence (location) and physical limits (size) of a wetland for the purposes of federal, state, and local regulations. A wetland delineation is based on the presence of three parameters: (1) predominance of hydrophytic vegetation, (2) hydric soils, and (3) wetland hydrology. Hydrophytic vegetation consists of those plant species growing in water, soil, or a substrate that at least periodically lacks oxygen. Hydric soils are saturated, flooded, undrained, or ponded long enough during the growing season to develop anaerobic conditions in the upper soil horizon. Wetland hydrology includes seasonal, periodic, or permanent inundation or soil saturation creating anaerobic conditions in the soils for a sufficient portion of the growing season.

Considering that the presence of wetlands is dependent on dynamic conditions and systems (hydrology, vegetation cover, and soils), it must also be noted that wetland areas in the project area are in constant flux and evolution. This is particularly prevalent in the project area due to the additional dynamic variable of beaver activity, which has the potential to alter surface water flows frequently and substantially.

Wetland Types

In addition to the above three parameters that determine wetland delineations, several different types of wetland classifications exist (Cowardin et al. 1979). Five predominant wetland types can be found in the project area.

Palustrine Emergent Wetlands. These wetlands are characterized by erect, rooted, herbaceous hydrophytic plants, excluding mosses and lichens. Plant species that dominate emergent wetlands in the park include sedges, rushes, spikerush, and various hydrophytic grasses. Palustrine emergent wetlands provide valuable forage for ungulates and avian species, especially during the early growing season when other forages have not yet greened up. These wetlands also provide cover for nesting, resting, and foraging waterfowl and upland birds; habitat for small mammals and reptiles; and reproductive habitat for amphibians (NPS 2006; Hansen et al. 1996).

Palustrine Scrub-Shrub Wetlands. This wetland type is typically dominated by woody vegetation less than 20 feet tall. Plant species may include true shrubs or young trees. Scrub-shrub wetlands may represent a successional stage, eventually leading to a forested wetland. Or, they may be stable, self-perpetuating shrub communities. Palustrine scrub- shrub wetlands in the park are usually dominated by various willow species, but may also be dominated by alders. Scrub-shrub wetlands provide important cover and breeding and foraging habitat for a variety of wildlife species, including moose, neotropical songbirds, and small mammals (NPS 2006).

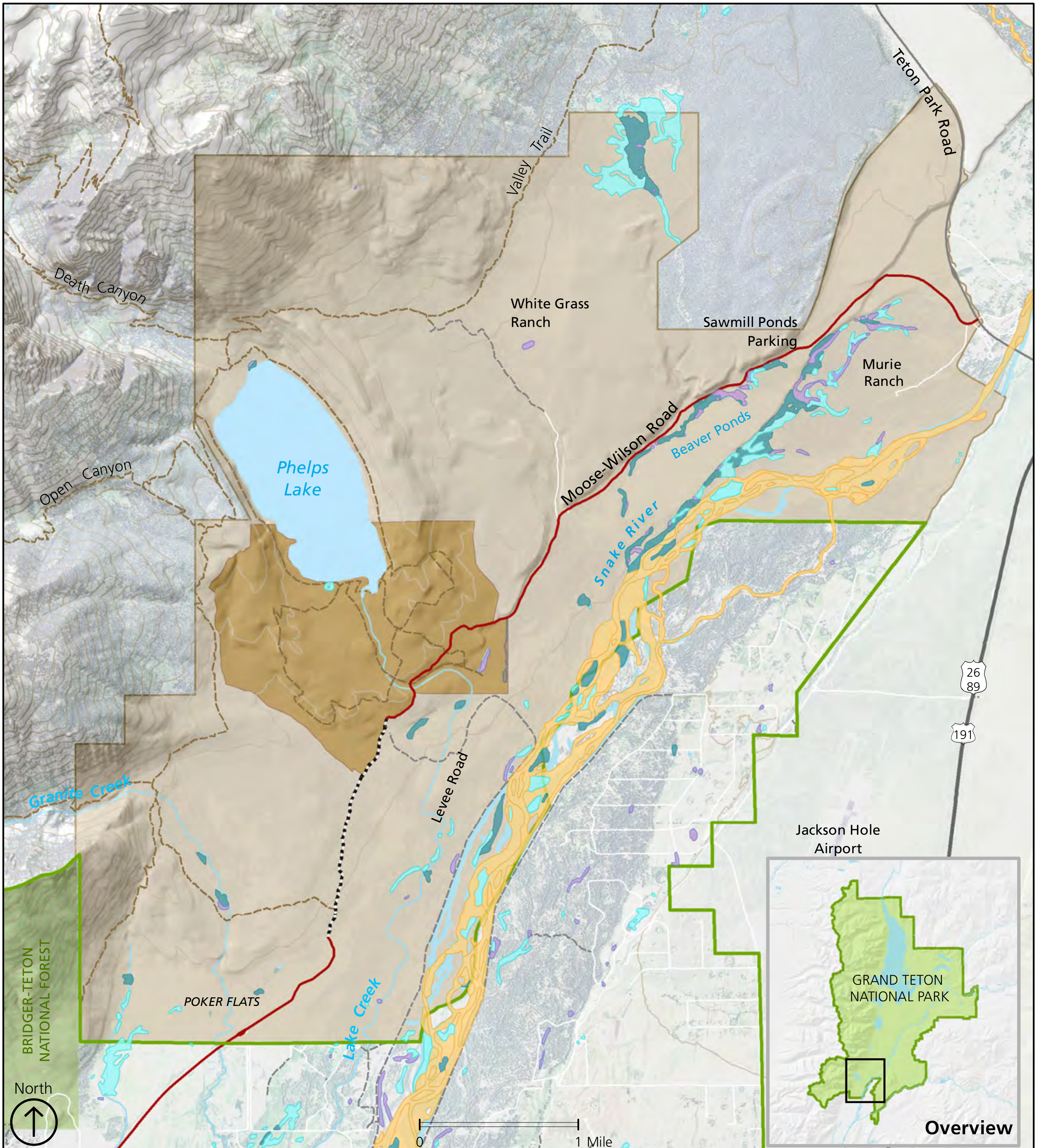
Palustrine Forested Wetlands. These wetlands have woody vegetation greater than 20 feet tall with more than a 30% canopy. The tree cover typically consists of a mixed forest of broad-leafed deciduous trees and various species of coniferous trees. Seedlings and older trees are regenerated and sustained, respectively, by the low-lying, wet conditions that are indicative of stream and river floodplains and beaver pond complexes. Palustrine forested wetlands may evolve from palustrine scrub-shrub wetlands, where shrubs such as various willow species may dominate the vegetation cover until the larger tree canopy develops and expands. These forested wetlands are particularly important for birds and bats, given the roosting/nesting potential in proximity to high concentrations of insects. They also provide an important food and tree source (for building dams and lodges) for beavers.

Lacustrine Wetlands. These wetland areas include shallow water, lakes and ponds, and stream channels within which water is present on an annual, but not necessarily permanent, basis. Macrophytic plants are usually present and include a variety of rooted and floating species. Shallow areas of open water habitat provide nesting, cover, and foraging opportunities for a variety of avian species, small mammals, and fish (NPS 2006).

Riverine Wetlands. Riverine wetlands typically possess similar vegetation types as lacustrine wetlands; however, these wetlands are contained along and within a waterway channel (e.g., Snake River or various tributaries). The vegetation and hydrological dynamics of riverine wetlands are dependent on the waterway's flow gradient (which varies considerably from the Snake River channel to the steep tributaries to the west). Thus, vegetation in riverine wetlands provides important streambank and channel stabilization by holding soils in place with root systems. Also, given that these wetlands follow channelized waterways and associated riparian corridors, riverine wetlands often serve to improve habitat value along the riparian wildlife movement corridors.

Wetlands in the Project Area

The primary identified wetland and open water features found within the project area are shown in map 11. However, it is important to note that the wetlands shown in the following map are not fully inclusive of all possible wetlands in the project area simply because the entire project area has not been field surveyed for wetlands. Additional pockets of unmapped wetlands likely exist in some areas.



Legend

- Streams
- Park Boundary
- Project Area Boundary
- Laurance S. Rockefeller Preserve

Wetland Types

- Palustrine Emergent Wetlands
- Palustrine Forested/Shrub Wetlands
- Palustrine Pond Wetlands
- Lacustrine Wetlands
- Other Wetlands
- Riverine Wetlands

Moose-Wilson Road

- Paved
- Unpaved

Wetlands

U.S. Fish and Wildlife Service
National Wetlands Inventory, 1979

Grand Teton National Park, Wyoming
National Park Service/U.S. Department of the Interior

Produced by Denver Service Center Planning Division, September 2014

The wetland mapping information is derived from the National Wetland Inventory (NWI) mapping that was completed in 1990 by the US Fish and Wildlife Service and is available for the entire project area (NPS 2006; USFWS 1990). Although many of the potential wetland areas noted on the NWI maps have not been specifically surveyed and/or delineated, this mapping identifies areas that likely possess wetland conditions or are wetland remnants from previous hydrological patterns. Some, but not all, of the wetlands identified in the NWI mapping have been confirmed by park staff.

Roughly 50 acres of wetlands in the vicinity of the previously identified Moose-Wilson Road realignment corridor were surveyed and delineated for the park(North Wind Resource Consulting 2012). Much more information is available on these wetlands (i.e., dominant vegetation, hydrology, functional values, etc.). A map of these delineated wetlands is found later in this section.

The following wetland condition descriptions for various locations along the road corridor were provided by park scientists (McCloskey, Mellander, pers. comm., 2014).

Generally, throughout the project area, wetlands are in relatively good condition, with the possible exception of areas where permitted water rights alter and divert surface water flows (e.g., from the Snake River and Granite Creek). In other areas, such as on the LSR Preserve, water diversions have created new wetlands in otherwise upland areas by substantially altering natural hydrologic patterns. Also, for the extent of Moose-Wilson Road (and along other connecting roads), the water quality in wetlands can be affected by point-source pollution from vehicles and road treatments (e.g., magnesium chloride on unpaved sections for dust abatement).

The most extensive area of wetlands along the road corridor exists from the Sawmill Ponds area to Death Canyon Road. Several of these wetlands are further discussed below in the section that references the 2012 wetland delineation of this area. Many of these wetlands have been created and/or modified by ongoing beaver activity. Given the preponderance of beaver dams and multiple stream crossings in this segment, road flooding is not uncommon during high water events and spring snow melt. Likewise, the adjacent wetlands in this segment are also affected by the continued management of the road and of nearby beaver pond water levels. The presence of Moose-Wilson Road is limiting the natural growth and evolution of wetland development in this area. As the road proceeds southward, it crosses a stream immediately north of Death Canyon Road. In this location, and in several other locations along its alignment, the roadbed is affected by many seeps and springs.

Through the LSR Preserve and farther to the south along the unpaved segment of Moose-Wilson Road (to the south of LSR Preserve), small pockets of wetlands are present adjacent to the road and/or near stream crossings (e.g., Lake Creek). Given their proximity to the road alignment, the wetlands that exist along the unpaved portions of the road are particularly prone to surface runoff from the road, which may contain eroded road material, magnesium chloride, as well as vehicle pollutants. Magnesium chloride is applied to the unpaved road two to three times per summer.

Wetlands also exist in the vicinity of various destination sites within the project area. Park staff noted wetland conditions at the following destination sites (McCloskey, Mellander, pers. comm. 2014):

> Teton Park Road and Pathway (Moose-Wilson Road junction to Chapel of the Transfiguration Road junction): Small palustrine, seasonally flooded wetlands present within the forested area south of entrance station.

Murie Ranch: Small palustrine, seasonally flooded wetlands around the historic district.

Sawmill Ponds Overlook: Extensive palustrine, seasonally flooded wetland complex immediately east of (and below) the overlook. Some of the wetlands in this area may also be spring-fed.

Death Canyon and Valley Trails: Small palustrine, seasonally flooded wetlands exist throughout this area.

Phelps Lake: Lacustrine wetland areas mostly at and near the lake's outlet.

LSR Preserve: Several riverine wetlands exist throughout the Preserve and along Lake Creek. The conversion of some upland areas to wetlands has resulted from water diversions. An artificial wetland also exists near a human-made waterfall and within the parking lot.

Open and Granite Canyon Trails: Small palustrine, seasonally flooded wetlands exist throughout this area.

Levee Road: Several wetlands exist to the west of Levee Road. The levee and adjacent water diversions have likely effects on wetland hydrology in this area (also see "Cumulative Impacts" subsection under the "Wetlands" section in chapter 4).

Poker Flats: Small palustrine, seasonally flooded wetlands exist throughout this area. Extensive equestrian use and social trails in various wet meadows are having negative effects on the wetland conditions (also see impact analyses "Wetlands" section in chapter 4).

2012 Wetland Delineation Survey

In 2012, the potential wetland areas in the vicinity of the previously identified Moose-Wilson Road realignment corridor were surveyed and delineated (North Wind Resource Consulting 2012). The report indicates that 20 sampling points were analyzed in this area during the field survey in the summer of 2012. All points assessed were found to contain the wetland characteristics required to be classified as a wetland as outlined in the Wetland Delineation Manual and Regional Supplement (North Wind Resource Consulting 2012; Environmental Laboratory 1987; USACE 2010) or Cowardin's Classification of Wetlands and Deep Water Habitat of the United States (Cowardin et al. 1979).

The 2012 report noted five delineated wetland areas along Moose-Wilson Road in the vicinity of the realignment area (see map 12 and table 12). A total of 50.14 acres of wetland were delineated in this area; 5.19 acres of wetland remnants were also identified. All of the wetlands are connected, either directly or indirectly, to the Snake River and thus are presumed to be under the jurisdiction of the US Army Corps of Engineers.

TABLE 12. DELINEATED WETLANDS IN ROAD REALIGNMENT STUDY AREA

Wetland Study Area	Wetland Classification	Acres
Area 1	Palustrine, Forested, Semi-permanently Flooded (PFOF)	0.37
Area 2	Remnant; (Palustrine, Scrub-Shrub, Unknown (PSSU)	0.10
Area 3	Palustrine, Scrub-Shrub, Seasonally Flooded (PSSC)	2.62
Area 4	Palustrine, Emergent (PEM)	2.34
	Palustrine, Scrub-Shrub, Seasonally Flooded (PSSC)	44.23
	Remnant	5.09
Area 5	Palustrine, Scrub-Shrub, Seasonally Flooded (PSSC)	0.58
	Total Delineated Wetlands	**50.14**
	Total Remnant Wetlands	**5.19**

The following wetland delineation summaries for each identified wetland in the 2012 study have been directly excerpted from the 2012 report and condensed for the purpose of this plan (North Wind Resource Consulting 2012).

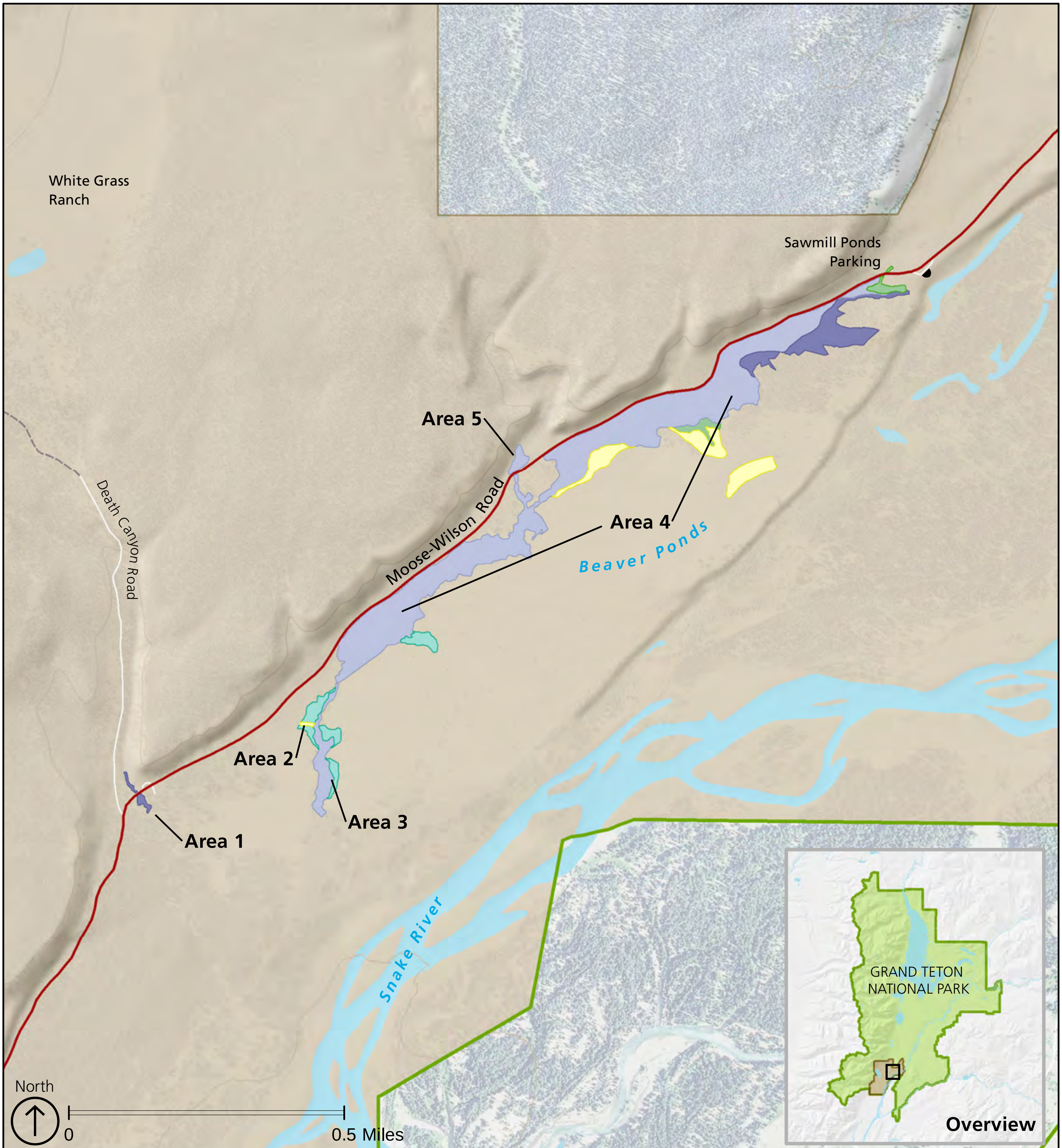
Area 1:

Description

The delineated area 1 wetlands encompass 0.37 acre and are at the southern end of the survey area just northeast of Death Canyon Road junction. This area is a tributary to the Snake River south of the project area. The delineated area 1 wetlands are classified as Palustrine, Forested, Semi-Permanently Flooded (PFOF) wetlands (Cowardin et. al. 1979). These wetlands are found along the upper banks of a spring-fed intermittent stream channel. There is a clear transition between upland and wetland vegetation. The upland vegetation along this area is forested upland and sagebrush steppe, which commonly occur in mountainous areas. Drummond's willow, lodgepole pine, and spreading bent are the most prevalent plant species. The soils within area 1 are dominated by dense cobble. High water mark indicators were observed in this area. The stream is known to be a spring-fed creek that flows intermittently throughout the growing season.

Functions and Values

The small stream in this area has the potential to provide habitat for wildlife including amphibians and aquatic invertebrates. It generally flows most of the season providing a source of water to wildlife and supporting some wetland vegetation. This stream is too small to provide significant hydrological functions but is connected to the Snake River. Thus, it could serve as an erosional and detrital export channel to the Snake River. Moose-Wilson Road crosses this stream and thus, any expansion or realignment of the transportation infrastructure may require installation of a new culvert or stream passage structure. The stream is not expected to have significant cultural, research, or economic value.



Legend

- Park Boundary
- Project Area Boundary
- Water Body
- Turnout
- Streams
- Moose-Wilson Road

Wetland

- PEMC - Palustrine, Emergent, Seasonally Flooded
- PFOF - Palustrine, Forested, Semi-permanently Flooded
- PSSC - Palustrine, Scrub-Shrub, Seasonally Flooded
- Potential Wetland Expansion Area
- Remnant Wetland

Delineated Wetlands

North Wind Resource Consulting, 2012

Grand Teton National Park, Wyoming
National Park Service/U.S. Department of the Interior

Produced by Denver Service Center Planning Division, November 2013

Area 2:

Description

The area 2 wetland encompasses 0.10 acre and appears to be a remnant wetland, which is assumed to have had a classification of a Palustrine, Scrub-Shrub, Unknown wetland (Cowardin et al. 1979). This area is geographically connected to area 3, which is a wetland. However, there is no longer any hydraulic connection. Area 2 is farther away from and slightly higher in elevation than the stream that runs through area 3. This area is not currently functioning as a wetland and thus is presumed to not be jurisdictional by the US Army Corps of Engineers. However, if the water table rises (for instance, by creation of a beaver dam downstream) then the area would likely become connected hydraulically to area 3 and would then likely be under USACE jurisdiction. The vegetation is trending toward dry with the more hydrophytic species showing stress and dying. Drummond's willow is the most dominant species within area 2, making up 40% of the vegetation in the area. Black hawthorn and white-stem gooseberry are also present. Because the dominant species have wetland indicator status, the vegetation in the delineated area has a positive hydrophytic vegetation indicator. No wetland hydrology indicators were observed in this area at the time of the survey. However, the current vegetation seems to indicate the area has received sufficient water in the past to support hydrophytic vegetation. The evidence for these stresses include a dominance of smooth brome in the understory, the presence of dry soils that lack hydric soils indicators, and the lack of any wetland hydrology indicators.

Functions and Values

Currently, the remnant wetland in this area provides little in terms of function or value. Canada thistle, a noxious weed, is present in the area (and undergoing integrated pest management treatment), which reduces the quality of habitat for wildlife.

Area 3:

Description

Two sampling points occurred in area 3: "Area 3-wet" and "Area 3-up." There is a clear transition between upland and wetland vegetation in this area. The upland vegetation in area 3-up contains grass species that commonly occur in livestock pasture habitats, namely smooth brome. Area 3-wet is associated with the banks and floodplains of an unnamed creek that flows through the area.

The delineated wetland area associated with area 3-wet encompasses 2.62 acres and is classified as a Palustrine, Scrub-Shrub, Seasonally Flooded wetland (Cowardin et al. 1979). Area 3-wet is hydrologically connected to area 4 on the northeast and is a tributary to the Snake River to the south, making it waters of the United States and presumed jurisdictional under the US Army Corps of Engineers. Northern territory sedge and Drummond's willow are the dominant species within area 3-wet, making up 80% and 20% of vegetation cover, respectively. These are both wetland species. The hydrology for area 3-wet is associated with a perennial stream. The water flowing within the creek averaged a depth of approximately 10 inches at the time of the field survey. The soils in area 3-wet were assessed and found to be moist to the surface and hydric.

Area 3-up did not contain wetland characteristics and is not a wetland. There are multiple areas along both the east and west boundaries of area 3 that appear to have been previously inundated by water, possibly from historic beaver activity in the area. These areas show signs of vegetation alteration that appear to be the result of prolonged inundation, but they currently fail to meet the characteristics required to be classified as a wetland. It is anticipated that a higher water table, for instance through increased beaver activity in the area, would cause the stream associated with area 3 to overflow its banks and inundate these areas, perhaps driving them toward being wetlands.

Functions and Values

The area 3-wet wetland currently provides some fish and wildlife habitat, but because of historic disturbance in the area, it is not functioning at its full potential. The area has been in private use in the past and at least two homesteads and associated roads are present in the area. Thistles are present throughout the area and are evidence of disturbance. The stream does provide hydrological function as it connects the wetlands and hydrology upstream to the Snake River downstream. This stream and associated wetland would have to be crossed to accommodate road corridor expansion or realignment. This would provide significant opportunity to improve and restore the wetlands in this area to a more functional biotic and hydrologic state. There are probably few cultural values left in the area even though there was a homestead here at one time. Some prehistoric sites may also be present as this wetland area has probably been used by American Indian tribes. The wetland does not provide research or scientific value and there are no significant economic values, although a private landowner downstream of the site does possess some water rights to the stream.

Area 4:

Area 4 is a large wetland complex that connects to area 3 and area 5. The delineation study divided the complex into four segments. There were four vegetation communities identified along transitions, which include emergent wetlands, scrub-shrub wetlands, remnant wetlands, and upland. Area 4 contains an unnamed perennial stream that flows through the length of the area to the Snake River. The southern boundary of the delineated area was clearly defined by an abrupt transition between wetland habitat and sagebrush steppe habitat.

Area 4 Emergent:

Description

The delineated wetlands in this area encompass 2.34 acres and are classified as Palustrine, Emergent (Cowardin et al. 1979). The connectivity of these delineated areas to the stream that flows through area 4 (a tributary to the Snake River) makes the emergent wetland areas presumed jurisdictional by the US Army Corps of Engineers. The emergent areas of area 4 were found to contain all three of the wetland indicators necessary for an area to be classified as wetlands. The delineated emergent areas occurred between the upland areas and the scrub-shrub wetland habitats. The scrub-shrub habitats are dominant along the active stream channel. Sedge species, Drummond's willow, speckled alder are dominant within the emergent wetland. The hydrology associated with the emergent area in area 4 varies from saturated soils to inundation from proximity to flowing water. The hydrology within the stream channel, which flows adjacent to the emergent areas, continues to the southwest and eventually flows into the Snake River. A beaver pond is also a hydrological feature in this area. The soils in the emergent sampling points of area 4 were assessed and found to be rich soils containing a dark matrix color, a hydric condition.

Area 4 Scrub/Shrub and Forested:

Description

These delineated areas encompass 44.23 acres along an active stream channel and are classified as Palustrine, Scrub-Shrub, Seasonally Flooded wetlands (Cowardin et al. 1979). Most of the sampling points in the scrub-shrub areas of area 4 were found to contain all three of the wetland indicators necessary for an area to be classified as wetland. The connectivity of these delineated areas to the stream that flows through area 4 (which is a tributary to the Snake River) makes the wetland areas presumed jurisdictional by the US Army Corps of Engineers. Portions of this wetland area have been created by inundation associated with recent beaver activity. Most of these wetland areas are dominated by Drummond's willow, alder-leaf buckthorn, speckled alder, and Saskatoon serviceberry, with the exception of the recently inundated area. The soils in the sampled areas are hydric.

Area 4 Remnant and Expanding Areas:

Description

There are multiple points along the southern boundary of area 4 that appear to have been previously inundated by historic beaver activity in the area. These areas show signs of vegetation alteration that appear to be the result of prolonged inundation but fail to meet the characteristics required to be classified as a wetland. This area was dominated by Drummond's willow with an understory of elk sedge, Canada thistle, and butter and eggs. These species have indicator status of FACW and FAC and pass the dominance test, classifying the vegetation as hydrophytic. The soils within the sampling point are rich and dark soils but do not contain any hydric soils indicators. However, further analysis via standardized methodology identifies these soils as hydric. At the time of the field survey, there were no hydrology indicators in the remnant areas due to the removal or natural breaching of the beaver dams, which inundated the area and other areas similar within area 4.

There is an additional area in the middle of the sagebrush steppe habitat that appears to be a remnant wetland area. This area did not contain any sign of hydrology, vegetation, or soils at the time of the field survey. However, due to its proximity to an abandoned irrigation ditch it is anticipated that the area supported these characteristics when it was actively ranched. This area may have served as a livestock watering pond or similar purpose.

There also were areas present within area 4 that showed new expansion of the wetlands caused by the presence of an active beaver dam complex. This beaver dam complex is resulting in water ponding and overflowing into sagebrush habitats. At the time of the survey, there were approximately 2 to 5 inches of standing water in these expansion areas, which has resulted in stressed and decadent sagebrush areas.

Area 4 Uplands:

Description

The sampling points assessed within the upland areas of area 4 did not contain the characteristics necessary to be classified as wetlands. The upland areas primarily occur along the southern boundary of the assessment area. The upland areas contain a combination of forested and sagebrush steppe habitats. Lodgepole pine, speckled alder, and mountain big sagebrush are the dominant species within the area 4 uplands, which are primarily upland species. The area 4 uplands do not contain any hydrologic characteristics or hydric soils associated with wetland conditions.

Functions and Values (Area 4)

The wetlands in area 4 provide a number of significant wetland functions and values. The wetlands in this area are heavily used by wildlife including moose, deer, elk, bears, and beavers, as well as a number of smaller mammals and birds. They also provide extensive habitat for amphibians and aquatic invertebrates. These wetlands are bounded on the west by Moose-Wilson Road and the rising topography west of the road but are open to expansion to the east. Current beaver activity has significantly expanded the wetland pools in this area and the wetland complex is expanding into upland sagebrush communities. The wetlands in area 4 also provide several hydrological functions, especially groundwater recharge, water supply, and erosion and sediment control. Cultural values likely exist along the uplands adjacent to the wetlands including both historic and prehistoric sites. The area may be able to provide some scientific value by studying the nature of wetland recovery and expansion if the current road is removed and the beaver activity is allowed to continue. This area also may be a place where some wetland mitigation activity can occur if the current Moose-Wilson Road is removed and the road grade lowered. This wetland area is a heavily visited site in the park, primarily because of the frequency with which wildlife can be observed in the road corridor.

Area 5:

Description

The delineated wetlands in area 5 encompass 0.58 acre and are classified as Palustrine, Scrub-Shrub, Intermittently Exposed wetlands (Cowardin et al. 1979). The stream flowing through the area connects to the stream in area 4 which is a tributary to the Snake River south of the project area, which makes it waters of the United States and presumed jurisdictional by the US Army Corps of Engineers. Area 5 is on the north side of Moose-Wilson Road where a natural drainage/draw intersects the roadway. The scrub-shrub wetland is associated with a dense willow complex on an alluvial fan or floodplain of the stream. There is a clear transition between upland and wetland vegetation. Drummond's willow, quaking aspen, and common cow parsnip are the dominant species in the wetland area. The vegetation in the delineated area is found to contain hydrophytic vegetation characteristics and the soils have been classified as hydric.

Functions and Values

The area 5 wetland provides important habitat for wildlife including amphibians and aquatic invertebrates. It is connected to area 4, although Moose-Wilson Road cuts through it. Thus, this area possesses a high restoration potential. The stream in this area is also an important contributor to the wetlands that occur in area 4. Like the other wetland areas in the project area, this area likely has some historic or prehistoric sites in the vicinity. It is not expected to have significant research or economic value.

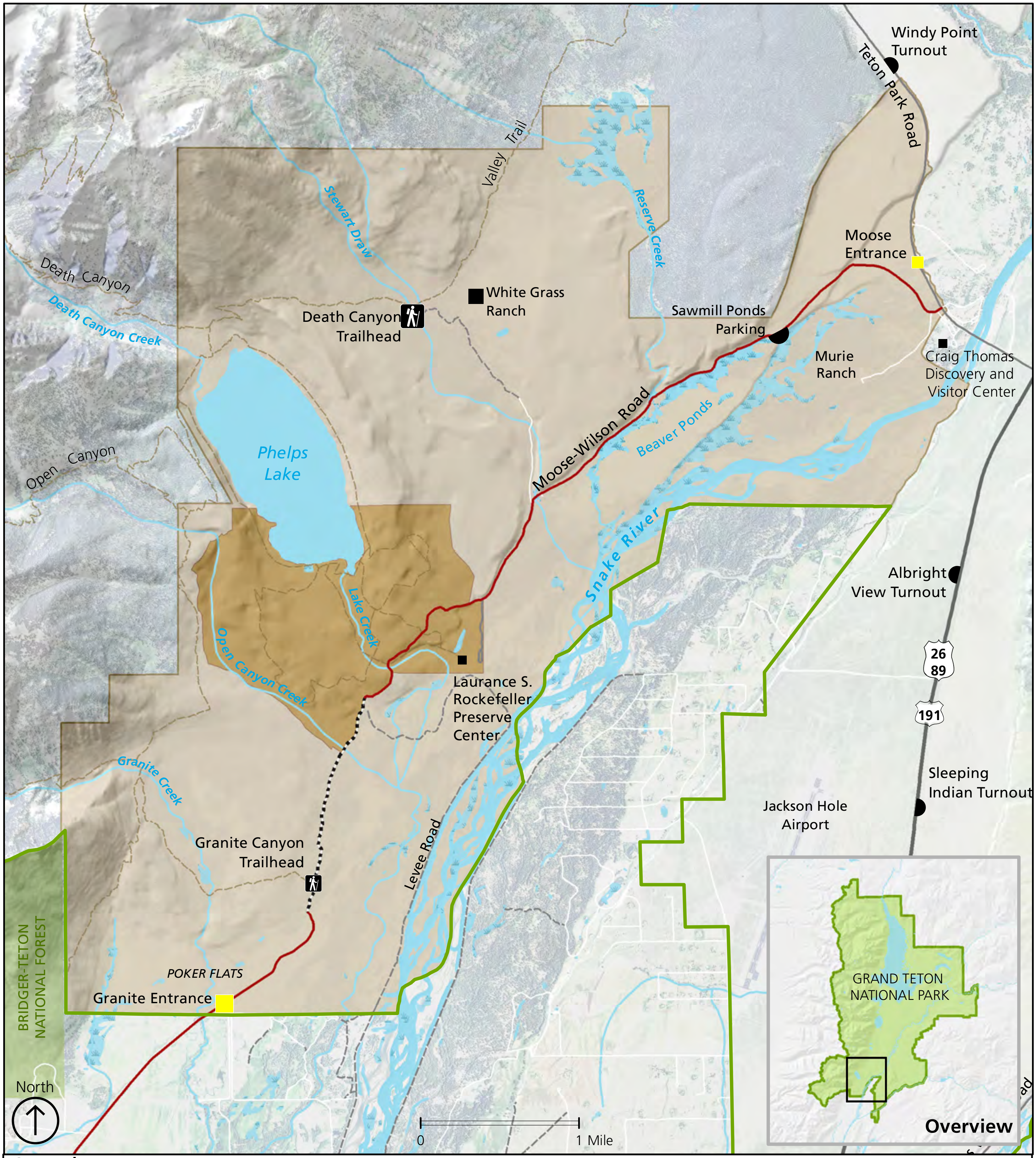
HYDROLOGY

Surface Water Hydrology

The natural surface water hydrology of the project area consists of several water bodies and features that are all tributary to the Snake River to the east. The surface water features include several perennial and intermittent streams, wetland complexes, beaver ponds, and most notably, Phelps Lake and the Snake River system. Given the prominence of wetlands along the Moose-Wilson corridor, a separate "Affected Environment" section has been dedicated solely to wetlands (see "Wetlands" section). Please refer to map 13 of the major hydrological features of the project area.

The Snake River system generally flows from north to south and runs along the eastern edge of the project area. This river system is the most notable water feature in the project area and in Grand Teton National Park. For most of its length along the project area, the Snake River flow regime consists of a braided stream morphology, with the exception of the single channel that flows past Moose near the northeast edge of the project area. For much of the river length in and along the project area, the river's floodplain is confined by a levee system maintained by the US Army Corps of Engineers (NPS 2012; NPS 2010b). The levee system begins just east of the LSR Preserve Center and parallels the Snake River southward to the southern boundary of the project area. The average annual flow of the Snake River at Moose (from the late 1980s to the present) is 2,869 cubic feet per second. Recorded daily flows range from 600 to 24,500 cubic feet per second (NPS 2012; USGS 2010).

In 2009, several segments of the Snake River throughout the park were designated for special protection under the Wild and Scenic Rivers Act. In the project area, the only designated stretch of the Snake River is at the northeastern edge of the project area (extending 1.0 mile south of the Teton Park Road bridge). This segment was classified as a Scenic River under the act.



Legend

- Entrance
- Trailhead
- Point of Interest
- Trails
- Streams

Moose-Wilson Road

- Paved
- Unpaved
- Park Boundary
- National Forest
- Water Body
- Wetland
- Project Area Boundary
- Laurance S. Rockefeller Preserve

Hydrology Overview

U.S. Geological Survey
(National Hydrography Dataset, 2001)
U.S. Fish and Wildlife Service
(National Wetlands Inventory, 1979)

Grand Teton National Park, Wyoming
National Park Service/U.S. Department of the Interior

Produced by Denver Service Center Planning Division, November 2013

Phelps Lake is another prominent hydrologic feature in the project area. Phelps Lake is a major glacial lake in the park that is noted for its substantial cutthroat trout population (as well as some nonnative fish species). Because there is little development around the perimeter, the lake is in stable condition and is predominantly affected by changes in snowmelt inflow volumes. However, some lakeshore erosion is occurring from social trail development around the lake's perimeter. Some wetland areas exist around the south end of the lake, mostly near the outlet into Lake Creek. The bridge over Lake Creek near the Phelps Lake outlet is prone to large flood stages during spring snowmelt and precipitation events. See subsection below for more information on Phelps Lake.

Another natural, dynamic feature that affects local hydrology in the project area is the development of beaver pond complexes. The beaver ponds in and around the Sawmill Ponds area is a prime example of how beaver activity affects local hydrology and the landscape itself (e.g., vegetation cover). And from time to time, beaver dam development results in stream flooding on Moose-Wilson Road. In recent years, park staff have installed a flow device in one area to allow water to flow through without flooding the road. However, given the continually dynamic nature of beaver ponds (and the beaver dam-building activities that generate the ponds), the stream courses and stream flows in several areas of the project area are continually shifting and changing (Mellander, pers. comm. 2014).

Aside from natural processes that play a role in local hydrology, the project area is also bisected by a network of irrigation ditches (past and present). Diversion ditches and control structures intersect with natural water courses in several locations of the project area. The water rights associated with the ditches dictate where, how much, and when water flows through the ditches. Thus, diversions of natural surface flow from the Snake River and its tributaries into the network of irrigation ditches directly affects surface hydrology by reducing stream/river flows in some stream channels and increasing water presence and groundwater recharge in other areas that would otherwise be dry. For example, Lake Creek becomes void of water for a short stretch when irrigation diversions from the creek (just above Lake Creek Trail bridge) occur in extreme low flow situations (Mellander, pers. comm. 2014). Conversely, some previously upland areas in the vicinity of Lake Creek have become wetlands due to the importation of irrigation water via the ditch (Mellander, pers. comm. 2014).

Likewise, increasingly shorter-term and smaller snowpack in the high country to the west of the project area due to climate change could continue to affect streamflow and alter channel dynamics of the perennial/intermittent streams and the Snake River (Mellander, pers. comm. 2014). Water levels of surface water bodies (e.g., beaver ponds, Phelps Lake) could also be affected by changes in snowmelt inflows. Likewise, early snowmelts from increasingly early snowmelt events could induce more notable flood events earlier in the spring.

Additional information on Phelps Lake and the tributaries to the Snake River is found below (Panny 2013; Dustin 1998; Cain, pers. comm. 2014; Mellander, pers. comm. 2014).

Reserve Creek. Approximately 2.3 miles (3.8 km) of Reserve Creek is within the project area, draining an extensive meadow/wetland complex between the Beaver Creek housing area (north of the project area) and historic White Grass Ranch. Two trail crossings occur on the stream within the project area. Three water diversion ditches use Reserve Creek as a water source: Ilse, Reserve, and Reserve Creek No. 2. Sawmill Ponds is composed of a wetland complex on the east side of Moose-Wilson Road and is fed by both Reserve Creek and Stewart Draw.

Stewart Draw. Approximately 5.2 miles (8.5 km) of Stewart Draw is within the Moose-

Wilson corridor project area. Death Canyon Road parallels the stream for approximately 0.5 mile (0.75 km) before crossing it via a bridge. Death Canyon Road again crosses two channels of Stewart Draw via culverts before ending at Death Canyon Trailhead. Seven trail crossings occur on the stream within the project area. Three diversion ditches use Stewart Draw as a water source: Hammond, Stewart, and Stewart No. 2.

Death Canyon Creek. Lower Death Canyon Creek flows for 0.8 mile (1.35 km) before meeting Phelps Lake. Several well-used trails cross the creek, including the Valley Trail / Phelps Lake Loop Trail, over a substantial foot bridge just upstream of Phelps Lake.

Open Canyon Creek. Approximately 4.6 miles (7.5 km) of Open Canyon Creek (also known as "Kaufman Creek") lies within the Moose-Wilson corridor project area, a portion of which flows along the southern boundary of the LSR Preserve area. A southern tributary meets the main stem on the western end of the LSR Preserve. At the confluence of these streams, historic livestock use has likely contributed to streambank instability and an abundance of noxious weeds (Novak et al. 2005). Moose-Wilson Road crosses Open Canyon Creek via a bridge at the southern end of the LSR Preserve boundary. Eight trail crossings occur on the stream within the project area upstream of its confluence with Lake Creek, south of the Preserve area. One diversion ditch uses Open Canyon Creek as a water source.

Lake Creek. Approximately 5.7 miles (9.2 km) of Lake Creek, from its source at Phelps Lake to the park boundary, falls within the project area. Trails cross the stream via bridges at approximately 5.0 miles (8.0 m) (Phelps Lake Loop Trail), 0.6 mile (1.0 km) (Woodland Trail), 1.6 miles (2.7 km) (Lake Creek Trail), and 5.1 miles (8.3 km) (Cara's Trail) downstream of Phelps Lake outlet. Lake Creek meets the Granite Supplemental Ditch 1.4 miles (2.3 km) downstream of the LSR Preserve boundary. Two additional stream crossings exist within the R Lazy S trail system in the southeastern corner of the project area. Three diversion ditches use Lake Creek as a water source. The Granite Creek Supplemental Ditch is a Snake River (main stem) diversion that adds significant volumetric flow to lower Lake Creek. The ditch continues in a southeasterly bearing, perpendicular to Lake Creek, eventually meeting Granite and Fish Creeks outside the park boundary.

Granite Creek. Approximately 4.5 miles (7.2 km) of Granite Creek lies within the Moose-Wilson corridor project area. An extensive network of social trails and stock trails exists in this area. About 1.0 mile (1.5 km) of Granite Creek flows through private land on an inholding. An official park trail crosses Granite Creek via bridges near the confluence with the northern tributary approximately 0.6 mile (1.0 km) from the Granite Canyon Trailhead and near the junction with Valley Trail at the mouth of Granite Canyon. Six diversion ditches use Granite Creek as a water source: Brown, Chicago, Enlargement of the Chicago, Chicago Ditch / Enlargement of the Chicago Ditch / John Miller Ditch, Granite, John Miller, and Kaufman.

Phelps Lake. Phelps Lake is the southernmost glacial lake in Grand Teton National Park, and sits at the mouth of Death Canyon at the foot of the Tetons, at an elevation of just over 6,600 feet above sea level. The lake has approximately 440 acres of surface area (Dustin 1998; Park GIS onscreen measurement, 2014). A trail system follows the entire lake shore (the Phelps Lake Loop Trail) connecting with the Death Canyon Trail, Valley Trail, and the Open Canyon Cutoff Trail. Trailhead access to this system is from Death Canyon Trailhead and the LSR Preserve. Several backcountry campsites are also on the northeast side of the lake. The lake inlet area (where Death Canyon Creek flows into the lake) and the lake itself provide sport fishing opportunities for visitors (see "Fisheries" section), although motorized boating is prohibited on Phelps Lake. Visitors generally pass by on the trails or walk down to the shore to view the lake and surrounding peaks. However, there is some swimming activity near the outlet to Lake Creek, at the northeast corner near the backcountry campsites, and also from the place known to locals at "jump rock" on the northern shore of the lake.

The residence time of a water body is the average time a unit of water will spend in the water body before discharging downstream. Phelps Lake has a "time in residence" (overall mean time water spends in a lake) of approximately eight years (Dustin 1998), and has consistently high water quality. In times of high runoff, considerable sedimentation occurs from the inlet; however, there have not yet been any bathymetric or other inventories from which to determine changes in the sedimentation rate from higher and earlier peak runoff events.

Groundwater Hydrology

The groundwater regime of the project area is primarily associated with the Snake River Valley aquifer (NPS 2006). The groundwater of this regional aquifer generally flows from the higher elevation lands to the west, down toward the Snake River and then generally to the southwest parallel to the river valley alignment (NPS 2012). The Snake River Valley aquifer is fed by groundwater recharge throughout the project area. The aquifer is recharged by infiltration of precipitation and snowmelt, wetland and beaver pond recharge, streamflow and irrigation water seepage, and inflow from other aquifers (NPS 2006).

The aquifer has relatively high permeability and is closely interconnected to surface waterways and water bodies (NPS 2006). Highly permeable aquifers are prone to water contamination from pollutants that originate on the surface (see the "Water Quality" section below). Although it is considered to have high water quality, the Snake River Valley aquifer could be threatened by contamination from visitor use (e.g., vehicle pollutants), park facilities and operations (e.g., magnesium chloride applications on roadways), and other pollutant sources along the Moose-Wilson corridor (NPS 2012; NPS 2010b).

Floodplains

Floodplains in the project area are associated with both the Snake River and the various tributary streams of the Snake. However, the timing, duration, and extent of the flooding vary considerably between the two. The Snake River floodplain is extensive and is fed by high river flows that originate in the Snake River headwaters that exist to the north in Grand Teton National Park, Yellowstone National Park, and Bridger-Teton National Forest. Given the size of the Snake River watershed, flood events along the Snake can be driven by storm events and snowmelt that occur many miles to the north. However, for most of the project area, the Snake River floodplain is artificially contained by the levee system that parallels the extent of the Moose-Wilson corridor, as well as the flood mitigating effects of water regulation from Jackson Lake Dam. The levee is maintained by the US Army Corps of Engineers, and levee work is anticipated in 2015–16. To date, Snake River floods have not breached the levee and flooded areas to the west along the Moose-Wilson corridor. Park staff have noted concerns with the effects of the levee on the natural hydrology of the Snake River and the associated ecological effects of floodwater being blocked from reaching lands to the west that experienced natural flooding prior to construction of the levee.

The gradient of the Snake River in the project area is relatively gradual when compared to the steep channels of its tributaries to the west of the Moose-Wilson corridor. Thus, flooding along the Snake River tends to be more gradual and foreseeable than the flood events along the steeper tributary streams. Unlike Snake River flooding, the floodplains along the various intermittent and perennial tributary streams are typically formed and fed more instantaneously by snowmelt and storm events happening nearer the project area.

Because Moose-Wilson Road generally runs perpendicular to the flow of the various Snake River tributary streams (which generally flow northwest to southeast toward the Snake River), there are numerous stream crossings along the road corridor. Other access roads in the project area also cross several intermittent and perennial streams. Given the number of crossings and the steep gradient to the west of Moose-Wilson Road, overflowing channels, flooded roadways/trails, and bridge damage are not uncommon during spring snowmelt and large storm events. Some portions of the project area that experience relatively frequent flooding and/or roadway erosion include Sawmill Ponds Overlook to Death Canyon Road, Death Canyon Road, Death Canyon and Valley Trails, areas along Lake Creek on the LSR Preserve, Open and Granite Canyon Trails, and Poker Flats.

Water Rights and Delivery System

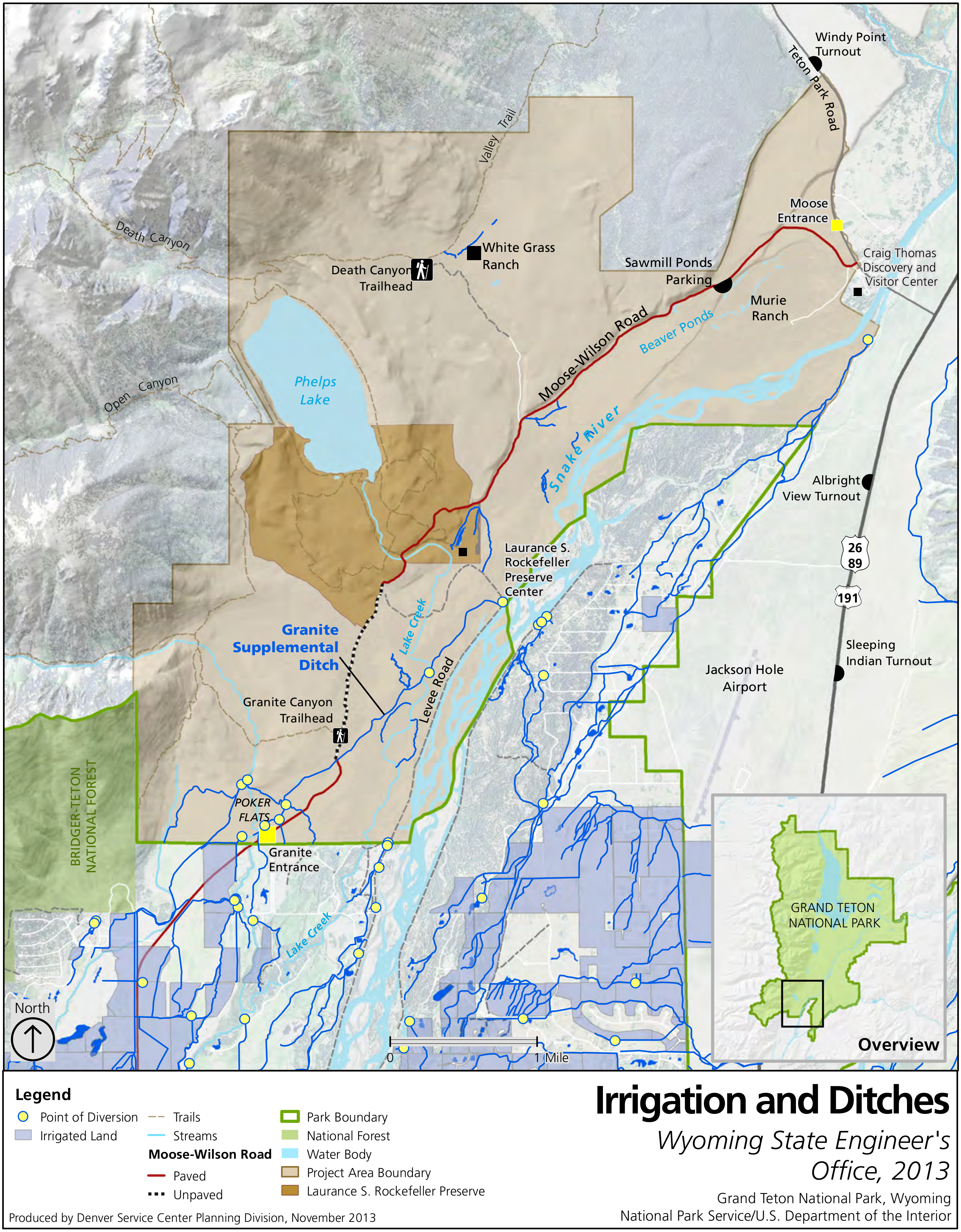
As noted above, a system of irrigation ditches and diversion structures for adjudicated water rights exists in the project area to the east of Moose-Wilson Road. Please refer to map 14 for the irrigation network in the project area. In several areas, the irrigation ditches and laterals (pipes which go from the control valves to sprinklers or drip emitter tubes) intersect with natural water courses. Due to water rights obligations, NPS staff are challenged with maintaining adequate flow deliveries to the irrigation ditches to fulfill the water rights regardless of the natural condition of the streams.

In the northern portions of the project area, former diversion ditches can be found adjacent to Teton Park Road. An irrigation ditch also exists near an inholding between Sawmill Ponds and Death Canyon Road (in an area of previously proposed road realignment). Likewise, White Grass Ranch is connected to nearby streams with an irrigation ditch. Water diversions from the Snake River feed a major irrigation ditch near Levee Road (Granite Creek Supplemental Ditch), where headgate and ditch maintenance occurs periodically. An irrigation ditch crossing exists immediately south of Granite Canyon Entrance Station and multiple irrigation ditch crossings of the Granite Creek Supplemental Ditch and other diversion ditches exist near Poker Flats at the southern end of the project area.

WATER QUALITY

Background

Water quality is an important indicator of overall ecosystem health, and the National Park Service intends to have unimpaired water quality in all park units. Alpine-subalpine ecosystems in the park are vitally important, not only as habitat but because they form the headwaters that supply water for human consumption, recreation, agriculture, and industry throughout the region. Under the auspices of the Clean Water Act, all surface waters in the park have been designated Outstanding Natural Resource Waters, where no degradation is allowed. Additionally, all surface waters are designated as class I (highest of four water quality classifications) by the Wyoming Department of Environmental Quality and meet or exceed these standards (WYDEQ 2001). The Snake River near Moose is of high-quality. Class I waters are recognized for their exceptional quality and therefore “no further water quality degradation by point source discharges other than from dams will be allowed” (WYDEQ 2001). Wyoming’s classification corresponds with the US Environmental Protection Agency’s Outstanding Natural Resource Waters designation, giving the Snake River within the park the highest level of protection from degradation (EPA 1994). Many of the nearly three million people who visit the park each year come to enjoy the lakes, rivers, and streams, which support a wide variety of recreational activities and a world-class trout fishery.



Irrigation and Ditches

Wyoming State Engineer's Office, 2013

Produced by Denver Service Center Planning Division, November 2013

Grand Teton National Park, Wyoming
National Park Service/U.S. Department of the Interior

Water Quality Condition

The overall water quality of the Moose-Wilson corridor is good, although there is little consistent monitoring of water quality parameters in the corridor. The need for consistent monitoring in the area exists, due to high visitation and vehicle use. Much of the aquifer exhibits high permeability and interconnection with the streams and lakes, making it vulnerable to contamination from facilities, visitor uses, and transportation corridors in the recharge areas (NPS 2010b). However, the type and quantity of contaminants in the park compared to the high volume of the Snake River drainage would lead any contamination to be localized and/or temporary in nature.

Issues and concerns for water quality in the Moose-Wilson corridor include:

- The potential for elevated nutrient concentrations in park streams, rivers, and lakes due to seepage from wastewater treatment plants and other sanitary facilities and runoff from grazing land.
- The potential for bacterial contamination of park streams, rivers, and lakes due to leakage from campground sanitary facilities, inappropriate backcountry camping techniques, and presence of livestock, elk, and other wildlife in and near park water bodies.
- The potential for increased sediment inflows to streams and rivers to cause high turbidity and impairment of fish habitat. Potential sediment sources include roads and trails, and grazing land.
- The impact of atmospheric deposition on the water quality status of high elevation lakes in the Teton Range and elsewhere in the park. These pristine water bodies are highly sensitive to acidification, and development in the region around the park (i.e., power generation, industry, agriculture, and transportation), as well as vehicle use within the park may cause increased deposition of acidifying compounds of nitrogen and sulfur.
- The impact of additional chemical contaminants on water quality from other sources such as oil and road salt runoff (NPS 2010b), and mineral, oil, and gas activities upstream of the corridor and park on other federal and private lands.

While these issues have been identified as a concern for park managers, there are presently no impaired water bodies in the park that are listed on the Wyoming 303(d) list (WDEQ 2012). All waters either meet state-designated beneficial uses or haven't been assessed.

Nutrients. Nutrient concentrations in park lakes and streams are a water quality issue of concern primarily because of the potential for eutrophication and the consequent development of algal blooms. Algal blooms are aesthetically undesirable and can deplete dissolved oxygen levels to the point where the water can no longer support aquatic life. Ingestion of nutrient contaminated drinking water and contact with or ingestion of algal blooms can have adverse health effects on humans.

Nutrients (nitrogen and phosphorus) in park streams, rivers, and lakes could come from a range of point and nonpoint sources. Although several of the point and nonpoint nutrient sources in the park exist outside the project area, the surface water and groundwater from these other park areas to the north drains southward through the project area. Thus, these external pollutant sources should be included when considering water quality in the project area. The Moose wastewater plant discharges treated effluent to the groundwater using a subsurface disposal field. Effluent from the Moose drain field would move southeast and south toward the Snake River, and eventually through the project area. The state permit for the disposal field authorizes a specified discharge volume with quality limits for biological oxygen demand, nitrate, and ammonia. Discharges from the Moose treatment plant are well below the specified volume (Nelson Engineering 2011). However, the treated effluent entering the disposal bed sometimes exceeds the permit limits for nitrate and ammonia (NPS 2009). There are multiple sewage disposal ponds (Colter Bay Village, Signal Mountain, and Flagg Ranch) and a sewage drain field (at Moose) further upstream from the project area. The effluent from these sites could be additional point sources for nutrients.

Grazing is a potential nonpoint source for nutrients, as well as bacteria and sediment. Livestock grazing has been permitted on land within Grand Teton National Park since the park was first established. Although the intention was for grazing to be phased out as the original permittees died, grazing continues on 24,445 acres, approximately 8% of park land. Nutrient loading from grazing on private lands beyond the park boundary also migrates into the Snake River, which passes through the project area. In addition, approximately half of the 7,500 head of elk that overwinter in the National Elk Refuge spend each summer in the park. Additional nutrient loading from the elk population contributes substantially to nutrient loading, bacteria, and sediment.

The trophic status of 17 park lakes was evaluated in 1995, and water quality, as defined by trophic status, was found to be generally good (Dustin and Woodruff Miller 2001). Phelps Lake is the only noted lake within the project area. The trophic status of Phelps Lake is mildly to strongly oligotrophic, depending on the input flows from Death Canyon (Dustin 1998; Savage 2009). The lake waters are clear, with high water quality; however, because of the level of use on the trails and Phelps Lake, the park is monitoring discharge and conducting *E. coli* sampling (see below).

The diatom *Didymosphenia geminate* (commonly known as didymo or rock snot) is present in Lake Creek and distributed to approximately 0.6 mile (1.0 km) downstream of Phelps Lake outlet (Spaulding et al. 2009.) Didymo threatens aquatic habitat, biodiversity, and recreational opportunities by producing large amounts of stalk material to form thick brown mats on stream bottoms. The potential spread of *Didymosphenia geminate* to other areas and tributaries from the infestation in Lake Creek is a concern for park staff (Spaulding et al. 2009).

Bacteria. Bacterial contamination of park waters is a water quality issue of concern because park streams and lakes are used for bathing and other water-based recreation. Ingestion of bacterially contaminated water can cause gastrointestinal disease in humans. Bacterial contamination of park waters could come from wastewater discharges from campgrounds and watercraft, inappropriate waste disposal at backcountry campsites, and from the presence of livestock and elk in and near streams.

Isolated *E. coli* sampling has been done in the project area for the last several years, for areas including the Phelps Lake inlet / Lake Creek, Granite Creek, and Open Canyon Creek. There have been no gross exceedances found (other than an isolated, probably anomalous instance in Open Canyon in 2013), but there is an expectation that increased use in the project area will necessitate further monitoring.

Sediment. Deposition of fine sediment in gravel-bedded streams can reduce the availability of spawning gravels for salmonids, leading to reduced reproduction rates and a long-term decline in salmonid populations. Potential sources of increased sediment in park streams and lakes include park roads and trails and livestock and elk grazing.

During certain portions of the runoff period, tributaries to the Snake River below the Jackson Lake Dam transport large concentrations of suspended material due to the erosion of unstable streambanks and overland flow during melt. Tributaries throughout the watershed are natural high sediment systems. For example, in the wild segment of the Snake River, natural debris flows from the volcanic geology yield considerable amounts of sediment and bed load during spring runoff. This is a natural process and is not considered a threat to the water quality of that area. Conversely, the most common nonpoint source problem in the upper Snake River basin is sediment loading caused by irrigated agriculture, rangeland grazing, land development, levee construction, road building for oil and gas development, and off-road vehicle use (NPS 1998).

Within the project area, recreation activities such as camping, hiking, floating, and horseback riding in heavily used areas may contribute to increased sedimentation. Social trailing within the Moose-Wilson corridor, particularly at Phelps Lake, can lead to increased sedimentation from lakeshore erosion.

Although park managers have identified sediment as an issue of concern for water quality, there is little evidence to suggest that current land use activities in the park have increased erosion rates to the point where sediment is a serious water quality concern. Any increases in use in the corridor may increase the effects of erosion and sedimentation on water quality of the montane streams and downstream hydrology.

Atmospheric Deposition. Sulfur and nitrogen oxides and ammonia contained in atmospheric deposition have the potential to cause acidification in park waters. Atmospheric deposition impacts are of particular concern in the high-elevation lakes of the Teton Range as well as the glacial lakes along the lower Teton slopes. The park is monitoring pH and other water quality measures for Phelps Lake, since the lake drains high-elevation snowpack that receives and stores atmospheric depositional materials, and in addition, the time in residence for the lake's water is approximately eight years (Dustin 1998). Sources of atmospheric deposition occur from outside the park boundary (i.e., power generation, industry, agriculture, and transportation), as well as vehicle use within the park.

Mountainous watersheds such as these within and nearby the Teton Range tend to have a low buffering capacity because of sparse vegetation, the short growing season, poor soil development, and the presence of extensive areas of exposed bedrock. As a result, nitrogen saturation is reached relatively easily, and nitrogen compounds contained in atmospheric deposition are more likely to be released into water bodies. In addition, atmospheric pollutants that accumulate in the winter snowpack in mountainous watersheds are released rapidly during the spring snowmelt, resulting in a large nutrient flux that quickly overwhelms the soil's limited storage capacity.

Atmospheric deposition impacts are an increasing issue of concern in the park due to: (1) increasing residential and business development in Jackson Hole, south of the park; (2) increasing use of prescribed burning in and around Jackson Hole; (3) proposed oil and gas development and associated activities south, east, and west of the park; (4) agricultural practices in Idaho west of the park; and (5) metropolitan and industrial development along the western slope of the Wasatch Mountains in the Salt Lake City, Utah, area.

A multiyear (1998–2002) summary of water quality for the Snake River at Moose, Wyoming, indicated that dissolved nutrient concentrations due to atmospheric deposition were low and less than the water quality criteria for surface waters of Wyoming and lower than median concentrations for undeveloped streams across the United States (Clark et al. 2004). Maximum concentrations reported in that study for dissolved ammonia was 0.05 mg/L, dissolved nitrate was 0.12 mg/L, ortho-phosphorus was 0.02 mg/L, and total phosphorus was 0.522 mg/L. Regardless, Clark et al. (2004) noted that sources of primary nutrients in the Snake River at Moose were likely to be natural in origin. During this period, a smaller number of samples were analyzed for a suite of 47 common pesticide compounds or breakdown products. Concentrations for all compounds were reportedly below reporting limits. A small number of samples (five) had detectable levels of dieldrin, but as noted, values for this insecticide were below reporting limits (Clark et al. 2004). At elevated levels, dieldrin is an acutely toxic carcinogen and endocrine-disrupting compound.

In addition, the Greater Yellowstone Inventory and Monitoring Network and park staff have been sampling waters in the Snake River at Moose for nearly a decade. Since 2006, concentrations of primary nutrients (nitrogen and phosphorus) have been low or below detection. In fact, there have been only six samples since 2006, where phosphorus (ortho-P) levels have been detected (range 0.01 – 0.03 mg/L as ortho-P). During this time period, nitrate and nitrate + nitrite levels (NO3-N and NO2 + NO3-N) and ammonia (NH3-N) have always been below detection levels (<0.01 mg/L and <0.02 mg/L, respectively).

Taken together, this work indicates that water quality in the Snake River at Moose is good and characteristic of high-quality, undeveloped waters in the United States (Clark et al. 2000).

A recent summary of mercury in fish collected from 21 national parks in the western United States (Eagles-Smith et al. 2014) indicated that mercury concentrations in fish sampled from Grand Teton National Park (fish were collected from Death Canyon Creek, Grizzly Bear Lake, and Lake Solitude) were "among the lowest measured in the study" (Eagles-Smith et al. 2014). Total range of mercury from 45 cutthroat trout in Grand Teton National Park was 16.2–99.0 ng/g wet weight. Mercury is a neurotoxin. Mercury levels in fish from the park did not exceed fish or bird toxicity thresholds, while 18% of fish exceeded only the most conservative human health threshold (50 parts per billion). Additionally, a separate study tested the same fish for reproductive abnormalities, and none were detected (Schreck and Kent 2013).

Other Chemical Contaminants. Magnesium chloride ($MgCl_2$)-based dust suppression products are commonly used at the park on unpaved roads and applied two to three times a summer for dust suppression and road stabilization. The concentration of chlorides has sharply increased in many bodies of water in the western United States since the widespread adoption of road salt as a deicer in the 1970s. The ecological implications of this change have yet to be fully determined. Because road salts often have heavy metal additives, high chloride concentrations may indicate the presence of other harmful substances in lakes and streams. Scientists who study watersheds use elevated chloride levels as one indicator of pollution in a body of water.

Relatively high numbers of vehicles use Moose-Wilson Road, which is directly adjacent to (and crosses multiple times) streams and wetlands in the area. This use affects water quality through leaking gas, motor oil, and other fluid contaminants.

VEGETATION

Background

The vegetation in the Moose-Wilson corridor project area is highly diverse for the small geographic area represented, compared to the rest of Grand Teton National Park. This diversity is largely due to the topographic variability of the area. As noted previously, the Snake River is nearer the mountains in the project area than in most of the rest of the park. The vegetation changes as the topography changes from the undulating floodplains of the Snake River on the valley floor to the higher elevation foothills and mountains. Most of the landscape in the project area is dominated by coniferous forest communities, although the vegetation nearest the road also contains substantial areas of sage-shrubland, aspen, and a variety of other plant associations (e.g., aspen forest, mixed grassland, flooded wet meadow herbaceous vegetation). A detailed description of about 40% of the vegetation in the project area was completed by McCloskey (2006). Map 14 below shows the vegetation communities in the project area based on vegetation mapping completed in 2002–05 (Cogan et al. 2005).

The largest forest community in the project corridor, covering about 26% of the area, is lodgepole pine (*Pinus contorta*) forest[1]. These forests are commonly found between 6,500 to 7,500 feet on all exposures. The lodgepole pine forests generally have a dense number of trees and a sparse or absent understory dominated by pinegrass (*Calamagrostis rubescens*), elk sedge (*Carex geyeri*), grouse whortleberry (*Vaccinium scoparium*), and/or highbush huckleberry (*Vaccinium membranaceum*). In the absence of disturbance, many of these lodgepole forests will eventually be replaced by Douglas-fir (*Pseudotsuga menziesii*) or spruce-fir forest communities. Aspen (*Populus tremuloides*) stands are present in scattered locations throughout the project area.

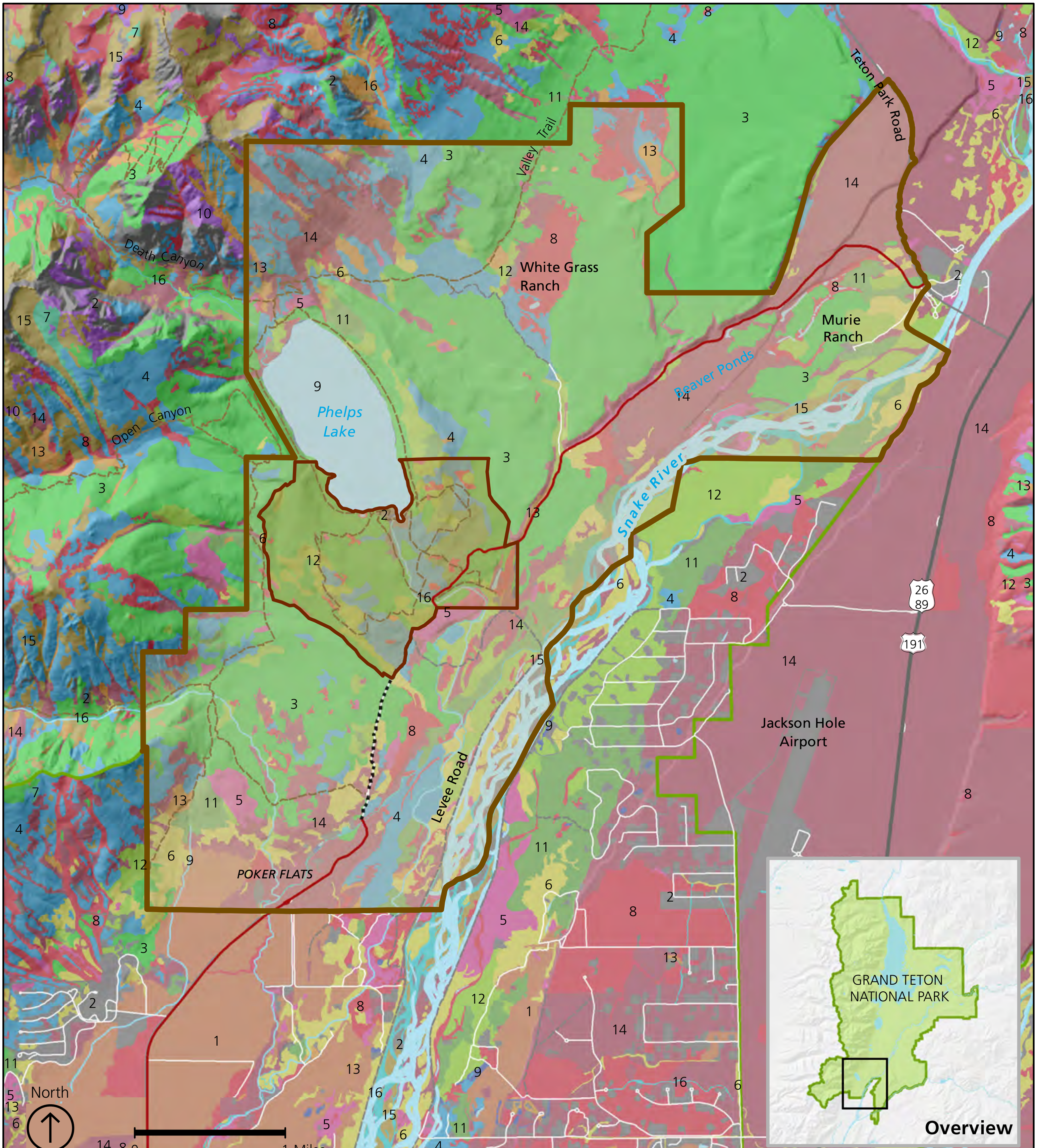
Other forest communities found in the project area, include Douglas-fir forest (about 7% of the project area), mixed evergreen-poplar forest (~6% of the area), mixed conifer forest (~5% of the area) and riparian forest (~9% of the area). Mixed conifer forest and Douglas-fir stands are most prevalent on south-facing slopes and along mesic drainages. Mixed conifer forests may contain Engelmann spruce (*Picea engelmannii*) and subalpine fir (*Abies lasiocarpa*) as well as Douglas-fir and/or lodgepole pine. Along the Snake River and its floodplain there are riparian forests, which can be dominated by blue spruce (*Picea pungens*), cottonwood (most frequently *Populus angustifolia*), aspen, or can be a blue spruce-cottonwood mixed forest. Areas dominated by willows (*Salix* spp.) and cottonwood are also found in the riparian zone.

Sagebrush shrubland is another common vegetation community, covering about 7% of the project area. Shrubland communities occur in several areas, primarily in the northeast and southwest portions of the project area. The shrublands are primarily mixed sagebrush-antelope bitterbrush (*Artemisia* spp. – *Purshia tridentata*) and dry shrubland, dominated by sagebrush. On slightly drier sites, low sagebrush (*A. arbuscula*) dominates, while mountain big sagebrush (*A. tridentate* spp. *vaseyana*) and bitterbrush are on the moderate sites. Moister areas may support shrubby cinquefoil (*Dasiphora floribunda*) and silver sage (*Artemisia cana*), or rabbitbrush (*Ericameria nauseosa*). Drier well-drained hillsides often lack shrubs and instead various bunchgrasses dominate. These include bluebunch wheatgrass (*Pseudoroegneria spicata*) and various needlegrasses (*Stipa* spp.).

Wetlands are present in several locations along the road corridor and are discussed in the "Wetlands" section.

No special or unique vegetation communities are known to occur in the project area. However, there are two plants in the area that are identified as species of concern by the Wyoming Natural Diversity Database (http://www.uwyo.edu/wyndd/species-of-concern/plants/vascular-plants.html). Large flower triteleia (*Triteleia grandiflora*) occurs in the sage flats and the shrubby slopes in the west side of the project area. Broad-leaved twayblade (*Listera convallarioides*) also occurs on forested slopes near Phelps Lake.

[1] Most of the following vegetation descriptions are taken from Cogan et al. 2005.



Legend

- Project Area Boundary
- Laurance S. Rockefeller Preserve
- Streams

Moose-Wilson Road

- Paved
- Unpaved

Vegetation

- 1 - Agricultural
- 2 - Barren
- 3 - Coniferous Forest
- 4 - Coniferous Woodland
- 5 - Deciduous Forest
- 6 - Deciduous Woodland
- 7 - Dwarf Shrubland
- 8 - Herbaceous Vegetation
- 9 - Impoundments
- 10 - Krummholtz
- 11 - Mixed Forest
- 12 - Mixed Woodland
- 13 - Regeneration
- 14 - Shrubland
- 15 - Sparse Vegetation
- 16 - Streams

Produced by Denver Service Center Planning Division, September 2014

Vegetation

U.S. Geological Survey-National Park Service, 2007

Grand Teton National Park, Wyoming

National Park Service/U.S. Department of the Interior

Vegetation Types Along Moose-Wilson Road

Moose-Wilson Road passes through about 24 vegetation cover types. The following roadside percentage vegetation cover figures were calculated based on a GIS analysis of vegetation communities within 2,000 feet of either side of the center line of Moose-Wilson Road. The most common vegetation community along the road is lodgepole pine forest (covering about 25% of the roadside vegetation), followed by sagebrush shrubland (~15%), sagebrush-Antelope bitterbrush mixed shrubland (~10%), mixed conifer forest (~7%), and mixed evergreen-poplar forest (~7%). The area forested with lodgepole pines is generally located along the middle portion of the Moose-Wilson corridor. Sagebrush shrubland and scattered aspen cover types generally occur on the south end, and tall deciduous shrub, mixed in with lodgepole pine, spruce-fir and aspen cover types occur on the north end of the road. From Moose to the Sawmill Ponds, the road is primarily in sagebrush shrubland and mixed shrubland. From Sawmill Ponds Overlook to Death Canyon Road, the road is primarily in willow shrubland and aspen forest, with wetlands common on the east side of the road. From Death Canyon Road to the LSR Preserve, the road is mainly in lodgepole pine forest, along with semi-open cottonwood and aspen forest. The road in the LSR Preserve crosses through lodgepole pine forest and aspen forest, as well as some mixed conifer and mixed evergreen-aspen forest. From the LSR Preserve to the Granite Canyon Trailhead the road also traverses a variety of communities, including lodgepole pine, aspen-cottonwood, spruce-fir, mixed evergreen-aspen forests, and mixed shrubland. From Poker Flats to the Granite Canyon Entrance the road is primarily in sagebrush shrubland.

Vegetation Conditions

In most of the project area the vegetation is relatively natural and in stable condition. The vegetation along the road corridor and in developed areas with infrastructure varies considerably from native to nonnative vegetation, including previously homesteaded agricultural nonnative grasses. Overall, much of the roadside vegetation is still relatively natural. But vegetation along the road corridor has been, and continues to be, modified—areas denuded of native vegetation continue to grow, and there are infestations of noxious weeds along the roadway as well as substantial infestations farther from the roadway.

Vegetation Damage Associated with Vehicles. Vegetation has been lost and damaged and continues to be lost due to vehicles in several parts of the road corridor. Monz, D'Antonio, and Heaslip (2014a) identified a total of 183 individual overflow/visitor-created parking areas in the Moose-Wilson corridor where vegetation has been altered—125 sites were along Moose-Wilson Road and 58 sites were along Death Canyon Road. Vegetation cover loss was classified as being "moderate" and ranged from 53% to 65% in these areas, with an overall average of 59%. Vegetation has been denuded in areas immediately adjacent to the road due to vehicles parking outside designated parking areas and turnouts, usually due to parking areas either being full or from vehicles leaving the roadway to view wildlife. Vegetation has been lost and damaged by vehicles parking on the side of and off Death Canyon Road so visitors can access the trailhead. Likewise, vegetation has been lost and damaged when the parking area by the Granite Canyon Trailhead is full and visitors park their cars on the roadside. In the past decade there was also an issue with vehicles driving and parking off roads and parking areas at White Grass Ranch.

The unpaved section of Moose-Wilson Road has become wider over time, resulting in vegetation loss due to vehicles avoiding wet spots and pot holes in the road, pulling off the road to park, and road maintenance activities that require road blading. Road widening and consequent vegetation loss is also occurring along unpaved Levee Road. In addition, vegetation loss is occurring in this area due to the creation of spoil piles from irrigation ditch cleaning.

Some vegetation loss and disturbance is occurring due to vehicles compacting and crushing plants when they do periodic maintenance work along the utility corridor that passes through the project area. The damage primarily occurs when the vehicles leave the road to access the corridor.

Another possible impact occurring to vegetation along the gravel portion of Moose-Wilson Road is due to the use of magnesium chloride ("Mag Water") to keep dust down. The frequency of Mag Water treatment has increased in recent years, from one to four times per year. This may be altering the vegetation along the roadside, although studies are needed to determine if vegetation damage or mortality is occurring.

Loss of native vegetation is expected to continue in the future due to increasing vehicle use in the road corridor, with more vehicles driving than can be supported by the existing road width and parking areas. The use of Mag Water is also expected to be a continuing threat to native vegetation, resulting in eventual or ongoing damage to vegetation.

Vegetation Damage Associated with Visitor-Created Trails. Visitor-created trails due to pedestrians and horses have resulted in the trampling and loss of native vegetation in several areas in the project area, primarily associated with trailheads, trails, parking areas, and turnouts. Visitor-created trails and concomitant loss of vegetation have been observed at Sawmill Ponds Overlook (especially south of the overlook), around Phelps Lake (particularly around "jump rock"), at the Granite Canyon Trailhead (although some of these trails are being rehabilitated), and at Poker Flats where there has been extensive horse use. Monz, D'Antonio, and Heaslip (2014a) reported 7 visitor-created trails at the Phelps Lake Overlook, 13 at "jump rock," 24 along the Phelps Lake shoreline, and 16 visitor-created trails at Sawmill Ponds Overlook. The authors described the visitor-created vegetation impacts in two dispersed use areas at the Phelps Lake Overlook and two areas at "jump rock" as being considerable, with an average loss of 72% and 89% vegetation cover, respectively. Although it has not been recorded, there also may be visitor-created trail issues and vegetation loss in other areas with development, including Death Canyon, Valley, Open, and Granite Canyon Trails, and trails in the LSR Preserve. In addition to vegetation loss, visitor-created trails are readily invaded by nonnative species, contributing to the spread of noxious weeds and other invasive species in the corridor (see below).

Other Sources of Disturbance. Native vegetation in the project area also has been lost and modified by past activities. A number of ranches operated in the area and native vegetation was cleared for fields. Smooth brome and other nonnative grasses are still present in these areas. Native vegetation also was cleared in the project area due to the construction of irrigation ditches, a utility corridor (powerline and cable), and an air strip north of the LSR Preserve, which is now dominated by nonnative plants.

Nonnative Invasive Species

The spread of nonnative invasive plants, including noxious weeds, is an issue throughout Grand Teton National Park and the Intermountain West. These nonnative plants can out-compete native plants and can quickly establish dense stands that threaten native plants and decrease wildlife habitat value and forage availability. Noxious weeds primarily occur along roadsides and trails and in other disturbed areas, including construction sites and former agricultural lands or homesteads. Roadsides are vulnerable to nonnative invasive species because of continual disturbance resulting from maintenance activities, vehicular traffic and runoff, as well as the roadway corridors acting as a vector for the spread of invasive species. Trails are susceptible to weed infestations because seeds can be easily carried and dispersed on shoes, socks, and clothing. Wildlife movement both within and through the corridor also contributes to seed dispersal of invasive species.

The most invasive and difficult to control nonnative plants in the park are spotted knapweed (*Centaurea stoebe* ssp. *micranthos*), Russian knapweed (*Acroptilon repens*), Dyer's woad (*Isatis tinctoria*), Dalmatian toadflax (*Linaria dalmatica*), yellow toadflax (*Linaria vulgaris*), marsh sowthistle (*Sonchus arvensis* ssp. *uliginosus*), sulfur cinquefoil (*Potentilla recta*), perennial pepperweed (*Lepidium latifolium*), and leafy spurge (*Euphorbia esula*) (NPS 2006). All of these species can colonize disturbed dry sites, often out-compete native vegetation and, in some cases, spread into undisturbed areas. Other invasive species that are actively managed within the park include musk thistle (*Carduus nutans*), bull thistle (*Cirsium vulgare*), Canada thistle (*Cirsium arvense*), oxeye daisy (*Leucanthemum vulgare*), orange hawkweed (*Hieracium aurantiacum*), common tansy (*Tanacetum vulgare*), St. John's wort (*Hypericum perforatum*), houndstongue (*Cynoglossum officinale*), woolly mullein (*Verbascum thapsus*), and cheatgrass (*Bromus tectorum*). All of these invasive species occur in the Moose-Wilson corridor. The largest infestation of St. John's wort in Teton County, Wyoming, is on the LSR Preserve portion of the project area.

Approximately 2,914 of the 10,924 acres in the project area (~27%) are infested with noxious weeds. Noxious weed management has been ongoing in the Moose-Wilson project area for the past decade. However, noxious weeds and invasive nonnative plants are still common and compromise ecological integrity, habitat value, and visual resources in portions of the project area. All of the road segments, on both sides of the road, have noxious weed issues. Existing populations of invasive nonnative plants, and the potential for their spread, are issues in several of the destinations in the project area, including Death Canyon and Valley Trails, the Granite Canyon Trailhead, Poker Flats, and the LSR Preserve. St. John's wort and oxeye daisy are present and of particular concern in White Grass Ranch and Death Canyon Road and Trailhead.

As is true for the park as a whole, nonnative plants are primarily being spread in the road corridor by wind, animals, vehicles, horses, and people. In addition, in a few areas near the road that were previously homesteaded or developed and then abandoned, nonnative grasses and noxious weed species that were planted as ornamentals are invading native vegetation in the project area. There are also noxious weed issues from the continuing use of heavy equipment to maintain levee and irrigation structures along Levee Road, which result in new ground disturbance as well as acting as vectors for seed dispersal.

Restoration of Native Vegetation

In several locations in the project area, disturbed sites have been recently revegetated with native plants. In the White Grass Ranch area, sites have been revegetated following the installation of leach field, sewer- and waterlines, and foundation work that has been completed on cabins. Visitor-created pedestrian and horse trails have been rehabilitated with the trail tread decompacted and seeded with local native seeds in the vicinity of Poker Flats, including areas bounded by the Valley Trail on the west and the Snake River on the east. These areas extend to the south boundary of the park and as far north as Phelps Lake and the LSR Preserve Visitor Center. This reclamation of user-created trails began in 2012 and will continue through 2014–15. Over time, native vegetation is expected to dominate and eventually obliterate these removed trails, provided neither visitors nor wildlife begin to use them again. Homesteaded sites that included agricultural fields and/or pasturelands remain dominated by nonnative agricultural grasses. These nonnative meadows or open fields are targeted for restoration to native plant species to return ecological function and diversity to the currently impoverished sites. Noxious weed management is ongoing throughout these areas.

SOILS

Background

Soils in Grand Teton National Park, including the Moose-Wilson project area, are described in the Soil Survey of Teton County, Wyoming, Grand Teton National Park (Young 1982). Soils in the valley floor that comprise the lower elevations of the park, including most of the project area, generally developed from porous quartzite sand and gravel deposited by glacial melt water. The glaciers underwent several cycles of advance and retreat, directly or indirectly modifying the valley floor topography and soils. Undulating moraines were deposited as the glaciers retreated. The glacial outwash soils generally are deep, well-drained, and have less water retention capability than moraine-derived soils. These soils are generally nutrient-poor. Lands within the Snake River floodplain have more recent alluvial soils, generally from the Tetonville series, which developed when modern streams reworked glacial material.

The Moose-Wilson project area includes a wider variety of soil types than other parts of the park due to the variety of forces that shaped this landscape, creating glacial moraines, outwash plains, and the terraces created by the Snake River. Nine primary or dominant soil map units are present in the project area. These units define the prevailing soil conditions that would be affected by the alternatives. Table 13 summarizes the characteristics of these soil types. The most common soil types, accounting for about 55% of the project area, are the Taglake-Sebud association (including steep slopes), Tetonville-Wilsonville fine sandy loams, and Turnerville silt loam (0% to 30% slopes).

TABLE 13. DOMINANT SOIL TYPES WITHIN MOOSE-WILSON CORRIDOR PROJECT AREA

Soil Type	Characteristics	Development and Revegetation Constraints
Cryaquolls-Cryofibrists complex	Nearly level, sandy loam and loam soils in seep areas, surrounding springs and old stream oxbows and along the Snake River. This map unit is deep, poorly and poorly drained. Boggy or mar soils exhibiting a deep horizon of organic material.	Easily compacted soils. Compaction limits revegetation success. Activities should be limited to periods when soil is dry.
Greyback-Charlos complex	Deep, well-drained, nearly level soils found on stream terraces. Area is approximately 45% Greyback gravelly loam and 45% Charlos loam.	Well-drained complex of soils described as "structurally sound" for construction activities. Frequently has lenses of high loam concentrations that are sensitive to compaction by activities, especially in wet conditions. Trails on these soils should be designed to reduce the hazard of erosion.
Taglake-Sebud association	Deep, well-drained soils are made up of approximately 75% Taglake stony, sandy loam, 15% Sebud stony sandy loam, and 10% Walcott soils. These soils are on alluvial fans, till plains, moraines, hills, and mountains.	Can be cobbly soils. Soil may require screening of larger rock/cobble materials to be successfully revegetated. Highly erosive. Intensive erosion control

TABLE 13. DOMINANT SOIL TYPES WITHIN MOOSE-WILSON CORRIDOR PROJECT AREA

Soil Type	Characteristics	Development and Revegetation Constraints
	They are gently sloping to steep and often are on glacial moraines. Taglake soils are typically dominated by forest vegetation types and Sebud are forest and grassland types. Soil permeability is moderate.	mitigation must accompany disturbance to these soils on slopes. Rooting depths are often >60 inches. Compaction should be avoided. Stones and boulders are a severe limitation for building developments.
Tetonville-Wilsonville fine sandy loams	This is a floodplain soil. Typical vegetation is grasslands and willows. Thin loam layer often underlain by thick gravel layer. Nearly level soils in old, braided stream channels in floodplains along the Snake River. It is made up of approximately 40% Tetonville fine sandy loam, 40% Wilsonville fine sandy loam, and 20% Tetonville gravelly sandy loam. Seasonal high water table is 1 to 3 ft (0.3 m to 0.9 m) during May to July. Soil permeability is moderately rapid.	Cobbles and gravel layer may inhibit revegetation efforts but efforts are successful on sandy loam upper layer. Revegetation success will depend on depth of loam layer. Erosion hazard is slight.
Tineman association	Nearly level to sloping soils on stream terraces and alluvial fans along the Snake River. It is made up of approximately 40% Tineman gravelly loam, 25% Tineman gravelly loam-wet, and 35% Aquic Cryoborolis and other gravelly or cobbly surfaces. Native vegetation ranges from grassland-forb to sagebrush plant community types.	Generally only slight erosion potential. These soils have been used as hayfields and can be productive.
Tineman-Bearmouth gravelly loams	Deep, well-drained, gravelly loam soils formed in alluvium that is 10 ft to 20 ft (3 m to 6 m) deep over extremely cobbly or extremely gravelly sand. These soils are on floodplains, stream terraces, and fans in mountain valleys. These soils generally support big sage plant communities. Soil permeability is moderate.	Erosion potential is moderate to low and permeability is rapid.
Tineman gravelly loam	Deep, well-drained, gravelly loam soil found along the Snake River; soils are on nearly level to steep alluvial fans, stream terraces, mountains, and moraines. Slopes are 0% to 40%. Deep soil supports grasslands, sagebrush, and bitterbrush plant communities. Soil permeability is moderate.	This soil type has been used for agricultural production. Revegetation should be successful in this soil type. Although erosion hazard is slight, trails on these soils should be designed to control the hazard of erosion.
Turnerville silt loam 0%–30% slopes	Deep, well-drained soil along the mountain front. This soil often occurs in forested settings. Typically, these soils support lodgepole pine and mixed conifer and have a 1 to 4 inch organic layer. Soil permeability is moderate.	Revegetation success is likely. Erosion hazard is slight to high, depending on local slope steepness. Typically construction activities do not occur on these soils.

Sources: Young 1982; NPS 2006; NPS 2012

Generally, the Tineman-Bearmouth soils are good for recreation and for roads, and the Taglake-Sebud soils are good for recreation and fair for roads. The Tetonville-Wilsonville soils are fair for recreation and poor for roads, and the Cryaquolls-Cryofibrists soils are poor for recreation and roads. For several of these soil types, including Turnerville gravelly loam, Turnerville silt loam, and Greyback-Charlos complex, recreation facilities such as trails need to be designed to avoid erosion hazards.

Soils along Moose-Wilson Road

Moose-Wilson Road crosses through a variety of soil types. The most common soil types found along the road are the Taglake-Sebud association, Tetonville-Wilsonville fine sandy loams, Tineman gravelly loam, and Turnerville silt loam (0% to 3% slopes). The road from Moose Junction to Sawmill Ponds is primarily underlain by Tetonville-Wilson fine sandy loams, Tineman gravelly loam, and Tineman-Bearmouth gravelly loams. The road passes through Cryaquolls-Cryofibrists complex southwest of the Sawmill Ponds and then is primarily in Tetonville-Wilson fine sandy loams up to Death Canyon. From Death Canyon Road to the Laurance S. Rockefeller Preserve, the road is primarily in Tetonville-Wilson fine sandy loams and Taglake-Sebud association (steep). The road in the LSR Preserve is almost all underlain by the Taglake-Sebud association. South of the LSR Preserve, a portion of the road crosses through the Tineman association, but most of this segment is underlain by the Taglake-Sebud association. From Poker Flats to the Granite Canyon Entrance the road primarily passes through Tineman gravelly loam and Greyback-Charlos complex.

Soil Conditions

Soils are in natural condition and stable in most of the project area—an estimated 90% of the soils in the project area are in good condition. The exceptions to this are in developed areas and on trails where soil compaction and slope cutting have occurred. Cut slopes associated with roads and trails are also sometimes unstable in the project area. Visitor-created sites and trails recently have been mapped along Moose-Wilson and Death Canyon Roads, and in a few specific areas in the Phelps Lake area (Monz, D'Antonio, and Heaslip 2014a). and in the Poker Flats area.

Soils have been and continue to be lost and altered immediately adjacent to Moose-Wilson Road, around parking areas and user-created parking areas, and turnouts. The unpaved segment of Moose-Wilson Road has become wider, resulting in further soil removal and compaction. The unpaved Levee and Death Canyon Roads also are widening due to visitor use and maintenance activities resulting in the loss of soil.

Vehicles parking in undesignated off-road areas is a continuing source of soil loss. Vehicles parking along Moose-Wilson Road to view wildlife have resulted in the creation of new turnouts and subsequent compaction, loss, and alteration of topsoil. Monz, D'Antonio, and Heaslip (2014a) identified a total of 184 overflow/visitor-created parking areas in the Moose-Wilson corridor, with a total combined area of about 2 acres of disturbance. The density of overflow/visitor-created parking was higher along Death Canyon Road than Moose-Wilson Road. Extensive soil erosion and compaction have occurred in the Death Canyon Trailhead area due to vehicles parking on the side of Death Canyon Road or off the road when the parking area is full. Monz, D'Antonio, and Heaslip (2014a) reported slight to moderate O horizon (surficial organic matter) loss and slight to moderate mineral soil exposure along both Moose-Wilson and Death Canyon Roads. The most common soil substrate observed in the overflow and visitor-created parking areas was a mixture of gravel and mineral soil along Moose-Wilson Road and a mixture of organic material and mineral soil along Death Canyon Road. Roadside parking at the Granite Canyon Trailhead, when the parking lot is full, also has resulted in the loss of soil. In the past, vehicles also drove and parked off roads and parking areas in White Grass Ranch, compacting and altering soils. Vehicles driving and parking off established roads in this area is a continuing possibility. All of the above impacts could worsen if vehicle use increases and no additional management action is taken.

Visitor-created trails due to hiking and horseback use are another source of continuing soil impacts. Soils have been compacted and lost due to visitor-created hiking trails along Moose-Wilson Road, as well as at several popular destinations, including Sawmill Ponds Overlook (especially to the south of the overlook), and around Phelps Lake (most noticeably around “jump rock”). The largest area of disturbance due to visitor-created trails and trail spurs was in the Sawmill Ponds Overlook area. However, Monz, D’Antonio, and Heaslip (2014a) found the highest level of impact they studied was at the Phelps Lake Overlook and “jump rock,” with moderate to considerable horizon loss and moderate to considerable mineral soil exposure. In the LSR Preserve there are several old closed trails with compacted and altered soils due to many years of horse and hiker use. These areas have been left to revegetate on their own and remain susceptible to erosion. In the Poker Flats area, both hiker and horseback unofficial trails have been created. Visitor-created trails and soil loss is also probably occurring in other developed areas, such as Death Canyon, Valley, Open, and Granite Canyon Trails, although these soils are believed generally to be stable. The above soil impacts could all increase if visitor use increases and no additional management actions are taken.

Another possible source of soil impacts is the periodic application of magnesium chloride to suppress dust along the 1.2-mile stretch of gravel road. This chemical is being washed off the road when it rains and may be building up in the soil along the road. The application of magnesium chloride could be altering the soil chemistry in this area, although no studies have been conducted to document this potential change.

Several other sources of soil disturbance and loss have occurred in the project area due to human habitation. In the past, at least three of these areas were ranches, with some relatively large hay fields that were irrigated, planted, and mowed. Soils in the fields were altered by these agricultural activities. Likewise, soils were altered and lost due to the construction and use of an old air strip near the Barker homestead in the northern part of the project area. A couple of major irrigation ditches on the east side of the road, south of the LSR Preserve, are periodically dredged and the spoils are placed along the ditches, altering the soils. The use of vehicles to do periodic maintenance work along the utility corridor that passes through the project area, as well as adjacent to irrigation ditches, also compacts and alters soils in this area.

In several areas, NPS staff have reduced or stopped visitor impacts on soils, improving their condition. Some soils have been decompacted, recontoured, and seeded to rehabilitate trails created by horses and hikers in the Poker Flats area. In the White Grass Ranch area, some soils were recently decompacted and revegetated, which should help maintain these soils. Visitor-created trails stemming from the Open and Granite Canyon Trails also have been recently removed, with the soils being decompacted and areas reseeded. In addition, in several areas park staff have placed logs along the roadway to prevent the development of unofficial turnouts.

CULTURAL RESOURCES

HISTORICAL BACKGROUND

For thousands of years, American Indian people have occupied lands now included in Grand Teton National Park and the current project area. Sustained by abundant game, plants and other resources, the lifeways of these early inhabitants is revealed in campsites, tool manufacturing areas, and other sites documented in the archeological record (discussed below). The area continues to hold enduring cultural importance for several associated tribes, reflected in their oral histories, traditions and connections to the landscape (CLI 2014).

John Colter, who accompanied the Lewis and Clark expedition, is credited with being the first European American to enter Jackson Hole in 1807. The Jackson Hole area was an important crossroads during the ensuing fur-trapping era. The early fur trappers who crossed the high passes and descended into the Jackson Hole valley in the 1820s provided some of the first accounts of the area and pioneered the use of American Indian trails as access routes. Many trappers later served as guides for other western emigrants entering the region (Mettler & Associates 2012).

Isolated Jackson Hole was among the last regions to be settled by 19th century emigrants, largely because of the cold climate and lands that were not well-suited to agriculture. Mormon settlers migrated to Jackson Hole from drought-stricken Utah in 1889, and by the following year more than 60 homesteaders occupied the valley. During the 1890s and early 1900s, settlers filed homestead claims from Wilson north along the west side of the Snake River. In 1894, William Menor developed his homestead at a favorable crossing point of the Snake River and developed a ferry that became one of three important crossings of the river. Some homesteaders raised livestock, relying on native grasses to provide winter feed. Homesteading peaked between 1908 and 1919, contributing to the Jackson Hole population of about 1,500 by 1909 (Mettler & Associates 2012).

Although livestock ranching became a major industry in the West and Midwest between 1860 and 1880 (an estimated 1,500,000 cattle were counted in Wyoming alone in 1860), Jackson Hole was not a particularly favorable area for raising or pasturing livestock because of the long, cold winters. Only 100 cattle were counted in the valley in 1893. However, rising livestock prices led to the eventual growth of area ranching operations from the mid-1890s to the 1930s (Mettler & Associates 2012).

Before livestock ranching declined during the Great Depression, dude ranching emerged directly from the working cattle ranches, offering a diversion for primarily eastern vacationers. Dude ranches became extremely popular during the 1920s, offering guests a rustic "old west" experience with recreational horseback riding and other activities. Guest cabins were typically built around a main house with a kitchen and dining room. The JY Ranch, founded in 1908 at the foot of Phelps Lake, is credited with being the first dude ranch in Jackson Hole. A second wave of dude ranching emerged in the 1930s as more livestock ranchers converted their ranches to the tourism industry in response to depressed cattle prices. Dude ranching played an important role in the development of the Jackson Hole economy and paved the way for the area's modern tourist industry (Mettler & Associates 2012).

HISTORIC STRUCTURES, SITES, AND CULTURAL LANDSCAPES

Introduction

Staff of Grand Teton National Park has surveyed and evaluated all known historic resources within the Moose-Wilson corridor project area for historic significance and integrity. As a result, the project area includes one national historic landmark (Murie Ranch Historic District), three additional historic districts (White Grass Dude Ranch Historic District, White Grass Ranger Station Historic District, and Sky Ranch Historic District), three identified cultural landscapes (Moose-Wilson Road and White Grass / Death Canyon Roads, Murie Ranch Historic District, White Grass Dude Ranch Historic District), and the historic Death Canyon Trail (part of the Valley Trail system). All of these historic resources are listed in or determined eligible for listing in the National Register of Historic Places. The condition of these historic resources ranges from fair to good, primarily as a result of differing levels of preservation maintenance and treatment.

Moose-Wilson Road

Moose-Wilson Road evolved from a primitive wagon road first developed in the 1890s that served area settlers. During the initial period of its development, the rugged route along the Snake River to Jackson Hole was seldom used. A crude wagon road over Teton Pass was in existence by 1888, linking the Jackson Hole Valley to a connection with the Union Pacific Railroad at St. Anthony, Idaho. An 1892 General Land Office map (Township 42 North, Range 116 West) displays a road on the west side of the Snake River that partly aligns with the present Moose-Wilson Road. An extensive network of wagon roads is also shown on the 1892 General Land Office map in the vicinity of Jackson and where the National Elk Refuge is now (Township 41 North, Range 116 West). The area's early road system is further documented on an 1893 General Land Office township map and the 1899 US Geological Survey (USGS) Grand Teton Quadrangle map. These roads enabled settlers to travel from one end of the valley to the other. The risky crossing of the Snake River required the use of established fords and ferry crossings. Many of the principal crossings are depicted on the early maps (Daugherty 1999; Harding 2006).

The proliferation of roads during the 1890s reflected the growth in regional settlement, as ranchers and homesteaders often built roads to connect their properties to primary routes. In the late 1890s, homesteaders moved north along the west side of the Snake River from Wilson. Among these early homesteaders was Robert Pemble, who claimed a 160-acre homestead along the Snake River about 0.25 mile east of Moose-Wilson Road and near the southern boundary of the corridor. Pemble took up residence on his claim in 1900, and in addition to his cultivated acreage he constructed a log house, corrals, stables, sheds, and fencing. West of Pemble's homestead, John F. Miller settled on 160 acres straddling Moose-Wilson Road at the south boundary of the park. Before 1900, settlers typically freighted supplies into the valley. The high cost of freighting began to decline as businesses developed in Jackson, Wilson, and Kelly, and area settlers increasingly relied on local suppliers (Daugherty 1999; Harding 2006).

Teton Pass Road received the first county-sponsored road improvements in 1901. By that date, the town of Wilson was established west of the Snake River on the route approaching Teton Pass from the east. Menor's Ferry (which later became the town of Moose at the northern junction of Moose-Wilson Road) dates from the mid-1890s. William D. Menor, recognizing the business potential of a ferry operation across the Snake River, filed for a homestead at the crossing point in 1894. His ferry gained renown as one of the most important river crossings in Jackson Hole. Menor operated the ferry during periods of high water, and constructed a bridge to substitute during low water periods. Subsequent owners operated the ferry until 1927 when it was replaced by a steel truss bridge as part of road improvements. Menor also operated a general store, blacksmith shop, and smokehouse on his property. A national register nomination has been prepared for the Menor's Ferry / Maud Noble Cabins Historic District that includes the collection of historic buildings and a replica of the ferry. The site is outside the study area for the current management plan / EIS (Daugherty 1999; Harding 2006; Park Website n.d.).

Automobiles were introduced to the area in the early 1900s, and a party of tourists is credited with driving the first automobile into the valley in 1908 by way of the rough Togwotee Pass Road from Fort Washakie, Wyoming. Reflecting the growing pressure of automobile owners for improvements to the nation's roads, three primary highways served Jackson Hole by 1925: the Teton Pass Road, the Hoback Road, and the Togwotee Pass Road. In 1932, the Bureau of Public Roads initiated major upgrades of the Teton Pass Road, including widening it to 18 feet, resurfacing, and reducing the grades of some sections over the same alignment. In most cases, area roads continued to follow the old wagon routes. The road from Wilson to Menor's Ferry on the west side of the Snake River generally followed the old alignments when it was improved in 1927. The most important development in the 1920s was the construction of a state highway from Jackson to Menor's Ferry on the east side of the Snake River. This road continued north from Menor's Ferry along the base of the Teton Range past Jenny Lake to Moran, where it connected with the Yellowstone-Lander highway. In addition to the steel truss bridge constructed at Menor's Ferry, the Bureau of Public Roads built a steel truss bridge across the Gros Ventre River near the present highway. The basic highway and county road system that was developed by the late 1920s remained intact until the 1950s (Daugherty 1999; Harding 2006).

Evaluation of Significance. Moose-Wilson Road was surveyed and evaluated as a historic property in 2006, including an assessment of its contributing features and eligibility for listing in the National Register of Historic Places. Investigators recorded the road using standard archeological field procedures. Because the scope of the project was to re-record the road, the survey area only extended to the road shoulders to include an inventory of culverts, bridges, and other road-related features. Other than Moose-Wilson Road, no other sites or isolated finds were located during the course of project investigations (Harding 2006).

The survey contractor recommended that the road was eligible for the national register for its association with the community and economic development of the Jackson Hole area (criterion A); for its embodiment of the distinctive characteristics of a type of vernacular road construction (criterion C); and for it information potential (criterion D). Although various sections of the road have been realigned during its history, its general alignment along the west side of the Snake River was not considered to have substantially affected its integrity of location. The road was described as basically in good condition except for paving. The period of significance for the road was then identified as extending from 1892 to the present. The road contributed to the economic development of the area by providing settlers with a means to transport goods and supplies, and allowed access from Wilson to communities to the north, such as Elk and Kelly, and to Menor's Ferry when the Snake River was otherwise impassable (Harding 2006). The Wyoming State Historic Preservation Office concurred with the determination of national register eligibility for Moose-Wilson Road in a letter to the park superintendent dated August 31, 2006.

Among the features recorded during the 2006 road investigations were seven galvanized metal culverts and one concrete box culvert. These culverts were not recommended as contributing to the significance of the road. Two contributing features were recorded. One of these, a timber stringer bridge, was altered by replacing the original timber stringers with steel I-beams. The appearance of the bridge, however, is consistent with other timber stringer bridges that were common highway features of the early and mid-20th century. The other contributing feature consists of two culverts placed side by side with mortared rock facing. The mortared rock culvert is consistent with the rural setting of the road and is a distinctive characteristic of this crossing (Harding 2006).

The national register eligibility of the road was reevaluated as part of a cultural landscape inventory of the road corridor completed in 2014. The cultural landscape inventory more narrowly focused on the Moose-Wilson corridor as developed and managed by the National Park Service. It also recommended that the road was eligible for listing in the national register at the local level of significance but only under criterion A for its association with the broad patterns of recreation/entertainment (tourism), politics and government, conservation and transportation, and its significant contribution to the park's associated historic contexts. The period of significance was changed to date between 1936 and 1960 to reflect the earliest National Park Service construction of the modern road alignment and the date at which the northernmost portion of the road was realigned to access the new NPS headquarters in Moose (CLI 2014).

Cultural Landscape Inventory. The 2014 cultural landscape inventory of the Moose-Wilson corridor provides a detailed history of the development of the road and assesses the corridor's cultural landscape under the criteria of eligibility for listing in the National Register of Historic Places. The White Grass / Death Canyon Roads were also evaluated as part of the investigations.

As identified in the cultural landscape inventory, the Moose-Wilson corridor consists of the historic road alignments constructed by the National Park Service primarily between 1936 and 1945 that form the basis of the modern Moose-Wilson Road within T42N, R116W; nine culverts that date to 1952; the Death Canyon Trail dating to 1933; the 1.8-mile White Grass / Death Canyon Roads (dating between 1913 and 1958) and the Granite Ditch Bridge dating to the 1930s. The Lake Creek Bridge (built in 2005) is a modern structure constructed outside the period of significance (CLI 2014).

The period of significance recommended for the Moose-Wilson corridor cultural landscape (1936 to 1960) reflects a modification of the broader period of significance identified previously in the 2006 assessment for the road. The beginning date of 1936 was selected to mark the beginning of the earliest NPS construction of the modern road alignment. Prior to this date, the road was farther to the east, with a few secondary roads providing access to homesteads and ranches along the Snake River. In 1945, the National Park Service realigned the portion of the road south of the White Grass / Death Canyon Roads and the alignment for this section has remained intact to the present. By 1958, Moose-Wilson Road had become the main road along the west side of the Snake River. The northern section of the road was modified sometime between 1958 and 1960 to provide access to the new NPS headquarters at Moose. The current alignment of the White Grass / Death Canyon Roads was completed in 1958, and the date marks the end of modern road development within the White Grass / Death Canyon Roads corridor and the end of the corridor's period of significance (CLI 2014).

Moose-Wilson Road Cultural Landscape Area. The National Park Service carried out new road construction as well as improvements to existing alignments of Moose-Wilson Road to provide access to hiking trails, scenic areas, and park service administrative areas. Each period of development coincided with NPS expansion. The National Park Service constructed the first segment of the road between the intersection with White Grass / Death Canyon Road and Moose in 1936. This area had come under NPS administration as part of Grand

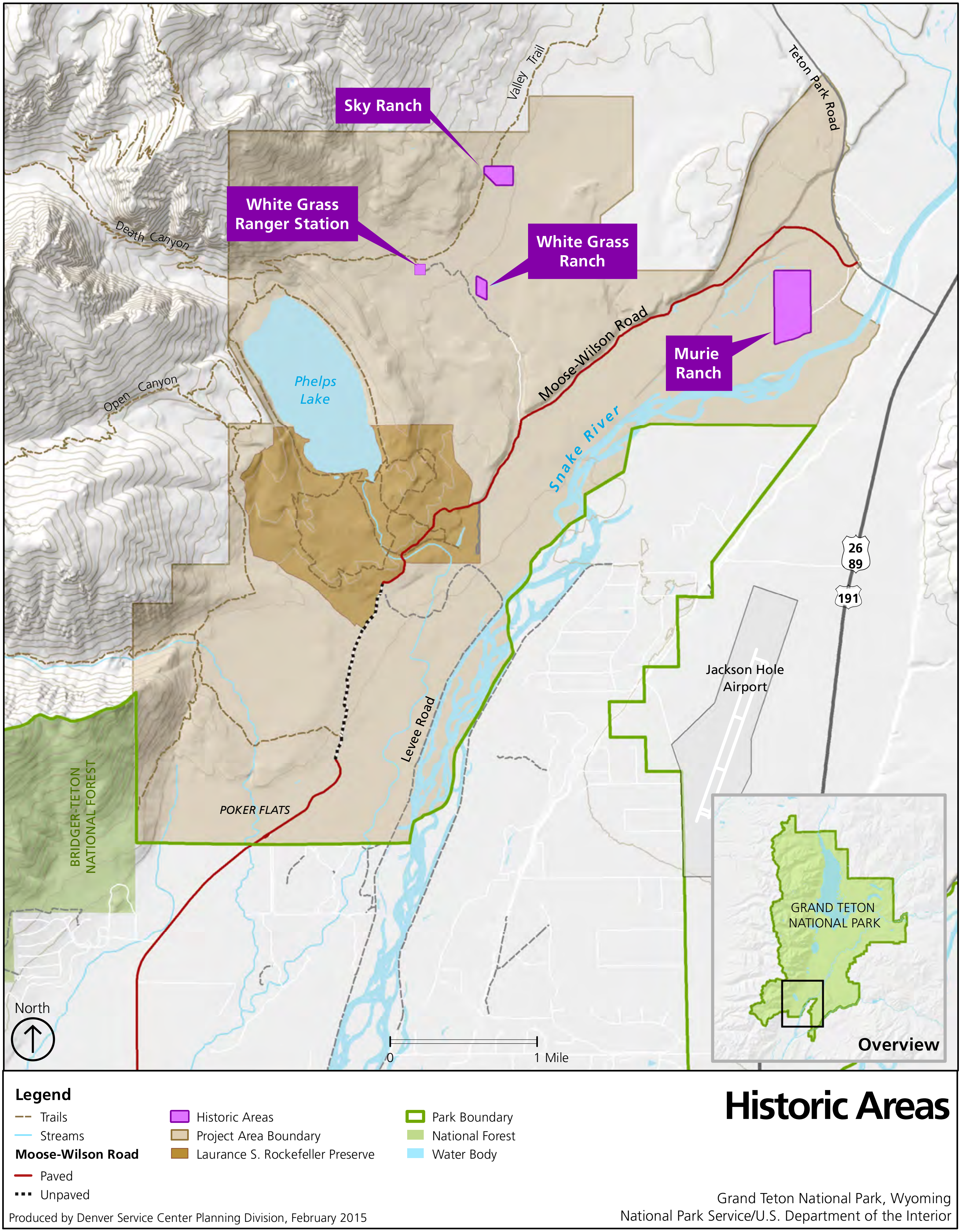
Teton National Park in 1929. The 1936 road alignment provided access to the 1930 NPS White Grass Snow Shoe Cabin (White Grass Ranger Station) via White Grass / Death Canyon Roads. The establishment of Jackson Hole National Monument in 1943 resulted in the NPS acquisition of additional lands to the south of the 1929 Grand Teton National Park boundary. In 1945, the National Park Service constructed the southern portion of Moose-Wilson Road in this newly acquired area. This new road alignment replaced an earlier alignment farther to the east. In 1950, Grand Teton National Park and Jackson Hole National Monument were combined creating a new Grand Teton National Park. The National Park Service relocated its headquarters from Beaver Creek to Moose in 1958 and realigned the northernmost portion of Moose-Wilson Road to provide more direct access to the new headquarters by 1960. The modern Moose-Wilson Road continues to follow the alignment established between 1936 and 1960.

Although ongoing maintenance and repairs to the road are necessary for visitor safety and access, these activities have not affected the road's location. The existing spatial relationship of the road and its circulation pattern relative to the natural systems and topographic features of the surrounding terrain remain in the same location as during the period of significance. Features constructed after the period of significance include the Lake Creek Bridge and the placement of natural boulders and log fencing to discourage the unplanned development of visitor turnouts. These elements were designed to blend in with the natural setting and do not detract from the overall integrity of the cultural landscape. The Moose-Wilson Road cultural landscape area retains integrity of location, design, setting, workmanship, feeling, and association (CLI 2014).

White Grass / Death Canyon Roads Cultural Landscape Area. The White Grass / Death Canyon Roads were originally established to provide access to a homestead claim filed in the 1910s. The homestead formed the nucleus of the White Grass Dude Ranch, which developed in 1919. In 1930, the National Park Service constructed the White Grass Snow Shoe Cabin, which became the White Grass Ranger Station. The road to the dude ranch was subsequently extended to provide access to the Snow Shoe Cabin. In the mid-20th century the National Park Service developed a trailhead for Death Canyon to the north of the ranger station. By 1958, the National Park Service constructed a new road alignment to the west that provided direct access to the Death Canyon Trailhead. The length of the road remained unpaved as late as 1977, although the southern portion was subsequently paved. The White Grass / Death Canyon Roads cultural landscape area retains integrity of location, design, setting, feeling, workmanship, and association (CLI 2014).

Murie Ranch Historic District

The 74-acre Murie Ranch Historic District is in a wooded area on the west side of the Snake River, south of Moose. The historic district is designated a national historic landmark, significant for its association with Olaus Murie and his wife Margaret (Mardy) Murie, his brother Adolph Murie and his wife Louise Murie, who made national contributions in the fields of biological science, natural resource management, conservation, and wilderness preservation. The Murie brothers achieved national prominence as influential federal government scientists during the1920s and 1930s. Their rigorous biological research fostered an ecological perspective that emphasized the intricate biological connections within ecosystems. Olaus Murie first visited the valley in 1927 when he conducted a study on the local elk herd. The two Murie families moved to the former STS Dude Ranch near Moose in 1945, and used the ranch as a base for their science and conservation activities. Those activities



Historic Areas

Grand Teton National Park, Wyoming

National Park Service/U.S. Department of the Interior

Produced by Denver Service Center Planning Division, February 2015 shaped the field of natural science and its use by public agencies charged with natural resource management. Upon appointment as director of the Wilderness Society, Olaus established the Wilderness Society headquarters at Murie Ranch, where he promoted conservation, wilderness, and the importance of protecting nature in modern society. Early conservation leaders met at the Murie Ranch in support of wilderness preservation. The Wilderness Act of 1964 was conceived and written by conservationists Howard Zahniser, Olaus Murie, Bob Marshall, and others who gathered at the ranch. Mardy Murie emerged as a significant conservation leader in her own right after Olaus's death in 1963. Although the Muries began living at the ranch in 1945, the property reflects the cumulative lifetime contributions of Olaus, Adolph, and Mardy Murie from the 1920s on. It is the best remaining site associated with their lives and careers (NHL nomination 2003).

The Murie Ranch consists of predominantly log-constructed residential buildings, which served as the homes of the Murie families, guest cabins dating from the ranch's earlier days as a dude ranch, utility structures for power, maintenance, and livestock, and other outbuildings. There are 25 contributing buildings and 1 contributing structure. The district retains a high degree of integrity from its 1945 to 1980 period of significance. A 2007 cultural landscape inventory of the property determined the cultural landscape to be eligible for the National Register of Historic Places and identified eight contributing landscape features (NHL nomination 2003; Snake River Headwaters CRM Plan 2013).

The Murie Ranch is presently managed through a general agreement with The Murie Center, a nonprofit organization. In partnership with Grand Teton National Park, The Murie Center promotes public understanding and commitment to wilderness and conservation values. Beginning in the late 1990s, extensive efforts were carried out by The Murie Center and the National Park Service to rehabilitate the historic buildings of the Murie Ranch Historic District and to modernize the site's infrastructure. Several of the buildings were rehabilitated for use as research facilities for The Murie Center. The Wyoming SHPO was involved in project planning and execution. Foundations and roofs were replaced, and the replacement of deteriorated logs and windows was conducted with careful attention to the preservation of original materials. Utilities were concealed within buildings and placed underground, where feasible. Rehabilitation activities were completed with sensitivity to retaining the original appearance of the site and did not compromise resource integrity. More preservation work is anticipated in the near future to stabilize the main residence and provide fire detection and suppression for this valuable historic resource (NHL nomination 2003).

White Grass Dude Ranch Historic District

The White Grass Dude Ranch Historic District was listed in the National Register of Historic Places in 1990. The ranch is along Death Canyon Road, a secondary access road connecting with the northern portion of Moose-Wilson Road. Along with the Bar BC and JY Ranches, the White Grass Dude Ranch helped define and set the standards for the local Jackson Hole dude ranch industry. The ranch exemplifies the local development and conversion of dude ranches from former cattle ranches. Built during World War I as a cattle ranch, it was converted to a dude ranch in 1919 by owners Harold Hammond and George Bispham. Control of the property later passed to Hammond's son-in-law Frank Galey who continued the operation until his death in 1985, making it the longest-lived active dude ranch in Jackson Hole (NPS 1988a; NPS 2008; Park Website n.d.).

The main cabin, thought to have been Harold Hammond's original 1913 homestead dwelling, evolved into the ranch's social center, kitchen, and dining facility. Cabins served specific purposes, such as the girls and bachelors cabins that housed female and male employees. The Hammond Cabin served as the owner's residence for the Hammond and Galey families. Many guest families returned to the same cabins year after year, which served to reinforce a sense of community. The ranch's remote location sparked ingenuity among dude wranglers who developed innovative ways to provide modern comforts. Wranglers diverted water from Stewart Draw for irrigation and entertainment. Cooling ditches ran past the guest cabins so guests could chill beverages in the mountain water (Park Website n.d.).

The historic district's contributing buildings consist of 10 guest cabins, a lodge, a dining hall, and a service/laundry building on the western edge of White Grass Valley. Extensive alterations to the former barn compromised its historical integrity, and it was dismantled and removed from the site in 1991. Other buildings (e.g., ice house, cook's cabin, garages) were also removed. The surviving buildings exhibit an architectural style referred to as "dude ranch vernacular," characterized by log construction with board and batten siding used for some additions. The rustic one-story buildings reflect the character and feeling of pioneer log structures with rough-hewn timbers and brown-stained dressed log exteriors. Although the cabins initially appear to be haphazardly scattered, they were arranged with the main lodge and dining hall as the centers of activity within easy access of a central path. The cabins are all north of the dining hall on either side of the pathway. Despite the loss of several former buildings, the district appears today much as it did during the 1919 to 1970 period of significance. The cabins and other contributing resources have not been substantially altered and retain good integrity (NPS 1988a; NPS 2008).

In 2005, the National Park Service began stabilizing, rehabilitating, and restoring the White Grass Dude Ranch in partnership with the National Trust for Historic Preservation. A cultural landscape assessment of the property was included in the 2004 environmental assessment completed for the rehabilitation and adaptive use project. A combined cultural landscape and historic structure report was subsequently prepared that provided a detailed history of the ranch, assessments of contributing and noncontributing landscape features, and treatment recommendations to guide the preservation efforts (NPS 2008). The report noted that the national register boundary of the property should be expanded to include agricultural lands and natural areas that were originally part of the Hammond and Bispham homestead claims. The primary cultural use areas that retain integrity consist of the building cluster, access corridors, outlying agricultural fields (hayfield and pasture), and associated remnant irrigation ditches and natural areas. The Western Center for Historic Preservation now occupies the ranch, using the site as a facility for training craftsmen in the art of preserving historic western structures. The White Grass Ranch preservation undertakings comprise the Western Center for Historic Preservation's first project and are slated for completion in 2016 (Park Website n.d.; NPS 2004, 2008).

White Grass Ranger Station Historic District

The White Grass Ranger Station Historic District is at the Death Canyon Trailhead, along the western edge of White Grass Valley southwest of Moose. The district, listed in the National Register of Historic Places in 1989, includes two surviving buildings constructed during the early years of Grand Teton National Park—a log cabin that functions as a ranger's office and quarters and a fire cache shed. The ranger station and fire cache retain integrity and are used intermittently by park staff. A former tack room shed and a corral have deteriorated and are beyond repair. District buildings were constructed in the NPS rustic style commonly used during the 1930s. Designs for the gabled one-story ranger station and other buildings were likely taken from standard plans used by the National Park Service during the late 1920s and early 1930s (NPS 1988b).

The White Grass Ranger Station Historic District was determined eligible for the national register primarily because of its association with the NPS rustic architectural style that sought to incorporate the use of natural building materials and design elements to harmonize with the surroundings. It is also the only example of a horse patrol-era ranger station extant in the park and one of the first stations to be built after the park's establishment. Remodeling and modernization compromised the interiors of the buildings (Mehls 1988b).

Sky Ranch Historic District

The Sky Ranch Historic District is a 13.44-acre former inholding at the base of Buck Mountain that was purchased by the National Park Service in 1980, although the owners retained the right to use and occupy the property until 2005. Sky Ranch was determined eligible for the National Register of Historic Places in 2005. The district is in fair condition and is significant for its associations with local history and architecture (e.g., vacation homes) and includes five contributing buildings and 16 contributing cultural landscape features associated with the themes of settlement, recreation/ entertainment, social history, and conservation. When the property was purchased by William Balderston II in 1952, it was used primarily as a vacation property providing a retreat from urban life, with opportunities to educate visiting family members and friends about an appreciation and respect for nature. The district's period of significance extends from 1952 to 2005, when the Balderston's 25-year use and occupancy term expired and the National Park Service took possession (Humstone 2005; NPS 2011).

Between 2005 and 2012 the Sky Ranch was used for NPS seasonal housing, but in 2013 it was vacated due to concerns about the lack of a safe domestic water supply, the extensive maintenance needs of the access road, a short potential occupancy period due to poor access and utility systems vulnerable to freezing, and its location in a diverse wildlife habitat area. The buildings are in good condition, although the original utility systems (installed in 1952) are inadequate and need to be upgraded.

Death Canyon and Valley Trails

The Death Canyon Trail (part of the Valley Trail System) is considered eligible for the National Register of Historic Places under criterion C for its association with the Civilian Conservation Corps (CCC). These trails are actively maintained by the park's trail crew and are in good condition. The trails are not subject to any immediate threats except the continued need for upkeep resulting from visitor use.

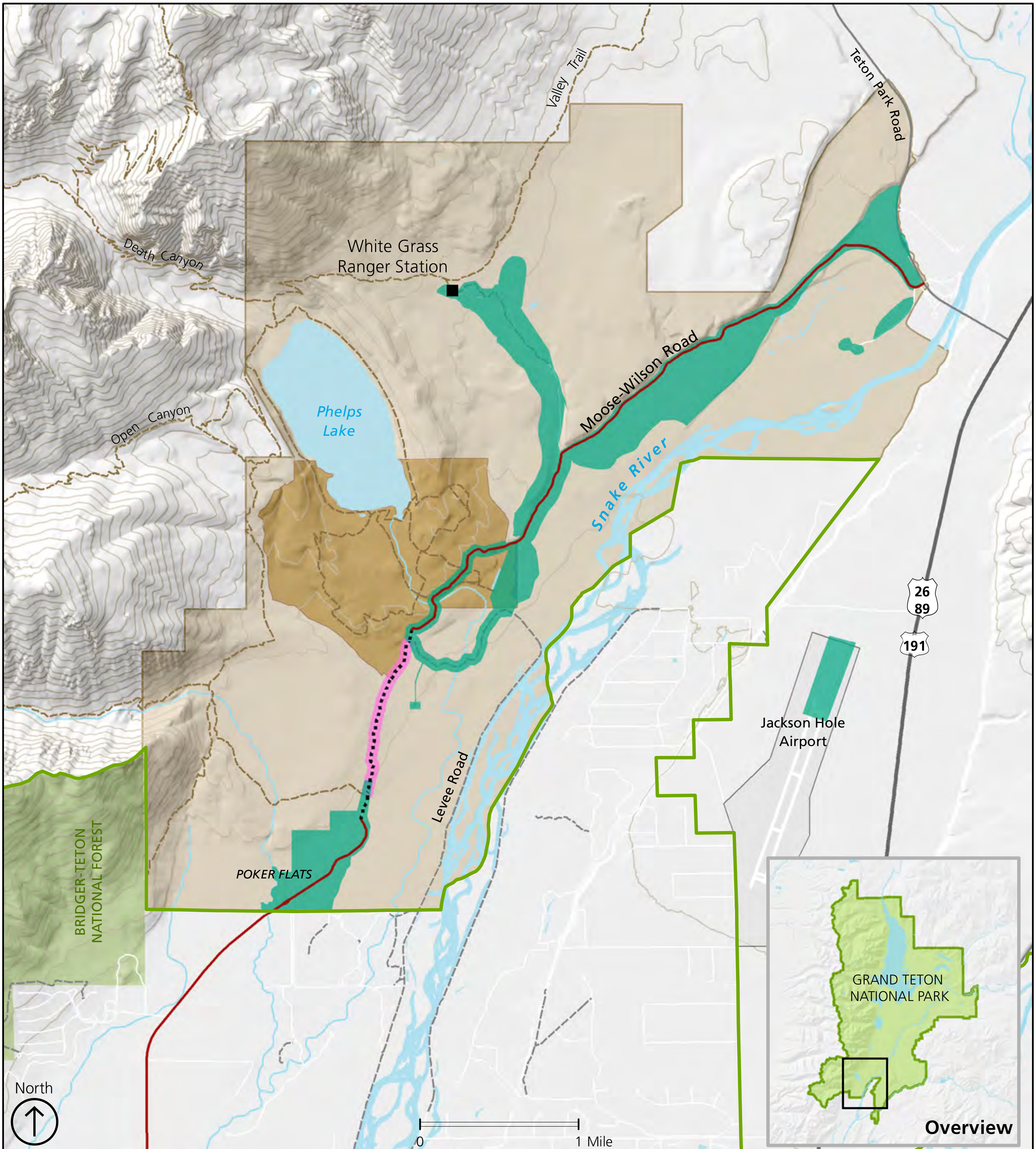
ARCHEOLOGICAL RESOURCES

Archeological evidence supports the presence of American Indian people in the Jackson Hole Valley over much of the past 11,000 years. The prehistoric chronology of Jackson Hole largely follows the chronology for the Northern Plains, which is typically divided into three major periods based on adaptive strategies and technological developments: Paleo-Indian (ca. 12,000–7500 BP); Archaic (ca. 7500–1450 BP); and Late Prehistoric (ca. 1450–200 BP). The Paleo-Indian period is generally recognized as the earliest period, characterized by small, highly mobile bands of subsistence hunters and gatherers who hunted large mammals and other species at the close of the last ice age. Finely crafted fluted projectile points are among the defining artifacts associated with the period. Obsidian was a particularly popular tool-making material, valued because of its fine flaking attributes and ability to hold a sharp edge. The use of obsidian for projectile points, knives, and other tools persisted during subsequent cultural periods. Large outcrops of obsidian have been found throughout the region; analysis of an outcrop near Teton Pass provides strong evidence that it was the predominant source for Paleo-Indian people in the Jackson Hole area. In the Greater Yellowstone Ecosystem, the earliest definable human occupation is recognized as the Jackson Hole Phase II (ca. 15,000–9200 BP) with ephemeral evidence of surface and poorly documented deposits reflecting association with the Clovis, Goshen, and Folsom cultures. There is evidence that Paleo-Indian people occupied seasonal camps from early summer to late fall in the greater Jackson Hole area. Around Jackson Lake and near Moose, they hunted bison, elk, deer, small mammals (e.g., badger, beaver, otter) and birds. About 8400 BP, Paleo-Indian hunters shifted toward a more varied diet, increasingly relying on a diverse range of strategies for exploiting faunal and plant resources within a wide array of environmental settings (Mettler & Associates 2012; Daugherty 1999).

The Archaic period (ca. 7500–1450 BP) followed the Paleo-Indian period. The period was characterized by cultural adaptations to changing climatic conditions enabling the use of a broad range of resources. Archaic period people became increasingly dependent on smaller mammals and wild plant resources. The use of large roasting pits and groundstone technology for processing plants first appears in the archeological record during this period. The Archaic period is divided into three subperiods based on changes in projectile point morphology: Early Archaic (ca. 7500–5000 BP); Middle Archaic (ca. 5000–2800 BP); and Late Archaic (ca. 2800–1450 BP). The Early Archaic is characterized by the development of a variety of large, side-notched projectile points; these were commonly replaced by large-stemmed base projectile points during the Middle Archaic period and by corner-notched projectile points during the Late Archaic. Archeologists noted an increase in the use of obsidian for projectile points from artifacts found in the Jackson Lake vicinity (Mettler & Associates 2012; Daugherty 1999).

The ensuing Late Prehistoric period (ca. 1450–200 BP) was marked on the northwestern Plains by the full transition to bow and arrow technology, adoption of ceramics, increased sedentism, population growth, and buffalo hunting. Site features commonly consist of drive lines (i.e., rocks and natural features arranged to channel game animals for hunting), stone circle (tipi ring) sites, and campsites. Smaller side-notched and corner-notched projectile points are diagnostic of the period, reflecting the adoption of the bow and arrow. Local phases of the Late Prehistoric period include the Jackson Hole Phase VI (ca. 1450–800 BP) and the Jackson Hole Phase VII (ca. 800–200 BP). These phases were characterized by intensified cultural use of the valley, with a noticeable reduction in seasonal use of the high country over the last 200 years (Mettler & Associates 2012; Daugherty 1999).

Archeological resources from the protohistoric and historic periods (AD 1650–1860) include ceramics, steatite pots, and tri-notched projectile points associated with the area's American Indian tribes, particularly the Shoshones. By the late 1700s, the horse-mounted Blackfoot, Kootenai, Flathead and Salish tribes pushed the Shoshones west across present-day Wyoming and north into Montana. Although several plains tribes first encountered European explorers during the 16th and 17th centuries, trade and other direct cultural interactions in the Jackson Hole area are generally associated with the arrival of European American fur trappers and explorers into the region during the early 19th century. Mountain dwelling people ("Sheepeaters" or Shoshone Indians) were described in the Lamar Valley of present-day Yellowstone National Park by American fur trapper Osborne Russell in 1835 (Mettler & Associates 2012).



Legend

- Trails
- Streams

Moose-Wilson Road

- Paved
- Unpaved

- Project Area Boundary
- Laurance S. Rockefeller Preserve
- Completed Survey
- Uncompleted Survey

- Park Boundary
- National Forest

Produced by Denver Service Center Planning Division, February 2015

Archeological Surveys

Grand Teton National Park, Wyoming
National Park Service/U.S. Department of the Interior

Although historical archeological resources associated with the fur-trapping era are scarce because of the brief ephemeral nature of that enterprise, it is likely that archeological resources associated with the sites of former homesteads, river fords, and ferry operations (e.g., Menor's Ferry), dude ranches and other historic sites exist along the Moose-Wilson corridor. These resources, much like those associated with prehistoric sites, offer researchers the potential to gain valuable insight into the nature of cultural adaptations and the day-to-day lives of early settlers in the Jackson Hole area.

Archeological Investigations

Only a small portion (approximately 8%) of the overall Moose-Wilson corridor has been surveyed for archeological resources. Seventeen archeological surveys of the corridor have been conducted beginning in 1994. To date, the corridor project area contains a total of 11 known archeological sites and 8 known isolated finds. Three of the prehistoric sites are recommended eligible for the National Register of Historic Places, consisting of a large base camp, and two lithic scatters. While there is a high probability for additional historic and prehistoric sites and/or isolates to be identified in unsurveyed portions of the overall Moose-Wilson corridor, the area of potential effect corresponding to the current project area has been substantially surveyed for archeological resources. The Archeological Surveys Map on the previous page indicates the extent of archeological surveys carried out in the current project area.

Contracted archeological investigations of a portion of the Moose-Wilson corridor were conducted in 2012 in support of the proposed Moose-Wilson Road Realignment Project. The project area at that time encompassed about 378 acres, of which 36 acres had been previously surveyed for cultural resources. Investigations were conducted to fulfill NPS compliance responsibilities under section 106 of the National Historic Preservation Act (Mettler & Associates 2012).

One archeological site in the Moose-Wilson corridor project area is a large prehistoric habitation area (48TE498). This site was originally recorded in 1973, re-recorded during the 2012 investigations, and was most recently assessed for integrity in 2013. The site is recommended eligible for the national register for its potential to yield scientific data. The multicomponent site retains integrity despite being unintentionally damaged by maintenance activities on Moose-Wilson Road and construction of a visitor area. This site encompasses 12 acres and contains at least 11 partial stone circles. These circles, or tipi rings, identify the site as a habitation area. The stones in tipi rings are thought to have held down the bottoms of skin tipi covers. When the cover was removed, the stones remained in place. Diagnostic projectile points from the site date to the Late Archaic period and indicate the site may be 1,450 to 2,800 years old. The depth of cultural material reaches approximately 12 inches (30 cm), and dateable features and artifact deposits exist in a subsurface context. The site is one of three large base camps in the Jackson Hole area and substantially contributes to understanding prehistoric, protohistoric, and historic occupation of the valley. The site faces threats from visitor use as a result of social trails and potential illegal artifact collection. Archeological data recovery and site monitoring during construction were recommended in the event the site could not be avoided by proposed rerouting of Moose-Wilson Road (Mettler & Associates 2012).

During the 2012 archeological surveys, investigators found and recorded four previously unrecorded sites and five isolated finds. A segment of an unnamed wagon road was recorded and, based on historic map evidence, is likely a continuation of a road that eventually merges with Moose-Wilson Road. A historic airstrip and an irrigation ditch with headgates, diversion dam, and culverts were recommended ineligible for the national register. Two prehistoric cairns were recorded and recommended ineligible for the national register, as well as five prehistoric isolated finds (Mettler & Associates 2012).

NPS staff recently conducted an archeological survey of the Moose-Wilson corridor project area between October 15 and October 24, 2014. The survey area encompassed approximately 233 acres and resulted in the identification of four isolated finds of less than 15 artifacts each and two sites. One previously recorded site (48TE1197) near the White Grass Ranch included over 30 lithic artifacts and was recommended eligible for the national register. An extensive previously unrecorded site in the vicinity of the Laurance S. Rockefeller Preserve (no site number at present) was identified and recorded consisting of 380 lithic artifacts that included nondiagnostic / irregular tools and tool fragments. The high percentage of primary flakes from obsidian cobbles suggests the site was long used as a place to initially reduce the size of material quarried from nearby obsidian source locations (NPS, Whitman Moore, October 2014 survey summary).

ETHNOGRAPHIC RESOURCES

Ethnographic resources are defined by the National Park Service in Director's Order 28 as a "site, structure, object, landscape, or natural resource feature assigned traditional legendary, religious, subsistence, or other significance in the cultural system of a group traditionally associated with it." Ethnographic resources typically hold significance for traditionally associated groups whose sense of purpose, existence as a community, and identity as an ethnically distinctive people are closely linked to particular resources and places.

American Indians have occupied the Jackson Hole area for thousands of years, and places and resources within Grand Teton National Park continue to hold both traditional and contemporary significance for many tribal groups. American Indians often passed through the area following stream and river corridors, or by way of other traditional access routes for hunting and foraging, migration, religious and ceremonial purposes, and other cultural activities. Today, numerous American Indian tribes retain traditional associations with what is now park lands including the Moose-Wilson corridor. Traditionally associated tribes whom park staff consult on a government-to-government basis include the following:

- Apache Tribe of Oklahoma
- Arapaho Tribe of the Wind River Reservation, Wyoming
- Assiniboine and Sioux Tribes of the Fort Peck Indian Reservation, Montana
- Blackfeet Tribe of the Blackfeet Indian Reservation of Montana
- Burns Paiute Tribe, Oregon
- Cheyenne and Arapaho Tribes, Oklahoma
- Coeur D'Alene Tribe, Idaho
- Comanche Nation, Oklahoma
- Confederated Salish and Kootenai Tribes of the Flathead Reservation, Montana
- Confederated Tribes of the Colville Reservation, Washington
- Confederated Tribes and Bands of the Yakama Nation, Washington
- Confederated Tribes of the Umatilla Indian Reservation, Oregon
- Crow Tribe of Montana
- Fort Belknap Indian Community of the Fort Belknap Reservation of Montana
- Kiowa Indian Tribe of Oklahoma
- Kootenai Tribe of Idaho
- Nez Perce Tribe, Idaho
- Northern Cheyenne Tribe of the Northern Cheyenne Indian Reservation, Montana

- Oglala Sioux Tribe, South Dakota
- Rosebud Sioux Tribe of the Rosebud Indian Reservation, South Dakota
- Shoshone-Bannock Tribes of the Fort Hall Reservation, Idaho
- Shoshone Tribe of the Wind River Reservation, Wyoming
- Standing Rock Sioux Tribe of North and South Dakota
- Yankton Sioux Tribe of South Dakota

A recent report entitled "An Assessment of American Indian Occupation and Uses of the Cultural and Natural Resources of Grand Teton National Park and the National Elk Refuge" (Walker Research Group, Ltd. 2007), summarizes the major published research documenting the traditional, protohistoric, and historic presence of the park's traditionally associated tribes. The report was not released to the general public because it contains sensitive cultural information. The report notes that tribes view the entire region and its resources holistically, with geographic and other features contributing to their spiritual, economic, and material cultures. On a broad scale, the Teton Range has long represented a monumental and sacred geological feature within the landscape, serving as a focus for vision quests, hunting and gathering, and other purposes. Other culturally important sites in the region include Jackson Lake, the obsidian quarries at Conant and Teton Passes, and the geysers and thermal features of Yellowstone National Park (Walker 2007).

The cultural importance of such natural resources as bison, obsidian, plants, hot springs, and other water features are reflected in spiritual practices such as ceremonies and offerings; medicinal uses; and as sources of food, water, and tools. An analysis of 2,000-year-old obsidian artifacts recovered in present-day southern Ohio indicate that they were fashioned from source material quarried at the Teton Pass site, demonstrating the widespread use and trade importance of area resources across the country. The vital importance of bison in the activities of the Plains tribes was manifested in the far-reaching reliance on bison for all aspects of subsistence and for spiritual guidance. The annual subsistence cycles of tribal groups were determined in large part by the migration patterns of bison herds. Seasonal subsistence strategies drew on the traditions of Great Basin and Plains cultures, permitting the exploitation of a broad range of resources. Within the watershed of the Snake River headwaters, the varied environments of canyons, wetlands, subalpine mountains, and plains supported a diverse variety of berries, fish, and large and small game that could be procured on a seasonal basis (Walker 2007).

Archeological evidence of former campsites often retain faunal evidence of bison, elk, deer and other animals, as well as hearths, lithic scatters, and rock structures. In addition to the archeological importance of these resources, they often retain enduring cultural value as traditional or sacred sites that continue to link tribes to particular geographic areas. Many resources and sites used during the protohistoric and early historic period (e.g., plants and animals, minerals, ceremonial sites) are used by contemporary tribes, but currently only for nonconsumptive use within the park under NPS regulations. Future ethnographic research is recommended in consultation with tribal elders and others to gain greater insight into specific tribal practices in the region and to investigate and document the cultural significance of specific site locations (Walker 2007).

NPS staff recently held on-site visits with tribal representatives at selected locations in the park, including the Moose-Wilson corridor, to assess tribal issues and concerns and to gain insight into potential ethnographic resources and traditional cultural properties. A site visit was conducted to Jenny Lake on July 15, 2014, followed by a site visit to the Moose-Wilson corridor on July 16. Representatives of the Arapaho Tribe of the Wind River Reservation, Crow Tribe of Montana, Fort Belknap Indian Community, Northern Cheyenne Tribe, Shoshone-Bannock Tribes of the Fort Hall Reservation, and Yankton Sioux Tribe of South Dakota accompanied NPS staff on the site visits. Participants discussed opportunities for tribal members to assist with archeological surveys to provide the benefit of tribal cultural knowledge in identifying and recording sites, as well as the importance of incorporating tribal perspectives in interpretive programs and media; measures to improve consultation; and the purpose and need of the Moose-Wilson Road environmental impact statement (Tribal Consultation Notes, July 15–16, 2014).

Subsequent tribal consultation meetings and a rapid ethnographic assessment of the Moose-Wilson corridor were held November 5–7, 2014, with the participation of representatives from the Assiniboine and Sioux Tribes of the Fort Peck Indian Reservation, Crow Tribe of Montana, Shoshone-Bannock Tribes of the Fort Hall Reservation, and Shoshone Tribe of the Wind River Reservation. The rapid ethnographic assessment examined and documented traditional and contemporary tribal perspectives on the resources and landscape of the corridor, and addressed potential impacts on ethnographic resources for this comprehensive management plan / environmental impact statement with recommended mitigation measures. Site visits were made to three archeological sites within the corridor. Tribal representatives identified the cultural importance of traditionally collected/used plants, animals, and stone/mineral resources. The enduring cultural importance of one of these sites was also expressed because the large number of stone circles strongly supports the repeated use of the site as an ideal winter camp location. As expressed by a tribal representative, "This place tells us how our ancestors lived. We need to respect this place. It tells us what they had to deal with in order for us to be here. . . I would be saddened if this were destroyed." The large site in the vicinity of the LSR Preserve was identified as a tool processing site indicative of the long history of tribal use of the corridor. Tribal representatives emphasized the paramount need to protect cultural sites, and disturbance and loss of sites was seen as an erosion of tribal cultural identities and heritage (Tribal Consultation Meetings, Summary of Findings, October 5–7, 2014).

Laurance S. Rockefeller Preserve

The Laurance S. Rockefeller Preserve is not managed by the National Park Service as a cultural resource or historic district and all historic buildings have been removed from the site. Brief discussion of the LSR Preserve is nevertheless included here to provide historical background and context associated with the property's development from a homestead, dude ranch, and eventually to the modern LSR Preserve and visitor center.

Lands comprising the Laurance S. Rockefeller Preserve began as a homestead established by Dave Spalding in 1903. Three years later, Spalding conveyed the homestead near Phelps Lake to Louis Joy. Joy and his partner, Struthers Burt, developed the property (named the JY Ranch) as the first dude ranch in Jackson Hole. The dude ranch offered visitors the opportunity to experience the trappings of western ranching but in a relaxed atmosphere. During its first summer of operation, the JY Ranch housed six visitors (dudes). In 1927, the ranch accommodated 65 guests, each paying $65 per week for food, lodging, and the use of boats and horses (Park Website n.d.).

John D. Rockefeller Jr. toured Jackson Hole with Yellowstone National Park Superintendent Horace Albright in 1926. Disturbed by the level of development he saw, Rockefeller founded the Snake River Land Co. to purchase valley lands for conservation. Over a six-year period, Rockefeller purchased 35,000 acres including the JY Ranch in 1932. The JY Ranch became his family's private summer retreat for nearly 70 years. Between 1969 and 1983, John D. Rockefeller Jr.'s son, Laurance S. Rockefeller, transferred roughly 2,300 acres to Grand Teton National Park. The final 1,106 acres passed to the park in

2007, marking the end of the JY Ranch. At Rockefeller's behest, 30 former ranch cabins and buildings were removed, along with two roads. The land was then returned to natural conditions and wildlife habitat. About half of the buildings were relocated throughout the park to serve as NPS employee housing and for other purposes, and the other half (the oldest residential cabins, dining, and recreation buildings) were moved to a new Rockefeller family property outside the park (Park Website n.d.).

The Laurance S. Rockefeller Preserve and Visitor Center were opened to the public in 2008, providing visitors a contemplative natural experience. The Preserve reflects Rockefeller's life-long commitment to making areas of natural scenic beauty accessible to the public to impart spiritual renewal and stewardship values. An 8-mile trail system was developed providing opportunities to hike to Phelps Lake, Lake Creek, and adjacent ridges. The 7,500-square-foot visitor center was the first platinum-level Leadership in Energy and Environmental Design (LEED) certified building constructed in the national park system (Park Website n.d.).

VISUAL RESOURCES

INTRODUCTION

This section describes aspects of visual resources that may be affected by the management alternatives in the Moose-Wilson corridor. The description of these elements is based on the best professional judgment of Grand Teton National Park staff, NPS planners, and research results from other specialists.

The Moose-Wilson corridor can be accessed either from the Moose Entrance or from the Granite Canyon Entrance from the south end of Moose-Wilson Road. For the purpose of this section, descriptions of the corridor will be provided from the north to the south.

The scenic views available in the Moose-Wilson corridor depend largely on where one is within the corridor. Descriptions of views have been organized in two categories—along the roadway and beyond the roadway. Along the roadway includes visual resources along Moose-Wilson Road or points of interest directly off the roadway. Beyond the roadway includes visual resources along trails and points of interest that are beyond the roadway. The discussion below includes diversity of views, special scenic features, seasonal variation, and cultural modifications (cultural visual resources, visible human development, etc.).

The Moose-Wilson corridor contains a variety of stunning scenery. Views of the Teton Range with its iconic peaks and high elevation canyons are visible from the corridor and offer a vantage point not readily found in other areas of Grand Teton National Park. The scenic quality of the corridor is characterized by outstanding representations of the park's major natural ecological communities. These natural communities include alpine and subalpine forests, sagebrush flats, wet meadows and wetlands, lakes, rivers, and ponds and the associated diverse native fish and wildlife. The natural communities are prime habitat for many species of wildlife such as beaver, moose, and grizzly bear. The corridor is enclosed roughly by the Teton Range to the west and the Snake River to the east. Stunning views of Phelps Lake and Death Canyon can be found along trails within the Laurance S. Rockefeller Preserve.

REGION OF COMPARISON

Many of the visual elements found in the Moose-Wilson corridor are not found or are not easily accessed from other areas in Grand Teton National Park. While views of the iconic Tetons are found throughout the park, the Moose-Wilson corridor provides unique views of the Tetons from sagebrush flats. The proximity of the Snake River to the corridor provides wetlands and riparian woodland habitats and the wildlife that forage and reside within them. The diversity of habitats attracts wildlife throughout the corridor, making it possible to view them in their native surroundings. Points of interest that can be accessed from the roadway offer impressive views of the surrounding landscapes such as the Snake River Valley.

SEASONAL VARIATIONS

The combination of visible alpine, coniferous forests, sagebrush, riparian woodland, wetlands, shrub, and open water habitats provide strong scenic views in each season. The gray and white Teton peaks contrast with green lodgepole pine, cottonwoods, wetland grasses, and sagebrush during the spring and summer seasons. During the fall, riparian woodland and shrub habitats change to an assortment of oranges, yellows, and reds, providing stunning fall views of forests, the Snake River, and Teton peaks alike. As the heavy snows of winter fall within the corridor, blanketing vegetation in white to mirror the snowcapped peaks of the Tetons, green conifers provide visual contrast. With each change in the season, and therefore vegetation, come changes in the types of wildlife visible within the corridor.

ALONG THE ROADWAY

Along Moose-Wilson Road, a variety of scenic views and vegetation types can be found. Scenic views include the Teton mountain peaks, steep canyons, the Snake River, Phelps Lake, and foothills of the Teton mountain range. Vegetation types found along the roadway include riparian woodland, wetland, shrub, sagebrush, coniferous forest, and Snake River open water habitats. Refer to the "Affected Environment" section under "Wildlife and Wildlife Habitat" for more information.

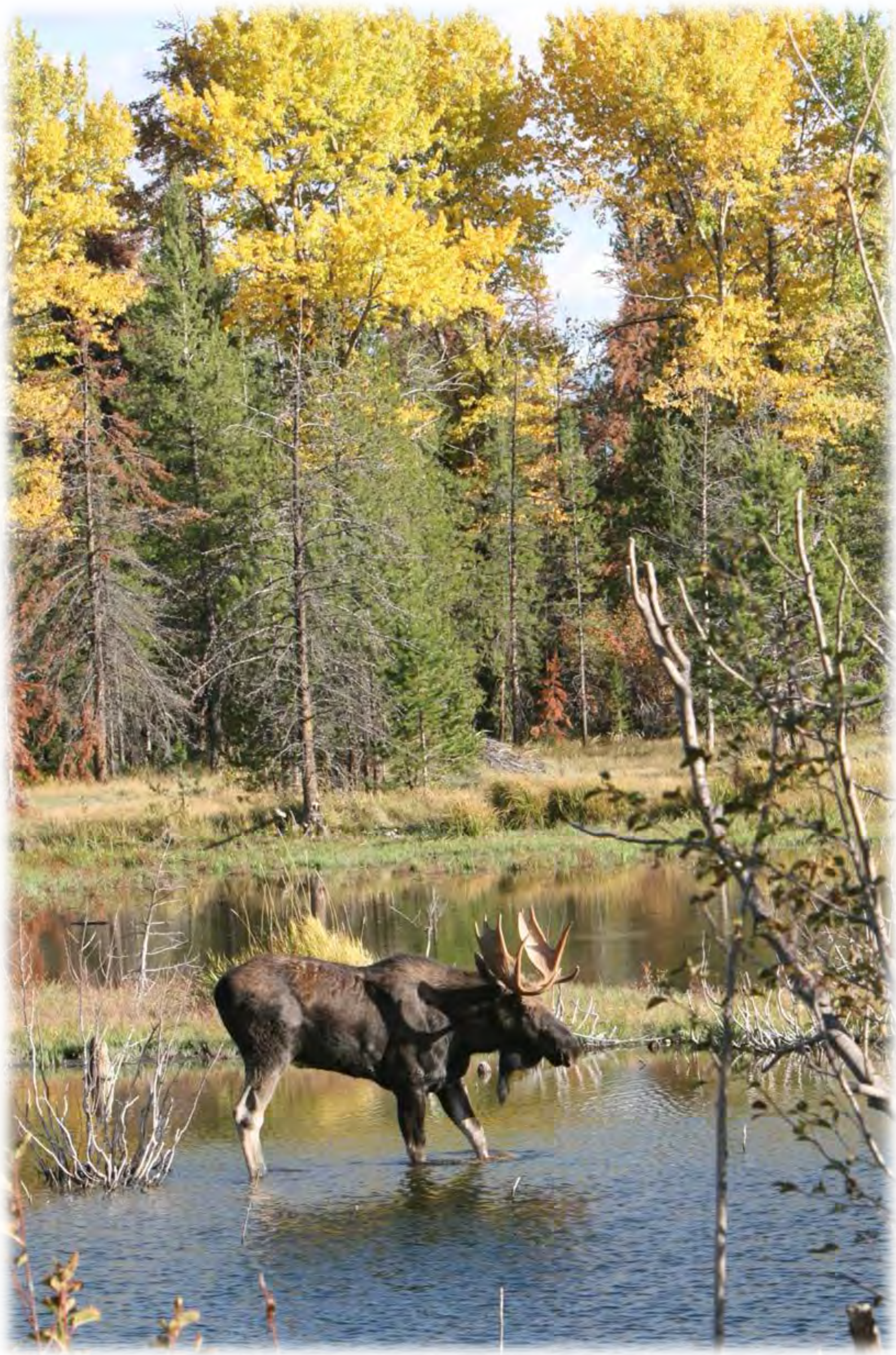
The Moose-Wilson corridor begins at the junction of Teton Park Road and Moose-Wilson Road. To the west, the iconic and jagged peaks of the Tetons can be seen from this portion of the road as well as open woodlands and sagebrush flats. Powerlines cross the road, at times disrupting the photographic panoramas of the Tetons. Within this area, cars waiting in line at the Moose Entrance are visible as are the visitor-created turnouts along this section of the road. Airplanes arriving and departing from the Jackson Hole Airport 3 miles southeast of the LSR Preserve also provide visual intrusions.

Between the road junction and the Sawmill Ponds parking area, riparian woodland, wetland, and sagebrush habitats are prevalent. These habitats attract and support a variety of wildlife that is often visible from the road. Beaver dams creating still deep waters, viewed from Sawmill Ponds, provide opportunities to observe moose and beavers in their natural habitat (opportunities not easily accessible in other parts of the park. Vehicles stopped in the road or off to the side are also visible as visitors stop to view wildlife or the Tetons.

South of Sawmill Ponds, sagebrush flats and wetlands give way to shrub and coniferous forest habitats. Berry-producing shrubs such as chokecherry and hawthorn primarily lining the west side of the roadway. Mountain peaks are less visible here as the road approaches the foothills of the Tetons and the vegetation is taller and more dense. When berries are in season, it is common to see wildlife foraging among the shrubs lining the road. On the eastern side of the road lie extensive wetlands leading to the Snake River. From this vantage point open water can be seen with beaver ponds as well as plants such as willows and reeds. Wildlife, including moose and beavers, can often be seen foraging in the wetland.

View of the Tetons at Junction of Teton Park Road and Moose-Wilson Road

Bears Foraging for Berries Along Moose-Wilson Road



Moose in Wetlands Along Moose-Wilson Road

Approaching the Laurance S. Rockefeller Preserve from the north, lodgepole pine and conifer forest become taller and thicker, shrubs are denser, and both trees and shrubs tightly hug the road edges. Views of both the foothills and the Teton peaks are obscured as vegetation shrouds the road. Wildlife can often be seen in the open understory. As the road rises and falls along the foothills, the narrow and winding nature of this portion of the roadway with its dense vegetation cover only allows limited sight lines. Views of the road are often obscured by vehicles as visitors stop to view wildlife. Hikers and horseback riders emerge from trails as they cross the roadway and a view of Lake Creek cascading toward the Snake River can be seen from the single-lane bridge.

South of the LSR Preserve, dense forest dominates the views. Then gradually, vegetation thins and changes from coniferous forest to sagebrush-covered flats at the Granite Canyon Trailhead parking area. Between the LSR Preserve boundary and the trailhead parking area the road is unpaved for approximately 1 mile and the Teton Ranges once again become visible to the north and west. Sagebrush flats dominate to the south and east.

The southern portion of the corridor from Poker Flats to the Granite Canyon Entrance provides breathtaking views of the Teton Range. The entrance station and horse trailer parking area are visible along this portion of the road corridor, which is in open sagebrush habitat with intermittent patches of woodlands. Visitors may observe horse trailers and horseback riders during the summer and autumn months of the year. Several residences of the Poker Flats area are visible on the west side of the road along the low foothills of the Teton Range.

Throughout the length of the corridor, one of the key visual characteristics for visitors traveling the road is that the foreground scenery is immediately adjacent to the roadway. Dense forests, riparian areas, sagebrush meadows, and other visual elements are located immediately adjacent to the road, rather than at a distance. The effect is to create an intimate connection with the resource as visitors travel the road.

BEYOND THE ROADWAY

At the northern end of Moose-Wilson Road is Murie Ranch and views of the Teton Range in this historic district. Historic ranch buildings are nestled in a wooded area surrounded by wetland and sagebrush habitat. The historic district provides a rich view into the past—from early dude ranchers to the conservationists that came later and for whom this place is commemorated. A history of ranching is visible in the log-constructed residential buildings, rustic cabins, utility structures, and outbuildings—all symbols of the past.

Approximately half way along the roadway, Death Canyon Road meets Moose-Wilson Road. At this point, White Grass Ranch and the Death Canyon Trailhead can be found. This two-track and rugged road is surrounded by coniferous forest habitat. The guest cabins, lodge, dining hall, and service/laundry buildings of the White Grass Dude Ranch Historic District are at the edge of a large meadow. The rustic appearance of these buildings is reminiscent of the pioneer structures of the past, providing a view into the period for which the district is considered historically significant. The open area of the meadow provides views of the Tetons. The historic structures at White Grass Ranch, set against the backdrop of meadows, coniferous forest, and mountain views, provides a glimpse into the dude ranching activities once common in this area.

The Death Canyon Trailhead is in a heavily forested area of lodgepole pine and other mixed conifer trees. Trails taken from Death Canyon Trailhead climb the foothills of the Tetons. Phelps Lake is visible and accessed from trails beginning at the Death Canyon Trailhead. This large body of water offers a unique contrast with the forested foothills of the area. From Phelps Lake itself, impressive views that encompass the lake, forested foothills, Death Canyon, and the serrated Teton peaks are seen. Due to the higher elevation of the Death Canyon Trailhead area, peaks of the Tetons can generally be seen to the northwest as well as sweeping views of the Snake River Valley to the east. Within views of the Snake River Valley, Moose-Wilson Road can be seen on the western edge of the valley, followed by outlet wetlands and the braided channels of the Snake River, and then the open and relatively flat valley floor. In the far distance, the Gros Ventre Range abuts the eastern edge of the valley.

View of Phelps Lake from Phelps Lake Overlook

Approximately a mile south of Death Canyon Road, the LSR Preserve can be accessed from Moose-Wilson Road. The LSR Preserve Center is nestled between open sagebrush and a mixed deciduous riparian woodland. Trails accessed from the LSR Preserve Center contain similar scenic views as those from the Death Canyon Trailhead. Trails circle Phelps Lake and again contain impressive views of the lake itself and the foothills and high-elevation canyons in which it is situated. The trails from the LSR Preserve Center range in elevation and therefore provide varying views of the Moose-Wilson corridor, the Snake River Valley, and the Teton peaks and foothills. Many scenic vistas can be reached from the LSR Preserve. These scenic rest areas and overlooks have been carefully considered and are maintained by trimming vegetation to maintain views according to the LSR Preserve Property Maintenance Plan (D. R. Horne & Co. 2007). Figure 19 depicts the locations of scenic rest areas at the LSR Preserve. Figure 20 depicts overlooks at the LSR Preserve.

FIGURE 19. SCENIC REST AREAS AT THE LAURANCE S. ROCKEFELLER PRESERVE

FIGURE 20. LAURANCE S. ROCKEFELLER PRESERVE OVERLOOKS

Levee Road can be accessed by foot from the LSR Preserve and from Moose-Wilson Road, just south of the LSR Preserve. Levee Road closely parallels the Snake River and its open water habitat. At times this gravel road travels through open sagebrush flats and mixed coniferous and deciduous forest areas. When views of the Snake River are unobstructed by trees or shrubs, the braided river channels are visible. Beyond the eastern bank of the Snake River, are coniferous forests in which residential housing developments can be seen. Aircraft arriving and departing from the airport just east of the Snake River are also visible.

View of Laurance S. Rockefeller Visitor Center

Farther along the corridor from the LSR Preserve, the Granite Canyon Trailhead lies just west of Moose-Wilson Road. A westward trail traverses sagebrush habitat before heading north into mixed coniferous and deciduous forest habitat. Trails can be taken toward Phelps Lake and the LSR Preserve as well as toward the alpine habitat of the Teton Range. The Tetons are highly visible to the north and west from popular viewpoints within this area (see figure 19). Moose-Wilson Road and the Snake River are visible to the east.

Down the road from Granite Canyon Trailhead is Poker Flats. This southern portion of the corridor is in open sagebrush habitat. The Poker Flats horse trailer parking area is on the western side of Moose-Wilson Road, approximately 0.5 mile north of the Granite Canyon Entrance Station. From horseback, visitors can traverse semi-open forested areas and small stream crossings on both sides of Moose-Wilson Road between the Poker Flats horse trailer parking area and the LSR Preserve. The semi-openness of these areas provide horseback riders with spectacular views of the Teton Range. Phelps Lake can be seen from trails that traverse the southern and western portions of the LSR Preserve. Horseback riders gain a different perspective of the corridor and use trails not often used by hikers.

Winter View from Granite Canyon Trailhead

ACOUSTIC RESOURCES AND SOUNDSCAPES

INTRODUCTION

For management and planning purposes, it is important to distinguish and define key terms such as acoustic resources and soundscapes. Acoustic resources are physical sound sources, including both natural sounds (wind, water, wildlife, vegetation) and cultural and historic sounds (dude ranch activities, tribal ceremonies). The acoustic environment is the combination of all the acoustic resources within a given area—natural sounds as well as human-caused sounds. The acoustic environment includes sound vibrations made by geological processes, biological activity, and even sounds that may be inaudible to the human ear, such as bat echolocation calls. Soundscape is the component of the acoustical environment that is audible by humans. The natural soundscape exists without human caused sounds. The nonnatural soundscape includes human-caused sounds. The character and quality of the soundscape influences human perceptions of an area, providing a sense of place that differentiates it from other regions. Noise refers to sound that is unwanted or extraneous because of its effects on humans and wildlife. Cultural soundscapes include appropriate cultural and historic sounds that are fundamental components of the purposes and values for which the parks were established.

The acoustic environment along the Moose-Wilson corridor varies across the landscape, with a variety of audible natural and nonnatural sounds, depending on the location. For example, the sound levels of backcountry winter areas are sometimes close to the lower limit of human hearing (0 A-weighted decibels [dBA]), while some vehicles on Moose-Wilson Road create loud (>70 dBA) nonnatural sounds that transmit into areas of the park. Additionally, the Jackson Hole Airport is within Grand Teton National Park, to the east of the Moose-Wilson corridor, and air traffic can be heard, sometimes at high levels, from within the corridor.

NATURAL SOUNDSCAPES

The natural soundscape has been identified as a fundamental resource and value within Grand Teton National Park. Natural soundscapes exist in the absence of human-caused sound, and natural ambient sounds are the aggregate of all the natural sounds that occur in park units, together with the physical capacity for transmitting natural sounds. Natural sounds occur within and beyond the range of sounds that humans can perceive and can be transmitted through air, water, or solid materials. The Moose-Wilson corridor is composed of a full suite of biological sounds and sounds created through physical processes. Examples include running water, thunder, bird calls, wind blowing, wolves howling, elk bugling, or a beaver tail slapping a warning, as well as the complete absence of all sounds. The frequency, magnitude, and duration of human-caused sound considered acceptable varies throughout the area, being generally greater in developed areas and less in undeveloped areas.

Wildlife

Natural sounds, including biological and physical sounds, are intrinsic elements of the environment and are necessary parts of its ecological functioning. Birds, mammals, amphibians, and insects often need to hear or produce sounds to attract mates, detect predators, find prey, or defend territories. Groups of animals benefit by producing alarm calls to warn of approaching predators and contact calls to maintain group cohesion. A reduction in communication distance created by noise (masking) decreases the effectiveness of these social networks. Animals also use incidental sounds produced by potential prey to find their next meal; other animals use these sounds to avoid predation. Noise can affect the natural soundscapes by disrupting wildlife. While the severity of the impacts vary depending on the species and other conditions, research strongly indicates that wildlife can suffer adverse behavioral and physiological changes from noise and other human disturbances. Documented responses of wildlife to noise include increased heart rate, startle responses, flight, disruption of behavior, separation of mothers and young, and habitat use (Selye 1956; Clough 1982; NPS 1994; USDA 1992; Anderssen et al. 1993; McClure et al. 2013). Masking degrades an animal's auditory awareness of its environment and fundamentally alters interactions among predators and prey Masking also affects acoustical communication. Animals have been shown to alter their calling behavior and shift their vocalizations in response to noise (Brumm and Slabbekoorn 2005; Patricelli and Blickley 2006; Slabbekoorn and Ripmeester 2008; Warren et al. 2006).

A number of studies related to the acoustic environment have occurred in Grand Teton National Park, and many of the findings are relevant to the Moose-Wilson corridor. The first two study areas were north of the Moose-Wilson corridor and contained similar habitat to areas within the corridor.

1. **"The Effects of Anthropogenic Noise and Human Activities on Ungulate Behavior" (Brown et al. 2012).** This study investigated the potential impacts of human-induced noise and human activities on the behavior of elk (*Cervus elaphus*) and pronghorn (*Antilocapra americana*) along a transportation corridor in Grand Teton National Park. Researchers conducted roadside scan surveys and focal observations of ungulate behavior while concurrently recording human activity and anthropogenic noise. Although researchers expected ungulates to be more responsive with greater human activity and noise, they were actually less responsive (less likely to perform vigilant, flight, traveling, and defensive behaviors) with increasing levels of vehicle traffic, the human activity most closely associated with noise. Noise levels themselves had relatively little effect on observed ungulate behavior, although there was a weak negative relationship between noise and responsiveness in the scan samples. In contrast, ungulates did increase their responsiveness with other forms of anthropogenic disturbance; they reacted to the presence of pedestrians (in the scan samples) and to passing motorcycles (in the focal observations). These findings suggest that ungulates did not consistently associate noise and human activity with an increase in predation risk or that they could not afford to maintain responsiveness to the most frequent human stimuli. Although reduced responsiveness to certain disturbances may allow greater investment in fitness-enhancing activities, it may also decrease detection of predators and other environmental cues and increase conflict with humans.

2. **"The Effects of Pathways within Grand Teton National Park on Avian Diversity, Abundance, Distribution, Nesting Productivity, and Breeding Behaviors" (Chalfoun 2011).** In this study, researchers used a comprehensive and experimental approach to examine the responses of breeding songbirds to a novel disturbance (new multiuse, nonmotorized pathway) in Grand

Teton National Park to further understand the impacts of different types of human activities (construction and recreational) on wildlife. Neither species diversity nor overall abundance of focal species was significantly associated with pathway construction or use activities. However, results clearly suggest avoidance of the pathway area for nesting activities, especially during pathway use, potentially reflecting perceived predation risk. The proportion of nests on the pathway side of the highway and the density of nests within 55 yards (50 m) of the pathway route decreased, and the average distance of nests from the pathway increased, post control year with no signs of acclimation by year four. As further evidence of avoidance, 83% of the color-banded Brewer's sparrows who switched sides of the highway to nest in subsequent years shifted from the pathway to the nonpathway side. The inclusion of two years of pathway use following implementation allowed investigation of potential acclimation of breeding birds to the new disturbance. Avoidance responses, however, as particularly indicated by the distribution of nests in relation to the pathway over time, did not decrease during the study period. Rather, differences in response metrics across treatments were greatest in 2010 compared to the 2007 control year. Both types of disturbance stimuli (construction and pathway use) in the study were intermittent and therefore somewhat unpredictable, which tend to be the types that elicit stronger wildlife avoidance responses (Borkowski et al. 2006; Thiel et al. 2007). The specific stimuli emitted by the human activities that elicited avoidance are unclear (i.e., noise, visual, or movement).

Sounds and Wilderness Character

The Moose-Wilson corridor contains areas of potential wilderness and borders recommended wilderness. Preserving the acoustic environment and the natural soundscapes of such areas are critical to effective wilderness management and can have important effects on wilderness character. Natural soundscapes and the absence of anthropogenic noise are crucial components of the wilderness qualities of solitude, naturalness, and undeveloped character. Noise, often from distant roads, park operations and maintenance activities, or aircraft overflights is one of the most common and pervasive human influence on the primeval character of wilderness. Other sounds are audible, including the excitement and joy of people (individuals or groups) participating in popular recreational activities such as diving/jumping and swimming in lakes. Noise from seasonal road traffic within the Moose-Wilson corridor, and year-round traffic from Highway 89 and the Teton Park Road propagates into these wilderness areas. Year-round airport-related noise is persistently audible in the adjacent potential and recommended wilderness. A loud or persistent noise source can be a prominent "imprint of man's work" that can make a wilderness hiker or camper instantly aware that they are not alone. Human-caused noise, especially low frequency sound from vehicles and machinery, can travel for miles.

Cultural Sounds

A primary mission for many national park units is to protect the resources and values related to the culture, ethnic heritage, and history of a group or a place. Many locations in national parks are significant because of the meaning, memories, and experiences that people associate with them. Many culturally based sounds are tangible symbols of an area's history and importance. From culturally significant music, to sounds associated with notable events and historic reenactments, relevant cultural sounds are a protected resource in national parks. Visitors to cultural and historic areas of the Moose-Wilson corridor may want to understand and embrace America's heritage in a personally meaningful way, which could include slowing down to listen to the sounds around them and reflecting on the quiet and peace that others may have experienced in years past. Cultural sounds within the Moose-Wilson corridor may include quiet reflection at the Murie Ranch or the sound of horseback activities that invoke the history of dude ranching at White Grass Dude Ranch and other areas in the corridor.

Soundscape-Related Visitor Experiences

The opportunity to experience natural and cultural/historic sounds is an important element of many visitor experiences in national parks. A 1998 survey of the US public revealed that 72% of respondents thought that providing opportunities to experience natural quiet and the sounds of nature was an important reason for having national parks, while another 23% thought that it was somewhat important (Haas and Wakefield 1998). In another survey specific to park visitors, 91% of respondents considered enjoyment of natural quiet and the sounds of nature as compelling reasons for visiting national parks (McDonald et al. 1995). Because of the diversity of habitats and wildlife species within the Moose-Wilson corridor, visitors have an abundance of opportunities to hear diverse natural sounds that not only enhance visitor experience, but serve a critical ecological role. Spring's early morning bird chorus heralds the arrival of migrants and the resumption of breeding activities for many species of wildlife. Territories are defended and mates are attracted through the use of songs and calls. In the wetland areas, amphibians join the chorus for the same purposes. Summer brings thunderstorms and the sounds of insects during warm afternoons. Elk bugling in the fall portends the upcoming winter season with both its winter snow storms and impressive silent nights. The sound of flowing water from the Snake River and its cascading tributaries and the common sound of wind pervades the forests and sagebrush flats year-round. These sounds add depth and meaning for visitors, as does the opportunity to experience natural quiet.

Soundscape-Related Visitor Surveys

During the summer of 2014, a visitor survey was conducted to examine social conditions within the Moose-Wilson corridor (Newman et al. 2015). The pre-experience survey asked participants about their planned activities, how they learned about the Moose-Wilson corridor, and their motivations for visiting the Moose-Wilson corridor. The post-experience survey asked participants their favorite and least favorite aspects of their visit, what managers could do to improve conditions, and if their experience matched their expectations. Participants in vehicles, hikers, and cyclist reported their top motivations for visiting, and enjoyment of natural quiet and sounds of nature are ranked at a high level. In fact, 97% of survey respondents in vehicles reported that enjoying natural sound and the sounds of nature was important, while 99% of hikers thought it was important, and 82% of cyclist found it to be important. Survey participants were also asked about their expectations compared to their actual opportunities to enjoy natural quiet and sounds of nature. Vehicle survey respondents reported the following in relation to their opportunities to enjoy natural quiet and sounds of nature: a lot less than expected (1.4%), less than expected (3.3%), about as expected (69.5%), more than expected (19.5%), and a lot more than expected (6.2%). Hiker survey respondents reported the following: a lot less than expected (0.2%), less than expected (3.6%), about as expected

(54.2%), more than expected (29.6%), and a lot more than expected (12.5%). Cyclist survey respondents reported the following: a lot less than expected (0%), less than expected (10%), about as expected 76.6%), more than expected (13.3%), and a lot more than expected (0%). Commuters were also surveyed about their motivation within the Moose-Wilson corridor, and 97.4% of commuters (with a primary destination within the Moose-Wilson corridor) indicated that enjoying the natural quiet and sounds of nature was important. It is interesting to note that commuters that were not planning to stop in the Moose-Wilson corridor or even in Grand Teton National Park also indicated that enjoying natural quiet and sounds of nature was important (96.4%). Commuters with primary destinations within the Moose-Wilson corridor also responded about their expectation versus their actual opportunities to enjoy natural quiet and sounds of nature: a lot less than expected (2%), less than expected (3%), about as expected (57%), more than expected (23%), and a lot more than expected (15%).Commuters that were not planning to stop in the Moose-Wilson corridor or even in Grand Teton National Park reported the following: (1.6%), less than expected (3.2%), about as expected (74.3%), more than expected (18.2%), and a lot more than expected (2.7%) (Newman et al. 2015).

In addition to this recent visitor survey conducted in the Moose-Wilson corridor, a 2006 visitor survey was conducted in a heavily visited area near where Cascade Creek flows into Jenny Lake in Grand Teton National Park, and those findings could be considered when assessing similar soundscapes in the Moose-Wilson corridor. Results from the visitor surveys (n=306) indicated that loud people were rated as annoying and unacceptable, and were heard by a majority of visitors (53%). Loud groups were heard by 15% of respondents, while 15% stated that they heard loud adults, and 23% reported hearing loud children. Because these sounds induced negative perceptions and were heard by a majority of the visitors, managers may want to consider the effects of these types of sounds along the Moose-Wilson corridor as well. Sounds associated with technology (cell phones, cameras, radios/headsets, etc.) were heard by 27% of respondents. Both of these categories were ranked negatively in both the personal interpretation and acceptability categories, except camera, which was neutral in personal interpretation and positive in acceptability. These sounds could also be considered as priority for management consideration for soundscapes along the corridor. A majority of respondents heard water (97%), wind (73%), bird song (71%), bird chatter (61%), voices (92%), and walking sounds (91%). Although visitors rated all of these sounds as acceptable, only the natural sounds were rated as pleasing. Voices and walking sounds were given a neutral rating. This is important information as it provides empirical evidence that people appreciate hearing natural sounds. Moreover, visitors rated all natural sounds as acceptable, and all but one natural sound (insects, which received a neutral rating) were rated as being pleasing (Pilcher et al. 2007). It should be noted that the ever-present rush of Cascade Canyon masked the distant sounds of aircraft and road vehicles in this study.

Acoustical Monitoring

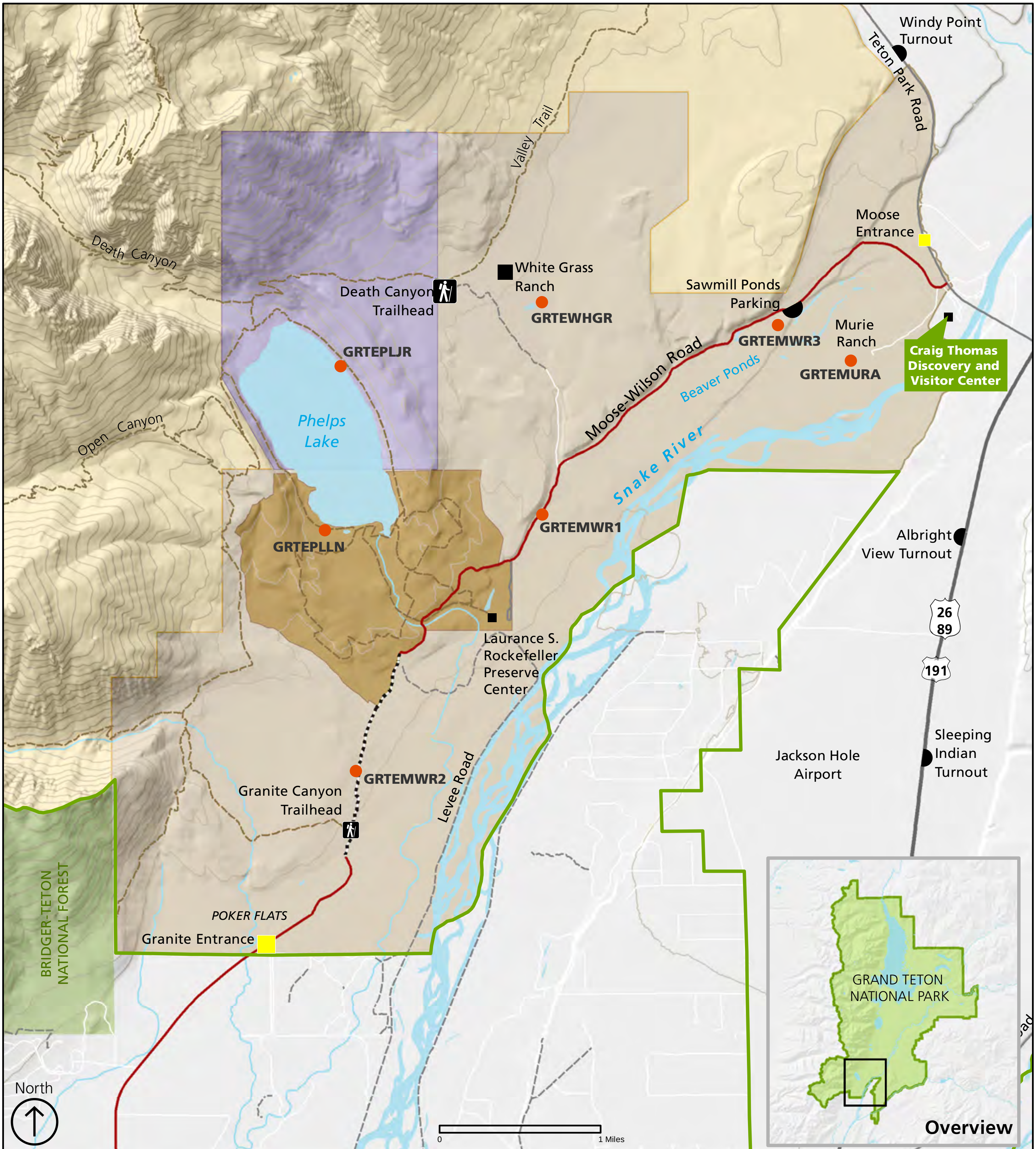
Acoustical monitoring provides a scientific basis for assessing the current status of acoustic resources within the Moose-Wilson corridor, identifying trends in resource conditions, quantifying impacts from other actions, assessing consistency with park management objectives and standards, and informing management decisions regarding desired future conditions.

Acoustical Monitoring Locations. Since 2003, acoustical data collection has occurred in the Moose-Wilson corridor at Murie Ranch (GRTEMURA), White Grass Ranch (GRTEWHGR) (map 17), and on the shores of Phelps Lake at two locations (north shore near “jump rock” (GRTEPLJR), and the south shore on the LSR Preserve (GRTEPLLN), and along Moose-Wilson Road at three different locations (near the Sawmill Ponds [GRTEMWR3], between Death Canyon Road and the LSR Preserve [GRTEMWR1], and near Granite Canyon Trailhead parking area [GRTEMWR2]). See the map of acoustical data collection locations below.

Acoustic Data Collection and Analysis. Data were collected at Murie Ranch (GRTEMURA) and near Granite Canyon Trailhead (GRTEMWR2) during the summer. The Phelps Lake systems operated during the fall. The other three sites (GRTEWHGR [White Grass Ranch], GRTEMWR1 [between LSR Preserve and Death Canyon Road], and GRTEMWR3 [Sawmill Ponds]) were in place throughout the year and captured the acoustic conditions in all seasons. The acoustic data used in this analysis were gathered using automated acoustical monitors, which collected continuous one-second sound levels and high-quality digital recordings. Sound level meters and microphones with windscreens were used to collect A-weighted wideband and 33 unweighted one-third octave band frequency (12.5-20,000 Hz) sound pressure levels each second for the sampling period.

Audibility— A systematic sampling scheme was used to select days for analyses. The recordings collected on the selected days were subsampled (10 seconds every 4 minutes) and were subsequently analyzed. Each sound was identified to as specific a source as possible (e.g., car, motor, nonnatural, or unknown). The percent time audible for each sound source was calculated using the combined 10-second samples as approximations of all periods of the day. For example, if a particular sound source was audible for half of the samples (180 of 360 samples) the percent time audible was calculated as 50%.


2006 Visitor Surveys Being Conducted Near Cascade Canyon and Jenny Lake



Legend

- Entrance
- Trailhead
- Point of Interest
- Acoustical Monitor
- Trails
- Streams

Moose-Wilson Road

- Paved
- Unpaved
- Park Boundary
- National Forest
- Water Body
- Project Area Boundary
- Laurance S. Rockefeller Preserve
- Recommended Wilderness
- Potential Wilderness

Moose-Wilson Corridor

Acoustical Monitoring Locations

Grand Teton National Park, Wyoming
National Park Service/U.S. Department of the Interior

Produced by Denver Service Center Planning Division, May 2015

FIGURE 21. THE WHITE GRASS SOUND MONITOR, THE MICROPHONE PROTECTED FROM CURIOUS ELK (FEBRUARY 2004–FEBRUARY 2005)

Sound Levels— Sound pressure level data (decibels) were summarized and common acoustic metrics (maximum, minimum, energy average [L_{eq}], L_{50} and L_{90}) were calculated. The percent exceedance metrics (L_x) are the sound levels (L), in decibels, exceeded *x%* of the time. For example, the L_{50} value represents the sound level exceed 50% of the measurement period; L_{50} is the same as the median. The L_{90} value represents the sound level exceeded 90% of the time during the measurement period. The L_{50} and L_{90} are useful measures of the natural sounds because in park situations, away from developed areas, they are less likely to be affected by human-caused sounds. Put another way, human-caused sounds in many park areas are likely to affect the measured sound levels for less than 50% of the time, and almost certainly for less than 90% of the time. However, near developed areas, the common sounds that could be present for more than 50% of the time include road traffic sounds.

Daily Sound Pictures— The one-third octave band frequency sound levels were plotted for each day. This created a daily picture that can readily be used to “see” the overall condition of the acoustic environment.

Findings from Acoustical Data Collection.

Audibility Results— The acoustic environment of the Moose-Wilson corridor is highly variable and changes from summer to winter. During the winter, the sounds of nature predominate, but are impacted by the distant noise of aircraft both related to an unrelated to the Jackson Hole Airport as well as road traffic from the plowed sections of Moose-

Wilson Road and the roads outside the Moose-Wilson corridor. During the summer, the sounds from traffic predominate near Moose-Wilson Road and along Death Canyon Road; sounds from hikers are frequent along the most visited trails on the LSR Preserve and Death Canyon. Aircraft are also frequently audible over most of the corridor.

Figures 22 through 25 demonstrate the percentage of time that various nonnatural and natural sounds were audible during each month, as collected by sound monitors placed along Moose-Wilson Road (GRTEMWR1) and at White Grass Ranch (GRTEWHGR). The x axis in these figures represents the month of the year, and the y axis shows the percentage of time that each sound was audible during that month. As documented near Moose-Wilson Road at sound monitor GRTEMWR1, figures 22 and 23 show both the stark difference in road traffic during the winter and summer and the prevalence of aircraft events during both seasons. As documented near White Grass Ranch at sound monitor GRTEWHGR, figure 24 demonstrates the nonnatural sounds that were audible each month of the year in 2004–05, and figure 25 shows the natural sounds that were audible. Even though Jackson Hole Airport aircraft activity is highest in the summer, other sounds including traffic, wind, birds, etc., are also louder so distant and quieter aircraft noise isn't audible. Conversely, in the winter the ambient sound levels are very low so distant and quiet aircraft can readily be heard. This likely explains the audibility shown in the figures.

Sound Levels—Exceedance levels (Lx) are metrics used to describe acoustical data. They represent the dBA exceeded x% of the time during the given measurement period (e.g., L_{90} is the dBA that has been exceeded 90% of the time). Figures 26 and27 report the L_{90}, L_{50}, and Leq, values for the a winter sample and a summer sample recorded by sound monitor GRTEMWR1 along Moose-Wilson Road. The x axis reveals the time of day on a 24 scale, and the y axis show the dBA that has been exceeded during specified hours of the day. Lmax is also shown, and represents the maximum sound level recorded during the specific hour shown on the graphic. For example, figure 27 shows that the loudest sound event between 5:00 a.m. and 6:00 a.m. was 60 dBA, and the L_{50} (statistical midpoint) measured between 5:00 a.m. and 6:00 a.m. was 34 dBA during July 2013.

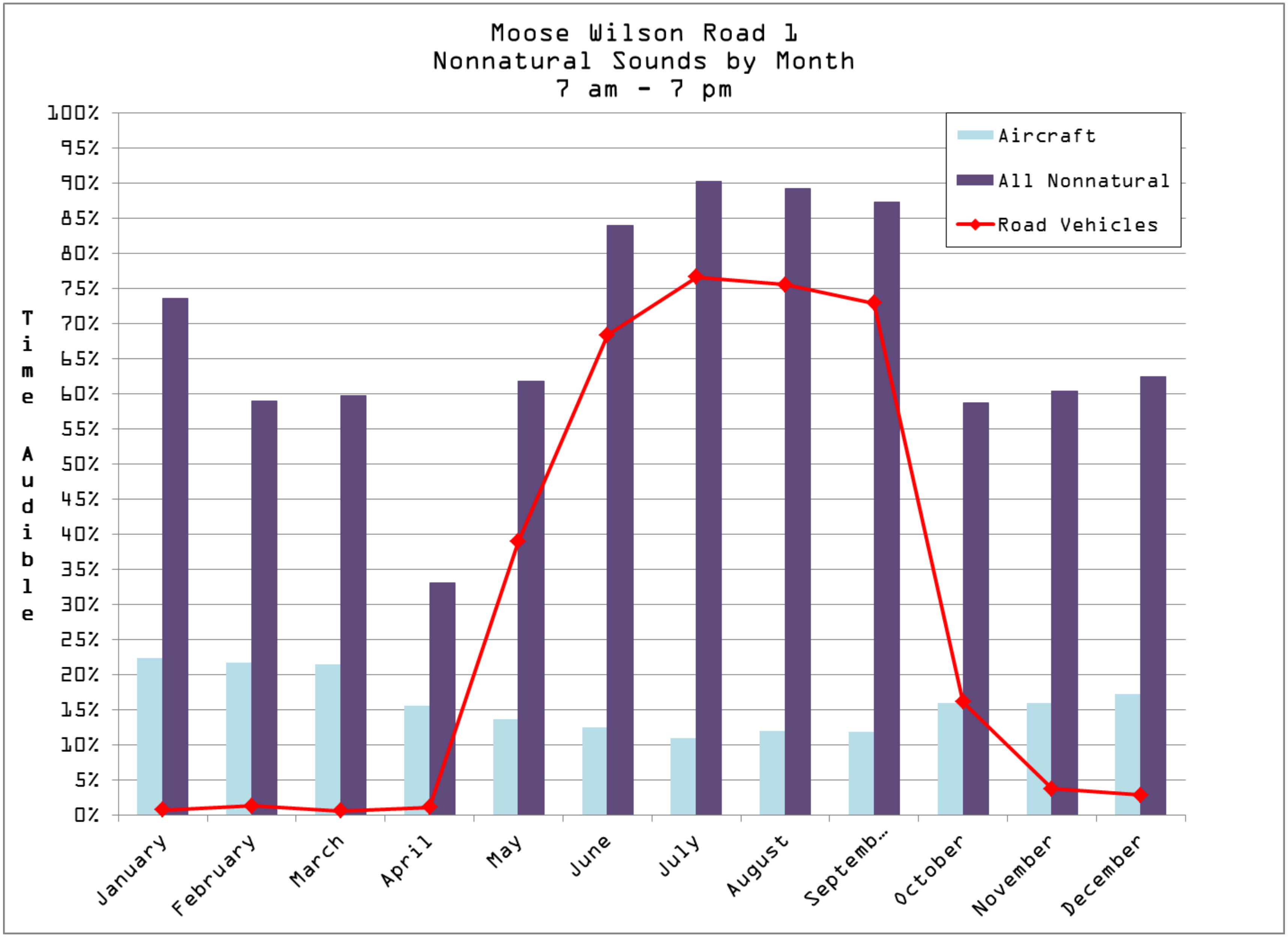


FIGURE 22. PERCENTAGE OF TIME THAT NONNATURAL SOUNDS WERE AUDIBLE AT SOUND MONITOR GRTEMWR1 IN 2013

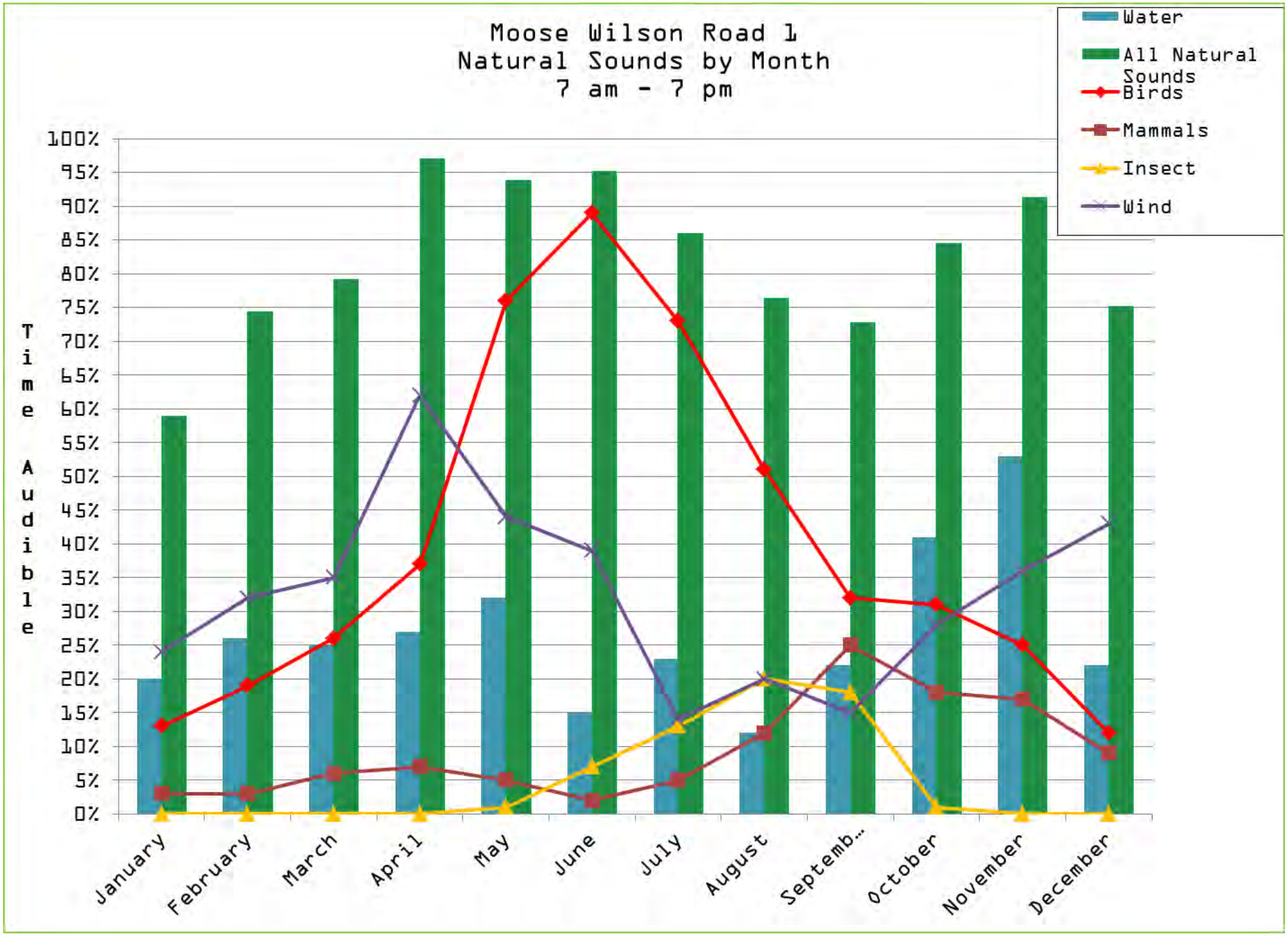


FIGURE 23. PERCENTAGE OF TIME THAT NATURAL SOUNDS WERE AUDIBLE AT SOUND MONITOR GRTEMWR1 IN 2013

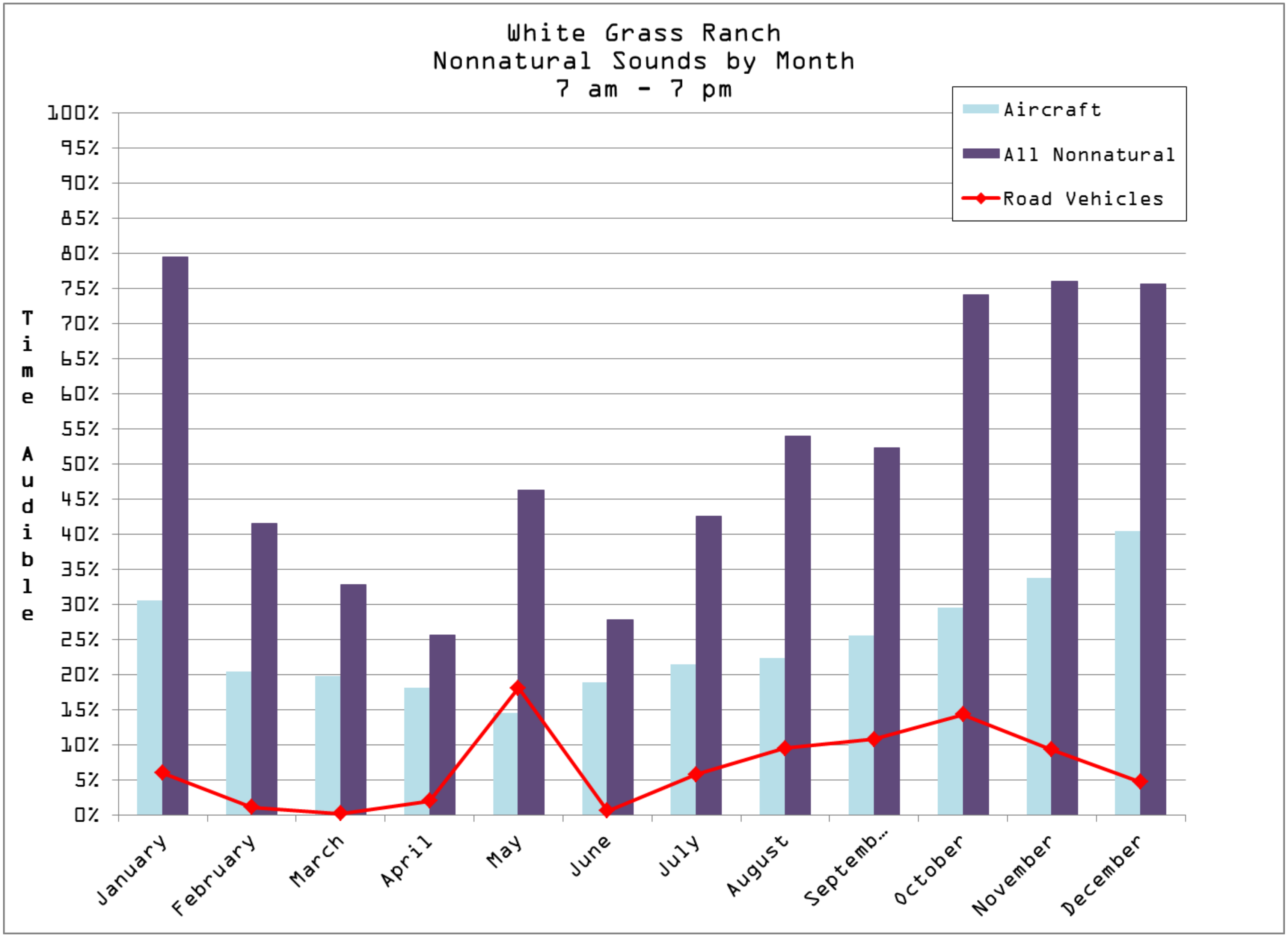


FIGURE 24. PERCENTAGE OF TIME THAT NONNATURAL SOUNDS WERE AUDIBLE AT SOUND MONITOR GRTEMWHGR IN 2004–05

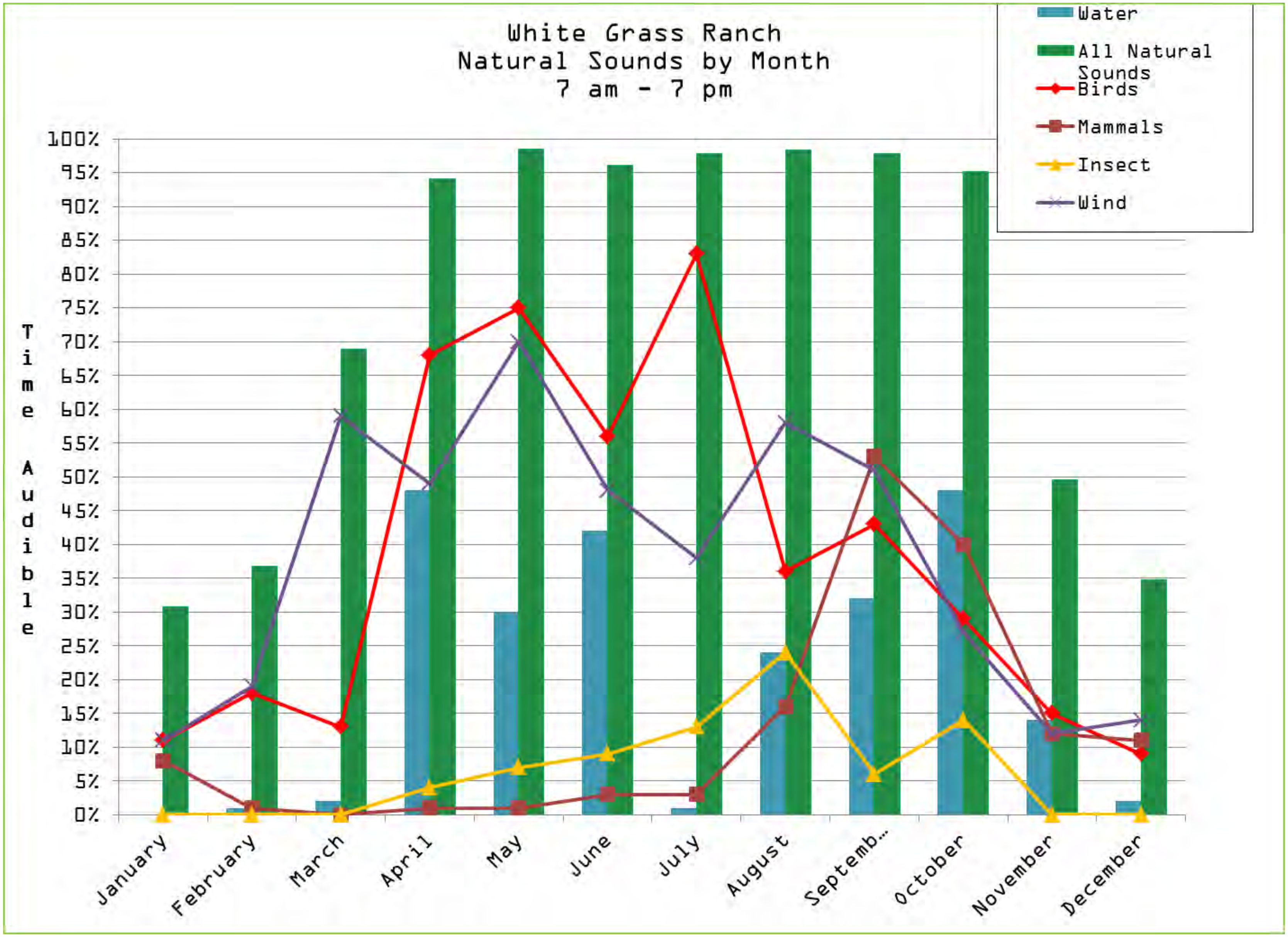


FIGURE 25. PERCENTAGE OF TIME THAT NATURAL SOUNDS WERE AUDIBLE AT SOUND MONITOR GRTEWHGR IN 2004-2005

Daily Sound Picture. Figure 26 and figure 27 display the audibility of sounds along Moose-Wilson Road on a typical winter day and a typical summer day. Sound pressure levels (SPL) from 24 hour samples are shown below. The one-third octave band frequency (33 bands from 12.5–20,000 Hz) sound levels were plotted for the 24-hour day. This created a daily picture that can readily be used to "see" the overall condition of the soundscape. Two hours of human-weighted SPL data is displayed on each of the 12 lines. Each line shows SPL values from low frequency 12.5 Hz (bottom of line) to high frequency 20 kHz (top of line).Values are represented with a color scale, where dark blue is quiet and orange/white is loud. As shown in figure 28, starting at 0448, many of the orange sound signatures represent the noise from aircraft on a typical winter day. As shown in figure 29, many of the orange sound signatures represent vehicles passing by on a typical summer day.

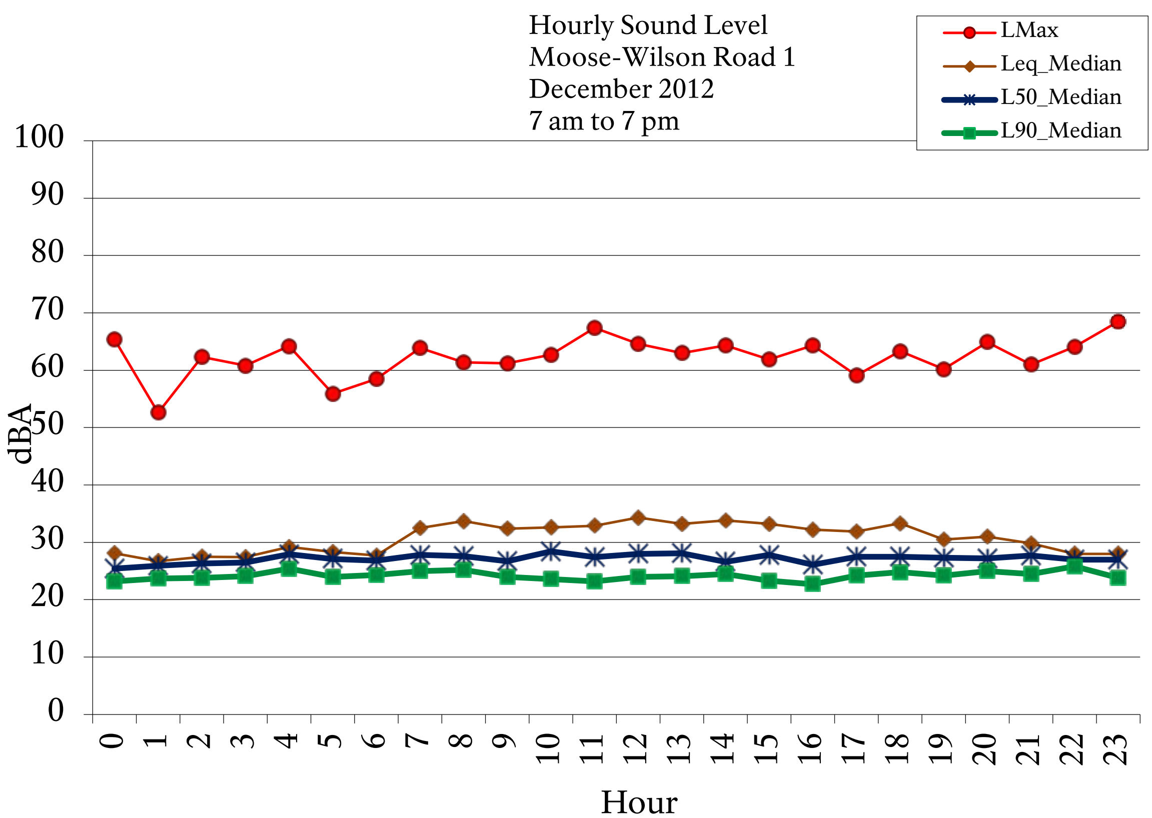


FIGURE 26. HOURLY SOUND LEVELS RECORDED AT SOUND MONITOR GRTEMWR1 IN DECEMBER 2012

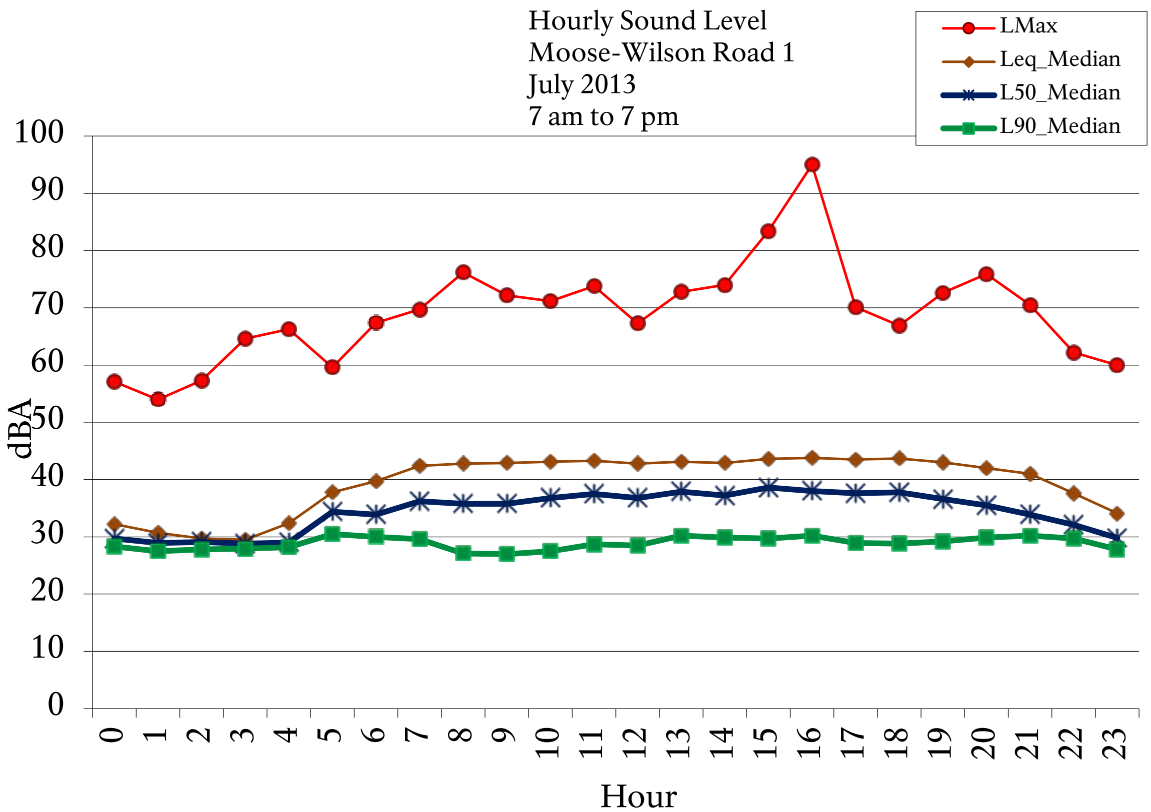


FIGURE 27. HOURLY SOUND LEVELS RECORDED AT SOUND MONITOR GRTEMWR1 IN JULY 2013

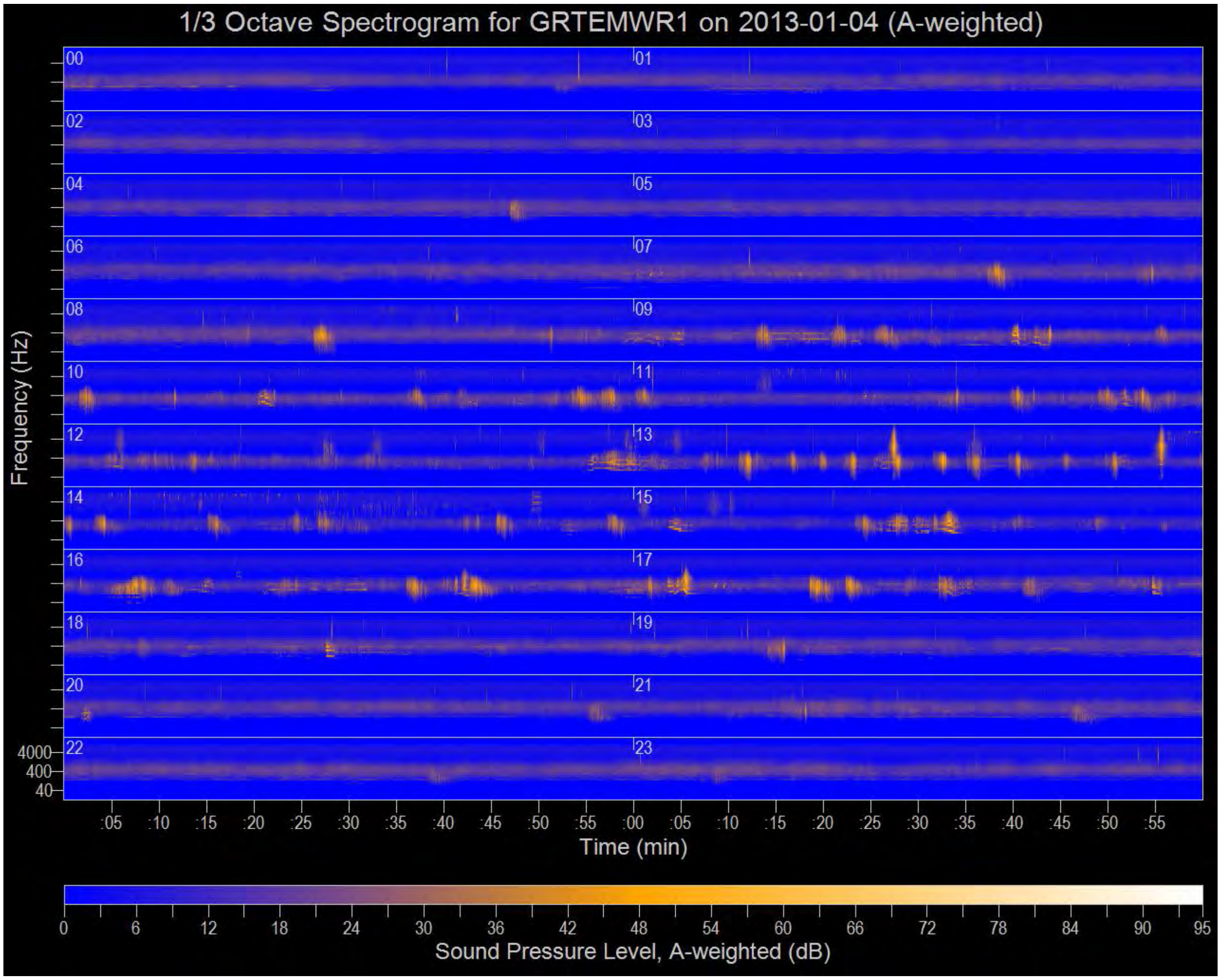


FIGURE 28. 24-HOUR SPECTROGRAM DEMONSTRATING SOUNDS 100 FEET FROM MOOSE-WILSON ROAD ON A TYPICAL WINTER DAY (SAMPLE FROM JANUARY 4, 2013). (NO ROAD VEHICLES ON UNPLOWED ROAD)

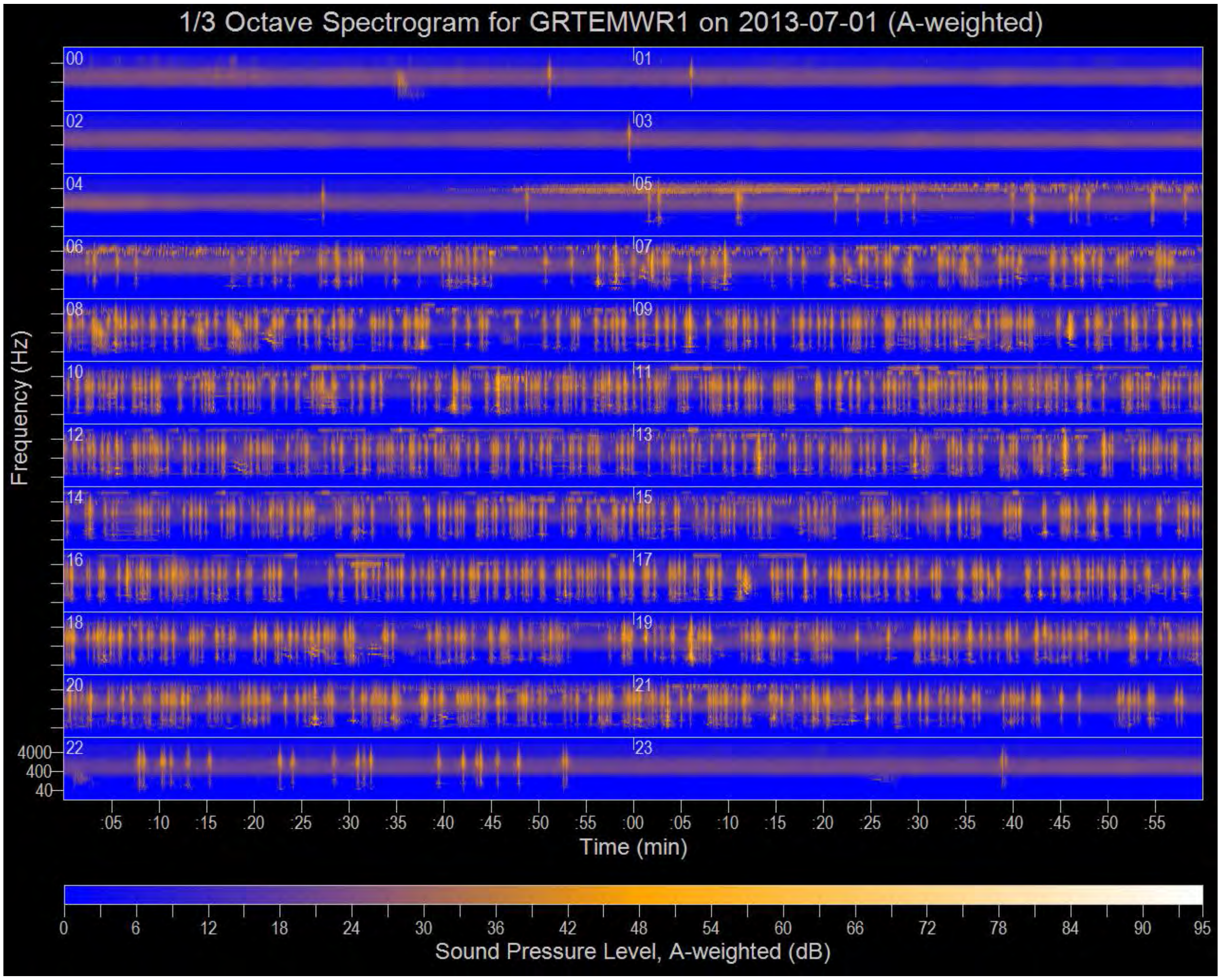


FIGURE 29. 24-HOUR SPECTROGRAM DEMONSTRATING SOUNDS 100 FEET FROM MOOSE-WILSON ROAD ON A TYPICAL SUMMER DAY (SAMPLE FROM JULY 1, 2013)

WILDERNESS

INTRODUCTION

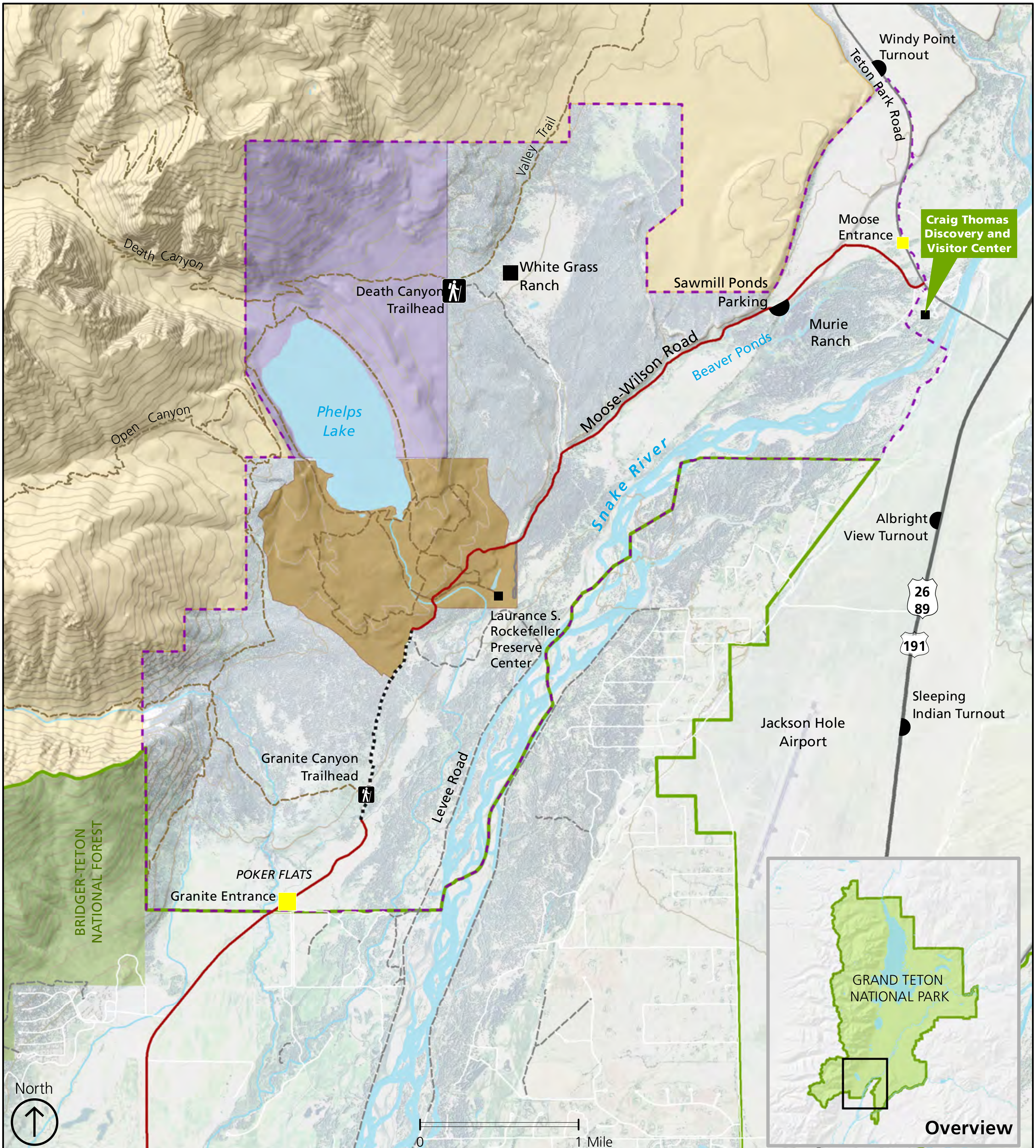
Wilderness, as defined in the Wilderness Act of 1964, is land "protected and managed so as to preserve its natural conditions and which generally appears to have been affected primary by the forces of nature, with the imprint of man's work substantially unnoticeable."

A portion of the Moose-Wilson corridor (1,650 acres) is classified as "potential wilderness," which refers to an eligible wilderness area that has been studied and proposed by the National Park Service as lands that qualify for a future wilderness designation pending the removal of temporary or incompatible conditions or uses. The incompatible use (motor boats on Phelps Lake, and grazing in some areas) no longer exists in this wilderness area and therefore would be considered part of designated wilderness on the date the wilderness is officially designated. Motorized and mechanized (i.e., bicycles) uses are prohibited in wilderness. The tract of potential wilderness within the Moose-Wilson corridor is bordered on the north and west by approximately 117,000 acres of "recommended wilderness," which is defined as an eligible wilderness area that has been studied and proposed by the National Park Service, recommended for wilderness designation by the Secretary to the President, and then transmitted by the president as his recommendation for wilderness designation to Congress. "Designated wilderness" is wilderness designated by Congress and signed by the president. Although Grand Teton National Park currently does not have designated wilderness, potential wilderness and recommended wilderness are managed by NPS policy the same as designated wilderness (NPS *Management Policies 2006*). Access points leading to the potential wilderness area of the corridor include the Death Canyon Trailhead and the Laurance S. Rockefeller Preserve Center. Trails passing through the area include Death Canyon Trail, Open Canyon Trail, and the trails around Phelps Lake. Please see the following map of the potential wilderness within the Moose-Wilson corridor.

WILDERNESS CHARACTER

Managing potential wilderness in the Moose-Wilson corridor begins by clearly articulating the five qualities of wilderness character so these qualities can be protected in accordance with the mandate of the Wilderness Act. These qualities include (1) untrammeled, (2) natural, (3) undeveloped, (4) solitude or primitive and unconfined recreation, and (5) other features and values—which together are referred to as wilderness character.

Principle tools for understanding the qualities of wilderness character include *Keeping it Wild: An Interagency Strategy to Monitor Trends in Wilderness Character Across the National Wilderness Preservation System* and *Keeping it Wild in the National Park Service: A User Guide to Integrating Wilderness Character and Park Planning, Management, and Monitoring* (hereafter *Keeping it Wild*) (USDA 2008; NPS 2014). This guidance interprets the congressional intent of the concept of wilderness character in the 1964 Wilderness Act to identify five qualities that are relevant and practical to wilderness stewardship. The definition for each wilderness quality and how it is relevant to the affected environment is delineated in the following sections. Additionally, some aspects of the five wilderness qualities are described in other sections of the "Affected Environment" section. For example, the natural quality of wilderness is described more fully in the natural resource section of the affected environment, and solitude is discussed as an aspect of visitor use and experience.



Legend

- Entrance
- Trailhead
- Point of Interest
- Trails

Moose-Wilson Road

- Paved
- Unpaved
- Streams
- Water Body

- Recommended Wilderness
- Potential Wilderness
- National Forest
- Park Boundary
- Project Area Boundary
- Laurance S. Rockefeller Preserve

Produced by Denver Service Center Planning Division, November 2013

Moose-Wilson Corridor

Wilderness

Grand Teton National Park, Wyoming
National Park Service/U.S. Department of the Interior

Natural

Wilderness ecological systems are substantially free from the effects of modern civilization. This quality is preserved or improved, for example, by controlling or removing nonnative species or restoring ecological processes. This quality is degraded by the loss of native species, occurrence of nonnative species, alteration of ecological processes such as water flow or fire regimes, the effects of climate change, and many others.

The recommended wilderness immediately adjacent to the Moose-Wilson corridor contains Grand Teton National Park's iconic peaks and steep canyons, which provide refuge for many species of native wildlife. This animal diversity includes black bear, grizzly bear, bighorn sheep, wolverine, and pika. The extreme topography in a relatively small geographic area leads to diverse vegetation communities ranging from high-elevation riparian streams and small lakes and rocky talus and scree slopes to alpine and subalpine habitats. The potential wilderness within the Moose-Wilson corridor contains a large portion of Phelps Lake (a large, natural, high-elevation glacial lake situated at the base of Death Canyon).

Within both of these wilderness areas natural predator-prey interactions reflect the health of the ecosystem. The lakes and streams are free-flowing and include outstanding natural resource waters. Natural soundscapes include sounds associated with predator avoidance, prey detection, mating, and other behavioral interactions; biological sounds such as birds singing, fish splashing, and elk bugling; and physical sounds such as waterfalls, rapids, wind in vegetation, and thunder.

Untrammeled

Wilderness is essentially unhindered and free from the intentional actions of modern human control or manipulation. This quality is influenced by any activity or action that intentionally controls or manipulates the components or processes of ecological systems inside wilderness. It is supported or preserved when such management actions are not taken. It is degraded when such management actions are taken, even when these actions are intended to protect resources, such as spraying herbicides to eradicate or control nonnative species or reducing fuel accumulation from decades of fire exclusion.

The recommended and potential wilderness areas in and adjacent to the Moose-Wilson corridor have been affected primarily by the forces of nature. Natural occurrences, such as fire, landslides, flooding, drought, and insect infestations, are allowed to influence the wilderness landscape. These wilderness areas contain free-flowing lakes and streams, naturally changing vegetation communities, limited human settlement in the form of backcountry cabins, no known mining or logging occurrences, and no avalanche control measures.

Solitude or a Primitive and Unconfined Type of Recreation

Wilderness provides outstanding opportunities for solitude or primitive and unconfined recreation. This quality is primarily about the opportunity for people to experience wilderness and is influenced by physical settings that affect these opportunities. This quality is preserved or improved by management actions that reduce visitor encounters, signs of modern civilization inside wilderness, agency-provided recreation facilities, and management restrictions on visitor behavior.

The unique and special qualities of solitude or a primitive and unconfined type of recreation within the recommended and potential wilderness areas in the Moose-Wilson corridor include self-reliance and choosing where to explore, listening to the sounds of nature, and the opportunity to explore wilderness without observing large numbers of other visitors, structures, and installations. This quality of discovering wilderness solitude expands and increases the sense of adventure and self-reliance. The level of risk heightens as the explorer moves deeper into the wilderness away from civilization. This "graduated" level of solitude also increases during the late fall, winter, and early spring months when Moose-Wilson Road is closed to vehicular traffic and access to wilderness is more challenging.

The unconfined type of recreation also includes the opportunity to explore areas, including new climbing routes, away from designated trails; the opportunity to self-reflect at the shores of numerous alpine lakes and atop the Teton peaks; and the opportunity for many visitors of varying abilities to explore wilderness, even those areas visited by many such as Phelps Lake.

Undeveloped

Wilderness retains its primeval character and influence and is essentially without permanent improvements or modern human occupation. This quality is influenced by what are commonly called the Wilderness Act "section 4(c) prohibited uses" or "nonconforming" uses, which are the presence of modern structures, installations, habitations, and the use of motor vehicles, motorized equipment, or mechanical transport. This quality is preserved by the absence of structures and installations and refraining from these prohibited uses. It is degraded by the presence of structures and by nonconforming uses, whether by the agency for administrative purposes, by others authorized by the agency, or unauthorized uses by the public.

The undeveloped qualities of the recommended and potential wilderness in and adjacent to the Moose-Wilson corridor include a designated trail system. The trail system, along with other minor structures and installations, such as backcountry patrol cabins, are limited to the minimum necessary to preserve wilderness character.

This undeveloped quality of wilderness plays an important role in the establishment of Grand Teton National Park as part of the "crucible for conservation" story. The park was primarily established because overdevelopment in the Jackson Hole Valley in the beginning of the 20th century was affecting the character of the Teton Range, the foothills leading up to the mountains, and the valley floor. This emphasis of land preservation in Grand Teton and other national parks throughout the country eventually expanded to the need for wilderness preservation in Grand Teton and other spectacular areas.

Other Features of Value

Wilderness preserves other tangible features that are of scientific, educational, scenic, or historical value. This quality is based on the last clause of section 2(c) of the Wilderness Act, which states that a wilderness "may also contain ecological, geological, or other features of scientific, educational, scenic, or historical value." This quality captures important elements of wilderness that may not be included in the other four qualities, such as cultural or paleontological resources. This quality is preserved or improved when these resources are preserved and their loss or impacts on such features degrade this quality of wilderness character.

Other features of value of the recommended and potential wilderness in and adjacent to the Moose-Wilson corridor include a unique scenic perspective of the iconic Teton peaks. Numerous other noteworthy peaks provide classic mountain viewscapes ranging from north to south—Wister, Buck, Static Peak, Prospectors Mountain, and Mount Hunt, with glimpses of Death, Open, and Granite Canyons and access to Phelps Lake, one of the largest natural high-elevation glacial lakes in the area.

VISITOR USE AND EXPERIENCE

INTRODUCTION

This section describes elements of visitor use and experience in the Moose-Wilson corridor that may be affected by the management alternatives. The description of these elements is based on the best professional judgment of National Park Service staff, public scoping for this plan, and both past and recent research efforts.

The following visitor use and experience elements will be discussed:

- the diversity and quality of experiences and opportunities available in the Moose-Wilson corridor
- opportunities for visitors to learn about and understand the important resources and stories within the corridor
- providing visitor safety within the corridor

Information about the above elements correspond to subtopics analyzed in "Chapter 4: Environmental Consequences" and the type and level of impacts addressed in chapter 4.

OVERVIEW OF VISITOR USE AND EXPERIENCE IN THE MOOSE-WILSON CORRIDOR

The visitor experience within the Moose-Wilson corridor is unlike anything else a visitor can find within Grand Teton National Park. This outstanding natural environment is truly an experience of its own as a unique concentration and diversity of plants and animals are found within this relatively small portion of Grand Teton National Park. No other portion of the park provides visitors the opportunity to experience wetland, sagebrush, forest, montane, and alpine communities so close together . The Moose-Wilson corridor is a spectacular setting in a quality, intact natural environment. Visitors have extraordinary opportunities to observe wildlife, experience solitude, explore wilderness, appreciate dark night skies, and enjoy the natural quiet and sounds that come only from nature. The rustic, narrow, and winding character of the road allows visitors to slow down and make a connection with nature. Moose-Wilson Road also provides a gateway to many unique park experiences. Whether hiking to Phelps Lake, accessing climbing routes and wilderness areas through Granite and Death Canyons, exploring the historic districts of White Grass Dude Ranch and Murie Ranch, or discovering the Laurance S. Rockefeller Preserve, visitors to the Moose-Wilson corridor have many ways to enjoy one of the most scenic and rustic road corridors found in any national park.

The Moose-Wilson corridor receives less visitation compared to most other areas of Grand Teton National Park. Many visitors to the corridor are repeat visitors that have familiarity with the area and the destinations within the corridor. The proximity to nearby residential areas makes it a popular area with locals. The outstanding natural environment, along with the unique recreational and educational opportunities found throughout the corridor, also make this area a draw for first time visitors who come from around the country and world alike.

A series of recent visitor surveys and visitor use studies have been conducted for the Moose-Wilson corridor. These studies aid the National Park Service in understanding how visitors use and experience the corridor. Although the surveys and visitor studies represent a snapshot in time, they provide useful insights and patterns into the characteristics of those visiting the corridor. A description of these studies and associated results follows. Results from these studies have been incorporated into the discussion below.

A comprehensive visitor transportation study conducted by Utah State University focused on the overall patterns and levels of visitor use in the Moose-Wilson corridor. The study identified the location and extent of visitor-created impacts in the corridor and the kinds of vehicle use. Data collection efforts took place during the summer/fall of 2013 and 2014 as part of the comprehensive study. This document focuses on the data collected in 2013, which was the year that this EIS process began and public scoping was completed. The major trends of the 2013 data collection were confirmed by the 2014 study (Monz 2014a; Monz 2015). A variety of methods were used to collect data at sample locations during July, August, September, and October, including trail and road counters, GPS tracking, and personal observation.

A 2014 visitor survey conducted by Pennsylvania State University during the summer of 2014 included data collection at four locations along the corridor: the Granite entrance of Moose-Wilson Road, the Laurance S. Rockefeller Preserve, the Death Canyon Trailhead, and the Moose entrance of Moose-Wilson Road (Newman et al.2015). The focus of this study was about current visitor use at the park as well as visitor motivations and expectations for their visits to the corridor. Three types of visitor groups (visitors traveling by vehicle [vehicle], bicycle [cyclist], and visitors on foot [hiker]), were asked to participate; 1,705 pre-experience and a post-experience surveys were completed. Key results from this survey can be found below in this chapter. Results are frequently reported for each of the three identified user groups (vehicle, cyclist, and hiker).

DIVERSITY AND QUALITY OF VISITOR EXPERIENCE AND OPPORTUNITIES

Visitor Activities and Characteristics

The Moose-Wilson corridor provides outstanding opportunities for a range of recreational activities, which vary by season. The range of recreational activities include viewing or photographing wildlife and scenery, scenic driving, bicycling, and cross-country skiing. Within the broader corridor area additional recreational activities can be accessed including hiking, walking, backpacking, climbing, horseback riding, fishing, swimming, boating, rafting, floating, cross-country skiing, backcountry skiing, and snowshoeing. Educational and interpretive activities are also available within the corridor; please see the "Opportunities for Orientation, Education, and Interpretation" section below.

Visitors come from a variety of places and in a variety of groups ranging from small groups of friends or family to large commercial groups. The 2014 summer visitor survey shows that most visitors came to the corridor in small groups. Overall, the average size of groups visiting was 2.23, consisting of both adults and children. Of those who visited the corridor, 11% were part of a larger commercial, educational, or other organized group. Visitors reported an average age of 50 years old from all three visitor groups. The majority of visitors (95.83%) reported that they were from the United States. Of those from the United States, 14.5% of those driving in the corridor, 56.4% of cyclists, and 14.2% of hikers were from the local Teton area. Visitors came from 27 foreign countries and many of the non-US visitors were from the United Kingdom (Newman et al. 2015).

People from across the United States and the world cherish the Moose-Wilson corridor as a unique and important place. During initial public scoping for this plan, individuals from 37 US states described what they valued most about the corridor. Corridor activities and attractions were frequently mentioned as what individuals value about visiting the corridor;

particularly the pristine scenery, viewing wildlife in their natural habitat, and the historic character of the corridor. When asked to describe what they hope will continue about the corridor in the future, the public again commonly mentioned maintaining the available activities. Individuals commonly noted that they hope to see continued maintenance of the historic character of the road, management of vehicle speeds and congestion, and two-way vehicular access carried into the future. Individuals also noted that in the future they would like to see realignment of the road and for bicycles to be accommodated in the corridor (a separate multiuse pathway, a paved road, and a bike lane were all mentioned).

Visitors who were surveyed in 2014 prioritized many of the same activities that the public described as being valued during public scoping efforts for this plan. The 2014 survey provided visitors with a list of 14 activities and asked them which they participated in. Results indicated that while visitors came to the corridor to primarily participate in the activity related to their mode of transportation (hiking, vehicle, bicycle) they also participated in other activities at the same time such as generally viewing scenery and viewing wildlife (Newman et al. 2015). For a full list of the activities that visitors reported participating in and a breakdown of how often each user group said they participated in that activity see figure 30. When asked what problems they encountered during their visit to the corridor the majority of visitors said they did not experience problems. However, cyclists reported issues of safety during their visit (see 'Visitor Safety' section below).

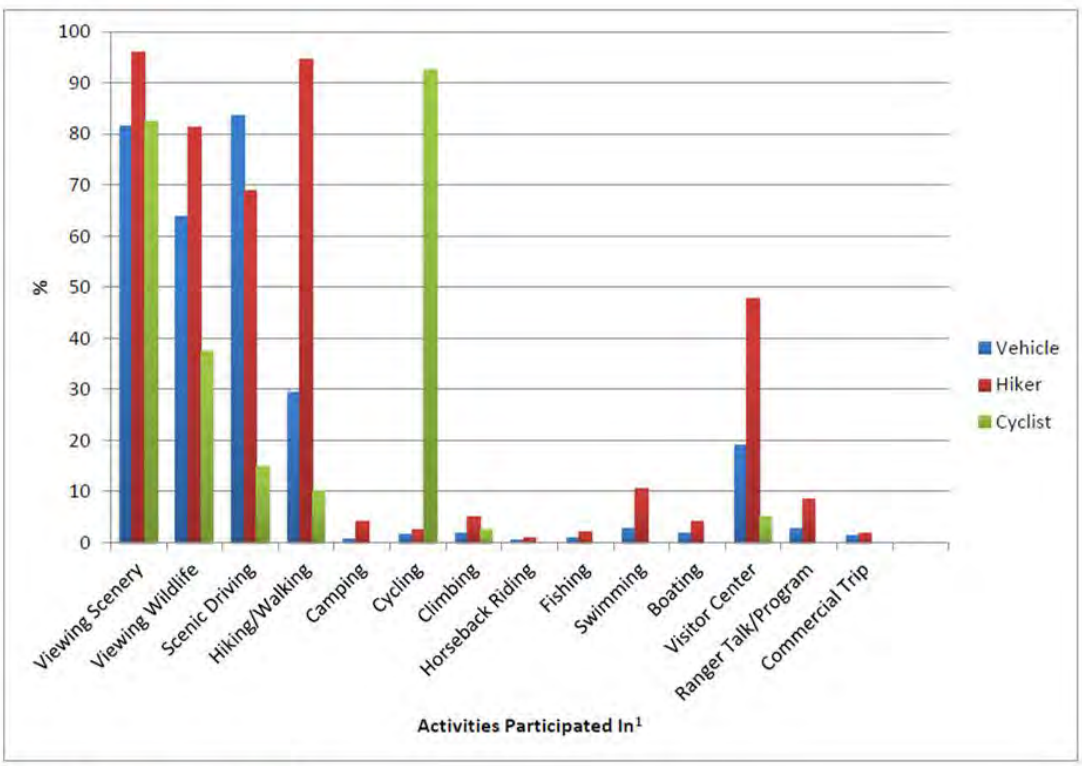


Figure 8: Activities participated in
[1]Total vehicles = 798, total hikers = 621, and total cyclists = 40

FIGURE 30. PRIMARY ACTIVITY BY USER GROUP FROM 2014 VISITOR SURVEY

SUMMER USE

Popularity of the Moose-Wilson corridor has increased over time. The scenic beauty and variety of activities found within the corridor draw many visitors. In addition to the corridor itself attracting visitors, a variety of factors have influenced this general increase in use. Viewing wildlife is a popular activity that the corridor is known for, particularly since grizzly bears have become present in the area since 2008 and are often seen in the corridor during the fall. An increase in commercial traffic, including taxi and wildlife expedition services has also been noticed in recent years. New development in the Teton Village area has provided alternative lodging options outside the town of Jackson. The Moose-Wilson corridor also provides the nearest access to Grand Teton National Park from Teton Village, Wilson, and other locations on the west bank of the Snake River.

As will be discussed below, visitors come to the Moose-Wilson corridor to take part in a variety of activities. While in the corridor, visitors can find activities at a number of destinations as well as taking a scenic drive through the corridor. According to the 2013 visitor transportation study, the destinations visitors most frequently stop at included Sawmill Ponds Overlook, LSR Preserve Center, and Death Canyon Trailhead (Monz 2014a). According to the same study, on average, 54% of visitors drive straight through the corridor without stopping and spend less than 30 minutes in the corridor on a daily basis during the 2013 summer season. For more information on how visitors travel in the corridor see the “Traffic and Transportation” section of this chapter.

As visitors make their way through the corridor or reach their destinations within it, they may encounter wildlife jams. As visitors stop or slow their vehicles to view wildlife, traffic jams frequently occur and the road becomes blocked in both directions. The narrow nature of the road combined with limited turnouts and the presence of wildlife cause these wildlife traffic jams to occur on a frequent basis from spring to fall. NPS staff manages these wildlife jams, when possible, to ensure visitor safety and direct traffic.

Given the popularity of the corridor in the summer, parking lots and turnout areas are in high demand and may frequently be full. Visitors will often park on roadway shoulders or at other unauthorized areas to be able to reach their desired destination in the corridor. In 2014 visitor surveys conducted by Penn State University, 21.3% of hikers reported the *amount of available parking at the trailheads* to be a “problem” (Newman et al. 2014).

The 2013 summer visitor study found that visitors parking in unauthorized areas occurred regularly throughout the corridor, particularly along Death Canyon Road. While visitors did not report parking as being an issue during the 2014 survey, the current parking availability and conditions influence the amount of visitors who can park in the corridor. Due to rough dirt roads and parking conditions along Death Canyon Road, four-wheel-drive vehicles are recommended. Along the unpaved section of Moose-Wilson Road, pot holes and washboard conditions can occur, particularly after periods of rain.

Bicycling is a popular activity in the local community and increasingly within the park due to the development of a system of multiuse pathways. However, bicycle use currently accounts for approximately 2%–3% of the visitation within the Moose-Wilson corridor. Many of the comments received during scoping and public review of preliminary alternatives identified the Moose-Wilson corridor as an area where a multiuse pathway would provide a connection to other pathways, both within and outside the park, a so-called “Grand Loop” connecting the town of Jackson with Moose and Teton Village.

The 2013 visitor transportation study documented the popularity of bicycling in the park on existing pathways. The study found that the highest average use of the bike path near the Snake River bridge in Moose was during August 1–15 with an estimated 569 visitors per day; 444 visitors could be found on an average weekend along the bike path during the summer months of 2013. The study found that many visitors who ride the Moose-Wilson corridor itself tend to ride for an average of 34 minutes in July, and closer to 50 minutes in August. Bicycle riders, like vehicle drivers, can enter the corridor from either the northbound or southbound entrance. The majority of bicyclists, 55%, were traveling southbound in the corridor, with 29% traveling northbound (Monz 2014a; Monz 2015).

The 2013 transportation study also looked at how and where visitors hike and walk on the many trails available in the corridor. During the study, visitors volunteered to take GPS units with them on their hikes. The study showed that the most frequently used trails were Valley Trail, Phelps Lake area, and Phelps Lake Overlook. Visitors spent approximately 2 hours and 30 minutes hiking in the Moose-Wilson corridor. While many visitors hike or walk for part of a day on trails, other hikers choose to stay the night. During the 2013 study, a total of 297 visitors began their overnight backcountry stay from the Granite Canyon Trailhead and 664 visitors started from the Death Canyon Trailhead (Monz 2014a, Monz 2015).

The amount of people traveling to and through the corridor has increased over time (see the “Traffic Volume” topic within the “Traffic and Transportation” section in this chapter). Increased use of the corridor creates a situation where many people are simultaneously using a narrow and relatively small amount of space. Frustrations over overlapping and sometimes competing visitor activities and a limited amount of parking have risen with the popularity of the corridor. During public scoping, the belief that the high levels of use and congestion in the corridor is an important issue that needs to be addressed was often heard. Problems identified by visitors traveling Moose-Wilson Road by vehicle most often were the road itself or a lack of wildlife viewing opportunities, or they reported that there were no problems. Cyclists who were part of the same survey also reported that the road itself was a problem along with traffic and stating that there were no problems. Hikers in the survey reported problems dealt with weather or a lack of wildlife viewing opportunities as well as stating they did not encounter problems during their visit (Newman et al. 2015).

WINTER USE

From November 1 until early/mid-May, Moose-Wilson Road is closed to motor vehicle through-traffic. However, the road is open at the south end from the Granite Canyon Entrance Station to the Granite Canyon Trailhead, and on the north end between Moose and the Death Canyon Road junction. This allows access to key areas of the corridor for nonmotorized activities such as cross-country skiing, snowshoeing, backcountry skiing, wildlife viewing, and other forms of winter recreation that provide visitors the opportunity to experience the peaceful quiet of winter while observing wildlife in their winter habitats.

According to the 2014 winter study, traffic counters recorded an average of 84 vehicles per day near the Granite Canyon Trailhead, with higher numbers (average of 115 vehicles) occurring on weekends. Somewhat lower numbers were recorded at the Death Canyon Road junction, with 58 vehicles per day on average, and 63 on weekends. The survey showed that the greatest number of visitors went to Death Canyon Road during their backcountry ski trips. Other popular sites included Moose-Wilson Road at Death Canyon Gate, Moose-Wilson Road at Granite Canyon Gate, and Phelps Lake UTV access road for cross-country skiers. Additionally, Granite Canyon Trailhead was the most popular winter recreation site for snowshoeing (Monz 2014b). Once visitors reach a trailhead road junction, the options of where they go on their skis, snowshoes, horses, etc., is almost limitless. During the 2014 study, visitors volunteered to take GPS units with them during their trips. Figure 31 shows on average how many visitors went to destinations in the corridor during the winter of 2013. In order to know what specific activities visitors participate in during the winter season, the survey used stop motion cameras to identify how visitors recreate in the often snow covered corridor. Most frequently observed activities included cross-country skiing, backcountry skiing, snowshoeing, and hiking and walking.

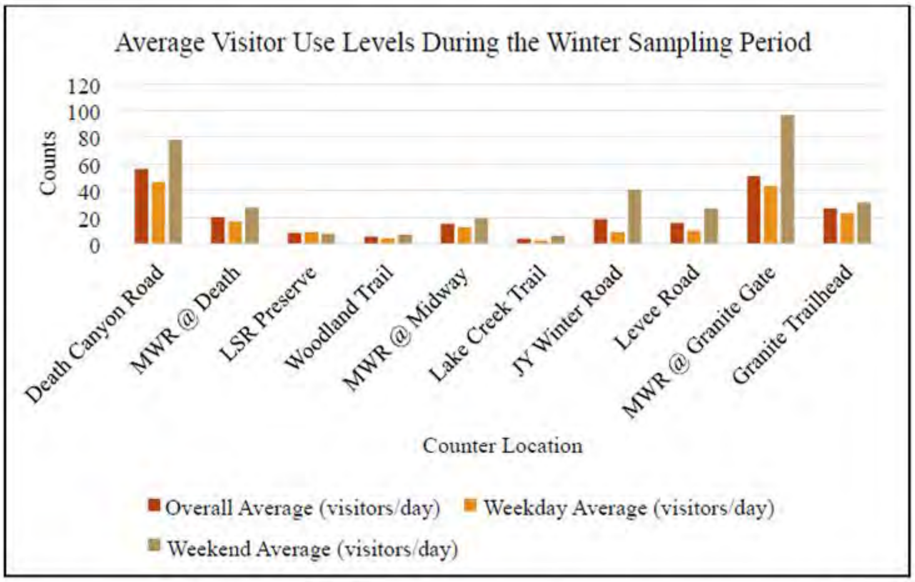


Figure 2.2: Average use levels (corrected with weight values) from all infrared trail counters placed in the Moose-Wilson Road corridor during the winter sampling period.

FIGURE 31. AVERAGE WINTER USE LEVELS IN THE MOOSE-WILSON CORRIDOR

There are many points of interest within the corridor. The table below briefly describes the main points of interest including the four key locations that have been analyzed as part of this plan to determine an appropriate visitor capacity. The visitor capacity is part of the visitor use management framework developed for this plan. More information on how visitor use management is being undertaken in this plan can be found in chapter 4 in the "Visitor Use and Experience" section.

TABLE 14. MAIN POINTS OF INTEREST IN THE MOOSE-WILSON CORRIDOR

Point of Interest	General Description
Murie Ranch	The Murie Ranch Historic District is currently operated by The Murie Center, a nonprofit park partner. The district largely centers on the legacy of conservationists Olaus and Margaret Murie and Adolph Murie and his wife Louise. The Murie Ranch was designated a national historic landmark in 2006. The designation formally recognizes the contributions of the Murie families to wildlife management and biological science as well as to the 20th century conservation movement. Depending on the season, visitors can take a tour of select ranch buildings and/or go on a guided nature walk. Visitors can also hike, snowshoe, or cross-country ski on the historic trails that are open year-round. The Murie Ranch is presently

TABLE 14. MAIN POINTS OF INTEREST IN THE MOOSE-WILSON CORRIDOR

Point of Interest	General Description
	managed through a general agreement with the Murie Center, a nonprofit organization (The Murie Center 2013).
Sawmill Ponds Overlook	This is the first formal parking area available for visitors entering Moose-Wilson Road from the north. A wildlife viewing area of a wetland is available at the overlook. During the fall, visitors can listen for elk bugling from this viewing area as well. The overlook acts as a turnaround area for vehicles that exceed the vehicle size limit. An interpretive wayside is available and ranger programs are held at this location during the month of September.
White Grass Ranch	The White Grass Ranch depicts the hard work and ingenuity of dude wranglers in the West. Opened as a dude ranch in 1919, the ranch has been owned by a variety of individuals before becoming part of Grand Teton National Park. In 2005, the National Park Service partnered with the National Trust for Historic Preservation to begin stabilizing and restoring White Grass Ranch. The ranch currently serves as a facility for training craftsmen in the art of preserving historic western structures and is slated to be completed in 2016. The site is currently under construction and buildings are therefore not open to the public. A large interpretive sign is available at a turnout on Death Canyon Road and is connected to the buildings by an unmaintained footpath.
Death Canyon Trailhead	The Death Canyon Trailhead is accessed from a 0.25-mile-long paved road that connects to 1.0 mile of an unpaved and rugged dirt road that recommends four-wheel-drive vehicles to reach. From the trailhead, numerous trails lead visitors into the foothills of the Teton Range. The trailhead acts as the main way to access wilderness from the Moose-Wilson corridor. Connecting trails to Phelps Lake and the Laurance S. Rockefeller Preserve can be accessed from the Death Canyon Trailhead.
Lower Death Canyon Trailhead	During the winter season, the junction of Death Canyon Road and Moose-Wilson Road serves as a parking area for winter recreationists. Moose-Wilson Road is plowed from Moose to this junction. From this site cross-country skiing, backcountry skiing, snowshoeing, and other winter activities can be undertaken.
Laurance S. Rockefeller Preserve Center	In 2007, Laurance S. Rockefeller donated the JY Ranch to the National Park Service, and the Laurance S. Rockefeller Preserve Center was opened to the public in June 2008. Located on 1,106 acres in Grand Teton National Park, the LSR Preserve is a model public-private partnership for conservation stewardship that builds visitor's reverence and responsibility for the natural world through personal experiences and interpretive programs. The LSR Preserve emphasizes the visitor experience to illustrate the power of nature to restore the human spirit. A Platinum-level Lead in Energy and Environment Design (LEED) certified interpretive center offers visitors a distinctive opportunity to learn about the natural world. Visual, auditory, and tactile explorations, engage visitors in an accessible and effective manner. A variety of interpretive programs, including ranger-led talks and walks can be found at the LSR Preserve. From its backdoor, trails lead visitors to incredible mountain, lake, and forest views.
Granite Canyon Trailhead	The Granite Canyon Trailhead is directly off Moose-Wilson Road near the southern end of the corridor. The Granite Canyon Trail connects to other trails that lead to the Bridger-Teton National Forest, Phelps Lake, and the LSR Preserve.

Visitor Experience

Compared to other popular areas in Grand Teton National Park, the Moose-Wilson corridor offers a slower paced, peaceful experience with opportunities for visitors to find quiet and solitude. There are fewer facilities and support services within the corridor, as well as less signage and information, so visitors can get a sense of self-discovery and independence during their visit. Visitors are able to take time to enjoy the beauty of park resources, commune with nature, and learn about park history. Visitors can choose from a range of recreational activities, as well as interesting sites, making the corridor a primary destination in the larger park.

Visitors traveling Moose-Wilson Road are able to enjoy the corridor's rustic setting and scenic qualities at a leisurely pace. The speed limit along the majority of Moose-Wilson Road is 25 mph. The rustic nature of the road is characterized by its narrow width (no lane striping and about 16 to 22 feet wide), undeveloped surface (gravel for over a mile), curvy contour both horizontally and vertically, and proximity to vegetation (the road winds through trees and vegetation, which hang over the road at times). The scenic quality of the corridor is characterized by outstanding representations of the park's major natural ecological communities. For more information on scenic and other visual resources, see the "Visual Resources" section of this chapter. These natural communities include alpine and subalpine forests, sagebrush flats, wet meadows and wetlands, lakes, rivers, ponds, and the associated diverse native fish and wildlife.

The unique character and settings found within the corridor make it a beloved place by people who live both near and far from the corridor. During initial public scoping on the plan, individuals described the many things they value about the corridor. Individuals frequently said they value the corridor for experiential and intangible reasons such as viewing wildlife in a natural and scenic setting. Beyond wildlife and scenery, individuals also described how they value the natural soundscapes and the access the corridor provides. During the visitor transportation study, visitors were asked what aspects of the corridor they hope will continue into the future. Of the three user groups identified as part of this study, cyclists most frequently (13.9%) responded that improving/changing the road was what they hope will continue. Both hikers (31.9%) and those in vehicles (25.1%) stated that they generally hope that everything about the current corridor will continue. In the same study, visitors were asked about any future changes in the corridor they would like to see. In response to this question both hikers and those in vehicles reported that they would change nothing. Cyclists (31.6%) reported they would like a bike path in the corridor in the future (Newman et al. 2015).

During the same 2014 visitor survey, visitors were asked a series of questions about their personal connections to the Moose-Wilson corridor. Most visitors strongly agreed that the corridor is of high value to them. Many participants "agreed" that they enjoy visiting the Moose-Wilson corridor more than any other area in the park; however, the majority of participants in vehicles (59.3%) and hikers (56.8%) reported being neutral toward this statement versus a lower portion of cyclists (35%) being neutral. For visitors who participated in the survey, the three most important reasons for visiting the corridor included: family, wildlife, and nature for participants in vehicles; nature, family, and wildlife for hikers; and health, nature, and family for cyclists (Newman et al. 2015).

For many, the reasons they participate in an activity like hiking, scenic driving, or attending a ranger-led talk goes beyond the physical conditions of that activity. The experience a visitor has while participating in a particular activity relates to less tangible reasons for undertaking that activity. During the 2014 summer survey, visitors were asked to identify and rank the reasons they chose to visit the corridor. The largest portion of visitors in vehicles said that commuting to other areas (27.8%), wildlife (22.2%), and scenery (12.0%) were extremely important reasons for their visit. The largest portion of hikers said that hiking (26%), exercise (26%), and access to the Moose-Wilson corridor (22.1%) were extremely important reasons for their visit. The largest portion of cyclists reported that scenery (28.9%), commuting (26.3%), and exercise(13.2%) were extremely important reasons for their visit (Newman et al. 2015).

Laurance S. Rockefeller Preserve

The Laurance S. Rockefeller Preserve is a popular destination that draws visitors to the Moose-Wilson corridor. The Preserve provides a special opportunity to connect with nature in an environment designed to reduce congestion and provide an opportunity for solitude and reflection. Visitors can explore the network of trails leading to Phelps Lake through mature forests and aspen groves. Upon the initial opening of the LSR Preserve to visitors in June 2008, visitation to the Preserve quickly increased. After six operating seasons, approximately 45,000 visitors came to the LSR Preserve, with 32,000 of those individuals touring the visitor center (LSR Preserve 2008). According to a 2009 visitor survey, the majority (43%) of visitors come to the LSR Preserve with one other person. For most visitors (66%), coming to the LSR Preserve was a family affair, while for others (17%) it was a trip with friends. Most visitors are not from the local area or the state of Wyoming; rather, 97% of visitors call one of 43 other states their home and were frequently visiting the LSR Preserve for the first time (LSR Preserve 2009).

Visitors travel along Moose-Wilson Road to access the LSR Preserve. The parking lot for the Preserve was intentionally built to accommodate 50 vehicles at one time. Due to the popularity of the site, the lot is managed by NPS staff seven days a week during the operating season. The limited parking influences the amount of visitors that can be on the grounds of the LSR Preserve at one time. This management strategy helps ensure that the Preserve remains a special place where visitors can connect to nature in a meaningful and personal way. An intentional uncrowded atmosphere in and beyond the visitor center is desired and is accomplished through the parking lot management. The 2009 survey indicated that most visitors do not feel crowded at the visitor center, the restrooms, or on the trails. In contrast, many visitors felt moderately to extremely crowded in the parking lot.

The 2009 visitor survey showed that the majority (85%) of visitors came to the LSR Preserve to hike or walk on the main trails or to enjoy scenic views (74%). Figure 32 shows what other activities brought visitors to the LSR Preserve. On average, visitors spent 2.7 hours at the Preserve.

In many ways, the 1,106 acres of the LSR Preserve embodies the overall character of the Moose-Wilson corridor. Visitors repeatedly mentioned, in an open format comment book at the LSR Preserve Center, the solitude, beauty, physical and spiritual renewal, intimacy with nature, experiencing natural quiet and sounds of nature, the tranquility, contemplativeness, experiencing an improved sense of wellbeing, calmness, peace, and excitement they experience.

The importance of unique experiences found in the LSR Preserve was demonstrated in the 2009 visitor survey. When visitors were asked to indicate the reasons for their trip to the Preserve, 48% cited the experience of natural quiet/sounds of nature as one of their reasons. The opportunity to experience solitude and contemplation was often cited (30%). NPS managers seek to foster these types of experiences. As visitation to the Moose-Wilson corridor increases, balancing the amount of visitors present at the LSR Preserve at one time will be important to maintain visitor experiences, to fulfill the intentions of the LSR Preserve, and to safeguard the essence of this unique place (LSR Preserve 2009).

OPPORTUNITIES FOR ORIENTATION, EDUCATION, AND INTERPRETATION

There are a variety of ways for visitors to learn about the important histories and resources of the Moose-Wilson corridor. Interpretive programs that visitors participate in within the corridor are largely centered around the LSR Preserve. Other interpretation within the corridor is visitor-initiated, meaning visitors seek out information about specific topics or places through interpretive panels and informational waysides and through park published information. Other opportunities for visitors to learn about the important histories and resources of the Moose-Wilson corridor include interactions with park staff; walking tours; children's programs; wildlife tours; and published materials such as the park newspaper and brochures.

These opportunities offer visitors a chance to learn about and be inspired by the history and natural processes that occur within the area. These interpretive and educational elements and programs also give visitors a chance to gain an understanding of their role in helping to protect resources. Interpretive and education opportunities can also encourage more responsible visitor behavior that results in less impact and directs visitation away from heavily used areas. Research has shown that

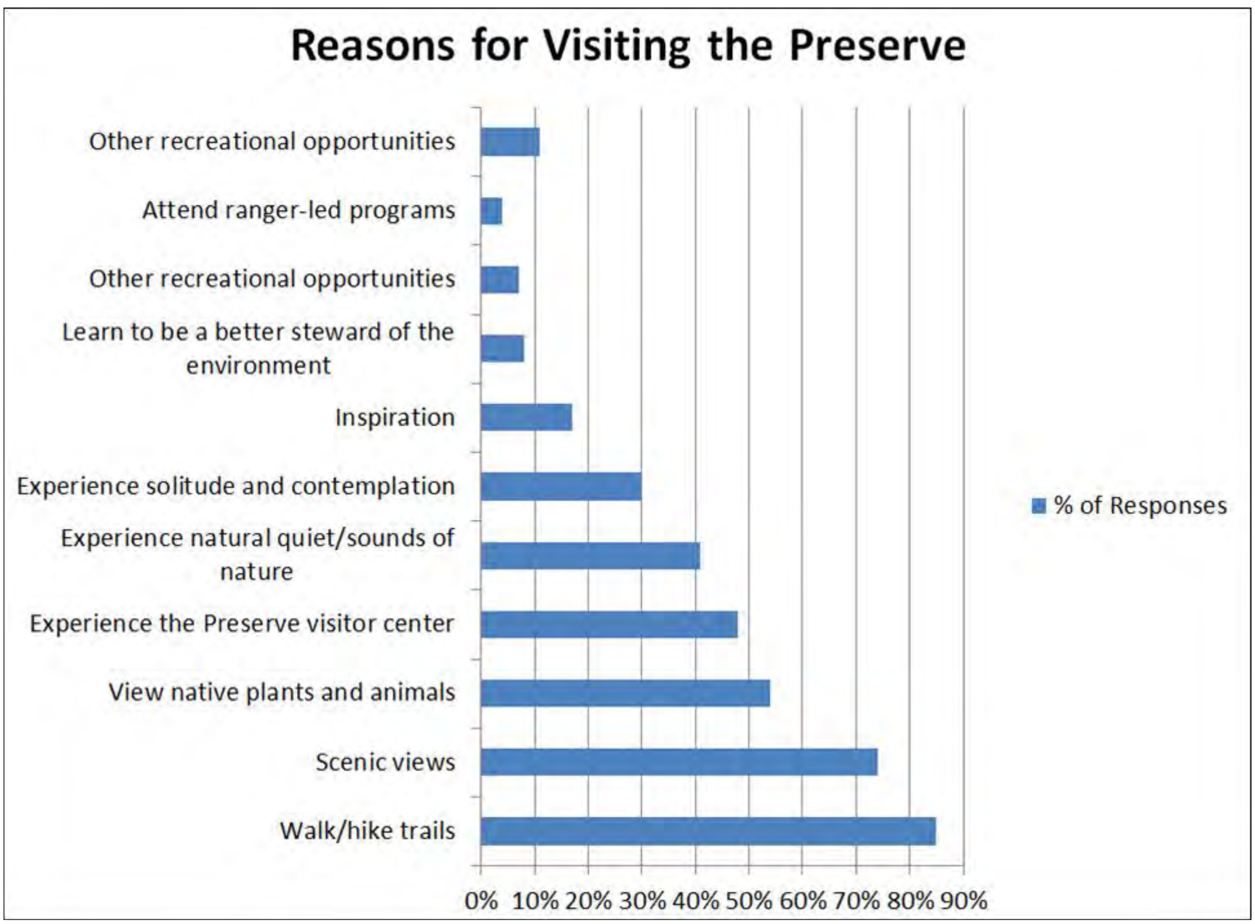


FIGURE 32. REASONS FOR VISITS TO THE LSR PRESERVE

multiple modes of educational contact (e.g., signs, brochures, media, and rangers), particularly personal contact, are most effective in cultivating understanding of the values of an area and reducing incidences of impacting behaviors (Roggenbuck 1992; Littlefair and Buckley 2008). The corridor is an important access point for a variety of visitor destinations. Interpretive efforts in the corridor focus mainly on promoting and supporting self-exploration and self-discovery to encourage visitors to appreciate the rustic character and unique resources of the area.

Visitors value opportunities to understand the significance of resources and the role they play in being stewards of those resources. According to visitor surveys conducted in 2014, most participants responded that learning about the area (the history and cultural significance, the plants and wildlife, nature conservation and preservation values) were "moderately important" (Newman et al. 2015). During public scoping for this plan, visitors mentioned their appreciation for interpretive signs, education, and the opportunity to take part in preserving and protecting park resources and important stories.

> *I hope that there will continue to be reasonable access to trails that take off from that road. I would like the road to "look like" a route that has been designed to serve the park's interpretive and stewardship mission, rather than just a shortcut from Teton Vg. to Moose.*

> *Grand Teton National Park obviously has a mandate to protect the current park's resources while at the same time providing recreational and educational, opportunities. However, if the parks resources are in danger because of providing visitor enjoyment, the resources take precedence.*

One of the most commonly sought after interpretive opportunities in the corridor is information and education about wildlife. According to Chief of Interpretation and Partnerships Victoria Mates, at Grand Teton National Park, visitors seek information about wildlife more than any other type of interpretive opportunity (Victoria Mates, pers. comm. 2015). She says the habitat in the Moose-Wilson corridor is so ripe for wildlife viewing opportunities that these conversations can be had with visitors almost anywhere in the corridor. Generally, the area between Sawmill Ponds Overlook to the LSR Preserve is the best place for these opportunities to occur between visitors and park staff and volunteers. Ranger contact with visitors in a visitor center also present opportunities for education. During these interpretive opportunities, staff can educate visitors about visitor safety, the natural history of wildlife present in the corridor, and the importance of wildlife habitat.

The Craig Thomas Discovery and Visitor Center is near the northern entrance to the Moose-Wilson corridor on Teton Park Road. Visitors entering the corridor from the north have the opportunity to stop at this visitor center to access a bookstore, maps, activity schedules, guided walks and talks, various exhibits, view a documentary on Grand Teton National Park, and register for backcountry camping permits. The discovery center was a public-private partnership between the National Park Service and the Grand Teton National Park Foundation. Its purpose is to "emphasize the interconnectedness of humans and nature—in our shared past, in our present enjoyment of this natural resource, and in our duty to be responsible stewards of this magnificent ecosystem" (Grand Teton National Park Foundation 2010). During the fall, park rangers from the visitor center drive caravans down to Sawmill Ponds as a part of the Wildlife Caravan ranger program. During stops on the caravan tour, rangers educate participants on the natural surroundings, wildlife, and general history of the corridor.

The LSR Preserve Center offers an opportunity to learn more about Laurance Rockefeller's vision for the Preserve and his legacy of conservation stewardship. One of the goals of the center is to provide an inspirational atmosphere that allows visitors to gain an understanding of the site, their connection to natural systems, and their role in conservation (D. R. Horne & Co. 2007). The center orients visitors to the Preserve and offers a series of unique sensory exhibits that highlight the visual, auditory, and tactile qualities of the Preserve's plants and wildlife. Visitors to the LSR Preserve Center have responded positively to the sensory exhibits and architecture. An informal survey in 2008 indicated an average visitor spent 18 minutes exploring the center. The center rarely reached its maximum desired capacity of 30 people at any given time, allowing for quiet, slow-paced visits. The Preserve is open June through mid-September. August is the busiest month with a total of 303 visitors per day (LSR Annual Report 2008).

Visitors to the Preserve can join a ranger for daily programs including a hike to Phelps Lake. In 2008, a total of 2,867 visitors attended one or more of the LSR Preserve's formal programs (LSR Annual Report 2008). The Preserve also offers a number of special programs including an audience centered facilitated dialog program titled "Your Parks, Your Views." A program for children called "Nature Explorer's Backpack" exposes children to the natural world of the Preserve. After a brief orientation by a ranger, each child receives their own nature journal and set of activities to take with them in a backpack as they explore the Preserve trails.

Recordings of Laurance Rockefeller speaking about conservation, high-definition nature videos, large-scale photography, and a soundscape room with nature recordings from the Preserve provide visitors with many different types of opportunities to learn about their surroundings. Trail guides are offered in English and in foreign languages.

White Grass Ranch offers a more intact example of a dude ranch than any other within the corridor. This dude ranch represents the ranching history and original economic building blocks of the Jackson Hole Valley, which helped establish Grand Teton National Park. White Grass Ranch is currently under rehabilitation and is planned to have enhanced interpretation by 2016. Right now visitors can walk around the buildings to get a sense of what a dude ranch looked like, view some interpretive panels on individual buildings, and a welcome kiosk on Death Canyon Road near the site.

Park partners also offer education and interpretive programs within the corridor. The Teton Science Schools runs curriculum school-based programs for their students at the LSR Preserve, The Murie Ranch, and along trails in Death and Granite Canyons. In winter months, the school provides curriculum-based snowshoe hikes from some of these locations as well. (Teton Science Schools 2015).

Murie Ranch is operated by The Murie Center, a nonprofit organization that promotes science-based wilderness and wildlife conservation while striving to inspire creative interactions with the natural environment. During the summer (May to October), weekday tours are offered through Mardy and Olaus's cabin and the homestead, the original building on the property. Tour information includes history of the ranch, the conservation work of the Muries, and updates about current work taking place at The Murie Center. The ranch also offers a nature walk on a trail that Mardy and Olaus created. On this tour, guides spot and talk about wildlife, natural fauna, and geology of the area (The Murie Center 2013).

In addition to the opportunities mentioned above, there are also interpretive panels and bulletin boards at the trailheads for Death Canyon and Granite Canyon. There is one wayside at Sawmill Ponds and one at the Murie Ranch Historic District.

VISITOR SAFETY

It is National Park Service policy to provide enjoyable and safe experiences at NPS sites. The saving of human life will take precedence over all other management actions as the National Park Service strives to protect human life and provide for injury-free visits. The Service will do this within the constraints of the 1916 Organic Act, and will use discretion to not impair park resources or values. While recognizing that there are limitations on its capability to totally eliminate all hazards, the Service and its concessioners, contractors, and cooperators will seek to provide a safe and healthful environment for visitors. The National Park Service cannot control all risk inherent in recreational activities and therefore, park visitors must assume a substantial degree of risk and responsibility for their own safety when visiting areas that are managed and maintained as natural, cultural, or recreational environments (NPS *Management Policies 2006* 8.2.5.1).

Some of the specific factors influencing safety in the Moose-Wilson corridor include increasing visitation, conflicts among visitor groups, interactions between visitors and wildlife, and shared use of the roadway for vehicles and bicycles. Other factors that affect visitor safety within the corridor include, traffic speeds, signs and markers that help orient visitors, and visitor behavior. Visitor behavior varies across individuals, and can be dependent on individual's skills, abilities, and experience. These interrelated factors are discussed together in this section and in the "Visitor Use and Experience" analysis of the alternatives in chapter 4.

During public scoping for this plan, there were several comments specific to visitor safety, including the following:

> *The safety of wild creatures large and small crossing the road should have the highest priority.*

> *Safety should be the primary concern on the Moose-Wilson road. Both the safety and well-being of the wildlife species that make this corridor their home and the people that visit or travel the corridor to recreate, view wildlife or pass through to another part of the park. . .Any change to the Moose-Wilson road should be done in a way that does not negatively impact the wildlife or the people looking to view them safely.*

> *I think the most important issue of this corridor is the safety of everyone using this rural road. When I ride the road I do NOT feel safe at all. I have enjoyed the new pathway system to and from the park and have ridden from my house to Jenny Lake many times. I am very hesitant to use this corridor now. It is heavily travelled by everyone: cars, pedestrians, bikers and animals.*

The park staff makes considerable efforts to provide safety information in easily accessible locations and formats. Safety information is available through interaction with park staff at visitor centers, at entrance gates, and along the road with patrols. Safety information is also available on the park website, in park brochures, at some trailheads, and waysides. However, there are multiple points of entry into the corridor, and visitors are sometimes unaware and unprepared for certain risks.

Visitation to the corridor is linked to traffic levels as most visitors travel to the corridor in personal vehicles. Traffic within the corridor has increased and is expected to rise, and as local residents continue to use the corridor for commuting and recreational purposes. From May to October 2006–2008, the average daily traffic along Moose-Wilson Road was approximately 1,200 vehicles, with the highest traffic volumes seen in July and August (Monz, D'Antonio, and Heaslip 2014a). More recent data collected in 2013 indicates that traffic has increased substantially, with average daily traffic near the Woodland Trail crossing in the LSR Preserve (approximately mid-corridor) reaching 2,209 vehicles from August 1–15 (for more information on this please see the “Traffic and Transportation” section of this chapter) (Monz, D’Antonio, and Heaslip 2014a).

In particular, northbound traffic on Moose-Wilson Road may continue to increase as development progresses south of the corridor in Teton Village. Increase in traffic levels and visitation has led to concerns over visitor safety associated with wildlife jams, bicyclists sharing the road with vehicles, and conflicts among visitors.

The speed limit for the majority of the road is 25 mph, although there are 35 mph sections toward the far northern and southern ends. The road is narrow, ranging between approximately 16 to 22 feet in width depending on whether it is paved or unpaved. Multiple types of traffic use the road other than motor vehicles, including bicycles, pedestrians, and equestrians.

Conflicts among visitors can pose both real and perceived safety problems, such as those between vehicles and pedestrians, or between bicyclists and vehicles. Perceived safety refers to an individual’s subjective level of comfort and perception of risk, without investigation of standards or safety history. Real safety refers to actual level of risk based on safety history and standards.

A road safety audit was conducted to examine real and perceived safety problems on Moose-Wilson Road during September 2013. When investigating collision data on the road between 2002 and 2012, the audit team anecdotally heard there were several incidents of road rage that led to physical confrontations between drivers, or between drivers and bicyclists, which may not be reflected in the collision data (FHWA 2014). For discussion of traffic-related safety issues and data on traffic levels within the corridor, refer to the “Traffic and Transportation” section of this chapter. During public comment periods, people expressed concern that the road was not designed appropriately or managed to help visitors avoid conflicts. In 2014 visitor surveys conducted by Penn State University, the majority of visitors reported each safety potential issue as “not a problem”; however, 50.0% of cyclists, as well as 37.6% of participants in vehicles and 23.2% of hikers considered *condition of roadway* as a “problem,” while 37.5% of cyclists and 24.3% of participants in a vehicles considered *the amount of room to adequately pull your vehicle off the road to view areas of interest* to be a “problem” (Newman et al.2015).

According to the road safety audit, numerous visitor conflicts on the road result from encounters between other traffic types besides drivers (i.e., bicycles, pedestrians, and equestrians), wildlife, and several drivers who are unsure about their location. For example, audit staff witnessed many drivers stopping in the middle of the road to ask directions and take photos of wildlife, and some motorists driving oversize vehicles despite restriction signs. These conflicts lead to some drivers passing on blind horizontal and vertical curves to get around other traffic types and confused drivers (FHWA 2014).

The safety audit highlighted that overall potential risk within the Moose-Wilson corridor is low to moderate-low because there is a low level of risk for occasional automobile accidents per year and moderate injury levels. The overall potential risk for bicycles and pedestrians on the road is moderate-low to moderate-high because there is less than one crash per year with high to extreme injury levels (FHWA 2014).

These concerns could become more serious as traffic, visitation, and recreation levels increase. On paved sections, pavement markings have faded or are completely obliterated. Road signage consists of some warning signs, guide signs, and regulatory signs, but generally few advanced warning signs. In addition, many signs are obscured by vegetation or have inconsistent or unclear language that may not be understood by visitors. In particular, there are places where trails from the LSR Preserve cross the road. At these locations, there are pedestrian crossing signs; however, they may not be readily apparent to drivers. Where the pedestrian trails cross the road there are different colored concrete lines with stones to delineate the crossing path from the road (FHWA 2014). There are also several horse crossings along the road, including one at the entrance of the LSR Preserve that is not marked and drivers are occasionally surprised when horses appear crossing the road.

Further, the road has become a somewhat popular route for bicyclists to connect to multiuse pathways outside the project area. Many bicyclists ride from the town of Jackson, north to Moose, south through the communities of Teton Village and Wilson, and back to Jackson. This route is called the "The Grand Loop" by local bicycling groups. There were two reported collisions involving cyclists on the road between 2002 and 2012. During one of these incidents the cyclist ran into a parked dump truck. The other incident involved a collision between a vehicle and cyclist. Both incidents resulted in minor injuries to the cyclists (FHWA 2014).

Increased bicycle use in combination with increasing traffic levels and other recreation activities, may increase the incidences of both real and perceived safety issues. During the 2014 visitor survey, participants were asked to rank how much of a problem certain visitor behaviors were to the experience while in the corridor. The three main visitor behaviors identified by cyclists were: number of people driving reckless or carelessly (27.5%), number of vehicles stopped along the roadside (25%), and the frequency of vehicle speed enforcement (22.5%). Hikers (10%) and participants in vehicles (14.6%) also identified the number of people driving recklessly or carelessly as one of their top problems (Newman et al.2015).

For data on use of the road by bicyclists and vehicles and incident data, please see the "Traffic and Transportation" section of this chapter.

The physical features of the land and the natural habitat can also pose safety risks. Visitors to the Moose-Wilson corridor have unparalleled opportunities to observe wildlife in their natural setting in close proximity. Wildlife viewing is one of the primary reasons visitors come to the Moose-Wilson corridor, but it also presents one of the most significant visitor safety concerns (more detail on bear behavior is provided in the "Natural Resources" section of this chapter). Wildlife viewing causes traffic jams along the narrow, winding road, since motorists have a limited area to turnoff while stopping to view wildlife. These daily jams can be a hazard to other motorists, law enforcement and emergency response personnel, and bicyclists, and can cause conflicts among visitors. Park staff and volunteers reported 84 wildlife jams within the corridor in the summer of 2013, which lasted anywhere from 15 minutes to more than two hours (Monz, D'Antonio, and Heaslip 2014a). Visitors that are present near the "jam" and able to see the wildlife are usually pleased, but those farther back in a long line of traffic may not be able to see the wildlife or those motorists trying to get through to another destination and can become frustrated.

Wildlife sightings are currently concentrated on the north end of the corridor between Sawmill Ponds and the LSR Preserve. This area contains seasonal wetlands fed by springs resulting in beaver activity and the presence of moose and bears. Depending on the year, the hawthorn and chokecherries can produce large amounts of berries, which bring black and grizzly bears to the area to feed. Depending on environmental conditions, if berries are abundant, the majority of traffic jams along the road are related to "bear jams" during September and October. The next most common wildlife sighting within the corridor is typically moose because of the abundant wetland habitat. Beaver are third-most likely to be seen followed by mule deer and then elk. The corridor is also within the home range of the Lower Gros Ventre wolf pack. The pack had a den and rendezvous site within the corridor in 2012 and 2014 (Steve Cain, pers. comm. 2015).

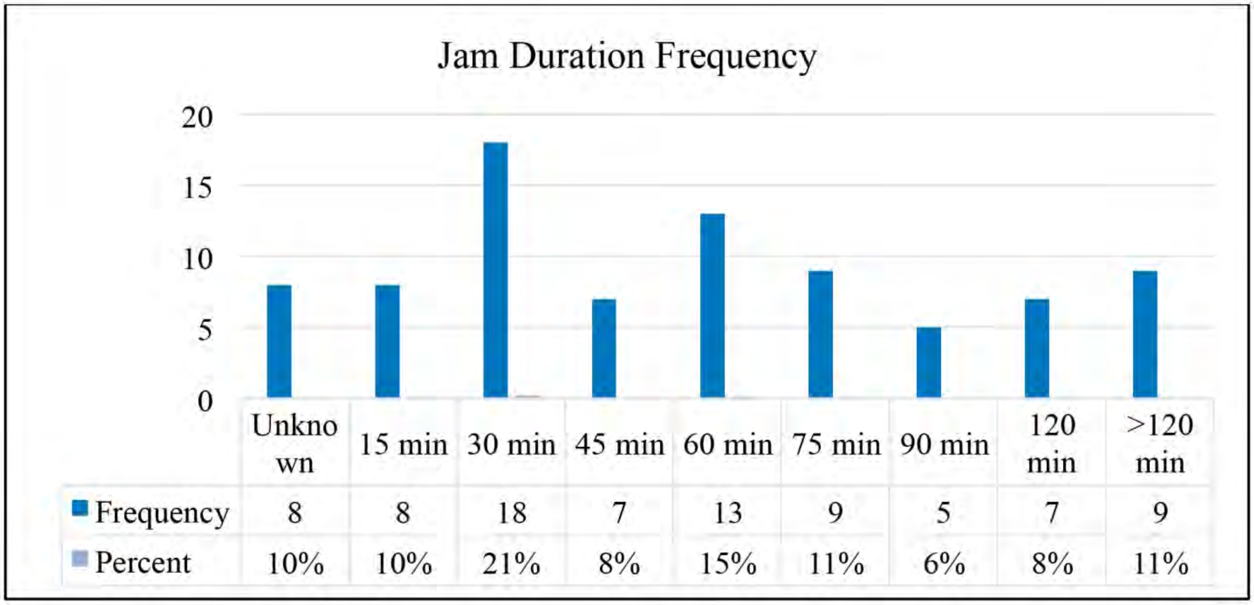


FIGURE 33. JAM DURATION FREQUENCY

Management strives to balance the desire of visitors for close wildlife viewing opportunities with the need to provide a safe environment for both visitors and wildlife. The parkwide standard of visitors being 100 yards away from bears and wolves is challenging to achieve due to the physical layout of the road. Visitors frequently leave their vehicles and approach wildlife too closely, putting them and the wildlife in an unsafe situation.

During public comment periods, people expressed concern over safety risks in the corridor, which included visitor-wildlife interactions. They also expressed appreciation for being able to view wildlife while in the corridor. Many commenters believed efforts should be made to educate visitors on safe viewing distances from wildlife and continue traffic control. Others suggested a need for additional facilities or adaptive management techniques to reduce congestion and safety concerns relating to wildlife viewing. However, according to visitor surveys conducted in the corridor in 2014, the majority of visitors thought other visitors getting too close to wildlife was "not a problem," and believe the majority of visitors view wildlife from a safe distance (Newman et al. 2015). Visitor survey results indicate people may not realize they are too close to wildlife for the safety of themselves and wildlife. Inconsistencies between public comments and visitor surveys illustrate the importance of continuing to educate visitors to the Moose-Wilson corridor on appropriate and safe behavior around wildlife.

Moose can be seen anywhere in the corridor to the delight of many visitors. The majority of moose sightings take place along the northern portion of the road near Sawmill Ponds. Although many visitors classify seeing moose as a positive experience, moose can be aggressive and protective, especially female moose with calves. Visitors have been injured in Grand Teton National Park in the past by moose, which are recognized as a potential safety concern.

Female moose are considered most dangerous during the spring, from mid-May to mid-July, with the highest level of risk during the first month of that period, while the calves are youngest. It is best for visitors to give moose as much space as possible. Some female moose have been reported to charge from several hundred yards away if they feel threatened (Steve Cain, pers. comm. 2015).

Human-bear interactions are of primary concern, since grizzly bears began to be observed in the Moose-Wilson corridor in 2008 and have been observed there ever since, according to Grand Teton National Park Senior Wildlife Biologist Steve Cain. Black bears also inhabit the project area. Based on observations by park staff, a small number of grizzly bears are present in the corridor throughout the nondenning period, grizzly bears are seen at low rates along the road as early as May. In the summer and fall, grizzly bears are seen more regularly and can be seen in August and stay as late as mid-November. For several weeks in the fall, when certain berries are ripe, grizzly bears may be present daily along portions of the road (Steve Cain, pers. comm. 2015).

If a grizzly bear(s) is present on or directly adjacent to Moose-Wilson Road, park staff close the road to protect the bear and visitors. Depending on where the bear(s) is foraging on the ripe berries, the closures generally take place between Death Canyon Road junction north to Sawmill Ponds Overlook or Murie Ranch Road. During closures, visitors can generally still access Moose-Wilson Road from the south to the Death Canyon Road junction. From the north, visitors can still access The Murie Center. The road is reopened when the bear(s) are no longer foraging along the road. Despite road closures for bears in 2014, overall visitation to the corridor did not change between the 2013 and 2014 seasons.

In 2011, there were at least 31 sightings of grizzly bears in the project area, at least 16 sightings in 2012, and at least 15 in 2013, according to the bear sighting and incident report forms filled out by park staff, volunteers, and the public (MacHutchon 2014). In 2014, at least 24 sightings of grizzly bears were recorded in the project area from the bear sighting and incident report forms filled out by park staff, volunteers, and the public. According to Katherine Wilmot, bear management specialist for Grand Teton National Park, the number of grizzly bear sightings each year represent minimum numbers because there are sightings for which park staff do not have an associated bear report form, and because certain years the Moose-Wilson Road is closed for several days decreasing the number of sightings that can be reported. Even if grizzly bears are not seen, it does not mean they are not using the corridor. For detailed information on how grizzly bears could be affected by management actions or strategies in the proposed alternatives, please reference the "Federally Listed Species and Wyoming Species of Greatest Conservation Need" of the "Natural Resources" section of this chapter.

Between 2004 and 2006, a study was conducted on the activity patterns of grizzly bears and black bears in Grand Teton National Park. Where grizzly bears and black bears occupied the same geographic area, black bears tended to be more active during the day to avoid conflict with grizzly bears, which were more active at night. Female grizzly bears were also more active during the day than male grizzly bears. Both bear species were more active early in the morning, less active midday near roads or developments, and grizzly bears were more active near roads and development in the evenings (Schwartz et al. 2010). Since both bear species are shown to be less active near developments during midday, this research suggests visitor use of roads and developed areas during this time would be safer than early morning or evenings.

A study conducted between 2001 and 2010 examined the effects on black bears by the first phase of multiuse pathways built in Grand Teton National Park. The study found black bears altered the way they used areas within 550 yards of the multiuse pathway corridor corresponding to times of peak human activity on the pathway during midsummer (June 15 to August 30). The bears decreased their activity near the pathway by approximately 35% during midday when human use of the pathway peaked, and increased their activity near the pathway by about 10% during morning and evening when human use was lower (Costello et al. 2014). This study and the one in the paragraph above, suggest that recreationists using roads or trails early or late in the day, or before or after peak summer activity (June 15 to August 30) may be more susceptible to bear encounters. This research illustrates that timing of visitor use can influence visitor safety.

According to a human-bear interaction risk assessment conducted in July 2014 for the Moose-Wilson corridor, sudden encounters, in which grizzly bears and people seem to not have been aware of each other until separated by less than 55 yards, were the main circumstance associated with grizzly bear-inflicted injuries to people on foot, but also with encounters between bicyclists and grizzly bears (MacHutchon 2014). Therefore, certain types of recreation may increase a visitors' chance of being attacked by a bear.

MacHutchon summarized data from multiple studies of bicyclist-bear interactions, most were of mountain bikers and bears since more information is available on the human safety risks associated with mountain biking than for road biking on multiuse pathways. The majority of interactions reported were with black bears on flat trails with bicyclists riding roughly 6 to 18 miles per hour. Most bicyclists stated they were unaware of the bear's presence until they were within 55 yards of the bear. Cyclists said they appeared to have startled the bear. Less than half of the grizzly bears encountered charged the cyclists. In another database of 33 grizzly bear-bicyclist encounters within western North America, the bears chased or charged the cyclists 29 of 33 times (MacHutchon 2014).

The data of bicyclists-bear interactions summarized by MacHutchon, suggests that cyclists are more likely to have sudden confrontations with bears than hikers, due to the higher speed of travel. The summarized reports also suggest that cyclists using a multiuse pathway have a higher probability of a sudden encounter with a bear than cyclists using a dirt mountain bike trail in similar bear habitat (MacHutchon 2014; 39.) Multiuse pathways provide faster and quieter travel than dirt trails for cyclists, increasing the probability of surprise encounters with bears.

In a 2000 report prepared for Banff National Park, grizzly bear attacks on mountain bicyclists had increased in a certain area of the park. The increase in attacks was attributed to the ease with which bicyclists can surprise bears given the low noise cyclists emit and the high speeds they travel. Certain sections of trail are now seasonally closed to mountain bikers during high fruit-bearing times to allow bears to feed with less human interruptions and to maintain visitor safety (Herrero and Herrero 2000). These studies suggest that management strategies focused on timing and type of visitor use along with timing of wildlife activity could prove to have visitor safety benefits.

TRAFFIC AND TRANSPORTATION

INTRODUCTION

This section describes the traffic and transportation components of the environment within the Moose-Wilson corridor that would be affected by implementing the alternatives. It includes an analysis of the physical characteristics of the transportation system within the corridor, as well as traffic flow considerations that could affect other identified impact topics. These characteristics will be described around six topics related to traffic and transportation, including

- Physical Characteristics
- Vehicular Access
- Traffic Mix
- Traffic Volumes
- Traffic Safety Conditions[2]
- Parking Conditions

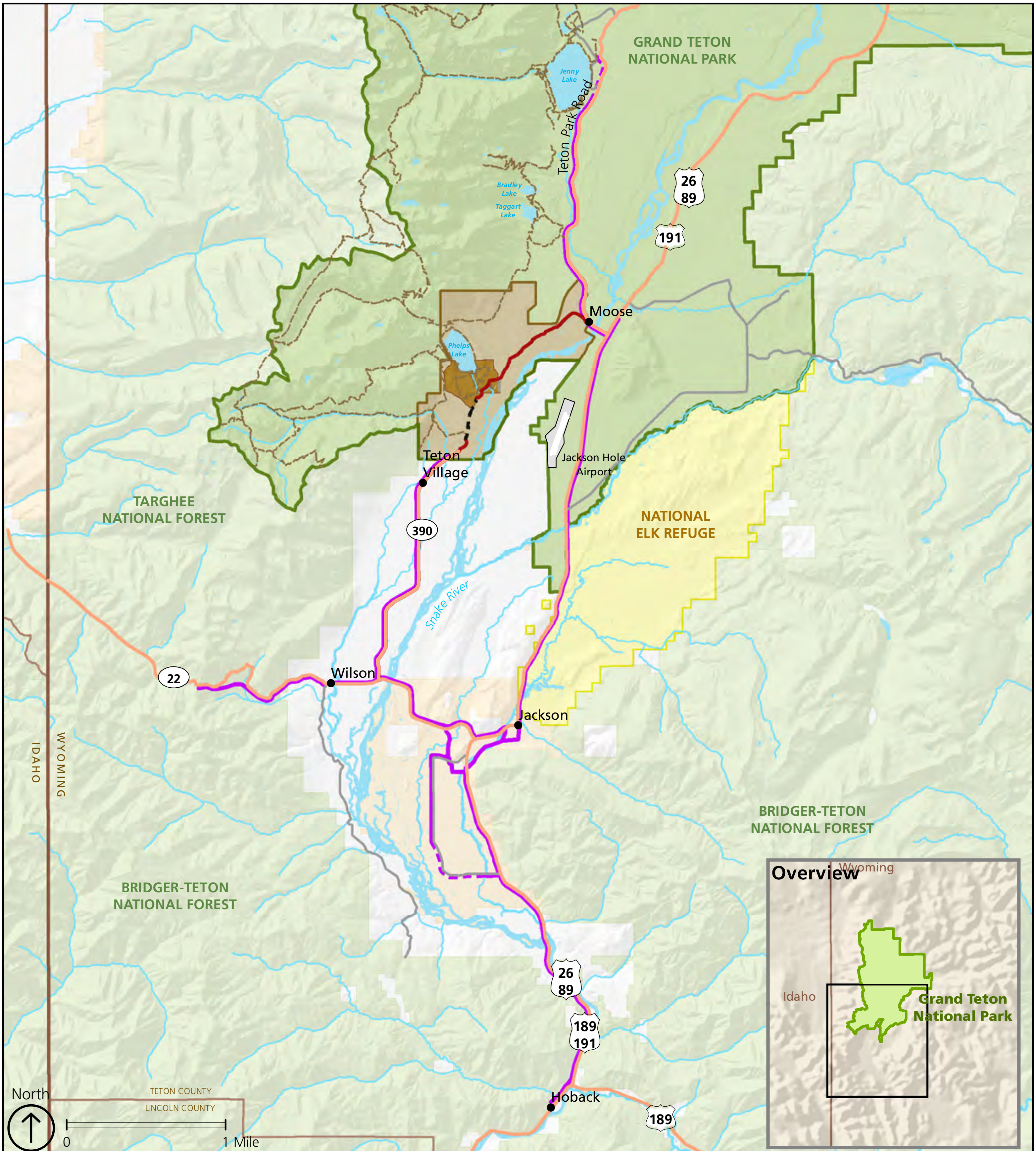
Most of the descriptions in this chapter are focused on the corridor as a whole rather than a segment-by-segment analysis. While it is appropriate to focus on conditions at particular destinations for topics like parking, many of the other topics depend on the functionality of the roadway within a larger context. References to conditions at specific destinations or along particular road segments are included, as appropriate.

OVERVIEW OF MOOSE-WILSON ROAD

Moose-Wilson Road lies at the south end of the park just west of the Snake River, linking the Granite Canyon Entrance Station with the park headquarters area in Moose. This seasonal roadway (open early to mid-May until October 31) connects several visitor destinations within the corridor and functions in an ancillary role as part of a greater regional transportation network that links nearby towns and other area destinations in Teton County, Wyoming. The community of Moose lies at the north end of the corridor, and Teton Village is near the park boundary to the south. Wyoming Highway 390 (WY 390) extends south from the park boundary, passing Teton Village and intersecting with Wyoming Highway 22 (WY 22). WY 22 continues west to Wilson and east to the town of Jackson (see the “Vehicular Access” section for more information on regional routes).

Within the park, Moose-Wilson Road offers a rustic, intimate, and scenic driving experience, along with opportunities for both outdoor recreation and wildlife viewing. Along this leisurely drive, visitors are able to experience the diverse array of park resources that are present in the corridor. These resources include natural scenery, flora, and fauna, and many of them are unique to this corridor within the park. The road is also used as a route to access park destinations beyond the corridor, and as a through-traffic connection for destinations beyond the park boundary.

[2] This section focuses on vehicle- and bicycle-related traffic incidents. See “Visitor Safety” section under “Visitor Use and Experience” for more information on visitor safety in general and visitor perceptions of safety on Moose-Wilson Road.



Trails
Streams
State Boundary
County Boundary
Major Roads
Water Body

Moose-Wilson Road
Paved
Unpaved

Multiuse Pathways
Approved
Existing

National Park
National Forest
Bureau of Land Management
National Elk Refuge
Park Boundary
Project Area Boundary
Laurance S. Rockefeller Preserve

Vicinity Map

Moose-Wilson Corridor

Grand Teton National Park, Wyoming
National Park Service/U.S. Department of the Interior

Produced by Denver Service Center Planning Division, November 2013.

The 7.1-mile road accommodates two-way traffic and features both paved and unpaved surfaces. The majority is paved (5.7 miles), with an unpaved gravel portion (1.4 miles) extending from near the Granite Canyon Trailhead to the levee access road just south of the Laurance S. Rockefeller Preserve Center. The road also provides access to several destinations within the corridor, including the LSR Preserve, Death Canyon Trailhead, Granite Canyon Trailhead (via Death Canyon Road), and Murie Ranch Historic District.

Moose-Wilson Road runs along the base of the Teton Range, and as such, it generally follows the slope of the terrain—higher elevation at the north to a lower elevation at the south. The alignment features winding horizontal and vertical curves along its route, which follow the natural topography and contribute to the overall character of the driving experience along the roadway. There are several gradual changes in elevation, with the greatest variability in vertical distance and alignment through the LSR Preserve.

In general, speed limits are relatively low along Moose-Wilson Road, with a majority limited to 25 mph and portions at the far northern and southern ends of the corridor at 35 mph (FHWA 2014). However, variably poor road conditions along the paved and unpaved road segments, frequent congestion, a one-lane bridge, and the winding and sloping terrain tend to further limit speeds.

PHYSICAL CHARACTERISTICS

The approximately 7.1-mile roadway is paved at a variable width of 16 to 20 feet, except for approximately 1.4 miles of unpaved gravel surface near the southern end of the corridor. The paved roadway surface is in poor condition, with issues like potholes and frost heaves occurring in several areas. Frost heaves are most pronounced in the spring and near the wetland area just south of the Sawmill Ponds Overlook; they often persist through the summer. Along the paved portions of the roadway, pavement markers are nonexistent or have faded and are no longer visible (FHWA 2014).

The unpaved portion is generally wider due to the lack of a defined road edge, varying in width between 18 and 22 feet. Vehicles sometimes drive wide of the road to avoid rough road conditions, which has caused trampling of vegetation at points immediately adjacent to the roadway (refer to the "Vegetation" section of this chapter for more information). The gravel surface of this segment of roadway requires stabilization through the use of magnesium chloride treatments, which are conducted about three times per year. These treatments help to compact and stabilize the gravel as well as to abate dust that results from the loss of fines in the road. This process is intended to provide a smoother driving surface and prevent potholes. The efficacy of the treatment depends largely on the amount of time it is allowed to cure, which can be affected by weather or inadequate closure time. Even under the best of application conditions however, this treatment is not effective in maintaining the road for long under the amount of traffic the road receives (see discussion of traffic levels in the "Traffic Volumes" section). In general, these treatments only stabilize the roadway for a few weeks, with numerous large potholes and ponding water becoming prevalent toward the end of the treatment cycle. Vehicles tend to move faster along the smoother gravel surface immediately following surface stabilization, but speeds generally decrease along with the degrading condition of the roadway during the following weeks.

Much of the unpaved road segment is graded below adjacent natural ground levels, and there are currently no drainage ditches to manage water runoff. This has further contributed to the ponding of water and creation of potholes. The puddles and potholes complicate maintenance of the gravel surface, as well as pose safety concerns, as drivers and bicyclists must sometimes veer into oncoming traffic to avoid these obstacles (FHWA 2014).

There are also unpaved designated parking areas at trailheads and key wildlife viewpoints, along with user-created turnouts and parking areas. These areas provide parking for wildlife viewing opportunities or for the passing of stopped or slow-moving vehicles. More information on designated and user-created parking is available under the “Parking Conditions” topic.

Other defining characteristics of the road include Lake Creek Bridge, which is a one-lane bridge that allows traffic to traverse Lake Creek, but also affects traffic flow along the roadway (see the “Traffic Volumes” section for more information). The bridge is approximately 18 feet wide, 48 feet long, and composed of timber planks that link two paved portions of Moose-Wilson Road just southwest of the LSR Preserve. It was reconstructed in 2005 and remains in good condition.

Signage along Moose-Wilson Road consists of warning signs, guide signs, and regulatory signs, but many of these are obscured by vegetation or have inconsistent or unclear language that may not be understood by visitors. Pedestrian crossings, Lake Creek Bridge, and some curves are also signed, but there are generally few advanced warning signs (FHWA 2014). This minimal signage contributes to the rustic nature of the corridor, but it could create challenges regarding safety and wayfinding.

The corridor also includes several intersecting roadways that link to Moose-Wilson Road and exclusively provide access to other area destinations. None of the intersecting roads have posted regulatory speed limits, but only three provide public vehicular access. The public roads include Murie Ranch Road, Death Canyon Road, and the LSR Preserve entrance road. These roadways and their physical characteristics are described below.

- Murie Ranch Road is a gravel road that extends approximately 0.6 mile from the northern end of Moose-Wilson Road, providing access to the Murie Ranch. It intersects with Moose-Wilson Road at the far north end of the roadway, near Teton Park Road. The route ends in two parking areas within the ranch, generally serving both visitors and The Murie Center administration.

- Death Canyon Road extends northwest from its junction with Moose-Wilson Road about mid-way through the corridor and provides access to the Death Canyon Trailhead. It is approximately 1.7 miles long, with the first 0.7 mile paved and the last mile unpaved. The unpaved portion of the roadway is in poor condition, with signage recommending four-wheel-drive vehicles. Due to the poor conditions (e.g., potholes, puddles, and large rocks), users have unintentionally widened the road by driving on adjacent vegetation while attempting to avoid certain areas. These disturbances are amplified by lower clearance vehicles that attempt to navigate the roadway. The road has widened to two to three lane widths in some of these areas. A small parking area is provided for access to the Death Canyon Trailhead, but it lacks delineation of individual spaces. There is also extensive user-created roadside parking that extends the entire length of the unpaved section of the road.

- Laurance S. Rockefeller Preserve entrance road is a paved road that extends approximately 0.5 mile southeast from Moose-Wilson Road, providing access to the LSR Preserve Center. Although it is paved, the relatively thin asphalt is susceptible to potholing, which has required periodic maintenance. The road intersects with Moose-Wilson Road just south of the junction with Death Canyon Road near the LSR Preserve. A designated parking area is provided for access to the LSR Preserve Center and the trail network within the Preserve, which ultimately links to the broader corridor trail network.

In addition to these public roads, there are several unpaved roads that are gated with access restricted to vehicles for administrative purposes only. These roads are closed to both public vehicles and bicycles, but can be accessed by pedestrians. The most substantial of the administrative roads is Levee Road, which extends from Moose-Wilson Road east to the Teton County levee along Snake River, then south outside of the park boundary. The road occasionally accommodates truck traffic and heavy equipment and materials for the maintenance of the levee, irrigation ditches, and the road itself; the levee access road also provides administrative access to the LSR Preserve Center. Additionally, there are two unpaved roads that split from Death Canyon Road at the end of the paved section: White Grass Road and Sky Ranch Road. White Grass Road provides access to White Grass Dude Ranch Historic District and Sky Ranch Road provides access to Sky Ranch, a historic district previously used as housing for seasonal park staff.

VEHICULAR ACCESS

Vehicular access refers to the ease and convenience of accessing the road with an automobile and driving to destinations along or adjacent to the Moose-Wilson corridor. The road has limited access based on maximum vehicle size. The central portion of the roadway, from Granite Canyon Trailhead to Death Canyon Road, is closed from approximately November 1 through May 1. Winter use is allowed to continue during that period, with parking available near both gated areas.

In the region, there are several adjacent roadways , including state routes and US highways, that conduct visitors to either end of the corridor and provide vehicular access. These routes are as follows:

- WY 390 is the continuation of Moose-Wilson Road south of Grand Teton National Park. It is a two-lane highway that runs from the Granite Canyon Entrance Station past Teton Village and the Jackson Hole Mountain Resort to a point east of the community of Wilson at WY 22. Just south of the park entrance, speeds are limited to 35 mph, with 45 and 55 mph speeds extending farther south through Teton Village and beyond. It serves as the primary route from Teton Village to the town of Jackson.
- WY 22 is a two-lane highway on an east-west alignment that serves as the primary route between the communities of Wilson and Jackson. It also links to Highway 390, providing a direct connection between these communities and the Moose-Wilson corridor.
- Teton Park Road lies at the northern terminus of Moose-Wilson Road in the town of Moose. It runs 21 miles on a primarily north-south alignment, traversing the northeastern edge of the corridor. It is served by the Moose Entrance Station and provides visitor access to several park destinations including Jenny Lake, String Lake, Leigh Lake, and Signal Mountain.
- Highway 26/89/191 runs parallel to the corridor. It is approximately 3.5 miles to the east, and follows a north-south alignment. Although it runs through several states, it stretches from the town of Jackson to Moran in the immediate area. Jackson Hole Airport, the busiest airport in the state, lies along this route.

Of these roadways, only two provide direct access to the corridor: WY 390 and Teton Park Road. The main points of entry include the community of Moose (Teton Park Road) at the north end and the Granite Canyon Entrance Station at the south via WY 390. Due to its alignment, visitors accessing Moose-Wilson Road from Teton Park Road do not have to stop at the Moose Entrance Station, or any other entrance station. Traffic entering the corridor from the south end, however, must enter through the fee-controlled Granite Canyon Entrance Station.

Utah State University conducted data collection efforts in the summer/fall of 2013 and 2014 as part of a comprehensive study. This document focuses on the data collected in 2013, which was the year that this EIS process began and public scoping was completed. The major trends of the 2013 data collection were confirmed by the 2014 data. During the period of August 1–15, 2013 (one of the busiest periods sampled), northbound traffic entering from the south was marginally higher overall than traffic entering through the north on weekdays, while directional traffic flow was roughly equal from the north and south on weekends. Figures 34 and 35 show a breakdown of weekday and weekend average hourly directional traffic flow that occurred during this sampling period (Monz, D'Antonio, and Heaslip 2014a).

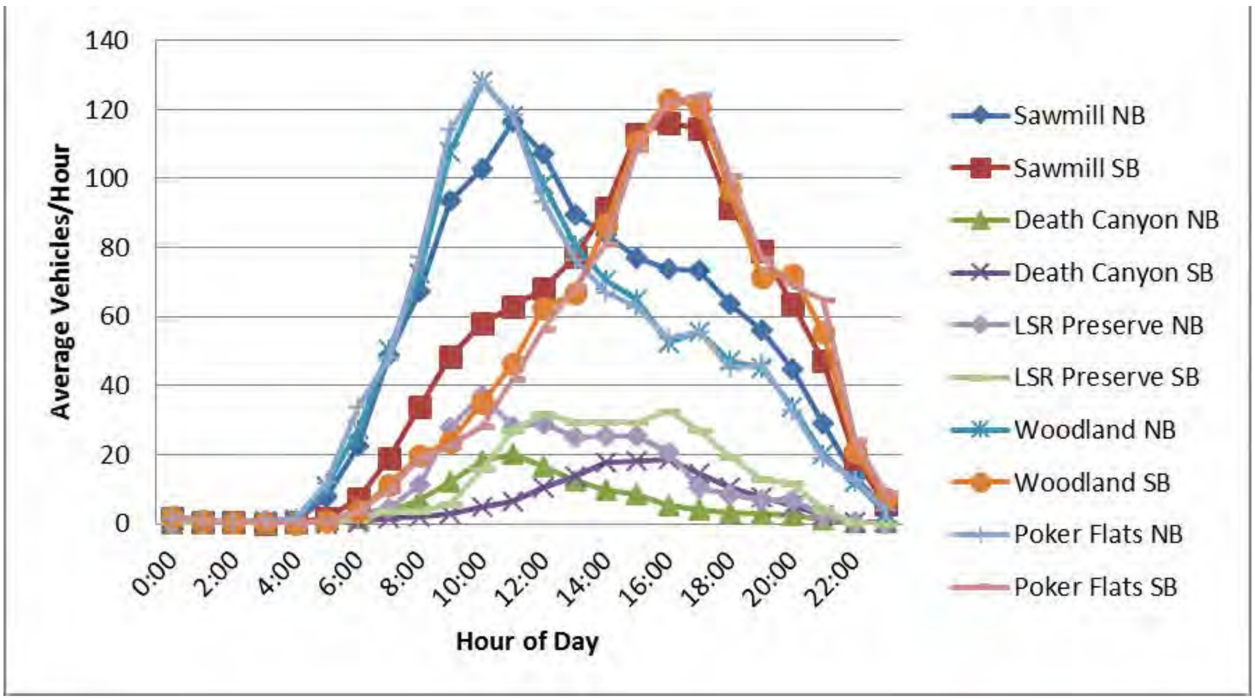


FIGURE 34. WEEKDAY HOURLY DIRECTIONAL FLOW, AUGUST 1–15

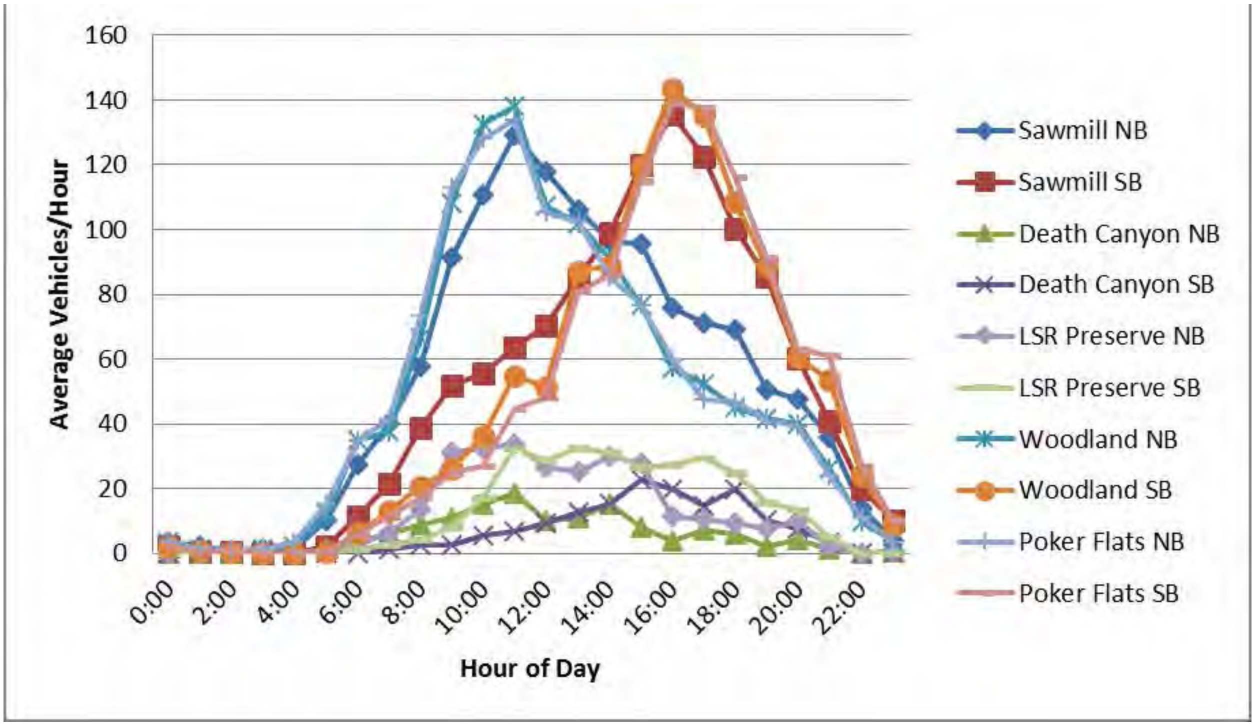


FIGURE 35. WEEKEND HOURLY DIRECTIONAL FLOW, AUGUST 1–15

The 2013 study found that across all sampling periods and both weekends and weekdays, over average, traffic accessing the corridor from the south and traveling northbound on Moose-Wilson Road was at its highest between approximately 8:00 a.m. and 10:00 a.m., at which point northbound traffic levels began to decrease and southbound traffic began to increase (entering from the north). On average, southbound traffic levels were at their highest levels between 2:00 p.m. and into the evening (around 6:00 p.m.). Average traffic to and from the LSR Preserve roughly mimicked that of the traffic on Moose-Wilson Road, with traffic to the LSR Preserve peaking between 8:00 a.m. and 10:00 a.m. and traffic leaving the LSR Preserve peaking between 2:00 p.m. and 6:00 p.m. On Death Canyon Road, average traffic levels toward the Death Canyon Trailhead peaked in the morning between 10:00 a.m. and 12:00 p.m., and traffic leaving Death Canyon Road peaked between 2:00 p.m. and 6:00 p.m. (Monz, D'Antonio, and Heaslip 2014a).

TRAFFIC MIX

Moose-Wilson Road is a multimodal corridor that supports a mix of vehicle types, including cars, medium to heavy trucks, vans, and bicycles. Table 15 summarizes traffic mix data collected near the Granite Canyon Entrance Station from August 1–15, 2013. As indicated in the table, the vast majority of vehicles traveling either northbound or southbound were cars. Bicycles were the second-largest user group (3% in either direction), followed by trucks/vans (1% in either direction). Slightly more northbound traffic was observed than southbound traffic during all data collection periods. The number of trucks/vans that use the corridor is likely limited by the vehicle size restrictions that are currently in place along Moose-Wilson Road (Monz, D'Antonio, and Heaslip 2014a).

TABLE 15. TRAFFIC MIX

Northbound				
	Car	Truck/Van	Bike	Total
Average	982	8	28	1,018
%	96%	1%	3%	100%
Southbound				
	Car	Truck/Van	Bike	Total
Average	912	7	25	944
%	97%	1%	3%	100%

TRAFFIC VOLUMES

Visitation, recreation, and traffic have increased substantially within the Moose-Wilson corridor during the summer months, which has contributed to issues like congestion and resource degradation along the roadway. Peak average vehicles in the corridor at one time during the period of August 1–15 was 200 vehicles. This peak average is typically exceeded between 12:30 p.m. and 2:30 p.m. Studies completed in 2006, 2007, 2008, and 2013 indicate that there have also been steady increases in average daily traffic over time (table 16; figure 36). These increases could be due, in part, to a variety of factors, including additional development along WY 390 and the opening of the LSR Preserve in 2008. Continued expansion of tourist and residential development south of the corridor in Teton Village and elsewhere along WY 390 will likely contribute to an overall increase in traffic, particularly northbound traffic entering through the Granite Canyon Entrance Station.

TABLE 16. AVERAGE DAILY VEHICLE USE LEVEL[3]

Month	2006	2007	2008	2013	Percent Change
July	1,668	1,740	1,870	2,094	26%
August	1,616	1,695	1,770	2,102	30%
September	1,110	1,267	1,355	1,772	60%

[3] Data in 2006, 2007, and 2008 is from Moose-Wilson Corridor Adaptive Management Plan (McGowen 2009), and 2013 data is from the Utah State University collection effort (Monz, D'Antonio, and Heaslip 2014a). Data collected in 2014 confirms this more recent overall increasing trend in use since 2006, but specific data points were not included due to certain challenges with data collection (i.e., road closure and equipment malfunction) (Monz, D'Antonio, and Heaslip 2015).

Because of traffic levels, driver behaviors, and road conditions, it generally takes longer to drive the length of the corridor than the posted speed limits would suggest. According to data collected in summer/fall of 2013, duration of time spent within the corridor averaged around one hour; however, more than half of the vehicles tracked spent less than 30 minutes in the corridor. Of the vehicle trips less than 30 minutes, the most frequent trip time was 18 minutes, with relatively few vehicles that traversed the corridor in less time. This indicates that even the fastest vehicles are traveling under 25 mph—the posted speed limit for the majority of the road.

Speeds are limited at five places along the corridor. The first is the Granite Canyon Entrance Station where visitors are required to stop and pay a fee; it is the major point of visitor contact along the roadway. Second, the unpaved section necessitates slower speeds due to rougher road conditions. The one-lane Lake Creek Bridge is a third point of regulation where users often slow down or stop to allow other vehicles to pass. The fourth is the segment of road between the bridge and the LSR Preserve entrance road, which has pronounced grade changes and road curves with limited sight lines. Last is the wetland area south of the Sawmill Ponds Overlook, which is a site of frequent wildlife jams.

Many visitors look forward to wildlife encounters as part of their national park experience, but the presence of wildlife in the Moose-Wilson corridor has impeded traffic flow because visitors are unable to entirely leave the road in many areas. The resulting wildlife jams can slow traffic movement or even stop it entirely. Park staff and volunteers reported 84 wildlife jams within the corridor in the summer of 2013, which lasted anywhere from 15 minutes to more than two hours (Monz, D'Antonio, and Heaslip 2014a).

Some of the most rich and diverse wildlife habitat in the park can be found along Moose-Wilson Road. Grizzly bears have inhabited the corridor since 2008, and other wildlife species, including moose, beavers, elk, black bears, and deer are also present. The presence of wildlife has also precipitated an increase in visitation, as well as commercial traffic that seeks to take advantage of viewing opportunities (see table 15 "Traffic Mix"). More information on interrelationships between wildlife and vehicles can be found in the "Visitor Use and Experience" section of this chapter.

Through-traffic is a major contributor to traffic volumes within the corridor, accounting for well over half of all vehicular trips. As reflected in figure 37, data collected from August 1–15, 2013, indicates that a majority of trips were northbound through-trips, followed by southbound through-trips. Only 22% of all trips during this period saw visitors enter and leave through the same location. An analysis of local versus nonlocal traffic provides further clarity on these travel patterns. During the sample period of the same study, researchers found that local visitors made up only 16% to 22% of total vehicles sampled, while nonlocal visitors made up the other 78% to 84% (Monz, D'Antonio, and Heaslip 2014a). Local users may be more inclined to visit specific destinations in the corridor, and are thus more likely to enter and exit from the same direction. Nonlocal users, however, may desire to use the corridor as a scenic through-route north to the rest of the park, or south to Teton Village or other locations.

Moose-Wilson Road provides access to and from locations within park boundaries and to other popular destinations outside the park, including Yellowstone National Park, Teton Village, the town of Jackson, and Jackson Hole Airport. According to visitor surveys, only 17.7% of vehicles that were surveyed had identified the Moose-Wilson corridor as their primary destination. An additional 44.4% had other primary destinations with no intent to stop in the corridor, and 31% had other primary destinations and either planned to

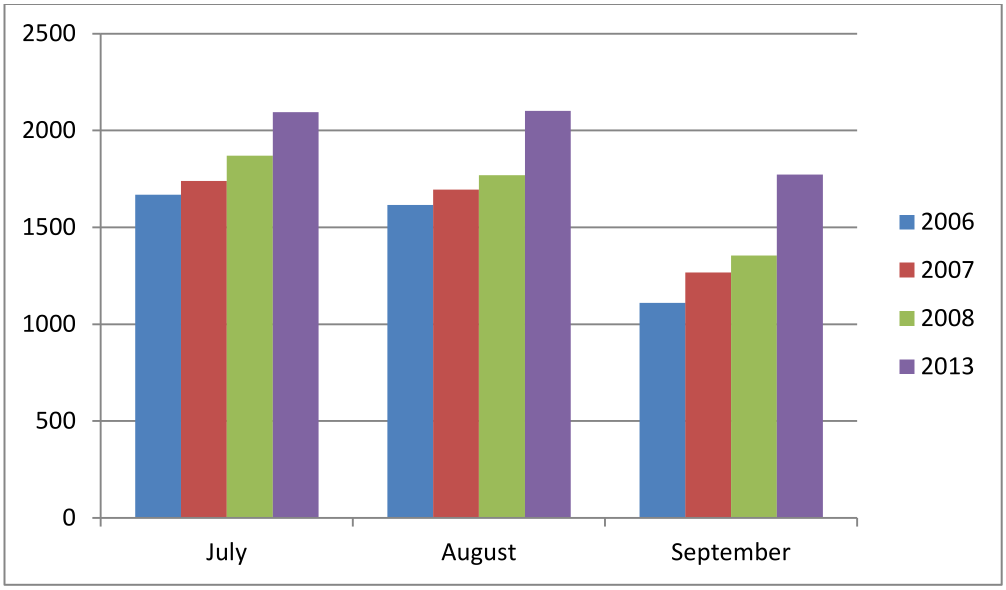


FIGURE 36. AVERAGE DAILY TRAFFIC BY MONTH

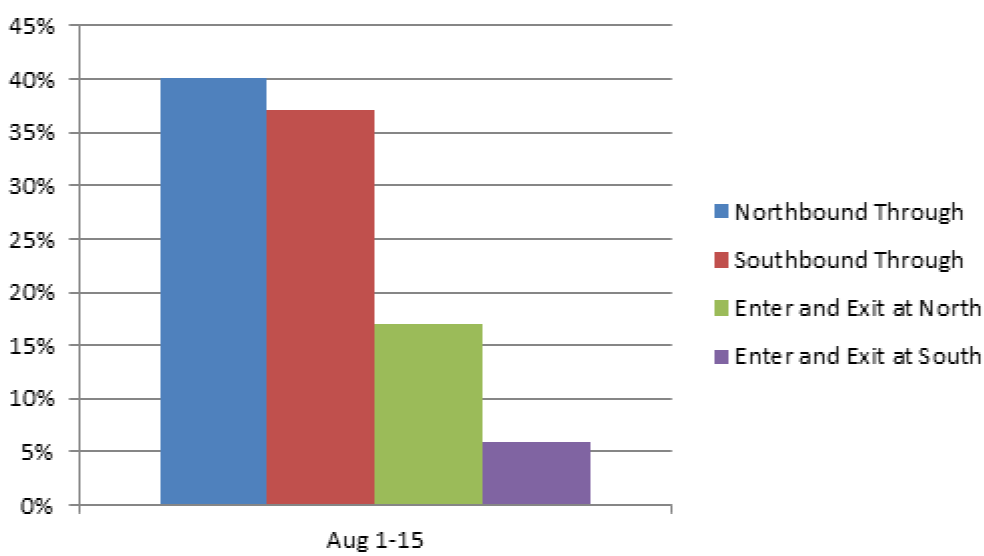


FIGURE 37. TRAVEL PATTERNS OF VEHICLES

stop in the corridor or was unsure. This shows that a strong majority of visitors surveyed (75.3%) were commuters who were primarily using the road as a through-route to other destinations. Approximately 30% of those surveyed did not intend to visit the park at all (Newman et al. 2015).

Moose-Wilson Road provides access to and from locations within park boundaries and to other popular destinations outside the park, including Yellowstone National Park, Teton Village, the town of Jackson, and the Jackson Hole Airport. According to visitor surveys, only 17.7% of vehicles that were surveyed had identified the Moose-Wilson corridor as their primary destination. An additional 44.4% had other primary destinations with no intent to stop in the corridor, and 31% had other primary destinations and either planned to stop in the corridor or was unsure. This shows that a strong majority of vehicles surveyed (75.3%) were commuters who were primarily using the road as a through-route to other destinations. Approximately 30% of those surveyed did not intend to visit the park at all (Newman et al. 2015).

Bicycle traffic as a share of overall traffic has also increased within the corridor, but not substantially. In summer 2006, the Western Transportation Institute conducted a study that included an assessment of travel modes within the Moose-Wilson corridor. In this study, the Western Transportation Institute found that 1.6% of vehicles entering the corridor through the Granite Canyon Entrance Station were bicycles (McGowan 2009). The 2013 data collection effort found that bikes accounted for 2% and 3% of vehicles traveling northbound at the Granite Canyon Entrance Station during July and August 1–15, respectively (Monz, D'Antonio, and Heaslip 2014a). Bicycle counts could be used more definitively establish an increase in use, but there were no data in previous data collection efforts that could be used for comparative purposes. This slight increase in share of traffic may be due, in part, to a growing network of multiuse pathways that extends throughout the region, and connections to the pathway system in Moose and Teton Village.

According to the Jackson/Teton County Comprehensive Plan (Town of Jackson and Teton County 2012), the multiuse pathway program has expanded significantly since it began in 1996 (to 57.17 miles as of June 2013) (Friends of Pathways 2013). Residents have expressed continued support for the Pathways Program through voter approval of a Special Purpose Excise Tax. The Pathways Master Plan indicates that demand exists for further expansion and connectivity of the system, although the county reports that accurate usage counts have been difficult for the Pathways Department to obtain (Town of Jackson & Teton County 2007).

The pathway network currently runs from the town of Jackson to Moose along Highway 26/89/191, and then along Teton Park Road, which provides access to the north end of the corridor. This network also extends south from the park boundary along WY 390 to WY 22. A connection along WY 22 between WY 390 and the town of Jackson is planned, and portions are now under construction (see the "Vicinity Map"). The only major segment of road without built or planned bicycle pathways is the Moose-Wilson corridor. Consequently, bicycles have pathway access to both ends of the corridor, but bicyclists currently share Moose-Wilson Road with vehicles.

Table 17 identifies the primary entrance and exit points for bicycles in the corridor, which indicates that a strong majority of users entered from the north and traveled southbound along the road (Monz, D'Antonio, and Heaslip 2014a).

TABLE 17. BICYCLE USER TRAVEL PATTERNS, AUGUST 1–15

Bicycle Travel Patterns	Percent of Corridor Visitors
Northbound Through	14%
Southbound Through	64%
North Enter and Exit	11%
South Enter and Exit	11%

Much of this information reflects summer usage, but the parts of the roadway that remain open in the winter months still attract visitors that seek to access recreational opportunities. Data regarding winter usage of Moose-Wilson Road was gathered from January 25 to February 9, 2014, at winter destinations within the corridor: Death Canyon Road junction and the Granite Canyon Trailhead. Daily average vehicles at these locations were 58 and 84 vehicles/day respectively. Substantially more users entered the corridor from the southern end during the winter (Monz, D'Antonio, and Heaslip 2014b). See "Parking Conditions" below for information regarding winter parking within the corridor.

TRAFFIC SAFETY CONDITIONS

Despite the levels of motorized vehicle and bicycle traffic along the corridor, there have been relatively few traffic incidents along Moose-Wilson Road. The Federal Highway Administration completed a road safety audit for the corridor in September 2013, which analyzed crash data received from the park regarding incidents that occurred between January 2002 and December 2012. The park provided data on 42 motor vehicle incidents that occurred between these dates (FHWA 2014). This data did not include detailed information on crash locations, contributing factors, weather, or citations issued, so only an overview of crash severity, collision types, and time of year is available.

Based on this data, the crash frequency for Moose-Wilson Road is 3.8 crashes per year (42 crashes / 11 years). There are no roads similar enough to Moose-Wilson Road for direct or in-depth comparisons, but Spring Gulch Road is a local county road with similar traffic volumes, surface conditions, and geometry. Crash numbers provided by Teton County reflect a crash frequency of 9.2 crashes per year, based on 95 crashes that occurred between January 2002 and April 2012 (95 crashes / 10.3 years). It should be noted that the frequency calculation does not take into account seasonal closures of a road (which Moose-Wilson Road experiences), so it may still be difficult to compare these two roads based on their crash frequencies.

Approximately 90% of the crashes (38 total) were property damage only, with the remaining incidents consisting of three injury crashes (two involving bicyclists), and a pedestrian-involved "other" incident with no reported injuries (see figure 38). The bicycle-related incidents were both bike vs. vehicle during peak visitation months and included one in which a cyclist ran into a parked dump truck; both incidents resulted in minor injuries to the cyclists.

Almost half of the crashes (19) on Moose-Wilson Road involved single vehicles in run-off-road incidents and just over a third (16) involved multiple vehicles (Multi). The other reported incidents included collision with wildlife (usually elk), bicycles, a pedestrian, and an equestrian (see figure 39).

The majority of the reported crashes happened between June and September, which are the historical peak visitation months (NPS Visitor Use Statistics) of any year, with about 26% occurring during the other months (figure 40). Approximately half of that 26% occurred during October when the road is still open to traffic, while the remaining number of crashes occurred between November and May when the section between the Death Canyon Road intersection and the Granite Trailhead parking area is generally closed to motorized traffic.

FIGURE 38. DISTRIBUTION BY CRASH TYPE

(Number of crashes shown in parenthesis)

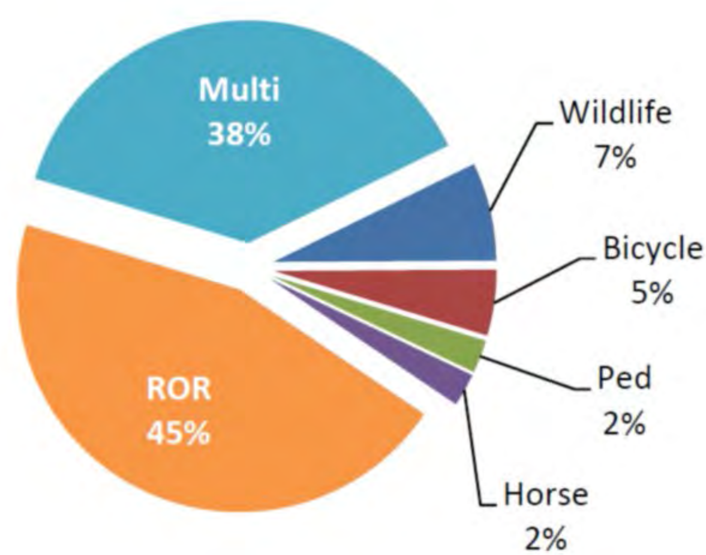


FIGURE 39. CRASH DISTRIBUTION BY COLLISION TYPE

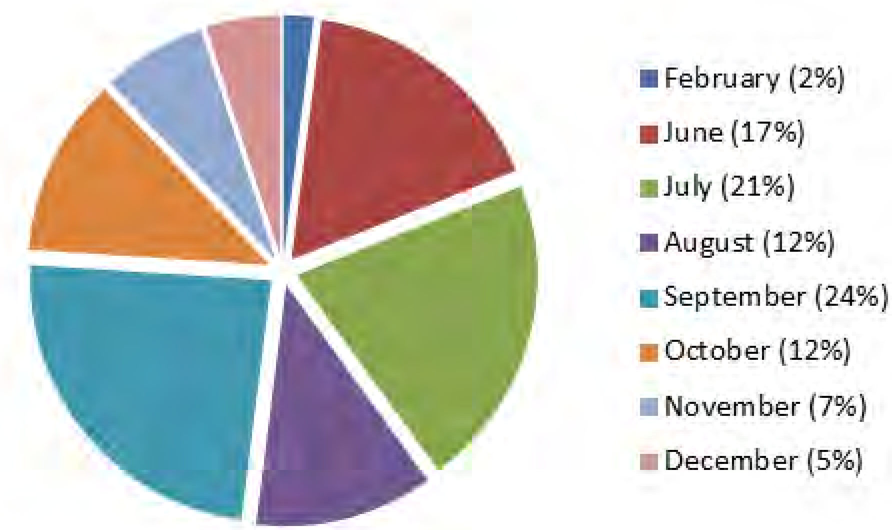


FIGURE 40. CRASH DISTRIBUTION BY MONTH

(Percent of crashes shown in parenthesis)

PARKING CONDITIONS

There are five designated parking areas within the corridor: Sawmill Ponds Overlook, Granite Canyon Trailhead, Death Canyon Trailhead, Laurance S. Rockefeller Preserve, and Poker Flats (horse trailer use). The Sawmill Ponds Overlook, Poker Flats, and Granite Canyon Trailhead parking areas are along Moose-Wilson Road, while the Death Canyon Trailhead and Laurance S. Rockefeller Preserve parking areas are at the ends of their own access roads. Parking is also available at Murie Ranch, but it is not formally signed and visitor use is low. Primary users include administration and guests of The Murie Center. Table 18 includes characteristics of each of the primary parking areas within the corridor.

TABLE 18. PARKING AREAS

Parking Area	Physical Description	Operational Considerations
Sawmill Ponds Overlook	This parking area is approximately 0.26 acre in size, unpaved, and unstriped. It is built to accommodate pull-in parking, as well as to provide adequate space to safely back onto the roadway. It is open to vehicles year-round.	This parking area is used for five primary purposes: (1) as an overlook to the wetlands below for wildlife viewing, (2) as an informal trailhead for pedestrians walking along the bench above and parallel to the wetlands below, (3) as a turnaround for southbound oversized vehicles, (4) as a convenient turnout for way-finding and other purposes, and (5) as an occasional horse trailer parking area, which is rarely filled to capacity.

TABLE 18. PARKING AREAS

Parking Area	Physical Description	Operational Considerations
Granite Canyon Trailhead	This parking area is approximately 0.24 acre in size, unpaved, and unstriped. It accommodates both pull-in and parallel parking. The lot has two ingress/egress points, and a circulation aisle between parked vehicles. It is open year-round.	This parking area accommodates overnight parking and is used primarily as a trailhead parking area for visitors heading west toward the Teton Range on foot or ski/snowshoe. There are often extensive lines at this lot and at adjacent user-created turnouts, even in the winter. This lot also contains a turnaround for northbound oversized vehicles.
Death Canyon Trailhead	This parking area is approximately 0.20 acre in size, unpaved, and is unstriped. It has a single ingress / egress point at the end of Death Canyon Road. It can accommodate head-in and parallel parking. It is open to vehicles until the road is closed for the winter season, at which point a smaller lot at the intersection with Moose-Wilson Road is available for use.	This parking area is intended to serve the Death Canyon Trailhead, which allows summer recreational use. Overnight parking is permitted at this lot for backcountry campers.
Laurance S. Rockefeller Preserve Center	This parking area is approximately 0.40 acre in size with a paved circulation road; the parking area is unstriped and unpaved. It has a single ingress/egress point and one-way traffic flow. The lot can accommodate approximately 50 vehicles, and there are also areas for bike and horse parking.	Parking is monitored by attendants for a majority of the day (9:00 a.m. to 4:00 p.m.) during peak summer visitation. The attendant manages parking in the lot to ensure capacity for approximately 50 vehicles, and also monitors the use of reserved spaces that are available for fuel-efficient vehicles and persons with disabilities. The lot is physically open 24 hours, but overnight parking is not allowed.
Poker Flats	This parking area is an approximately 0.26-acre horse trailer lot with a gravel base. The parking lot has edges that are delineated through log barriers. Signs are posted to encourage drivers to back trailers into the lot.	This parking lot is intended to serve equestrians and provides access to trails that exit the parking area from the north, northeast, and south sides. Despite being a horse trailer lot, there are no hitching posts to tie horses to while riders set up before or break down after a ride.

While only the LSR Preserve parking area has a formal capacity, Utah State University researchers have determined that the Sawmill Ponds Overlook parking area and Granite Canyon Trailhead parking area can accommodate approximately 15 to 25 vehicles. Death Canyon Trailhead can accommodate approximately 30 vehicles, and the Poker Flats parking lot could hold as many as five horse trailers at once (during their period of observation in the summer/fall 2013). However, as indicated in the table, these parking areas are all unpaved and unstriped. The lack of striping has resulted in haphazard parking patterns and inefficient use of available space. With the exception of the LSR Preserve, which is actively managed by attendants, overflow parking for these "full" lots has occurred via user-created disturbances along the access roads. Additionally, rough terrain along the unpaved portion of Death Canyon Road has forced many visitors with low-clearance vehicles to park in disturbed areas along the road rather than venture to find available parking in the parking area at the trailhead, which might have space available.

This informal, user-created parking has become prevalent at each of the designated parking areas within the corridor. Visitor failure to park fully off of the roadway disrupts traffic flow along the roadway, and all user-created parking has caused resource degradation (see the "Natural Resources" section of this chapter for more information regarding resource impacts). To limit the size of user-created parking areas, park staff has placed boulders or log barriers along the edges of the roadway.

Utah State University observed parking at each of these parking areas as part of their 2013/2014 data collection. Across all sampling periods, vehicle use of Granite Canyon, Death Canyon, and Poker Flats parking areas was greatest during midday, from around 11:00 a.m. to 2:00 p.m.–3:00 p.m. The researchers observed no consistent trend or pattern at Sawmill Ponds. The LSR Preserve parking area was generally the busiest overall, with increasing use until 11:00 a.m., remaining high, and dropping off slightly after 2:00 p.m. It was also the busiest of the lots examined during the late afternoon (4:00 p.m.–6:00 p.m.).

Data was also gathered regarding hourly use of visitor-created overflow parking. Table 19 below shows the maximum number of vehicles in each designated area during each sampling period, as well as maximum number of vehicles in associated overflow parking. The LSR Preserve designated parking area showed the highest observed number of vehicles at one time, which was 55 vehicles during July. This area, however, is regulated to accommodate approximately 50 vehicles. Death Canyon had the highest observed number of vehicles parking in overflow parking, with 85 vehicles observed during July. This can likely be linked not only to the unstriped lot at the Death Canyon Trailhead, but also to the rough road conditions on the road leading to the trailhead. Most of the user-created overflow parking at Death Canyon was along the roadway.

TABLE 19. MAXIMUM NUMBER OF VEHICLES OBSERVED IN DESIGNATED AND OVERFLOW PARKING AREAS

Designated				
	July	Aug 1–15	Aug 16–31	September
Sawmill Ponds	20	7	20	15
Death Canyon	33	31	25	22
LSR Preserve	55	54	54	53
Granite Canyon	20	20	21	10
Poker Flats	5	5	5	5
Overflow				
	July	Aug 1–15	Aug 16–31	September
Sawmill Ponds	0	0	2	0
Death Canyon	85	76	42	30
LSR Preserve[4]	N/A	N/A	N/A	N/A
Granite Canyon	3	3	2	0
Poker Flats	3	0	1	2

[4] There is no overflow parking at the LSR Preserve due to active management of the designated parking lot. Visitors wait for the next available parking space.

SOCIOECONOMIC ENVIRONMENT

INTRODUCTION

This section describes current social and economic conditions that could potentially be affected by the proposed alternatives evaluated in this *Moose-Wilson Corridor Comprehensive Management Plan / Environmental Impact Statement*. The social and economic conditions of a region are characterized by its demographic composition, structure, and size of its economy, and types and levels of service and social qualities and factors available to its citizens. Grand Teton National Park provides recreational opportunities, economic benefits, quality of life attributes and factors, and other amenities to both visitors and residents of the region.

This section describes the socioeconomic area of consideration, including demographic and economic characteristics for Teton County and a number of the communities within the county most likely to be affected by proposed strategies in the plan. In addition, public services, such as fire, emergency services, police, medical facilities, and schools are described as well as fiscal resources, including assessed values and sales and use and property tax receipts. Finally, the section describes recreation opportunities, quality of life amenities, and attributes of the region and specifically Moose-Wilson corridor; the importance of recreation and park visitation to the region; and the contribution of park visitor spending to jobs and income.

SOCIOECONOMIC AREA OF CONSIDERATION

The Moose-Wilson corridor is used as a thoroughfare by residents traveling to and from their place of employment. Shuttle and taxi service providers use Moose-Wilson Road to shuttle visitors and residents from Teton Village, Wilson, and the southern part of the road northward to the airport, bypassing traffic in the town of Jackson.

The Moose-Wilson corridor, larger park unit, and communities adjacent to the park where people live and visitors frequent are in Teton County, Wyoming. As a result, Teton County, Wyoming, represents the study area for this analysis. The town of Jackson is the only incorporated municipality in Teton County. Other potentially affected communities in the study area are classified as "census designated places" and include Moose-Wilson Road census designated place and the communities of Wilson, South Park, and Teton Village. These five communities account for 70% of total population in Teton County (see vicinity map).

DEMOGRAPHIC CHARACTERISTICS

Demographic characteristics are described for the study area geographies in this section. Much of the data in the section was obtained from the Census Bureau,[5] the Jackson Hole Chamber of Commerce, and other relevant reports and documents.

Teton County

Teton County, which encompasses Grand Teton National Park, is the primary economic sphere of the tourism industry in and around the park. Summer is the peak tourist season. During this time, the area offers many recreational opportunities such as viewing scenery and wildlife, scenic driving, hiking and backpacking, mountain climbing,

[5] The US Census Bureau American Community Survey five-year estimates (2008 to 2012) were obtained for the geographies in the study. The five-year estimates provide average indicators across a five-year period and are the only population estimate available for geographies with a population less than 20,000.

whitewater rafting and kayaking, bicycling, fishing, and horseback riding. During the winter, the area provides world-class downhill skiing opportunities at Jackson Hole Mountain Resort, Snow King Resort, and Grand Targhee Resort; and additional recreation in national forests, particularly at Bridger-Teton and Caribou-Targhee National Forests.

Because the census is completed in April and counts only people living at their "usual residences," resort areas such Teton County typically undercount population and employment. During this time, seasonal employees have left the resorts, permanent employees may be on vacation, and seasonal residents are living in their primary homes. To address these undercounts, local planners use a combination of existing housing units, building permits, and household population factors to more accurately estimate the population. In addition to the resident population, Teton County can have a tourist population that is more than twice the resident population. Year-round residents accounted for almost 22,000 people in Teton County in 2012 (US Census Bureau 2012), an increase of 16.8% from a population of 18,251 in 2000. The vast majority of Teton County residents are non-Hispanic white alone (84%), while 14% of the Teton County population is characterized as Hispanic.

Tourists contribute an additional 24,000 individuals to the population of Teton County during the peak summer season (Jackson Hole Conservation Alliance 2013). Seasonal residents and seasonal workers add another 6,000 and 5,000, respectively, to the population during the summer months. Residents from adjacent counties also commute into the Teton County for work, often due to the high housing prices in the county. Table 20 summarize the population and demographic characteristics in Teton County.

Housing in Teton County is generally extremely expensive compared to adjacent counties. In 2012, the median housing value was $692,000 in Teton County, an increase of 89% from $365,400 in 2000 (US Census Bureau 2000; US Census Bureau 2012b). In 2012, the median housing value in Teton County, Wyoming, was over three times higher than the value in Teton County, Idaho, and Lincoln County, Wyoming, which were $226,600 and $204,600, respectively (US Census Bureau 2012b). In 2012, the average sales price of a single-family home in Teton County, Wyoming, rose to $1,496,711, up 22% from 2011. In contrast, the state of Wyoming's average sales price was $266,406 for the same time period (Wyoming Community Development Authority 2013).

TABLE 20. EFFECTIVE POPULATIONS IN TETON COUNTY, 2012

Components of Effective Population	Winter		Spring		Summer		Fall	
	no.	%	no.	%	no.	%	no.	%
Permanent Residents	21,675	54%	21,675	73%	21,675	36%	21,675	73%
Commuters	3,809	10%	3,809	13%	3,809	6%	3,809	13%
Seasonal Residents	4,047	10%	1,212	4%	5,858	10%	1,145	4%
Seasonal Workers	1,327	3%	204	1%	5,066	8%	343	1%
Visitors	9,108	23%	2,731	9%	23,874	40%	2,577	9%
Total	39,966	100%	29,631	100%	60,282	100%	29,549	100%

Source: Jackson Hole Conservation Alliance 2013

Town of Jackson

Teton County, which encompasses Grand Teton National Park, is the primary economic sphere of the tourism industry in and around the park. The region was first populated by various American Indian tribes and later trappers and mountain men. The introduction of livestock ranching in the 1890s, establishment of Grand Teton National Park in 1929, and eventual introduction of ski areas in the 1960s all contributed to population increases over time (Town of Jackson 2013).

The town of Jackson serves as the primary gateway community to the park. Jackson provides year-round visitor lodging and other services for Grand Teton and Yellowstone National Parks, two of the most popular units in the national park system; the National Elk Refuge; and several other public lands and recreation sites in the region.

In 2012, the town had a residential population of 9,646, an increase of 11.6% from 2000 (US Census Bureau 2012a and 2000). The town of Jackson accounts for 45% of Teton County's residential population in 2012 and 36% of the housing units in the county (US Census Bureau 2012b).

The vast majority of Jackson residents are characterized as non-Hispanic white alone. The town has a higher proportion of minority residents (32.5%) than the proportion of minority residents in Teton County as a whole (17.4%) and the state of Wyoming as a whole (14.4%). In 2012, there were 4,671 housing units in the town of Jackson. The median housing value in the town of Jackson was $587,300, over three times higher than the state's median housing value of $184,400 (US Census Bureau 2012b).

Moose-Wilson Road Census Designated Place

The Moose-Wilson Road Census Designated Place is north of Wilson and includes houses, condominiums, and businesses along Wyoming 390 between Teton Village and the Teton Pass Highway (Wyoming Highway 22). In 2012, this region had a population of 2,551, an increase of 77.3% from 2000 (US Census Bureau 2012a and 2000). Most of the residents are characterized as non-Hispanic white alone (the census category for those who reported white and no other race group and did not report being of Hispanic origin) at 91.8%, while 8.2% of the Moose-Wilson Road population is Hispanic. In 2012, the Moose-Wilson Road region had 693 housing units. The median home value is more than $1 million (US Census Bureau 2012b).

South Park Census Designated Place

The South Park Census Designated Place is south of Moose-Wilson Road and southwest of the town of Jackson. In 2012, the area had a population of 1,556, an increase of more than 80% from 2000 (US Census Bureau 2012a and 2000). More than 99% of the population is characterized as non-Hispanic white. In 2012, there were 692 housing units, and the median home value exceeded $1 million (US Census Bureau 2012b).

Teton Village

The town of Jackson is approximately 12 miles south of the park and approximately 15 miles from the Idaho border and serves as the county seat for Teton County. The Town of Jackson was originally named in 1894, and is the county seat of Teton County. It is the only incorporated municipality in the region (Town of Jackson 2015). In the late 1970s, Jackson underwent rapid growth from increased tourism.

Due to the nature of Teton Village being a ski and summer resort area, the number of housing units is greater than the number of full-time residents. In 2012, there were 449 housing units in Teton Village, and the median home value was more than $1 million (US Census Bureau 2014b).

Wilson

The community of Wilson is adjacent to and southwest of the Moose-Wilson Road Census Designated Place along the Teton Pass Highway. In 2012, the area had a population of 1,109, a decrease of 9.4% from 2000 (US Census Bureau 2012a and 2000). Approximately 97.6% of residents are characterized as non-Hispanic white alone. In 2012, there were 839 housing units in Wilson. The median home value was $659,800, notably higher than the state of Wyoming median housing value.

EMPLOYMENT AND INCOME

The economy of Teton County relies heavily on the tourism industry, with a large majority of the employment supported by visitor spending. It should be noted that Teton County had workforce of 13,104 residents in the county in 2012 (US Census Bureau 2012b); the census estimates the employed workforce as the number of residents within the county with a job. However, there are many people who commute into Teton County for work or relocate temporarily for a summer or winter season who would not be included in these estimates. In addition, people in Teton County typically hold more than one job. The Bureau of Economic Analysis estimates the number of full-time and part-time jobs in Teton County as 28,138 in 2013, more than twice the census figure (US Bureau of Economic Analysis 2015), which are based on the number of jobs at the place of work.

In 2013, per capita personal income in Teton County ($105,821) was considerably higher than in the state ($52,826) or the nation ($44,765) (US Bureau of Economic Analysis 2015). Per capita income has grown at a much higher rate than in the state and nation. However, it fell in 2007 and 2008 and has rebounded since 2009 (figure 41).

TABLE 21. POPULATION AND RACE AND ETHNICITY CHARACTERISTICS IN THE STUDY AREA GEOGRAPHIES, 2012

Race and Ethnicity	Town of Jackson	Moose-Wilson Road*	South Park*	Teton Village*	Wilson*	Teton County, Wyoming	State of Wyoming
Population	**9,646**	**2,551**	**1,556**	**147**	**1,173**	**21,326**	**562,803**
White alone	92.9%	100.0%	100.0%	100.0%	97.9%	96.0%	91.2%
Non-Hispanic White alone	72.6%	91.8%	99.3%	100.0%	97.6%	86.0%	93.9%
Hispanic White alone	27.4%	8.2%	0.7%	0.0%	2.4%	14.0%	6.1%
Black or African American alone	0.0%	0.0%	0.0%	0.0%	0.0%	0.2%	0.8%
American Indian and Alaska Native alone	0.5%	0.0%	0.0%	0.0%	0.0%	0.4%	2.3%
Asian alone	1.0%	0.0%	0.0%	0.0%	1.0%	0.5%	0.8%
Native Hawaiian and Other Pacific Islander alone	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Other**	5.6%	0.0%	0.0%	0.0%	1.1%	2.8%	4.9%
Minority***	32.5%	8.2%	0.7%	0.0%	4.5%	17.4%	14.4%
Hispanic or Latino Origin	27.9%	8.2%	0.7%	0.0%	2.4%	14.6%	8.9%
Total Housing Units	4,671	1,563	692	449	839	12,821	261,430
Median Home Value (2012$)	$587,300	$1,000,000+	$1,000,000+	$1,000,000+	$659,800	$692,700	$184,400

Source: US Census Bureau, American Community Survey, 2014b; 2012 five-year estimates

Note: *Areas classified as census designated places

**The Other category includes those who identify themselves as Some other race alone or two or more races

***A minority is classified as those who identify themselves as being of a race other than non-Hispanic White alone

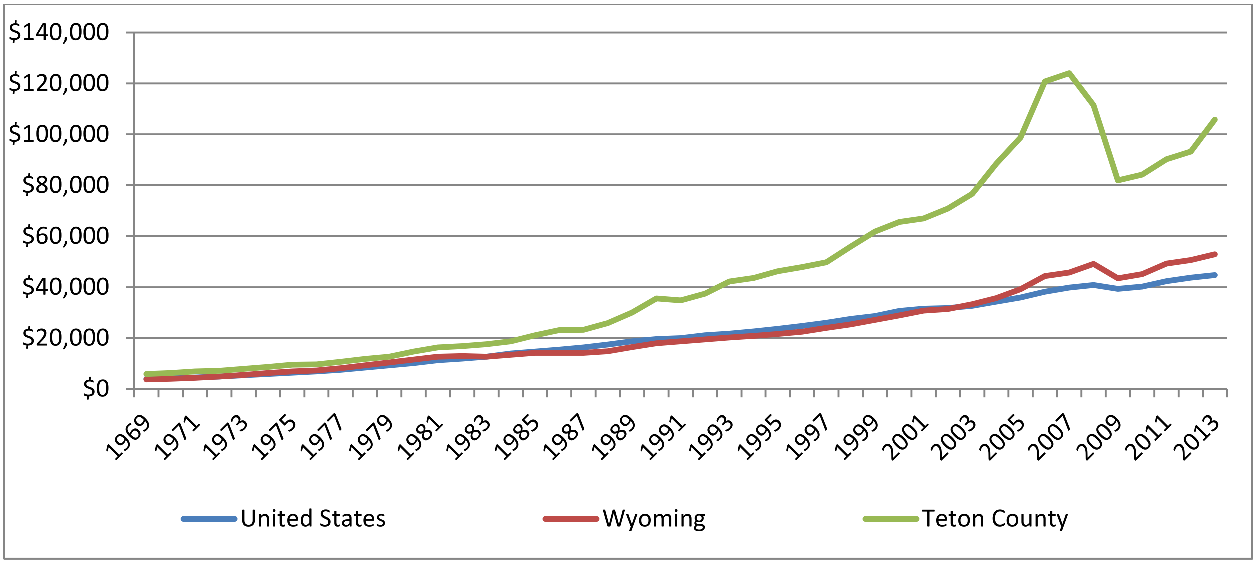


FIGURE 41. PER CAPITA PERSONAL INCOME, 1969–2012

Employment in the tourism sectors, including accommodations; restaurants; arts, entertainment, and recreation services; and retail trade, dominate the county, accounting for 36.5% of the workforce. In contrast, the percentage of the workforce in the arts, entertainment, recreation, accommodations, and food services accounts for 9.5% in the state of Wyoming. Other important sectors in the county include construction (8.8%); real estate, rental and leasing (9.6%); and professional, scientific, and technical services (7.1%). Notably, the workforce residing in Teton Village is primarily employed in arts, entertainment, recreation, accommodations, and food services (56.6%) and construction (26.3%) sectors. Full- and part-time employment by industry (for place of work) for Teton County is presented in table 22 from the US Bureau of Economic Analysis. Employed workforce from the US Census for the smaller geographies for place of residence is presented in table 23.

Major employers in Teton County are presented in table 24. The largest summer employer is the Xanterra Parks and Resorts while the largest winter employer is Jackson Hole Mountain Resort. St. John's Medical Center is the largest year-round employer in the county. In the summer, there are approximately 2,300 employees in the park, which includes park employees and concessioners (NPS and USFWS 2013).

TABLE 22. TETON COUNTY FULL- AND PART-TIME EMPLOYMENT BY INDUSTRY, 2013

Description	Number of Jobs	Percent of Jobs in Teton County
Farm	182	0.6%
Forestry, fishing, and related activities	143	0.5%
Mining	284	1.0%
Utilities	(D)	(D)
Construction	2486	8.8%
Manufacturing	277	1.0%
Wholesale trade	(D)	(D)
Retail trade	2352	*8.4%*
Transportation and warehousing	522	1.9%
Information	346	1.2%
Finance and insurance	2007	7.1%
Real estate and rental and leasing	2713	9.6%
Professional, scientific, and technical services	2007	7.1%
Management of companies and enterprises	137	0.5%
Administrative and waste management services	1273	4.5%
Educational services	405	1.4%
Health care and social assistance	1092	3.9%
Arts, entertainment, and recreation	1368	*4.9%*
Accommodation and food services	6540	*23.2%*
Other services, except public administration	1288	4.6%
Government and government enterprises	2415	8.6%
Federal, civilian	406	1.4%
Military	119	0.4%
State and local	1890	6.7%
Total Employment	***28,138***	***100.0%***

(D) – Not disclosed for proprietary purposes.
Source: US Bureau of Economic Analysis (2015)

TABLE 23. EMPLOYMENT AND LABOR FORCE CHARACTERISTICS WITHIN STUDY AREA GEOGRAPHIES, 2008–2012

Indicator	Town of Jackson	Moose-Wilson Road*	South Park*	Teton Village*	Wilson*	Teton County	State of Wyoming
POPULATION 16 YEARS AND OVER	**7,571**	**2,144**	**1,229**	**113**	**1,109**	**17,580**	**442,182**
In Labor Force	84.5%	77.8%	72.1%	67.3%	82.0%	78.7%	69.5%
Civilian Labor Force	6,400	1,668	886	76	909	13,838	304,384
Employed	*96.4%*	*86.5%*	*96.4%*	*100.0%*	*100.0%*	*94.7%*	*94.9%*
Unemployed	*3.6%*	*13.5%*	*3.6%*	*0.0%*	*0.0%*	*5.3%*	*5.1%*
Armed Forces	0	0	0	0	0	0	2,9040
Not in Labor Force	15.5%	22.2%	27.9%	32.7%	18.0%	21.3%	30.5%
EMPLOYED WORKFORCE	**6,168**	**1,443**	**854**	**76**	**909**	**See table 23**	**288,847**
Agriculture, forestry, fishing and hunting, and mining	3.6%	10.3%	0.0%	0.0%	16.3%		12.3%
Construction	9.4%	19.8%	6.3%	26.3%	10.2%		8.4%
Manufacturing	1.3%	0.0%	1.4%	0.0%	0.0%		4.7%
Wholesale trade	0.6%	1.4%	3.7%	0.0%	0.0%		2.1%
Retail trade	11.8%	7.0%	7.8%	0.0%	4.8%		10.8%
Transportation and warehousing, and utilities	4.2%	3.5%	2.0%	0.0%	3.7%		6.9%
Information	1.7%	0.0%	0.0%	0.0%	0.0%		1.7%
Fire*	4.3%	4.1%	5.0%	0.0%	7.8%		4.2%
Professional, scientific, and management, and administrative and waste management services	12.5%	12.0%	11.5%	0.0%	4.2%		6.5%
Educational services, and health care and social assistance	17.9%	5.2%	27.3%	17.1%	16.8%		21.8%
Arts, entertainment, and recreation, and accommodation and food services	27.3%	33.1%	30.2%	56.6%	14.5%		9.5%
Other services, except public administration	4.4%	3.7%	3.0%	0.0%	20.1%		4.6%
Public administration	1.0%	0.0%	1.6%	0.0%	1.4%		6.4%

Source: 2008–2012 American Community Survey, US Census Bureau, 2012b
Note: *FIRE includes the finance and insurance, and real estate and rental and leasing sectors

TABLE 24. TOP EMPLOYING COMPANIES IN TETON COUNTY, 2014

No.	Winter	Summer	Year-Round
1	Jackson Hole Mountain Resort	Xanterra Parks and Resorts / Yellowstone	St. John's Medical Center
2	St. John's Medical Center	Grand Teton Lodge Company	Jackson Hole Mountain Resort
3	Teton County School District	St. John's Medical Center	Four Seasons Resort Jackson Hole
4	Grand Targhee Resort	Jackson Hole Mountain Resort	Teton County Government
5	Four Seasons Resort Jackson Hole	Grand Teton National Park	Terra Resort Group
6	Teton County Government	Four Seasons Resort Jackson Hole	Grand Targhee Resort
7	Terra Resort Group	Teton County Government	Snow King Resort
8	Snow King Resort	Terra Resort Group	Xanterra Parks and Resorts / Yellowstone
9	Xanterra Parks and Resorts / Yellowstone	Snow King Resort	Grand Teton National Park
10	Town of Jackson	Grand Targhee Resort	Town of Jackson

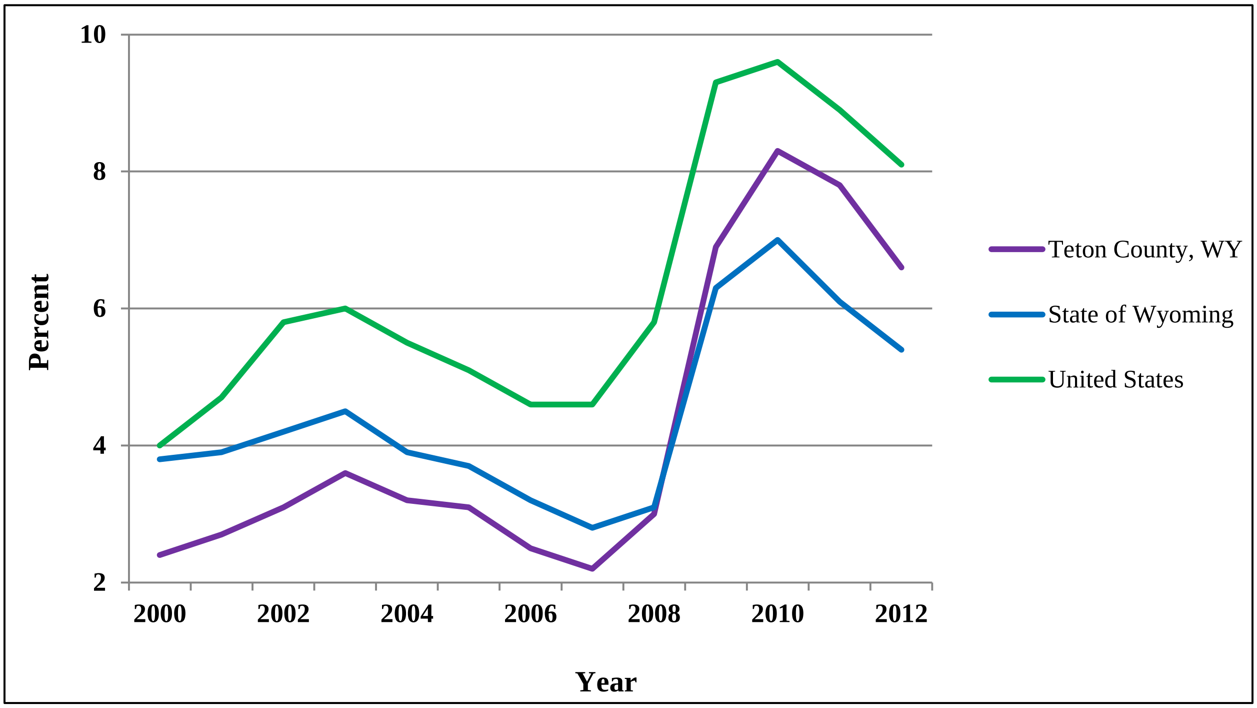
Source: Chamber of Commerce (2014)

Unemployment rates, obtained from the US Bureau of Labor Statistics, are presented in figure 42.[6] Unemployment rates in Teton County over the past 13 years generally follow state and national trends, although Teton County and Wyoming have considerably lower unemployment rates than those in the nation as a whole. Between 2000 and 2009, the unemployment rate in Teton County was lower than the Wyoming average. Since the economic downturn began in 2009, the unemployment rate in Teton County has been higher than the state average (Bureau of Labor Statistics 2014); however, the unemployment rate has fallen since 2010 and, in 2012, was 6.6%.

PUBLIC SERVICES

This section provides an overview of police, fire, and medical services available to residents and visitors throughout the study area. The number of public schools and enrollment across the study area is also presented.

[6] The Bureau of Labor Statistics reports on unemployment and other economic indicators for larger geographic areas and therefore information specific to the communities described in the study area is not available.



Source: US Department of Labor, Bureau of Labor Statistics, 2014

FIGURE 42. 2000–12 UNEMPLOYMENT RATES WITHIN TETON COUNTY, WYOMING, AND THE UNITED STATES

Police Services

The Teton County Sheriff's Office in Jackson, Wyoming, provides a variety of services ranging from administrative, animal control, and detention to patrol, search and rescue, and training. The patrol section is staffed 24 hours a day; deputies work a 10 hour day, four days a week. Patrol teams are composed of three deputies and a sergeant. The policing area covers more than 4,000 square miles and also includes numerous outlying residential subdivisions, three ski resorts, and national forest lands. The sheriff's office works collaboratively with the Jackson Police Department, Wyoming Game and Fish Department, Wyoming Highway Patrol, Grand Teton National Park, National Elk Refuge, and neighboring law enforcement agencies. Alternative transportation modes are often used, depending on the environment in which patrol is occurring. Alternative transportation modes include snowmobiles, all-terrain vehicles, bicycle, foot, and horseback (Teton County Sheriff's Department n.d.).

Within Grand Teton National Park, law enforcement is provided by the National Park Service, as provided in the General Authorities Act of 1976 (NPS 2015).

The uniformed patrol division is the largest unit in the Jackson Police Department. The unit is co-supervised by four sergeants. Patrol duties include proactive crime prevention, emergency call response, in-depth field investigations, evidence preservation and collection, enforcement of state statutes and town ordinances, educational outreach and crime prevention programs. The Jackson Mounted Patrol is composed of both sworn officers and the all-volunteer Citizens Mounted Unit (Town of Jackson 2013).

Fire Services

There are three fire departments in Teton County. A summary of these departments is provided below (US Fire Administration 2015).

Grand Teton National Park. The park has two fire stations and 20 active firefighters who are paid per call.

Jackson Hole Fire/EMS. This department is composed of career and volunteer firefighters. There are seven fire stations and the department is staffed with 5 career firefighters, 125 volunteer firefighters, and 6 nonfirefighting civilians.

Teton Village Volunteer Fire Department. This volunteer department has one fire station and 17 firefighters who are paid per call.

Medical Services

St. John's Medical Center serves as the regional hospital and is in Jackson. The facility has 108 beds, which includes 48 acute care beds and 40 primary care unit beds. Included in this number are five intensive care unit (ICU) beds and another three for labor, delivery, recovery, and postpartum beds. An average of 500 people are employed at St. John's Medical Center, which includes more than 150 medical providers. The facility has an emergency department and a family health and urgent care clinic (St. John's Medical Center 2014). Smaller medical practices are available across Teton County.

Schools

During the 2011–2012 academic year, there were 2,481 students enrolled in 11 public schools in Teton County. Pre-kindergarten and kindergarten represent 10.4% of total enrollment while students enrolled in grades 1–8 represent 63.1% of total enrollment. High school aged students in grades 9–12 represent 26.4% of total enrollment. There were 208 full-time equivalent teachers during the 2011–12 academic year (US Department of Education 2014).

PROPERTY VALUES AND FISCAL RECEIPTS

Although some changes in property valuations result from annual reassessments, most property value increases in Teton County, Wyoming, reflect real property and improvements through new construction of buildings and facilities that are added to the tax rolls. Therefore, property valuation trends are a good indicator of construction activity and economic growth in the area.

From 2006 through 2014, Teton County, Wyoming, registered a 23.5% increase in total real property assessed values. Residential and commercial valuations accounted for virtually the entire increase. Residential property represents 85.2% of the total real property assessed valuation in the county in 2014. The increases in assessed valuation have led to increased property tax revenues (WY DOR 2006; WY DOR 2014a).

Sales, use, and property taxes generate important revenues for Teton County and its communities. In 2014, $72.3 million in sales and use taxes were generated in Teton County, while $68.1 million were collected in property taxes (WY DOR 2014a). This section provides additional information on sales and use taxes and assessed valuation for Teton County and the communities of Jackson and Teton Village, where available.

Total sales taxes generated between July 2013 and June 2014 by Teton County, Wyoming, were $72.7 million, of which $26.1 million (35.9%) was generated in the Town of Jackson and $3.4 million (4.7%) in Teton Village (Wyoming DOR 2014b). The remaining sales tax receipts, $43.3 million or 59.6%, were generated in the unincorporated areas of Teton County. Approximately 58% of the sales and use taxes were distributed back to the county and its municipalities. During the 2013–2014 period, $41.9 million in sales and use taxes (including lodging and resort tax) were distributed back to Teton County and its towns, of which $12.3 million (29.4%) was distributed to the Town of Jackson and $3.4 million (8.1%) to Teton Village (Wyoming DOR 2014a). The remaining sales taxes, $26.2 million or 62.5%, were distributed to the remainder of Teton County. This unincorporated part of Teton County includes summer only facilities in the park and accounts for the largest share of sales and use tax revenues as well as lodging taxes in the county.

The retail trade, accommodations, and food services business sectors account for over 70% of total sales tax generation in Teton County, Wyoming (A&I 2011 cited in NPS and USFWS 2013). Across Teton County, approximately 60% of the sales and use taxes are generated in the summer months, between May and October.[7] According to Wyoming DOR, September is the largest sales-producing month, followed by October and August (US WY DOR 2014b). Sales tax receipts for Teton Village in the summer account for 42% of the annual receipts, excluding lodging taxes, while winter receipts (December through April) account for 56% of receipts for Teton Village, when Jackson Hole Mountain Resort is open.

Lodging tax receipts are part of sales and use taxes, with $4.6 million distributed across Teton County, accounting for 10.9% of the sales and use taxes in the county. In the Town of Jackson, lodging tax receipts are $1.5 million, accounting for 12.5% of sales and use taxes in the town. In Teton Village, lodging tax receipts totaled $1.1 million and accounted for 32.6% of sales and use taxes distributed to Teton Village (WY DOR 2014a). In addition, Teton Village levies a Resort District Tax of 2%, which yielded sales tax receipts of $2.3 million during the 2013–2014 year (WY DOR 2014a) accounting for 67.6% of tax distributions to Teton Village. Teton Village receives a much larger proportion of tax receipts from lodging and accommodations and from winter visitation than other areas in Teton County. Across Teton County, during the summer months, lodging, hotels, motels, cabins, and other park accommodations for visitors are typically at close to full occupancy (Jackson Hole Chamber of Commerce 2013).

In Teton County, total assessed valuation (on which property taxes are levied) was $1.1 billion, the overwhelming majority (98.8%) of which was locally assessed residential and commercial land, improvements, and personal property. Teton County property tax receipts account for 5.9% of total property taxes collected across the state. Oil and gas production, which occurs in other areas of the state, accounts for the bulk of the property tax receipts to the state.

RECREATION AND QUALITY OF LIFE

As described in the visitor use and experience section, recreation opportunities, awe-inspiring landscapes, and natural, cultural, and scenic amenities dominate the lifestyle of the region. These opportunities, the park, Jackson Hole Mountain Resort, and other amenities draw considerable visitors to the region, contributing to the region's economy. Grand Teton National Park draws approximately 2.6 million annual recreational visitors to the region. Approximately 400,000, or 15%, of these visitors travel Moose-Wilson Road (NPS 2014) to view wildlife, nature, hike, bicycle, and more.

The seasonality of recreational visits, and the associated visitor spending and economic impact, varies considerably at the park. The summer season (May through September) typically accounts for 85% or greater of total annual recreational visits. On average, recreational visits during the six-month period from November through April account for only 10% of the total annual recreational

[7] Lodging tax distributions are not provided on a monthly basis from the Wyoming Department of Revenue.

visits (NPS and USFWS 2013). Annual fluctuations in visitation can result from factors such as forest fires, drought, fuel prices, and state of the economy.

In addition to providing recreational opportunities and unparalleled viewscapes and amenities to visitors, the park, and in particular, Moose-Wilson Road, provides access to passive and active recreation opportunities to permanent and seasonal residents, an important attribute of the quality of life for these residents. Access to some of the park's most popular destinations is provided via the Moose-Wilson corridor, including Death Canyon and Granite Canyon Trailheads, Laurance S. Rockefeller Preserve, White Grass Ranch and Murie Ranch Historic Districts, and Sawmill Ponds Overlook.

Bicycling Moose-Wilson Road in the summer is increasing in popularity. In 2008, bicycling accounted for 6% of use across the park. Three percent of visitors arriving from the north took part in bicycling in the Moose-Wilson corridor, while 2% of visitors arriving from the south used bicycles in the corridor (University of Idaho 2008). More recent data collected near Granite Canyon in August 2013 shows that 3% of travel in both directions was bike traffic (Utah State University 2014). Summer visitor use levels at the bike path near the Snake River Bridge in Moose (83% of which were bicycle use) ranged from 110 visitors per day at the end of August to 273 visitors per day in the first part of August during weekends (Utah State University 2014).

Visitation, recreation, and traffic have increased substantially in the Moose-Wilson corridor during the summer months, which has contributed to issues such as congestion and resource degradation along the roadway. Approximately 25% of visitors arriving at the park from the north traveled Moose-Wilson Road, while 32% of visitors arriving from the south traveled the road, making it one of the top ten most visited sites at the park (University of Idaho, 2008). This increase in use of the corridor could be due, in part, to a variety of factors, including additional development along WY 390 and the opening of the LSR Preserve in 2008. Continued expansion of tourism and residential development south of the corridor in Teton Village and elsewhere along WY 390 will likely contribute to an overall increase in traffic, particularly northbound traffic entering the corridor through the Granite Canyon Entrance Station. This increase in traffic is frequently extending vehicle queuing lengths beyond the south boundary of the park along WY 390. During these times, vehicles that are waiting to enter the park at the Granite Canyon Entrance Station are unintentionally blocking local access roads, which makes it difficult for residents and emergency response vehicles to enter and exit these local roads efficiently and safely. These longer queuing periods also make it difficult for residents that live within the park boundary to access their residences. Additionally, as described in the "Traffic and Transportation" in the Environmental Consequences chapter, Teton County has forecast that vehicle miles travelled will increase approximately 1.3% each year. Considering these figures, substantial changes in traffic volumes in the corridor would likely occur in the future.

According to the Jackson/Teton County Comprehensive Plan (2012), the shared-use pathway program has expanded significantly since it began in 1996—to 57.17 miles as of June 2013 (Friends of Pathways 2013). The *Pathways Master Plan* indicates that demand exists for further expansion and connectivity of the system, although the county reports that accurate usage counts have been difficult for the Pathways Department to obtain (Town of Jackson and Teton County 2007).

The pathway network currently runs from the town of Jackson to Moose along Highway 26/89/191 and then along Teton Park Road, which provides access to the north end of the corridor. This network also extends south from the park boundary along WY 390 to WY 22. A connection along WY 22 between WY 390 and the town of Jackson is planned, and portions are under construction. The only major segment of road without built or planned bicycle pathways is the Moose-Wilson corridor.

Moose-Wilson Road is not fully plowed in the winter and so is closed to through-traffic from November 1 to early May. Nonvehicle access is available, and winter parking areas are located at the Granite Canyon Trailhead and the Death Canyon Road junction. Popular activities at these locations include cross-country and backcountry skiing and snowshoeing. Once visitors reach a trailhead road junction, the options of where they go on their skis and snowshoes are almost limitless (see additional information on visitation in the visitor use and experience section).

In addition, the Moose-Wilson corridor provides a scenic north-south alternative route connecting the south side of the corridor, including Teton Village, communities along Moose-Wilson Road, and Wilson to the park and the airport on the north side.

VISITOR SPENDING AND CONTRIBUTION TO LOCAL ECONOMIES

The influx of tourists to Grand Teton National Park not only brings tourist spending to the study area, but also generates jobs and income for the region. The economic viability of the communities in the area depends heavily on recreation and tourism generated by Grand Teton National Park. In the summer, there are approximately 2,300 employees in the park, which includes park employees and concessioners. Given the substantial drop in visitation from November through April, these employment numbers drop considerably during winter months (NPS and USFWS 2013). The communities in the Grand Teton National Park area provide food, lodging, medical services, groceries, gasoline, other automotive supplies/services, gifts, souvenirs, and other goods and services to visitors.

A visitor survey conducted in 2002 estimates that nonlocal park summer visitors spent $77 to $97 per person per day (2002 dollars) in the Jackson area (Loomis and Caughlan 2004). At 2012 dollars, annual visitor spending is estimated to be $865.5 million during the five summer months. The survey found that approximately 92% of visitors are nonlocal, coming from more than 30 to 60 miles from the park.

Another study conducted by the National Park Service and the University of Idaho revealed that the average expenditure per capita for Grand Teton and the 100-mile radius surrounding the park was $472 in 2008. Average total expenditure per capita inside the park was $151, with the largest expense being lodging. Outside the park, the average total expenditure per capita was $407, with the largest expense also being lodging (University of Idaho 2008).

Average summer visitation between 2000 and 2013 was 2,144,711, with nonlocals accounting for 1,973,231 of visits. Adjusting the analysis for current average visitation, visitor spending of $865.5 million supports 13,010 jobs and $279.5 million in income in the region, including direct, indirect, and induced effects (Loomis and Caughlan 2004). With 26,870 full- and part-time jobs in Teton County in 2011, nonlocal summer visitor spending supports 13,010 jobs and accounts for 48.4% of total employment in the county.

There are generally three types of visitors to the Jackson area: visitors with the primary purpose of visiting the park; visitors with an equal purpose of visiting both Grand Teton and Yellowstone National Parks; and visitors with an incidental purpose of visiting the park (Loomis and Caughlan 2004). Each of these visitors spends a different amount of time in the region associated with visiting the park: primary purpose visitors on average spend more than six days in the Jackson area; equal purpose visitors spend approximately two days in the area; and incidental purpose visitors spend approximately one day. Each of these visitors has a different profile for spending in the region. For example, primarily purpose visitors, who stay for a number of days, spend more of their money on lodging and hotels than the other visitors.

Consistent with the Loomis and Caughlin study (2002), the University of Idaho Visitor Survey estimated that 90% of visitors were from the United States and the remainder from international locations. Approximately 93% of US visitors were from states outside the host state of Wyoming. A travel and use study conducted by Utah State University found that of the vehicles traveling Moose-Wilson Road on three days in August, 24.5% were local vehicles, while 61.3% were visitors with nonlocal license plates (Utah State University 2014), indicating a higher local use level of the Moose-Wilson corridor than across the park as a whole.

CONCESSIONERS AND COMMERCIAL ACTIVITY

A number of park concessioners and commercial establishments use and benefit from Moose-Wilson Road. Dornan's, a private employer although not concession operated, includes a number of family owned businesses and is just east of Moose on the north end of the corridor. Dornan's offers retail, a fly fishing shop, and bike rentals, among other services. The Grand Teton Lodge Company is the largest non-NPS employer within the park's boundary.

There are a number of businesses in Teton Village and south of the corridor on Moose-Wilson Road (WY 390), offering restaurants, lodging, retail, and various services. As described above, Teton Village accounts for 4.7% of sales and use tax receipts in Teton County. Taxis also use Moose-Wilson Road to transport customers between Teton Village and the airport.

Wildlife viewing tours also use Moose-Wilson Road, and recent data has indicated that 24 tours were identified over three days during the peak summer period (Utah State University 2014). Parkwide, only 2% of visitors were part of a commercially guided tour group (University of Idaho 2008). More recently, data was collected for two weeks in the beginning of August 2013 that showed that 1% of travel along the corridor in both directions was trucks and vans, likely associated with commercial use. Current rules on the corridor restrict vehicle size and commercial activity types, affecting commercial travel on the corridor (please see the "Traffic and Transportation Affected Environment" section).

PARK OPERATIONS

INTRODUCTION

Park operations for Grand Teton National Park consist of NPS, concessioner, partner, and contractor operations that encompass protection of natural resources; maintaining all assets in a safe and aesthetically pleasing condition; preventing deterioration that would render these assets unsightly, unsafe, or beyond efficient repair; and provision of a variety of visitor services. The National Park Service provides operations and support for administrative services, management of cultural and natural resources, visitor facilities, visitor protection, and emergency services throughout the Moose-Wilson corridor and Grand Teton National Park as a whole.

Grand Teton National Park and John D. Rockefeller, Jr. Memorial Parkway is administered and managed from the office of the superintendent at Grand Teton National Park, in Moose, Wyoming. The park staff is operationally organized into five divisions: Visitor and Resource Protection, Interpretation and Partnerships, Science and Resource Management, Facility Management, and Business and Administration. The park operational budget in FY 2014 was $12,527,000, including funds for staff salaries, supplies and materials, and other operational needs. This amount excludes funds obtained for other purposes such as construction or special projects, which are allocated by year or by project. In FY 2014, the park staff consisted of 141 permanent employees, 11 term employees, 197 seasonal employees, with most of the latter employed during the busy summer season. The following section provides a brief summary of the five divisions of the park and their roles in overall park operations.

Business and Administration Division

The Business and Administration Division primarily supports the other park divisions in their activities through budgeting, contracting, human resources, information technology support, and management of commercial services.

Facility Management Division

The Facility Management Division is the largest operational unit in the park. The division is divided between two branches: Project Management, which is responsible for planning, design, and construction; and Operations, which is responsible for the operation and maintenance of all roads, trails, buildings, and utility systems in the park. The operations branch is divided into two districts, with the North District based in Colter Bay and the South District based in Moose.

Visitor and Resource Protection

The Visitor and Resource Protection Division is responsible for providing law enforcement; wildland and structural fire; search and rescue; fee collection; aviation management; permits for backcountry, boat, and special uses, emergency medical services, and the operation of a joint fire/law enforcement/ dispatch center with the US Forest Service. The division maintains some 24-hour per day operations during the busy summer season, although hours of operation are reduced at other times of the year when park activities decrease.

Division of Interpretation and Partnerships

The Division of Interpretation and Partnerships is responsible for operating park visitor centers and providing a wide variety of visitor services and interpretive and educational programs for and with park visitors. These include guided walks, campfire programs, interpretive talks, roving interpretation, and various other services. The division also manages the planning and design of media-based interpretation, such as brochures, site bulletins, wayside exhibits, various social media outlets, the park website, and other materials. Cultivating partnerships is another crucial component of the division with five vital park partners and multiple external partnerships.

Division of Science and Resource Management

The Division of Science and Resource Management performs a wide variety of duties associated with stewardship of the park's natural and cultural resources. Natural resource staff conduct research, wildlife and vegetation management activities, and noxious weed control. Cultural resource staff are responsible for the protection and monitoring of archeological sites, historic structures, and ethnographic resources, as well as tribal consultation. The division also has programmatic duties related to ensuring compliance with applicable laws, policies, and regulations.

PARK OPERATIONS IN THE MOOSE-WILSON CORRIDOR

The Moose-Wilson corridor contains a number of popular attractions, including scenic drives, historic districts, a visitor center, hiking trails, and wildlife viewing opportunities. In addition to providing access for park visitors, Moose-Wilson Road is used by park staff to reach their daily work locations, including the Laurance S. Rockefeller Preserve, Murie Ranch Historic District, the White Grass Ranch and Ranger Station, and the South and Moose Entrance Stations. Rangers use the road for their patrols and for accessing trails and occasionally for emergency response in the corridor. Park staff access the road from both the north and south ends, although most of the access is to or from the park headquarters at Moose.

The following section describes park operations that occur throughout the Moose-Wilson corridor by park division.

Business and Administration

Aside from providing basic support to the other park divisions, the staff in the Business and Administration Division are responsible for management of commercial services in the corridor. A total of 0.2 permanent and 0.1 seasonal FTE staff time is dedicated to commercial services activities within the corridor.

A number of recreational activities within the corridor are provided via concession contract. The R Lazy S Ranch is authorized to provide horseback rides on designated trails in the Poker Flats area as well as in the northern part of the corridor, west of Moose-Wilson Road. Some concession contracts for float trips authorize launches on the Snake River, south of Moose. There are three concession contracts for guided skiing and snowshoeing on designated trails, and two concession contracts for guided youth day hiking and backpacking on designated trails.

There are also several commercial use authorizations in effect within the corridor—several allow guided youth day hiking on all official trails within the corridor except for those within the LSR Preserve. Another commercial use authorization allows road-based tours of the corridor, which include hikes within 0.5 mile of Moose-Wilson Road.

Facility Management Division

The facility management staff is responsible for the planning, design, construction, operation, and maintenance of all park facility assets in the Moose-Wilson corridor.

The park maintains all park roads in the corridor to be passable by low-clearance two-wheel drive vehicles, with the exception of the unpaved section of Death Canyon Road, which receives limited maintenance to remain passable by four-wheel-drive high-clearance vehicles.

Most of the roadway operations efforts are focused on Moose-Wilson Road. Moose-Wilson Road is 7.1 miles in length, and is paved except for the 1.25-mile segment between the LSR Preserve and just south of the Granite Canyon Trailhead. Heavy use, poor construction, and the erosion of the road shoulders caused by roadside parking have degraded the road surface to the point that it is considered to be in "serious" condition. The road currently has a deferred maintenance backlog of $2.8 million. The road includes bridge structures at Lake Creek, Kaufman Creek, and near Granite Canyon Ranch.

The facility management staff plows sections of the road during the winter season to allow access by park visitors, staff, and private residents. Due to its isolation from park operations during the winter months, the road is plowed from the south park boundary to the Granite Canyon Trailhead by contract. The section from Death Canyon Road to the Granite Canyon Trailhead (including the LSR Preserve) is not plowed or groomed and is closed to motorized vehicles from approximately November 1 to May 1 each year. This section is generally allowed to melt naturally and is opened to traffic after a light plowing to clear any remaining patches of snow. Snow poles are placed along Moose-Wilson Road to guide snowplows in winter, and some of them are left in place throughout the year to delineate the roadway edge in specific areas. The entire length of the road is open to motorized vehicles from approximately May through October.

In an effort to keep the unpaved section of Moose-Wilson Road in smooth driving condition, the park conducts treatment with a magnesium chloride solution for dust suppression three times per season. Each closure for application lasts up to three days, and requires five days of time for the entire South District road crew to handle preparation, treatment, and demobilization, plus additional time for public affairs activities including closure announcements. The park places additional gravel on the unpaved section each spring and patches potholes in the paved section to improve the surface.

Parking operations in the Moose-Wilson corridor poses a major challenge to park staff. There are user-created gravel turnouts throughout the length of Moose-Wilson Road and Death Canyon Road. These turnouts result in the deterioration of the pavement edge and the creation of drop-offs, which accelerate the deterioration of the pavement surface and reduce driving safety along the road. Facility management staff place barrier logs at these turnouts to prevent the growth of these disturbed areas or to restrict roadside parking, but these must be moved seasonally so as not to interfere with winter plowing. Placement of barriers to close or prevent the expansion of user-created parking areas can result in the creation of new turnouts just beyond the barriers. Staff also applies fill material to smooth the transition at these turnouts to protect the pavement edge, not to formalize the user-created turnouts.

Custodial services are provided for the public vault toilet at the Death Canyon Trailhead and for the three composting toilets within the LSR Preserve. The cost of operating and maintaining the two entrance stations at Granite and Moose is partially offset by the fee revenue generated by the stations.

Building operation and maintenance is provided for all facilities in the corridor with the exception of routine maintenance functions at Murie Ranch, which are performed by The Murie Center and at White Grass Ranch, which are performed by the NPS Western Center for Historic Preservation.

Trail maintenance is performed by the park trail crew for all designated hiking and horse trails in the corridor. User-created horse trails in the corridor are being either removed or formalized. User-created hiking trails exist throughout the corridor but are not maintained by the park.

A total of 2.4 permanent and 2.0 seasonal FTE staff time is dedicated to the corridor.

Visitor and Resource Protection Division

The corridor is frequently patrolled by law enforcement rangers in marked patrol vehicles but without a set schedule during the months of May through October, and the backcountry within the corridor area is patrolled by rangers on foot. Due to the number and variety of user groups, traffic congestion in the Moose-Wilson corridor is a challenge for park staff. Traffic jams caused by wildlife sightings can bring traffic to a standstill and lead to conflict among wildlife viewers and other user groups. Rangers are frequently called upon to break up these traffic jams, and must enforce traffic regulations, pet regulations, and wildlife protection regulations.

Fee collection staff are stationed at the Moose and Granite Entrance Stations, where they greet and orient visitors and collect park entrance fees.

Mechanical thinning and prescribed burn projects are performed within the corridor by wildland fire management staff as funding allows. These projects are intended to prevent the unchecked spread of wildfire throughout the corridor, with a special emphasis on protecting park structures within and adjacent to the corridor at Beaver Creek and Moose.

The roads in the corridor are used by ambulances and related emergency medical services personnel, and larger structural fire engines if there is a need to respond to one of the structures in the corridor. Wildland fire trucks and crews also use the road while performing fuel reduction projects, controlled burns, or investigating smoke reports in the corridor. With the exception of the law enforcement vehicles, these other vehicles often require a lead or “spotter” vehicle to help navigate the narrow portions of the roads. Congestion along Moose-Wilson Road can result in delayed emergency response within the corridor.

A total of 7.6 permanent FTE and 4.0 seasonal FTE staff time is dedicated to the corridor.

Division of Interpretation and Partnerships

Park interpretive staff are stationed at the LSR Preserve. Interpretive staff rove throughout the corridor, providing interpretation of park resources outside of formal programs and provide a general presence in the corridor with special focus on areas of high visitor use. At the LSR Preserve Center, these staff provide visitor orientation, interpretation of the vision and conservation legacy of Laurance S. Rockefeller, the natural resources of the Preserve, the emphasis on the sustainable design of the LSR Preserve Center building, and a series of special programs. A total of 0.5 permanent FTE and 2.6 seasonal FTE staff time is dedicated to the corridor, along with 1.2 FTE provided by volunteers and other alternatively funded positions.

Division of Science and Resource Management

Science and Resource Management staff perform a number of operational tasks throughout the park and specifically in the Moose-Wilson corridor. Vegetation management staff inventory and monitor vegetation in the corridor, control nonnative species, and re-vegetate disturbed areas with native species. Wildlife management staff monitor all animal species found in the corridor, as well as manage the Wildlife Brigade, which serves as the first line in managing wildlife-induced traffic jams on Moose-Wilson Road, protecting both visitors and animals. Hydrologists conduct stream level and water quality monitoring in the corridor. A sound ecologist staff position is shared with Yellowstone National Park, and conducts soundscape monitoring in the corridor. Cultural resource management staff monitor prehistoric and historic sites in the corridor, and the GIS staff supports this and all other park divisions with any geospatial data and mapping needs.

A total of 1.1 permanent FTE and 1.5 seasonal FTE staff time is dedicated to the corridor.

PARK OPERATIONS AND FACILITIES BY SPECIFIC SITE

The following section describes park operations and facilities within specific areas of the Moose-Wilson corridor.

Moose Entrance Station

This area includes the Moose Entrance Station facility, a 1.5-mile segment of Teton Park Road that lies inside the corridor area, and a parallel segment of the park's shared use pathway system.

The Moose Entrance Station is open year-round, except from November 1 to December 15, and is staffed with 4.7 FTE. The entrance station is on Teton Park Road north of the junction with Moose-Wilson Road, which allows visitors to the Moose-Wilson corridor to bypass the entrance station facility. The entrance station is connected to the Moose headquarters water and wastewater systems. The park also maintains a telecommunications connection to the entrance station in addition to commercial telephone service. The cost of operating and maintaining the entrance station at Moose is partially offset by the fee revenue collected from visitors.

A segment of the multiuse pathway lies in the corridor area, parallel to Teton Park Road, and is monitored by volunteer pathway ambassadors by bicycle. The pathway will receive pavement preservation treatment in the form of fog seals at approximately 10-year intervals.

Murie Ranch

The Murie Ranch site includes a 0.61 mile unpaved access road, 24 buildings and structures, and maintained landscape. The park operates and maintains a water system to the ranch as part of the greater Moose water system. Wastewater is treated by septic and leach field systems that are operated and maintained by The Murie Center. The park plows the road to the ranch office and parking areas. The Murie Center is responsible for the operations and maintenance of buildings, roads, trails, and other facilities in the ranch area.

The Murie Ranch area does not receive heavy use by visitors, although use has increased recently with the construction of a trail connecting the ranch to the visitor center and the initiation of ranger-led walks to the ranch on this trail in the summer. Much of the area's visitation is associated with The Murie Center programs.

Sawmill Ponds Overlook

The unpaved Sawmill Ponds parking area receives minimal maintenance aside from occasional grading of the gravel surface. The geography of the area restricts the space available for parking, and park staff place and maintain barrier logs to contain user-created parking areas beyond the perimeter of the designated parking area. A single interpretive wayside exhibit is also maintained. A user-created trail extending to the south of the overlook is not maintained by the National

Park Service but persists due to regular use by visitors.

White Grass Ranch

The White Grass Ranch area currently serves as the base of operations for the Western Center for Historic Preservation, which operates through a combination of NPS project funds and partner donations. Center staff currently maintain winter snowmobile access to the area while restoration of a number of structures on-site is underway. Once this restoration effort is finished, the center will operate from May through October, and the park will maintain access to the center via Death Canyon Road.

The park will continue to maintain the water and wastewater system that serves the area. The center will be responsible for the ongoing operations and maintenance needs of the structures and surrounding landscape. Twelve cabins, a utility building, and a pump house are all currently under restoration by the Western Center for Historic Preservation.

Death Canyon Road, Trailhead, and Trail Network

The Death Canyon Road, Trailhead, and trail network receive heavy use, with hikers parking at the trailhead for access to the backcountry. Death Canyon Road connects the Death Canyon Trailhead to Moose-Wilson Road. Death Canyon Road is paved for the first 0.66 of a mile and unpaved the remaining 1.0 mile to the trailhead, and is currently in poor condition. Death Canyon Road is not plowed, and receives minimal maintenance efforts. User-created parking areas on the road shoulders are managed with placement of log barriers along the road.

The Death Canyon Trailhead is patrolled regularly by law enforcement rangers in the summer months, and patrolled sporadically in the winter months. Facility management staff maintain the White Grass Ranger Station, trailhead, associated trails, and vault toilet, which is cleaned daily and pumped by truck on an as-needed basis from May through October.

A small segment of the Death Canyon Trail lies in the corridor. The Valley Trail enters the corridor area from the north, and connects with Death Canyon and Open Canyon Trails. Visitors to Phelps Lake and its overlook use the Valley Trail for most of their journey.

The White Grass Ranger Station, which is near the Death Canyon Trailhead, is accessed via Death Canyon Road. The ranger station is occupied by a park volunteer in summer, and is maintained by facility management staff. Other facilities at the site include the fire cache, a barn and corral, and two vault toilets, one of which is for public use and the other exclusively for the resident of the ranger station. The White Grass Ranger Station does not have a water system.

Phelps Lake

Rangers rove and patrol the Phelps Lake area sporadically from May through September.

Laurance S. Rockefeller Preserve

The LSR Preserve Center, a 7,500 square foot facility is LEED (Leadership in Environmental and Energy Design) certified at the platinum level. The center serves visitor and administrative needs, and is open from June until the third week of September. The front desk at the LSR Preserve Center is staffed by a single interpretive ranger daily from 9:00 a.m. until 5:00 p.m. The Preserve staff consists of one LSR Preserve supervisory ranger, one seasonal lead park ranger, three seasonal park rangers, three facility maintenance staff, and a number of interpretive interns and volunteers. The staff provides daily interpretive programs including ranger-led hikes, talks, and informal chats. Preserve staff also rove the trail network and maintain the center and other facilities within the Preserve.

Active management of the parking lot at the LSR Preserve is the key to achieving the intended visitor experience at the Preserve. The original vision for the LSR Preserve was for a low-visitation area, to maintain a quiet, tranquil atmosphere for visitors, and the parking lot was sized at 50 spaces with this goal in mind. Visitation has exceeded initial expectations, and as a result visitors regularly wait at least 15 minutes for a parking space. In the peak summer season, these waits can exceed 1 hour as the lot is typically full at least from 10:00 a.m. until 3:00 p.m. daily. From approximately 9:00 a.m. until 4:00 p.m. daily, up to two Preserve staff are stationed at the parking lot to welcome visitors to the Preserve, manage the lot, and prevent the use of the entrance road as additional parking.

Due to heavy use, the 0.42-mile paved entry road is in poor condition and requires frequent patching. The road was constructed with a thin asphalt overlay, which both degrades more quickly than one of traditional thickness, and makes pothole patching more difficult as patches need a certain amount of asphalt depth to stay in place. The entry road is not plowed in winter. Gravel migrates out of the unpaved parking area, which degrades the plastic cell underlayment and requires gravel replacement. Accessible parking spaces do not meet accessibility standards due to shifting surface material and shifting flagstones which outline the spaces.

Park staff operate and maintain a water system and a lift station for the LSR Preserve. The three restrooms within the Preserve use toilets with composting technology. The composting restrooms are maintained by the facility management staff. During the first six seasons of operation, the solid waste has been composted to a point to negate removal; the liquid waste is currently being pumped out by tanker truck. Staff access the composting toilet at Phelps Lake by utility terrain vehicle on a narrow service road from the LSR Preserve Center.

The LSR Preserve has a 7.83-mile trail network and a number of viewing areas. The Lakefront Overlook and six nearby rest areas are on the south shore of Phelps Lake. Five other overlooks are within the Preserve—two along Aspen Ridge Trail, one along Boulder Ridge Trail, and two along the Lake Creek Trail (D. R. Horne & Co. 2007).

Open Canyon Trail

The Open Canyon trail is 7 miles in length, and is accessed via the Valley Trail. Only a small portion at the mouth of the canyon near Phelps Lake lies inside the corridor area. Facility management staff maintain the trail as funding allows.

Levee Access Road

The levee access road is maintained cooperatively by the park and the Teton County Road and Levee Department. The levee itself is maintained by the county. Levee Road includes a bridge structure crossing Lake Creek.

Park staff use the section of Levee Road that connects Moose-Wilson Road to the LSR Preserve Center to access the center, as there is no direct road access from the Preserve parking lot to the center itself. The park performs occasional maintenance on this section of the road, including grading and graveling, but this road is not tracked in NPS facility management systems. There is a two-track that connects the parking area to Levee Road for administrative use only. This road is also used to provide emergency response to the LSR Preserve Center and as a hiker staging area.

Granite Canyon Trailhead

The Granite Canyon Trailhead includes an unpaved parking area for access to trails in the southern portion of the corridor, which provide entry to the park backcountry/ wilderness. Granite Canyon Trail provides the most direct access to Granite Canyon and the south end of the Valley Trail, and continues well beyond the project area. Parking at the trailhead is constrained by topography to the west, and by the vegetated island between the parking area and Moose-Wilson Road. The road itself is being widened at the trailhead by user-created overflow parking areas.

Law enforcement rangers (specifically backcountry rangers) rove this area primarily from June through September. Park search and rescue personnel use the Granite Canyon Trailhead in conjunction with another nearby access point to rescue injured skiers who have entered the park backcountry from the adjacent ski resort. These rescues can be large-scale efforts, involving multiple agencies, helicopters, or snowmobiles.

Poker Flats

Poker Flats is the site of a horse trailer parking area and horse trail network. Facility management staff maintain barrier logs around this parking area, grade the surface as funding allows, and maintain the official horse trail network.

Granite Canyon Entrance

The Granite Entrance area is on the park's southern boundary. This area includes the Granite Entrance Station building, a paved parking area, the North Fork Bridge, and a water and wastewater system dedicated to the entrance station. The entrance station is open year-round, except from November 1 to December 15. It is staffed with 2.3 FTE. Facility management staff maintain the building, parking area, and water and wastewater systems. The cost of operating and maintaining the Granite Entrance Station is partially offset by the fee revenue collected from visitors.

Utilities

Telecommunications connections in the corridor, including that at the Moose Entrance Station, are provided by private utility companies. All electrical power is provided by a private utility cooperative.

Summary

Table 25 contains a summary of the inventory and condition of the park assets in the Moose-Wilson corridor.

In an aggregate sense, each facility category is in good condition except for roads and buildings, which account for most of the deferred maintenance within the corridor. Road condition is driven by the large amount of deferred maintenance for Moose-Wilson Road, and building condition is primarily influenced by structures at White Grass Ranch and Murie Ranch.

Grand Teton National Park has recently completed the asset re-optimization process, in which park staff studied and revised the required and planned O&M costs for individual park assets. Total O&M includes the costs of Facility Operations, Preventive Maintenance, and Recurring Maintenance.

The total required O&M spending for the facilities in the corridor is $1,063,396, while the amount of spending planned is $121,204. Required O&M includes all required activities based on industry standards, service levels, and associated labor and nonlabor costs. Planned O&M spending represents a shortfall of $942,192 due to available funding.

In some cases, individual assets lacked values for required and planned O&M. Values from some assets are interpolated from median unit values of the same facility type, e.g., O&M per square foot, linear mile, gallons, etc.

TABLE 25. MOOSE-WILSON CORRIDOR ASSET INVENTORY AND CONDITION

Asset Type	Count	Quantity	Unit	Replacement Value	Deferred Maintenance	Overall Condition
Teton Park Road*	1	1.48	mi	$ 3,878,361	$ 766,303	Poor
Moose-Wilson Road	1	7.09	mi	$12,330,921	$2,846,797	Poor
Other Roads	2	2.08	mi	$ 2,218,431	$ 652,519	Poor
Parking Areas	4	32,443	sq ft	$ 265,931	$ 21,720	Good
Bridges	1	800	sq ft	$ 230,612	$ 16,320	Good
Trails	6	399,168	ln ft	$36,631,437	$1,495,156	Good
Trail Bridges	1	456	sq ft	$ 179,962	$ 0	Good
Maintained Landscapes	3	96	ac	$ 2,175,122	$ 44,030	Good
Buildings	51	32,695	sq ft	$13,383,637	$2,570,775	Fair**
Water Systems	2	72,500	gpd	$ 581,683	$ 0	Good
Wastewater Systems	3	328,880	gpd	$ 1,051,600	$ 0	Good
Fuel Systems	1	1,000	gal	$ 14,533	$ 0	Good
Interpretive Media	3			$ 12,461	$ 0	Good
Total	**79**			**$72,954,691**	**$8,413,620**	**Fair**

Source: Park asset management system, AMRS Report accessed 12/18/2013 and RIP report produced 12/9/14
*Segment of Teton Park Road within the corridor
**Based on improvements underway on historic structures at White Grass Ranch and Murie Ranch as of May 2015

Environmental Consequences 4

INTRODUCTION

OVERVIEW

The National Environmental Policy Act requires that environmental documents discuss the environmental impacts of a proposed federal action, feasible alternatives to that action, and any adverse environmental effects that cannot be avoided if a proposed action is implemented. In this case, the proposed federal action is the adoption of a comprehensive management plan for the Moose-Wilson corridor in Grand Teton National Park. This chapter analyzes the environmental impacts of implementing each of the four alternatives on natural resources, cultural resources, scenery, the acoustic resources, and soundscapes, wilderness character, visitor use and experience, traffic and transportation, socioeconomics, and park operations that may be affected by actions proposed in the alternatives. (Please refer to the impact topics section in chapter 1 for a list of the impact topics that are addressed in this chapter.) The analysis is the basis for comparing the beneficial and adverse effects of implementing the alternatives. By examining the environmental consequences of all alternatives on an equivalent basis, decision makers can evaluate which approach would create the most desirable combination of benefits with the fewest adverse effects on the park.

This chapter begins a brief explanation of how climate change is considered, followed by a discussion of how cumulative impacts are analyzed for the alternatives. Following this section, the impact analysis is presented. Each impact topic begins with a discussion of methods and assumptions followed by an analysis of each of the four alternatives. Each of the alternatives, including the no-action alternative (continuation of current management), is analyzed for adverse or beneficial changes that would occur to the existing conditions of each impact topic as presented in the "Affected Environment" chapter. After describing the impacts of the alternative, each impact topic then includes a discussion of cumulative effects, followed by a conclusion statement. Adverse effects are not significant unless specifically stated. The impacts of each alternative are also summarized by impact topic in table 9 at the end of "Chapter 2: Alternatives."

CLIMATE CHANGE

The impacts of climate change on the Moose-Wilson corridor are not expected to vary by alternative, and the lack of certainty about regional climate change adds to the difficulty of predicting how these impacts would be realized. Furthermore, management actions that are inherently part of each alternative would not fundamentally change with the anticipated added effects of climate change. Climate change is one factor among many that cause similar outcomes among the alternatives, so management actions would not likely be taken due to climate change alone. Given this complexity, the potential influences of these changes on the park environment are included in "Chapter 3: Affected Environment," but are not analyzed in detail with respect to each alternative in this chapter. Please refer to the carbon footprint topic discussed under "Impact Topics Considered But Dismissed From Detailed Analysis" section in chapter 1 for additional information.

CUMULATIVE IMPACTS

The Council on Environmental Quality, which ensures that federal agencies meet their obligations under the National Environmental Policy Act, requires an assessment of cumulative impacts in the decision-making process for all federal projects. Cumulative impacts are described in CEQ regulation 1508.7 as follows:

> Cumulative impacts are the impacts that result from the incremental impacts of the action when added to other past, present, and reasonably foreseeable actions, regardless of what agency (federal or nonfederal) or person undertakes such other actions. Cumulative impacts can result from individually minor, but collectively significant, actions taking place over time.

Cumulative impacts are evaluated separately for the no-action and the three action alternatives by adding the impacts of each alternative with the impacts of other past, present, and reasonably foreseeable actions. To make these determinations, it was necessary to identify other actions in and adjacent to the Moose-Wilson project area. To determine which actions within and outside this area may have cumulative impacts on Moose-Wilson project area resources and values, the National Park Service identified projects and programs that have occurred in the past, are currently being implemented, or would likely be implemented in the "action area" over the next 10 to 15 years. Combined, these actions are referred to as the "cumulative scenario."

The action area for assessing cumulative impacts was limited to Teton County south of Jackson Lake Dam. It includes federal, state, county, and private lands, including the Town of Jackson, Teton Village, Jackson Hole Mountain Resort, and Wilson.

Past, present, and reasonably foreseeable actions have been organized into two main categories—actions attributable to the National Park Service (primarily within Grand Teton National Park, including park infrastructure, recreation programs, and resource protection activities) and non-NPS actions that are likely to affect the project area (including tourism enhancements, residential and commercial developments, road construction and improvements, and resource protection activities). A summary of the actions that could contribute to cumulative impacts is provided for each of these categories. The evaluation of cumulative impacts, described under each impact topic, is qualitative in nature.

NPS Actions and Projects

The following section describes past, ongoing, and future NPS actions and projects that could affect the Moose-Wilson corridor and project area. In addition to the plans and projects listed below, Grand Teton National Park has completed a number of recent planning efforts such as a fire management plan. These plans have not been included in the cumulative scenario. This is because either the actions that result from these plans are not anticipated to impact resources or visitors in the Moose-Wilson project area, or because aspects of these plans have already been incorporated into the no-action and action alternatives. These planning efforts are described under the "Relationship of This Plan to Other Planning Efforts" section in chapter 1.

Park Infrastructure Management. The National Park Service has several ongoing and planned projects affecting park infrastructure, both within and outside the project area, independent of this plan, which could contribute to cumulative impacts.

Past Actions

Development Concept Plan for the Teton Corridor (Moose to North Jenny Lake) (Environmental Assessment 1991)— As a result of this plan, housing units were added at Moose.

Southwest Entrance Facilities (Environmental Assessment 1998)— As a result of this plan, a new entrance station was constructed.

Moose Entrance Station Replacement (Environmental Assessment 2000)— The

Moose entrance area was reconstructed, including widening the existing roadway, installation of fee collection kiosks, and a new administration building.

Murie Ranch Rehabilitation and Adaptive Reuse (Environmental Assessment 2001)— The plan called for the National Park Service, in partnership with The Murie Center, to rehabilitate the interior and exterior of 15 primary historic buildings to provide a variety of residential, meeting, and study spaces. Utility, road, and parking improvements were implemented.

Craig Thomas Discovery and Visitor Center (Moose Visitor Center) and Area Plan (Environmental Assessment 2002)— Under this plan, the National Park Service undertook a number of actions in the Moose Visitor Center area. These actions included replacement of the existing visitor center with a new visitor center, construction of a new administration building, new parking areas were provided to serve the visitor center and for administrative use, new footpaths were constructed, and the existing boat launch and boater parking areas were reconfigured.

Rehabilitation of the Moose Headquarters Area (2010 Environmental Assessment)— This project was recently completed. Its purpose was to upgrade and improve site conditions in a way that enhanced visitor experience while providing a safe, functional, and efficient working/living environment for park employees and their families. The project involved the complete reconfiguration of vehicle and pedestrian traffic within the administrative and Moose Landing areas, reducing the built environment in the Moose Headquarters area by removing several temporary buildings, and site restoration work targeted to improve stormwater management.

Ongoing Actions

Jenny Lake Renewal Plan (2014 Environmental Assessment)— This plan was intended to provide a safe, environmentally sensitive, and enhanced visitor experience. The plan will restore the backcountry areas of the Jenny Lake trail system, including Inspiration Point and Hidden Falls Overlooks, and make improvements in the frontcountry areas of the South Jenny Lake developed area, Jenny Lake Overlook, and String Lake Outlet. Visitor orientation and interpretation and visitor circulation will be improved throughout the South Jenny Lake developed area. The plan addresses trails, walkways and bridges in the area, resource impacts caused by visitors, interpretation/ orientation needs, and water and wastewater systems and restrooms.

Jackson Hole Airport Agreement (2010 Environmental Impact Statement)— The Jackson Hole Airport, on 533 acres within Grand Teton National Park, east of the Moose-Wilson project area. The airport operates under an agreement administered by the National Park Service and is authorized to continue operating until April 27, 2053. The revised agreement strengthens the requirements of the Jackson Hole Airport Board to work in "good faith" to further reduce and mitigate the effects of the airport on the park. Efforts are to be taken by the board to reduce the impacts of the airport, including those pertaining to noise, to as low a level as is practicable, provided that the measures are reasonable, consistent with the safe and efficient operation of the airport, and with applicable law, regulation, and contractual requirements. Specific mitigation measures are outlined as part of the agreement, which primarily focus on noise impacts. The agreement also calls for the National Park Service and the board to develop procedures, methods, and strategies to minimize disturbance to sage-grouse from aircraft operations.

Grand Teton National Park Transportation Plan (2006 Environmental Impact Statement; 2007 Record of Decision)— This plan recommended a preferred system of transportation improvements within Grand Teton National Park including roadways and parking, development of a plan to evaluate the need and feasibility for a transit system within the park, construction of improved road shoulders and multiuse pathways, improvements to developed areas, and development of traveler information systems.

The 2007 Transportation Plan called for a number of actions affecting management and use of Moose-Wilson Road. These actions are being replaced with the actions proposed in this *Moose-Wilson Corridor Comprehensive Management Plan*.

White Grass Ranch Rehabilitation and Adaptive Use (Environmental Assessment 2004)— The plan authorizes a number of actions to rehabilitate and restore the historic district. Three historic buildings were to be rehabilitated immediately and function as a Western Center for Preservation Training and Technology, and 10 other historic structures were to be stabilized and eventually rehabilitated. Full utilities were to be provided at the training center. A small spur road was to be built to provide access for operational activities from Death Canyon Road to the ranch, and a small parking area was proposed. The plan also encouraged carpooling and/or shuttles for trainees at the center. Ultimately, lodging for about 12 to 15 overnight users would be provided.

Future Actions

Water System and Wastewater Improvements at Moose (2012 Environmental Assessment)— This plan authorizes the replacement or upgrading of most components of the existing water system, including water system pumping, storage, and transmission facilities. A new 300,000-gallon tank would be built near Taggart Creek, and a new wastewater treatment plan would be constructed in Moose near the post office.

Construction of a New Boat Launch Site at Moose (2013)— A new access point to the Snake River will be built at Moose, as called for in the *Snake River Headwaters Comprehensive River Management Plan / Environmental Assessment*. The facility will include a boat ramp for larger boats to land and haul out of the Snake River.

Recreation Management Actions.

Ongoing Actions

Backcountry Management Plan (1990)— This plan set management direction for the park's backcountry and wilderness. The backcountry area was zoned and quotas were set for all camping zones. (Most of the lands adjacent to the corridor are within the open space zone.) Management topics covered by the plan include camping, pets, trail construction and maintenance, signs, fire management, and rehabilitation of damaged resources.

Jackson Hole Mountain Resort Open Gate Backcountry Policy— The resort has agreed to keep a gate open to the park's backcountry, including the Moose-Wilson corridor, during the winter. It is intended to provide additional opportunities for backcountry skiing, and also assure skier safety and decrease the need for NPS search and rescues. The backcountry gate system began during the winter of 1999–2000 and continues today. As a result, backcountry use between the resort and the park has increased.

Management of the Laurance S. Rockefeller Preserve ("Property Maintenance Plan" 2007)— This plan is intended to ensure the long-term protection of the area's natural resources and its setting as an intimate, undeveloped place, and maintain the inspirational quality of the visitor experience. The plan states that visitors should be discouraged from lingering along Moose-Wilson Road and vehicles should not be allowed to park along the road. Visitors are to be discouraged from using natural areas in the LSR Preserve. Traffic calming features to slow traffic are to be maintained on the road, and the speed limit is to be kept as low as possible to promote safety and reduce vehicle noise. On LSR Preserve trails and at the lake "visitors should have opportunities for solitude, adventure, self-discovery, and self-directed learning…" Encounters with park staff and other visitors along trails and at the lake should be infrequent. Visitor activities should not disrupt other users. Human-generated sounds are to be carefully managed at the Preserve, which includes managing the level of visitation and limiting the types of permitted uses. The plan also requires a secondary trail connection to the Snake River.

Non-NPS Actions and Projects

Transportation and Land Use Plans.

Past Actions

Jackson/Teton County Comprehensive Plan (2012)— The plan focuses on private lands in the county, and specifically on ecosystem stewardship, growth management, and quality of life. The plan called for partnerships with Grand Teton National Park and others, to build a transportation system that is more reliant on alternatives to the automobile. The 2012 plan also requires continuing to follow parts of the 2000 county/town transportation plan, which among other things stated that the town, county, and Wyoming Department of Transportation will coordinate with public land management agencies to connect the Pathway System with pathway and trail systems on federal lands, including Grand Teton National Park.

Future Actions

Integrated Transportation Plan (in process)— Jackson and Teton County are developing an integrated transportation plan to meet future transportation demands through the use of alternative modes. The plan is intended to integrate land use and transportation between different modes of travel and between jurisdictions, including federal land managers. This plan will provide detail strategies to achieve the transportation objectives set forth in the 2012 comprehensive plan.

Recreation and Tourism Enhancements.

Ongoing Actions

Jackson Hole Community Pathways Master Plan (2007)— This plan proposed a number of shared-use pathways to create an integrated multimodal system for nonmotorized transportation and recreation in Jackson Hole and Teton County, covering bicycling, walking, hiking, Nordic skiing, and equestrian travel. The complete system will be more than 75 to 80 miles long, and will connect to a growing regional network, with links to shared-use paths in the park and other public lands. One of the pathways proposed was from the town of Jackson to the south boundary of the park on the east side of Highway 89. Other high priority pathways identified in the plan were from Teton Village to Moose and from Jackson to Moose. Pathways have been built from Teton Village to the boundary of the park and from Jackson to Moose.

Private Developments.

Several past, ongoing, and planned residential and commercial developments are occurring in the vicinity of the Moose-Wilson project area. Ongoing maintenance is also occurring on some private developments in the project area. The following projects are among those that could contribute to cumulative impacts.

Past Actions

Jackson Hole Ski Area Master Development Plan Revision Final Environmental Impact Statement (1996)— This plan includes a series of upgrades and improvements to the Jackson Hole Ski Area, incorporating new and upgraded lifts, new skiing terrain, a revised carrying capacity, additional trail grooming (both summer and winter), improved Nordic skiing facilities, and additional recreational opportunities.

Ongoing Actions

Teton Village Expansion Master Plan (2013)— This plan provides for additional growth in Teton Village as part of a planned unit development. New developments are planned in the village core, including public areas, local and visitor services, commercial space, pathways, condominiums, townhouses, affordable housing and employee housing, and a new residential development south of Teton Village. A total of 380 new dwelling units are included in the plan. The developer will preserve open lands along Highway 390 to enhance the scenic approach to the resort and the park, and will restrict the density of developments on four parcels adjacent to the Teton Village expansion planned unit development.

Other Non-NPS Management Actions

Ongoing Actions

Operation of Jackson Lake Dam. The storage and release of water from Jackson Lake Dam could have cumulative impacts on the resources and values of the Snake River in the project area due to the alteration of natural flow regimes of the Snake River. Jackson Lake is a natural lake augmented by the Jackson Lake Dam, which was originally constructed by the Bureau of Reclamation in 1907. It was then raised higher in 1916 and again reconstructed in 1989, with a total current storage capacity of 847,000 acre-feet. The Bureau of Reclamation is responsible for operating the dam for the storage and release of water to meet downstream irrigation demands and for flood control.

The target refill at Jackson Lake is generally mid-May to early July and varies with snow conditions. The maximum daily average flood control releases (from June to July) is around 11,500 cfs during a wet year and around 6,200 cubic feet per second (cfs) during an average year. These maximum releases generally occur in early to mid-June before tapering off to irrigation release levels. There are no releases for flood control in some years.

After the flood control period, irrigation releases begin, usually in late June or July. The Bureau of Reclamation estimates that in 50% of years, flows exceed 2,400 cfs for the July through September period. In this same period, flows exceed 1,500 cfs in 95% of years. The minimum average monthly release during this period is 976 cfs in August.

In 50% of years, the reservoir may be drafted to 635,000 acre-feet active storage by October. The Bureau of Reclamation's assessment predicts minimum average monthly outflows would not drop below 273 cfs. There are no ramping requirements for flow changes at Jackson Lake Dam.

Management of Irrigation Ditches in the Project Area. There are 18 diversion structures in the Moose-Wilson corridor, including nine ditches that had flowing water in 2013; additional ditches are present that are not currently used, but could be used in the future. The National Park Service is required to allow reasonable access to the ditches by the water rights owners. The water rights owners annually check the ditches and maintain the ditches and the headgates that control the water flows. Heavy equipment is seasonally used for this work (as well as for emergency maintenance). Several of the water rights owners use Moose-Wilson Road and the Levy Access Road to access their ditches. Proposed changes to the road could also affect some of these ditches.

Water use is holding steady or increasing in the ditches, depending on the year. There is currently a request for additional water from the Granite Creek Supplemental Ditch. Excess withdrawals via the ditches, from Granite Creek could dewater the creek. Fish entrainment also occurs in the ditches, especially at the larger diversion points from the Snake River.

NATURAL RESOURCES

INTRODUCTION

These analyses of the environmental consequences of alternatives A, B, C, and D on natural resources in the Moose-Wilson corridor are based on the professional judgment of park staff, NPS resource planners, other specialists in the field of natural resources management, as well as common knowledge of ecological principles and natural processes. Each of the alternatives includes management strategies that range from site-specific actions that address localized management needs to corridorwide actions (or parkwide actions) that offer a more broad based or standardized management of park resources (e.g., standard mitigation measures, resource monitoring guidelines, best management practices). As a result, the impacts of the management alternatives on natural resources are described at both a corridorwide scale and a site-specific scale where applicable.

To provide a thorough analysis of effects on the natural resources of the corridor, this section has been organized by the following four impact topics, which correspond to the natural resource topics described in "Chapter 3: The Affected Environment." To the extent possible, similar topics have been grouped together to limit redundancy and to present the analyses in a concise, understandable way. The impact topic sections are

- Wildlife and Wildlife Habitat
- Federally Listed and Candidate Wildlife Species
- Wetlands
- Hydrology
- Water Quality
- Vegetation
- Soils

WILDLIFE AND WILDLIFE HABITAT

Methods and Assumptions for Analyzing Impacts

This section addresses potential impacts on general wildlife habitat conditions as well as potential impacts on wildlife behavior. The impact analyses considered a variety of factors that could affect wildlife or wildlife habitat, either beneficially or adversely. In general, the effects of the alternatives on wildlife and wildlife habitat in the project area were analyzed based on impacts resulting from visitor use levels and patterns and developments associated with each alternative. To accomplish this, the following three impact analysis questions were considered to identify the potential impacts of each alternative:

Impact Analysis Questions.

1. What degree of physical habitat fragmentation would occur under each alternative?
   - habitat disturbances related to habitat connectivity and daily or seasonal wildlife movement or migration
2. What degree of sensory-based behavioral disturbances would occur under each alternative?
   - individual wildlife behavior disturbances caused by wildlife sensing noise, visual disturbances, or scents from nearby human activities/uses
3. What degree of physical habitat removal, alteration, or restoration would occur under each alternative?
   - degradation or improvement of habitat quality/condition and removal or restoration of habitat area

The following assumptions were considered in concert with each of the above impact analysis questions when assessing the effects of each alternative management strategy:

General Assumptions.

- All construction activities would be limited to the identified construction zones.
- All of the mitigation measures, best management practices, and monitoring guidelines described in chapter 2 would be followed.
- Visitation would continue to steadily increase in the corridor over time.

Habitat Removal or Restoration Assumptions.

- Habitat loss could result from vegetation removal, physical constructed infrastructure/facilities, and physical presence of visitors and vehicles.
- Roadway/pathway design features could mitigate some habitat loss or alteration effects (e.g., degree of vegetation cover retained, avoidance of fencing, placement of pathways in road visual and disturbance corridor).
- Construction activities and disturbances would have short-term effects on habitat. The resulting built environment would have short- and long-term effects on habitat.
- Dust-covered vegetation is less desirable forage for wildlife.

Wildlife Behavioral Disturbance Assumptions.

- Sensory-based disturbances to wildlife behavior can result from noise, visual disturbances, or scents from nearby human presence, activities, or uses.
- Construction activities would have short-term effects on wildlife behavior. Continued and changing visitor use patterns would have both short- and long-term effects on wildlife behavior.
- Visitor use patterns and types have varying levels of effect on wildlife behavior (vehicle traffic volume, bike/pedestrian traffic volume, type of vehicles (i.e., noise production), diurnal and seasonal traffic/visitor use patterns, etc.).
- Each wildlife species possesses a unique tolerance for sensory disturbances and a resulting unique threshold for behavioral reactions to the disturbances (e.g., flushing distances or habitat avoidance).
- Wildlife behavioral responses in a particular species may vary across individuals and an individual's life stages and activities (e.g., premature/adult, during breeding season, etc.).

Habitat Connectivity Disturbance and Habitat Fragmentation Assumptions.

- Unhindered wildlife movement, migration, and passage and habitat connectivity are integral components of habitat quality because this movement affects foraging patterns, breeding, predator avoidance, and more.
- "Habitat fragmentation" is defined and analyzed in many different ways (Fahrig 2003; Franklin et al. 2002). For the purpose of the analyses that follow, the term habitat fragmentation is assumed to mean the discontinuity of habitat for various species resulting from human-induced disturbances that alter the accessibility, use, and spatial connectivity of habitat. Under this definition, habitat fragmentation and impediments to habitat connectivity

could result from the physical loss of habitat due to development (e.g., linear corridor of vegetation loss from roadway construction) and be compounded by the ongoing human use of the developed infrastructure and associated wildlife behavior disturbances (e.g., wildlife disturbances from vehicles, pedestrians, bicyclists, etc., using the road). In addition, habitat fragmentation could occur from continued, ongoing use of and human disturbance along existing developed infrastructure.

- Conceptually speaking, a large, intact habitat area is typically more valuable to wildlife than an equal-sized assemblage of smaller, separated habitat areas. Habitat availability, use, and connectivity diminish along the zones of influence (human disturbance zones) associated with roadways and pathways. Thus, such features and their use contribute to habitat fragmentation.
- Dual roadway/pathway corridors compound disturbance to habitat availability, use, and connectivity due to the combined effect of the dual zones of influence along both corridors. For many wildlife species, including bears, the farther the pathway is offset from the roadway, the greater the overall width of human effect on habitat availability and the greater the potential for habitat fragmentation (MacHutchon 2014).
- Roadway/pathway corridor design features could mitigate some habitat connectivity and fragmentation effects (e.g., wildlife passages, degree of vegetation cover retained, avoidance of fencing, siting of high visitor use areas in areas of low wildlife activity).
- Construction activities and disturbances would have short-term effects on habitat connectivity. The resulting built environment would have long-term effects on habitat connectivity.

Alternative A (No Action)

The continuation of current management of the corridor under alternative A would result in both beneficial and adverse effects to wildlife and wildlife habitat in the corridor. Many of these adverse impacts would likely continue and intensify as visitation and traffic volumes in the corridor increase over time (as projected). Many of the human activities in the corridor contribute to behavioral disturbances to wildlife, habitat fragmentation, and even habitat removal. Please note, “Wildlife and Wildlife Habitat” under the “Affected Environment” chapter includes a subsection titled “Wildlife and Wildlife Habitat Condition” that provides a brief discussion on some current impacts on wildlife in the corridor.

Traffic Management along Moose-Wilson Road. Under alternative A, traffic management along Moose-Wilson Road would remain as it is now. Traffic volume growth, traffic flow congestion, and resulting visitation volumes in the corridor would not be actively addressed (with the exception of periodic road closures and frequent assistance from park staff in managing wildlife-related traffic congestion). Likewise, the current speed limit on Moose-Wilson Road (25 mph) would remain and the road’s winter closure dates would remain unchanged. Over recent years, park staff have observed increasing levels of visitor activity and recreation (concentrated and dispersed) in the corridor and at adjacent destinations within the project area. They have also noted an increase in wildlife viewing and photography as one of the primary visitor activities (which increases the likelihood of human-wildlife interactions). With these current and anticipated increases in traffic and visitor use in the future, the potential for wildlife and habitat disturbances from traffic and parked cars, vehicle-wildlife collisions, unsafe human-wildlife encounters, large concentrations of visitors in high-use wildlife areas, and dispersed recreation would increase. Thus, on a corridorwide scale under alternative A, adverse impacts such as habitat fragmentation, behavioral disturbances, and habitat degradation or removal would all likely increase over time and could become substantial in the upcoming years. These disturbances could force wildlife that forage along the road corridor and other high-use areas to move to lower quality foraging habitat, which may affect productivity of some species over the long term.

Physical Characteristics of Moose-Wilson Road. The physical characteristics of Moose-Wilson Road would also remain unchanged under alternative A. Most notably, the 1.4-mile unpaved road segment would remain unpaved. This unpaved section would continue to be treated with dust abatement chemicals such as magnesium chloride (MgCl). The condition of wildlife habitat and vegetation along the unpaved section would thus continue to be adversely affected by road surface erosion and sedimentation, vehicle-generated dust, and the migration of MgCl into the surrounding soils and water. Adjacent plants, insects, and bird communities would likely continue to be most affected.

Moose-Wilson Road Realignment. Under alternative A, the existing alignment of Moose-Wilson Road and associated human use along it would continue to disturb wildlife behavior, fragment wildlife habitat, and contribute to daily and seasonal alterations of wildlife movement and habitat connectivity. At a corridorwide scale, Moose-Wilson Road runs relatively parallel to the Snake River. Therefore, human activity along the road would continue to cause disturbances and obstacles for wildlife moving between the higher elevation montane coniferous forests to the west and the lower elevation riparian woodlands of the Snake River to the east (whether it be on a daily, weekly, or seasonal basis). Aside from this broader-scale effect on wildlife movement, the human use and traffic along the existing Moose-Wilson Road alignment would also continue to have adverse effects on specific high-use wildlife areas in the corridor. One of the most notable areas of habitat and wildlife disturbance caused by Moose-Wilson Road activity is the road segment that traverses the beaver pond wetland habitat and adjacent shrub habitat to the southwest of Sawmill Ponds Overlook. Under alternative A, human disturbance impacts on bird foraging, roosting, breeding, and nesting; ungulate foraging; and bear foraging in this area would continue and likely increase over time due to projected increases in visitation in the corridor. The continued and increasing adverse impacts on grizzly and black bear activity in the shrub habitat (i.e., berry patches) in this area during autumn is of particular concern, as high concentrations of bears congregate in the shrub habitat along Moose-Wilson Road. By not realigning the road segment adjacent to the Sawmill Ponds wetlands and surrounding habitat, visitors would continue to have opportunities to experience wildlife close-up in this area. Because visitors frequently leave their vehicles and approach wildlife too closely, they often put themselves and the wildlife in unsafe situations. The physical alignment of the road (and the surrounding topography and vegetation) between Death Canyon Road and Sawmill Ponds Overlook makes achieving the parkwide standard of visitors being 100 yards away from bears and wolves difficult to maintain. For example, if visitors see wildlife from the road in this wetland habitat area, they are already likely less than 100 yards away. This would likely continue to result in behavioral disturbances to wildlife and possible unsafe situations for the visitors and wildlife.

Also, given the unchanged road alignment through this wetland area, the need for road and road drainage repair would continue along Moose-Wilson Road in this area. Thus, park managers would need to continue efforts that protect the road from flooding and eroding by artificially manipulating water levels on beaver ponds adjacent to the road. Aside from continued adverse effects on beaver behavior and habitat, this maintenance would also continue to modify local hydrology that would likely have secondary adverse effects on downstream wetland habitat conditions for a variety of other mammals, birds, and amphibians (e.g., altered wetland hydrology, altered wetland vegetation types and species).

Overall, from a wildlife habitat perspective, this element of alternative A would continue to fragment important wildlife habitat and disturb wildlife behavior along the road corridor, as well as interfere with habitat connectivity to the Snake River riparian corridor. Given the importance of this habitat and its connectivity to other habitat areas, and the existing alignment through high-quality wetland and shrub habitat areas, the alignments under this alternative would continue to have considerable adverse effects on the Ecological Communities and Wildlife fundamental resource and value.

Turnouts and Parking. The vehicle turnout and parking management of alternative A would continue to adversely affect wildlife and wildlife habitat by causing sensory disturbances to wildlife and physical loss of habitats. Undesignated, user-created parking areas along the Moose-Wilson corridor would continue to degrade vegetation and facilitate the spread of noxious weeds into previously undisturbed areas. Also, opportunistic, unauthorized parking along the road would continue to impact wildlife behavior and habitat condition as visitors would continue to park in areas that are important for wildlife foraging and/or movement. The parked vehicles themselves are one cause of the adverse effect (particularly the degradation of vegetation). However, people getting out of their parked cars and walking through adjacent habitat (often to get closer to wildlife activity) is a more notable contributor to the disturbance, as their off-road activity tramples vegetation and disperses human disturbances (e.g., noise, human presence) beyond the immediate road corridor. This concentration of human pedestrian activity in quality habitat areas would continue to cause further behavioral disturbance to individual wildlife using the area and cause further impediments to habitat accessibility and connectivity. As visitation and vehicle traffic increases in the corridor over time (as projected), such disturbances to wildlife would likely increase.

Bicycle Use. Under alternative A, cyclists would continue to share Moose-Wilson Road with motor vehicle traffic. Bicycle use on Moose-Wilson Road and other roads in the corridor would continue to cause intermittent disturbance to wildlife behavior and habitat conditions. However, since the overall numbers and percentages of bicycle use on these roads is minimal compared to motor vehicles on the same roads, the adverse effects likely would not be as extensive as the disturbances from visitors that get out of their vehicles.

Commercial Activity. Authorized commercial activity would continue to be allowed and administered under alternative A, which would continue to have intermittent and concentrated adverse effects on wildlife behavior in the vicinity of commercial group activities. Habitat condition would also continue to be adversely affected in areas where commercial groups tend to congregate and/or frequent. More specifically, current levels of guided wildlife viewing groups would continue to introduce clusters of human activity disturbances in proximity to wildlife and wildlife habitat for both short and long durations. However, the commercial outfitters are closely regulated by the park to maintain appropriate distances. Guided horseback use in the corridor would continue to result in wildlife and habitat disturbances. Continued levels of guided skiing and snowshoeing would also continue to affect wintering wildlife in the corridor. Behavioral disturbances to wintering wildlife from winter use are of particular concern because of the numerous other natural stressors on wintering wildlife (weather, limited food sources, etc.).

Death Canyon. Under alternative A, the current management of the Death Canyon area would continue to have adverse effects on wildlife behavior and habitat conditions. Most notably, increasing levels of traffic and human activity at the Death Canyon Trailhead and along Death Canyon Road would continue to cause disturbances to wildlife behavior and fragment habitat a relatively long distance from the main corridor of human disturbance in the project area (i.e., along Moose-Wilson Road). With the continued use of Death Canyon Road and Trailhead, considerable levels of wildlife/habitat disturbance would continue to occur upwards of 1.25 miles from Moose-Wilson Road and in proximity to undeveloped backcountry and wilderness lands to the west. The highest levels of habitat fragmentation and wildlife disturbance in this area would continue from May through October (i.e., when Moose-Wilson Road and Death Canyon Road remain open). In winter, considerably lower levels of wildlife disturbances would occur in the Death Canyon area from backcountry visitor use. Also, from May through October, user-created parking areas along the unpaved Death Canyon Road segment would continue to degrade vegetation and facilitate nonnative plant infestation, which in turn would further degrade habitat conditions in this area. As vehicle use in the corridor increases into the future, it is likely the above wildlife behavior and habitat fragmentation impacts in the Death Canyon area would also increase under alternative A.

Winter Access and Use. The continued management of winter access and use in the Moose-Wilson corridor would continue to have beneficial and adverse effects on wildlife and wildlife habitat. Snow plowing operations and vehicle traffic along plowed portions of Moose-Wilson Road (between the Moose Entrance and Death Canyon Road junction and between the Granite Canyon Entrance and Granite Canyon Trailhead) would continue to disturb wintering wildlife in the vicinity of these accessible areas. Winter recreational use along unplowed portions of the road (Death Canyon Road junction to Granite Canyon) and in surrounding backcountry areas would also continue to disturb wintering wildlife behavior under alternative A. The above-mentioned road activity (visitor vehicles, plowing operations) and other winter recreational uses in unplowed areas would continue to fragment habitat that connects the montane forests to the west and important Snake River riparian corridor to the east during winter months when active wildlife are already stressed by harsh weather conditions, deep snow, and scarce food sources. However, conversely, relative to the May–October months, the closed, unplowed section of Moose-Wilson Road (Death Canyon Road junction to Granite Canyon Trailhead) would continue to contribute to a substantial reduction in vehicle use and human use in the corridor, and thus substantial reductions in wildlife disturbances and habitat fragmentation. Thus, compared to the primary visitor season, this winter management of the corridor would continue to provide seasonal beneficial effects on wildlife behavior and habitat conditions.

Visitor Use and Experience. Under alternative A, management for visitor use and experience would continue to have beneficial and adverse effects on wildlife and wildlife habitat. Concentrated and dispersed visitor use in the frontcountry and dispersed visitor use in the backcountry would continue to disturb wildlife and degrade habitat conditions in the vicinity of designated trail routes and visitor concentration areas (particularly during times of peak visitor use). With a documented increase in visitor use in the corridor in recent years, and an anticipated increase in the future, such visitor use impacts on wildlife would likely increase. However, the continued interpretation and education amenities and backcountry patrols would continue to benefit the resources by informing visitors of the importance of protecting ecological resources, resulting in some reductions in wildlife and habitat disturbances.

Horse Use. Equestrian use in the Moose-Wilson corridor would continue to have adverse effects on wildlife and wildlife habitat under alternative A. Human activity associated with equestrian use would continue to cause behavioral disturbances to wildlife in proximity to the four equestrian parking trailheads in the corridor (Poker Flats, Sawmill Ponds Overlook, Death Canyon Road junction, and Granite Canyon Trailhead). Equestrian use in the Poker Flats area and other higher use equestrian areas of the corridor would continue to result in habitat quality degradation from off-trail vegetation trampling and social trail development that further fragments previously intact habitat.

Best Management Practices. As a continuation of existing management under alternative A, the park would implement best management practices to protect wildlife habitat. These practices are based on NPS *Management Policies 2006* and intend to protect the area's wildlife habitat and to limit disturbances from current management actions and ongoing visitor use. Among other strategies, these wildlife management practices and measures would include monitoring and enforcing inappropriate visitor activities around wildlife, managing trail densities and social trails to minimize wildlife disturbances and impacts on habitat accessibility and use, monitoring indicator species for effects from human use, and working with other resource management agencies on controlling the spread of nonnative species. All of these best management practices would result in short- and long-term, beneficial effects on wildlife in the corridor, as they would collectively minimize adverse effects from ongoing corridor management and ongoing visitor uses.

Overall, continued corridor management under alternative A would continue several existing adverse effects on wildlife and wildlife habitat, and would likely result in an increase in these effects as traffic and corridor visitation increase in the future (as projected). The most notable continuing adverse effect of alternative A would involve the continued use of the existing Moose-Wilson Road alignment and associated traffic and visitor use along it. This alignment would continue to fragment the high-use wetland and shrub habitat between Sawmill Ponds Overlook and Death Canyon Road from montane forest habitat to the west. Continued human activity along the road would also continue to cause noise and human presence disturbances on wildlife activity along the road corridor, most notably bear behavior during the berry season in the shrub habitats (although some of these impacts could continue to be mitigated by temporary road closures). This use along the existing road alignment would continue to adversely alter the Ecological Communities and Wildlife fundamental resource and value. Other adverse effects from alternative A would include increasing disturbances to wildlife behavior, degradation of habitat quality, and fragmentation from unmanaged traffic and visitor use volumes in the corridor, unmanaged and dispersed roadside parking, ongoing winter use/vehicle traffic, and a Death Canyon Trailhead that is over a mile away from the main corridor of human activity (along Moose-Wilson Road). Collectively, alternative A would result in a considerable, long-term, adverse effect on wildlife and wildlife habitat, particularly in areas along Moose-Wilson Road between Death Canyon Road and Sawmill

Ponds Overlook and adjacent wetland and shrub habitat.

Cumulative Effects. A variety of other actions have altered, and would continue to alter wildlife habitat within and outside the project area. Inside the project area, past and ongoing development of park infrastructure, such as roads, parking areas, and visitor activity areas, has displaced wildlife habitat and/or degraded habitat quality in the corridor. The most notable past action in the project would involve the development and/or upgrade of multiple roads, including Moose-Wilson Road. The use of these roads over past decades has introduced disturbances to wildlife behavior and have fragmented otherwise intact habitat. Also, the Moose and Granite Entrance Station developments, along with the facility reuse development and use at White Grass Ranch and Murie Ranch have introduced areas of increased human activity, which continue to introduce human noise and visual disturbances to wildlife habitat and behavior. The LSR Preserve development introduced similar adverse effects due the high levels of human use and disturbances in the area (although the LSR Preserve visitor carrying capacity management helps to mitigate these effects). All of these past and ongoing park facility developments and use in the corridor have collectively caused considerable, long-term adverse impacts on wildlife habitat in the corridor. In general, these adverse effects have mostly been in the form of habitat fragmentation or loss, and associated impediments to habitat accessibility, use, and connectivity.

Also, outside the project area, other NPS and non-NPS actions have and would continue, to alter wildlife habitat and disturb wildlife behavior (also see cumulative impacts scenario section). Residential, commercial development, and tourism development on private land throughout the area has had substantial adverse effects on wildlife behavior and habitat. This includes Teton Village to the south of the park, areas around Jackson, and a large number of rural residential properties dispersed throughout the region. This high density and low density land use and development has increased considerably over the past couple decades and continues to fragment large habitat areas and introduce substantial movement impediments to wildlife attempting to migrate to and from pockets of intact habitat on a daily or seasonal basis. In addition, transportation infrastructure in the area has also contributed notable impediments to wildlife movement, disturbances to wildlife behavior (e.g., lights, noise), and fragmentation to wildlife habitat. Such transportation facilities include local and regional highways, the Jackson Hole Airport, as well as development of park roads to the north of the corridor. Other development plans and projects at other high-use areas within the park (to the north) have also contributed to wildlife disturbance and habitat fragmentation. Collectively, actions such as these contribute substantial adverse effects to wildlife habitat and wildlife behavior in the region. The adverse effects involve the disruption of foraging, roosting, breeding, and migrating wildlife behaviors for many species that also occupy the project area.

When the effects of alternative A on wildlife and habitat are added to these other past, ongoing, and likely future effects, a substantial, long-term, cumulative adverse effect would continue to occur. However, the incremental effect of alternative A, added to the adverse effects of these other actions in the area, would be relatively small.

Conclusion. Alternative A would result in a continuation of several existing adverse effects on wildlife and habitat in the corridor and would likely result in an increase in these effects as traffic and corridor visitation increase over time (as projected). The most notable continuing adverse effect of alternative A would involve the continued use of the existing Moose-Wilson Road alignment and associated traffic and visitor use along it. This alignment would continue to fragment the high-use wetland and shrub habitat between Sawmill Ponds Overlook and Death Canyon Road from montane forest habitat to the west. Continued human activity along the road would also continue to cause noise and human presence disturbances on wildlife activity along the road corridor, most notably bear behavior during the berry season in the shrub habitats (although some of these impacts could continue to be mitigated by temporary road closures). This use along the existing alignment would continue to adversely alter the Ecological Communities and Wildlife fundamental resource and value. Other adverse effects from alternative A would include increasing disturbances to wildlife behavior, degradation of habitat quality, and fragmentation from unmanaged traffic and visitor use volumes in the corridor, unmanaged and dispersed roadside parking, ongoing winter use/vehicle traffic, and a Death Canyon Trailhead that is over a mile away from the main corridor of human activity (along Moose-Wilson Road). Collectively, alternative A would result in a considerable, long-term, adverse effect on wildlife and wildlife habitat, particularly in areas between Death Canyon Road and Sawmill Ponds Overlook and adjacent wetland and shrub habitat. However, because the most notable adverse effects to wildlife would be limited to a relatively localized portion of the corridor, the adverse impacts on wildlife and wildlife habitat would not likely be significant.

When the effects of alternative A on wildlife and habitat are added to the effects of other past, ongoing, and likely future actions, a substantial, long-term, cumulative adverse effect would continue to occur. However, the incremental effect of alternative A added to the adverse effects of the other actions in the area would be relatively small.

Alternative B

Traffic Management along Moose-Wilson Road. Under alternative B, traffic volumes and patterns along Moose-Wilson Road (and thus in the overall corridor) would be substantially modified by including a traffic management gate system that closes the road to through-traffic during periods of peak use (e.g., peak hours during peak season). During gate closure periods, this traffic management strategy would likely have beneficial effects on wildlife by reducing disturbances to wildlife behavior and reducing the interference of habitat connectivity via the elimination of through-traffic. Even though the dual one-way-in and one-way-out traffic from the Moose Entrance and the Granite Canyon Entrance would continue during these gate closure periods (and thus continue to adversely affect wildlife behavior and habitat conditions), the stressors from the current and increasing high traffic volumes on wildlife during peak use would be managed. In addition to reductions in wildlife disturbances from vehicular traffic, the gate closure management strategy could also result in reductions in out-of-vehicle visitor use in the corridor during the peak use periods due to the reduction in through vehicles accessing the corridor. Collectively, these changes in traffic and visitor use levels and patterns in the corridor during peak periods would likely reduce disturbances to wildlife behavior and habitat condition from traffic and parked cars, vehicle-wildlife collisions, unsafe human-wildlife encounters, large concentrations of visitors in high-use wildlife areas, and dispersed recreation. In addition, alternative B includes a speed limit reduction along Moose-Wilson Road from 25 mph to 20 mph. This modification could result in a reduction in wildlife being startled by fast-moving vehicles around blind curves and could also reduce the risk of wildlife mortality from vehicle-wildlife collisions. On a corridorwide scale, under traffic management strategies of alternative B, impacts such as habitat fragmentation, behavioral disturbances, and habitat degradation over time would likely decrease during peak visitor use periods, resulting in an appreciable long-term, beneficial effect.

However, despite the above-described reductions in adverse effects when the gate closure is in effect, implementation of this traffic management strategy would likely have notable adverse effects on wildlife behavior and habitat conditions in the vicinity of Moose-Wilson Road during the hours just before and after the gate closures take effect (e.g., during morning and early evening periods). As the public and visitors get accustomed to the gate closure implementation over time, a likely pulse of high through-traffic volumes would likely occur prior to the gate closing and shortly after the gate reopens. In other words, instead of traffic volume peaking during the afternoon hours (currently, without gate closure), this action would likely trigger some degree of traffic peaking in both the morning and afternoon hours. This would have notable adverse effects on the behavior of crepuscular wildlife (active during twilight) along Moose-Wilson Road in mornings and late afternoons or early evenings because crepuscular species are much more active during these periods. Historically, crepuscular species have benefited from lower traffic volumes in the corridor during the early morning and early evening hours. Considering that several of the prominent wildlife species of the corridor are crepuscular (e.g., bears, beaver, moose, deer), the potential for this adverse effect is likely under this alternative.

In addition, as implied above, because use of the gate system would technically only eliminate through-traffic in the corridor, it is not certain that this alternative would adequately reduce vehicles (and corridor visitation in general) to benefit wildlife and habitat over the long term. It is possible that one-way-in and one-way-out traffic during gated closure periods would still be high enough to continue to have substantial adverse effects on wildlife in the future.

Lastly, to facilitate the gate closure and associated traffic management, access roads and parking near the LSR Preserve would need to be reconfigured and rebuilt. This would result in both short-term and long-term, localized, adverse effects on wildlife habitat and wildlife behavior. Construction noise and human activity during the road/parking development operation would result in short-term, adverse effects on wildlife behavior and habitat conditions in this area. This reconfiguration and development of a new access road and parking lot in the vicinity of the LSR Preserve would also have a long-term, localized adverse effect on wildlife due to the necessary removal of vegetation and habitat in these areas and further fragmenting adjacent intact habitat.

Physical Characteristics of Moose-Wilson Road. Under alternative B, some physical characteristics of Moose-Wilson Road would also be modified. One of the most notable changes to physical characteristics, as it relates to wildlife and habitat, would be paving the 1.4-mile segment of currently unpaved roadway. Thus, this segment would no longer need to be treated with dust abatement chemicals such as magnesium chloride, which means migration of MgCl to surrounding soils and plants would cease, a beneficial effect on the quality of wildlife habitat. Likewise, road surface erosion and sedimentation and vehicle-generated dust would decrease along this 1.4-mile segment. As a result, the condition of wildlife habitat and vegetation along this stretch of Moose-Wilson Road would realize some limited levels of beneficial effect. Adjacent plants, insects, and bird communities would be the greatest long-term beneficiaries to this paving action. However, construction noise and activity during the paving operation would result in short-term, adverse effects on wildlife behavior and habitat condition in this area from increased human presence/activity and considerable construction noise disturbances. In addition, visitor vehicle speeds may increase after the paving of this segment, resulting in possible modest increases in vehicle noise disturbances to wildlife and mortality risks to wildlife crossing the road.

Moose-Wilson Road Realignment. Two large-scale realignments of Moose-Wilson Road would also occur under alternative B, which would include the restoration of the current alignments to natural conditions. Most notably, the southern realignment between the Death Canyon Road junction and Sawmill Ponds Overlook would result in substantial long-term, beneficial effects to wildlife habitat connectivity and habitat condition, particularly in the vicinity of the wetland complex to the southwest of Sawmill Ponds Overlook (despite some adverse effects to sagebrush habitat in new realignment area described below). This wetland complex habitat and surrounding shrub habitat is one of the most biodiverse, robust habitats in the corridor. Its connectivity and proximity to protective forested areas to the west makes this habitat even more valuable to an abundance of wildlife species. Removing Moose-Wilson Road (and its traffic and human use) from this low-lying wetland habitat at the base of the steeper montane forests to the west would considerably reduce habitat fragmentation in this transition area, greatly improve bear and moose habitat quality (wetlands and adjacent shrub habitat), and improve habitat availability and connectivity for many other mammal and bird species. For example, road impediments to beaver activity and associated dynamic beaver pond processes would be eliminated. In addition, the improved hydrological connectivity of the wetlands with their tributary streams and seeps (resulting from removing this segment of road) would likely improve wetland habitat conditions for other wildlife, such as amphibians, that are dependent on high-quality wetland habitat. This realignment would also likely reduce the risk of human-grizzly bear interactions by eliminating and restoring sections of road that currently dissect high-use areas for bears (near wetlands and shrub/berry habitat), a high visitor use area frequented by wildlife viewers and photographers due to easy access along the road. These beneficial effects of this realignment would primarily be localized and mostly confined to this wetland complex area and other shrub habitat along the road corridor and would be most important during the fall berry-producing months when bear activity in the area peaks. However, given the connectivity of this important wetland habitat to surrounding montane habitats and its value to a multitude of species throughout the year (for foraging, breeding, roosting, etc.), the beneficial effects would also extend beyond this localized area and beyond the late summer and autumn months.

Also under alternative B, a realignment of the northernmost segment of Moose-Wilson Road would occur, along with a relocation of the Moose Entrance Station and realignment of the four-way intersection with Teton Park Road. These northern realignment and development changes would remove Moose-Wilson Road from its current proximity to the Snake River riparian corridor and would substantially improve habitat connectivity for wildlife using the river corridor for north and south movements. Long-term, beneficial effects to wildlife behavior and habitat accessibility and connectivity would result from reducing habitat fragmentation from the existing road and moving high traffic volumes and associated visitor use up and out of the riparian zone. However, adverse effects to sagebrush habitat and the different assemblage of wildlife species that use it would also occur.

However, regardless of these two realignments that would greatly benefit wildlife relative to the current condition, it is important to note that Moose-Wilson Road and associated human use along it would continue to disturb wildlife behavior, fragment wildlife habitat, and contribute to daily and seasonal alterations of wildlife movement and habitat connectivity. At a corridorwide scale, Moose-Wilson Road runs relatively parallel to the Snake River. Therefore, the human activity along the road would continue to cause disturbances and obstacles for wildlife moving between the higher elevation montane coniferous forests to the west and the lower elevation riparian woodlands of the Snake River to the east (whether it be on a daily, weekly, or seasonal basis).

Also, the proposed southern and northern realignments of Moose-Wilson Road would result in new road alignments through the sagebrush meadows southeast of the beaver pond wetlands and to the northwest of the Snake River riparian corridor, respectively. The development of these new roads would have long-term, adverse effects on the quality and connectivity of sagebrush habitat in both of these previously undeveloped areas. Native vegetation and habitat would be permanently removed along the lengths of these new roads and around the relocated Moose Entrance Station. Some wetland habitat would also be altered and/or removed in the vicinity of Sawmill Ponds Overlook due to the new southern realignment, which would reduce or degrade available wetland habitat for birds, amphibians, and other aquatic species. Also, randomly parked vehicles and associated pedestrian use would likely cause degradation of vegetation and habitat for varying distances on both sides of the new road alignments (e.g., social trail development, trampled roadside vegetation). Dispersed pedestrian recreation originating from these new road alignments could also be expected and would result in disturbances to wildlife behavior in the adjacent sagebrush habitat and possibly beyond (e.g., Snake River riparian habitat, beaver pond wetland habitat). Construction activities associated with the new road construction and the restoration of the old road (and associated noise, human presence, excavation, etc.) would have several short-term, adverse impacts on wildlife behavior, habitat accessibility and connectivity, water quality, vegetation, and other ecological attributes that affect wildlife. These impacts would affect a relatively large area of the corridor (throughout lengths of all road modifications) and would generally affect a different habitat type and assemblage of species than those habitat/species that benefit from improved wetland habitat connectivity (noted above).

However, overall, from a wildlife habitat perspective, the beneficial effects of these two road realignments (noted above) greatly outweigh the adverse effects of two new alignments due to the importance of restoring the quality of the wetland area habitat and shrub habitat and improving connectivity to adjacent habitats. Given the importance of these habitat values, the proposed southern and northern realignments under this alternative would greatly benefit the Ecological Communities and Wildlife fundamental resource and value (despite the adverse effects of the realignments on the sagebrush habitat and assemblage of species that use it).

Turnouts and Parking. Under alternative B, strategically located designated turnouts and parking would be provided, along with design solutions that deter opportunistic, user-created parking in other areas (to accommodate up to 120 vehicles). In addition, the alternative would include increased use of park staff to assist in maintaining parking management during high wildlife activity periods. These parking management strategies would reduce wildlife behavior disturbances from human activities associated with randomly parked vehicles along the road corridor, and in turn, would maintain wildlife movement and migration patterns. Although Moose-Wilson Road would still fragment habitat in the corridor, these measures would mitigate the severity of the ongoing habitat fragmentation and destruction as it would reduce random parking and human activity in areas that are critical for wildlife movement across and along the road. These parking management strategies would also maintain natural vegetation communities and reduce the spread of noxious weeds by reducing the numbers and frequency of vehicles parking in undesignated areas, which contributes to improved habitat quality conditions along the Moose-Wilson corridor. However, conversely, by providing official turnouts for up to 120 vehicles, visitors driving through may actually be encouraged to stop along the road corridor if they see wildlife when they would otherwise continue driving through at slow speeds. This possible increase in vehicle stopping (and/or visitors getting out of cars) due to designated turnouts could have an adverse effect on wildlife behavior. Also, in areas around the designated parking locations, localized areas of vegetation trampling and habitat disturbance from people getting out of parked vehicles and wandering off-road could be expected. Thus, collectively, these strategies would have long-term, corridorwide beneficial and adverse effects on wildlife and wildlife habitat, particularly during high wildlife activity periods such as late summer and autumn.

Bicycle Use. Under alternative B, cyclists would continue to share Moose-Wilson Road with motor vehicle traffic. Bicycle use on Moose-Wilson Road and other roads in the corridor would continue to cause intermittent disturbance to wildlife behavior and habitat conditions. Because the overall numbers and percentages of bicycle use on these roads is minimal compared to motor vehicles on the same roads, the adverse effects would likely not be as extensive as the disturbances from motor vehicles and their occupants who leave their vehicles. However, with increased information-sharing on how Moose-Wilson Road connects other regional multiuse paths and improved cycling conditions and facilities being provided along Moose-Wilson Road (e.g., paving the unpaved section, lower speed limit, bike racks, facilitated transitions to and from existing paths, installed safety edge on road), it is likely that bicycle use in the corridor would increase an appreciable amount over time. Increased bicycle use along Moose-Wilson Road would increase frequency and degree of the above-noted adverse effects on wildlife behavior and habitat due to the associated increase of human activity, noise, and off-road/off-bike pedestrian activity that would result.

Commercial Activity. Various authorized commercial activity would continue to be allowed and administered under alternative B, which would continue to have intermittent and concentrated adverse effects on wildlife behavior in the vicinity of commercial group activities. Habitat condition would also continue to be adversely affected in areas where commercial groups tend to congregate and/or frequent. Guided groups that seek wildlife viewing or occur in the vicinity of wildlife activity would continue to introduce clusters of human activity disturbances in proximity to wildlife and wildlife habitat for both short and long durations. However, the commercial outfitters are closely regulated by the park to maintain appropriate distances. Guided horseback use in the corridor would continue to result in wildlife and habitat disturbances. Guided skiing and snowshoeing would also continue to affect wintering wildlife in the corridor. Behavioral disturbances to wintering wildlife from winter use is of particular concern because of the other natural stressors on wintering wildlife (weather, limited food sources, etc.). Aside from these corridorwide, adverse effects on wildlife and wildlife habitat, the prohibition of taxi use and other nonpark-dependent commercial traffic, as well as site-specific special events, would have beneficial effects on wildlife habitat by reducing vehicle traffic and concentrated human activity, respectively. In addition, the road-based tours that focus on corridor-specific, resource-based interpretation would inform visitors on the ecological values of wildlife and habitat in the corridor and educate visitors on appropriate human behavior.

Death Canyon. Under alternative B, the proposed management of the Death Canyon area would have both beneficial and adverse effects on wildlife behavior and habitat conditions. The most notable management change would involve the relocation of the Death Canyon Trailhead and parking area approximately 0.4 mile to a site near White Grass Ranch. The abandoned road segment and parking area would be restored to natural conditions and converted to a trail. The new parking area size (approximately 60 vehicles) would be a considerable increase from the existing parking lot size. These changes would have relatively modest beneficial effects on wildlife by bringing the trailhead closer to the high use of the Moose-Wilson corridor, thus reducing the amount of habitat fragmentation from the Death Canyon Road and its use. The larger designated parking area would also improve surrounding habitat conditions by reducing the amount of vegetation impacts and weed infestation associated with user-created parking along Death Canyon Road. The restoration of the existing parking area would also increase available habitat area.

The adverse effects of the proposed Death Canyon management under alternative B would primarily relate to the continued use of the Death Canyon Road and Trailhead, despite the 0.4-mile relocation. Although traffic and visitor use volumes in the corridor would be managed by the gate closure system of alternative B during peak visitation periods, vehicle traffic and human activity at the proposed Death Canyon Trailhead and Death Canyon Road would continue to cause disturbances to wildlife behavior and fragment habitat up to a mile from the main corridor of human disturbance in the project area (i.e., along Moose-Wilson Road) and in relative proximity to undeveloped backcountry and wilderness lands to the west. The highest levels of wildlife disturbance and habitat fragmentation in this area would continue from mid-May through October (i.e., when Moose-Wilson Road and Death Canyon Road remain open). In winter, considerably lower levels of wildlife disturbances would occur in the Death Canyon area from backcountry visitor use. In addition, some small, localized adverse effects would also result from the new, larger parking area to the southeast of the existing trailhead that displaces a relatively larger area of habitat in a currently less disturbed area. Construction activities associated with the new parking area construction and the restoration of the abandoned road and parking would also have short-term, adverse disturbance effects on wildlife and habitat. Construction activities and associated noise, human presence, and excavation would have several short-term impacts on wildlife behavior, habitat connectivity, vegetation cover, and other ecological attributes that affect wildlife. However, these construction impacts would affect a relatively small area of the corridor.

Winter Access and Use. Under alternative B, the management of winter access and use in the Moose-Wilson corridor would have beneficial and adverse effects on wildlife and wildlife habitat. The primary change in winter use management under this alternative involves increasing the length of unplowed Moose-Wilson Road. Under alternative B, the road would remain unplowed from Granite Canyon Trailhead to the Murie Ranch Road junction (compared to Granite Canyon to Death Canyon Road junction, as currently managed under alternative A). This change would reduce impacts on wintering wildlife behavior from vehicle traffic, visitor use, and park operations (e.g., plowing), particularly along and around the segment between the Death Canyon Road junction and the Murie Ranch Road junction. In addition, since some backcountry areas would be much more difficult for visitors to reach due to the notable pulling back of road access (e.g., Death Canyon backcountry area), reductions in dispersed backcountry winter use could be expected under this alternative. This reduction in human disturbances (e.g., noise, human presence) in the backcountry would have beneficial effects on wildlife and habitat. However, snow plowing operations and vehicle traffic along plowed portions of Moose-Wilson Road (between the Moose Entrance and Murie Ranch Road and between the Granite Canyon Entrance and Granite Canyon Trailhead) would continue to disturb wintering wildlife in the vicinity of these accessible areas. Likewise, winter recreational use along unplowed portions of the road (Murie Ranch Road junction to Granite Canyon) and in surrounding backcountry areas would also disturb wintering wildlife behavior under alternative B. The above-mentioned road activity (visitor vehicles, plowing operations) and other winter recreational uses in unplowed areas would continue to fragment habitat that connects the montane forests to the west and important Snake River riparian corridor to the east during winter months when active wildlife are already stressed by harsh weather conditions, deep snow, and scarce food sources. However, conversely, relative to the May–October months, the closed, unplowed section of Moose-Wilson Road (Murie Ranch Road junction to Granite Canyon Trailhead) would continue to contribute to a substantial reduction in vehicle use and human use in the corridor, and thus substantial reductions in wildlife disturbances and habitat fragmentation. Thus, compared to the primary visitor season, this winter management of the corridor would continue to provide seasonal beneficial effects on wildlife behavior and habitat conditions.

Visitor Use and Experience. The management of visitor use and experience under alternative B would continue much of the management strategies of alternative A, but would also include enhancements that provide visitors with improved pre-visit information, providing a sense of arrival experience that cues visitors that they are entering a unique area, and providing low-impact, self-discovery interpretive media that focus on the unique natural and cultural resources of the corridor. These proposed management strategies would have long-term, beneficial effects by reducing impacts on wildlife habitat (e.g., reduced plant trampling) and wildlife behavior (e.g., reduced disturbances to wildlife activity) by informing visitors of the importance of ecological protection, sensitive areas, and appropriate visitor behavior. However, continued concentrated and dispersed visitor use in the frontcountry and dispersed visitor use in the backcountry would continue to have adverse effects that result from disturbed wildlife behavior and degraded habitat conditions in the vicinity of designated trail routes and visitor concentration areas (particularly during times of peak visitor use).

Horse Use. Under alternative B, the management of equestrian use in the Moose-Wilson corridor would have both adverse and beneficial effects on wildlife and wildlife habitat. Outside the Poker Flats area, unsustainable horse trails would be removed and/or rerouted and a limited number of road crossings would be provided. These actions would minimize impacts on habitat accessibility and connectivity and reduce habitat quality degradation from localized reductions in human activity disturbances to wildlife and vegetation trampling. Also, human disturbances to wildlife and habitat from equestrian activity in areas around Sawmill Ponds and Granite Canyon Trailheads would decrease notably due to decreased equestrian use resulting from the removal of horse trailer parking in these areas under this alternative. However, the continued equestrian use on the horse trail system throughout other areas of the corridor would also continue to have adverse effects on wildlife and wildlife habitat under alternative B. Human activity associated with equestrian use would continue to cause behavioral disturbances to wildlife in proximity to the two equestrian parking trailheads in the corridor (Poker Flats, Death Canyon Road junction). Equestrian use in the Poker Flats area and other heavily used equestrian areas of the corridor would continue to result in habitat quality degradation from off-trail vegetation trampling and social trail development that further fragments previously intact habitat.

Best Management Practices, Monitoring Guidelines, and Mitigation Measures. As part of all action alternatives, the park would implement best management practices, monitoring guidelines, and mitigation measures to protect the area's wildlife habitat and to limit disturbances from proposed actions and visitor use that would occur under each alternative. Among other strategies, these wildlife management practices and measures would include assessing population counts and trends of various mammal and bird species (including the grizzly bear), monitoring "indicator" wildlife species for effects from human use in the corridor, actively educating park visitors on habitat value and ways to reduce undesirable human-wildlife encounters, employing area closures during critical wildlife activity periods, minimizing noise and light disturbances to wildlife from visitor use and/or park operations, coordinating construction projects to minimize effects on wildlife behavior, and working with other resource management agencies on controlling the spread of nonnative species. All of these best management practices, monitoring guidelines, and mitigation measures would result in short- and long-term, beneficial effects on wildlife in the corridor, as they would collectively minimize adverse effects from other proposed actions and ongoing future uses. These efforts would also foster the holistic approach to ecological management, of which wildlife management plays an integral role.

> Overall, alternative B would have both beneficial and adverse effects on wildlife and wildlife habitat in the corridor. The most noteworthy beneficial impact from alternative B management actions would relate to the two realignments of Moose-Wilson Road that would substantially reduce habitat fragmentation and substantially improve wetland and shrub habitat quality between Sawmill Ponds Overlook and Death Canyon Road. By removing the main visitor use and travel corridor from these high-quality habitat areas, human noise and presence disturbances to wildlife foraging behavior in these areas would be greatly reduced (despite causing adverse effects to sagebrush habitat). The northern realignment would also restore daily and seasonal wildlife movement to, from, and along the Snake River riparian corridor. These realignment actions would greatly benefit the Ecological Communities and Wildlife fundamental resource and value. Other beneficial effects of alternative B would include reductions in wildlife behavior disturbances and habitat fragmentation with the elimination of through-traffic in the corridor from the gate system during peak periods, pulling the Death Canyon Trailhead (and its high-use activity) 0.4 mile closer to the Moose-Wilson high-use corridor, closing two equestrian parking areas, lengthening the unplowed road segment in winter, and controlling roadside parking. Monitoring guidelines, best management practices, and mitigation measures would also protect habitat conditions and mitigate some adverse effects. The most notable adverse effects of alternative B would include likely increases in vehicle and visitor use disturbances to crepuscular wildlife behavior in the mornings and evenings (i.e., pre/post-gate closures) and sagebrush habitat fragmentation for the two road realignments. Also, by providing designated turnouts for up to 120 vehicles, visitors driving through may actually be encouraged to stop along the road corridor if they see wildlife (as opposed to driving through slowly), which could increase behavioral disturbances. Other adverse effects would include construction activity disturbances to wildlife behavior for the development of the road realignments, Death Canyon Trailhead, and paving the unpaved road segment.

Cumulative Effects. A variety of other actions have altered, and would continue to alter wildlife habitat within and outside the project area. Inside the project area, past and ongoing development of park infrastructure, such as roads, parking areas, and visitor activity areas, has displaced wildlife habitat and/or degraded habitat quality in the corridor. The most notable past action in the project would involve the development and/or upgrade of multiple roads, including Moose-Wilson Road. The use of these roads over past decades has introduced disturbances to wildlife behavior and have fragmented otherwise intact habitat. Also, the Moose and Granite Entrance Station developments, along with the facility reuse development and use at White Grass Ranch and Murie Ranch have introduced areas of increased human activity, which continue to introduce human noise and visual disturbances to wildlife habitat and behavior. The LSR Preserve development introduced similar adverse effects due to the higher levels of human use and disturbances in the area (although the LSR Preserve visitor carrying capacity management helps to mitigate these effects). All of these past and ongoing park facility developments and use in the corridor have collectively caused considerable, long-term adverse impacts on wildlife habitat in the corridor. In general, these adverse effects have mostly been in the form of habitat fragmentation and associated impediments to habitat accessibility, use, and connectivity.

Also, outside the project area, other NPS and non-NPS actions have and would continue, to alter wildlife habitat and disturb wildlife behavior (also see cumulative impacts scenario section). Residential, commercial development, and tourism development on private land throughout the area has had substantial adverse effects on wildlife behavior and habitat. This includes Teton Village to the south of the park, areas around Jackson, and a large number of rural residential properties dispersed throughout the region. This high density and low density land use and development has increased considerably over the past couple decades and continues to fragment large habitat areas and introduce substantial movement impediments to wildlife attempting to migrate to and from pockets of intact habitat on a daily or seasonal basis. In addition, transportation infrastructure in the area has also contributed notable impediments to wildlife movement, disturbances to wildlife behavior (e.g., lights, noise), and fragmentation to wildlife habitat. Such transportation facilities include local and regional highways, the Jackson Hole Airport, as well as development of park roads to the north of the corridor. Other development plans and projects at other high-use areas within the park (to the north) have also contributed to wildlife disturbance and habitat fragmentation. Collectively, actions such as these contribute substantial adverse effects to wildlife habitat and wildlife behavior in the region. The adverse effects involve the disruption of foraging, roosting, breeding, and migrating wildlife behaviors for many species that also occupy the project area.

When the effects of alternative B on wildlife and habitat are added to these other past, ongoing, and likely future effects, a substantial, long-term, cumulative adverse effect would continue to occur. However, the incremental effect of alternative B added to the adverse effects of these other actions in the area would be small and would mostly involve a beneficial increment.

Conclusion. Alternative B would result in various beneficial and adverse effects on wildlife and habitat in the corridor. The most noteworthy beneficial impact from alternative B management actions would relate to the two realignments of Moose-Wilson Road that would substantially reduce habitat fragmentation and noticeably improve wetland and shrub habitat quality between Sawmill Ponds Overlook and Death Canyon Road (despite having adverse effects on sagebrush habitat). By removing the main visitor use and travel corridor from these high-quality habitat areas, human noise and presence disturbances to wildlife foraging behavior in these areas would be greatly reduced. The northern realignment would also restore daily and seasonal wildlife movement to, from, and along the Snake River riparian corridor. These realignment actions would greatly benefit the Ecological Communities and Wildlife fundamental resource and value. Other beneficial effects of alternative B would include reductions in wildlife behavior disturbances and habitat fragmentation from the elimination of through-traffic in the corridor from the gate system during peak periods, pulling the Death Canyon Trailhead (and its high-use activity) 0.4 mile closer to the Moose-Wilson high-use corridor, closing two equestrian parking areas, lengthening the unplowed road segment in winter, and controlling roadside parking. Monitoring guidelines, best management practices, and mitigation measures would also protect habitat conditions and mitigate some adverse effects. The most notable adverse effects of alternative B would include likely increases in vehicle and visitor use disturbances to crepuscular wildlife behavior in the mornings and evenings (i.e., pre/post-gate closures) and sagebrush habitat fragmentation for the two road realignments. Also, by providing designated turnouts for up to 120 vehicles, visitors driving through may actually be encouraged to stop along the road corridor if they see wildlife (as opposed to driving through slowly), which could increase behavioral disturbances. Other adverse effects would include construction activity disturbances to wildlife behavior for the development of the road realignments, Death Canyon Trailhead, and paving the unpaved segment. However, although alternative B would have these adverse impacts on wildlife and wildlife habitat, the adverse impacts would not likely be significant because of the relatively localized and intermittent nature of the effects in the corridor. Furthermore, collectively across all beneficial and adverse effects, and relative to other alternatives, alternative B would offer the greatest benefit to wildlife and habitat, primarily due to the two realignments away from highly used shrub, wetland, and riparian habitats and the fact that it does not include other large development expansions.

When the effects of alternative B on wildlife and habitat are added to the effects of other past, ongoing, and likely future actions, a substantial, long-term, cumulative adverse effect would continue to occur. However, the incremental effect of alternative B added to the adverse effects of the other actions in the area would be small and would mostly involve a beneficial increment.

Alternative C (NPS Preferred)

Traffic Management along Moose-Wilson Road. Under alternative C, traffic volumes and patterns along Moose-Wilson Road (and thus in the overall corridor) would be substantially modified by implementing a corridor access vehicle time sequencing system that regulates the number of vehicles in the corridor during peak periods. This traffic management strategy would likely have beneficial effects on wildlife over the long-term by reducing disturbances to wildlife behavior and habitat connectivity by maintaining a set number of vehicles during peak visitor use periods. In addition to reductions in wildlife disturbances from vehicular traffic, the time sequencing system management strategy would also result in reductions in out-of-vehicle visitor use in the corridor during these times due to the managed volume of vehicles accessing the corridor (relative to projected increases in use under the no-action alternative). Collectively, these changes in traffic and visitor use levels and patterns in the corridor (particularly during peak periods) would likely reduce disturbances to wildlife behavior and habitat condition from traffic and parked cars, vehicle-wildlife collisions, unsafe human-wildlife encounters, large concentrations of visitors in high-use wildlife areas, and dispersed recreation. In addition, alternative C includes a reduction in speed limit along Moose-Wilson Road from 25 mph to 20 mph. This modification could result in a reduction in wildlife being startled by fast-moving vehicles around blind curves and could also reduce the risk of wildlife mortality from vehicle-wildlife collisions. On a corridorwide scale, under traffic management strategies of alternative C, impacts such as ongoing habitat fragmentation, wildlife disturbances, and habitat degradation would likely decrease over time, resulting in considerable long-term, beneficial effects.

However, despite the above-described reductions in adverse effects under the vehicle time sequencing system, the implementation of this traffic management strategy could possibly have adverse effects on wildlife behavior and habitat conditions in the vicinity of Moose-Wilson Road during the morning and evening hours before and after the peak visitation period, when vehicle queues and waiting may make the corridor less attractive for visitors. As the public and visitors get accustomed to the time sequencing system over time, it is possible that some degree of a morning and evening pulse of traffic could occur during busy periods (e.g., to get into the corridor before the time sequencing system activates for the day). If this occurs, it would have some adverse effects on the behavior of crepuscular wildlife along Moose-Wilson Road in mornings and late afternoons or early evenings because crepuscular species are much more active during these periods. Historically, crepuscular species have benefited from lower traffic volumes in the corridor during the early morning and early evening hours. Several of the prominent wildlife species of the corridor are crepuscular (e.g., bears, moose, deer). If this traffic phenomenon occurs, several species may be forced to rely on lower quality foraging habitat/areas than they would otherwise choose along the Moose-Wilson corridor and adjacent wetlands.

Also, to facilitate this new traffic management system, vehicle queuing lanes would need to be constructed at the Moose Entrance and the Granite Canyon Entrance to the corridor. This would result in both short-term and long-term, localized, adverse effects on wildlife habitat and wildlife behavior. Construction noise and human activity during the lane development operation would result in minor, short-term, adverse effects on wildlife behavior and habitat condition in this area. The long-term use of these lanes would also have a long-term, localized, adverse effect on wildlife and habitat due to the increase in human activity and noise during peak periods of the day (when vehicles are queued and visitors are waiting to enter the corridor (in and outside their vehicles).

Physical Characteristics of Moose-Wilson Road. Under alternative C, some physical characteristics of Moose-Wilson Road would also be modified. One of the most notable changes to physical characteristics, as it relates to wildlife and habitat, would be the paving of the 1.4-mile segment of currently unpaved roadway. Thus, this segment would no longer need to be treated with dust abatement chemicals such as magnesium chloride, which means migration of MgCl to surrounding soils and plants would cease, a beneficial effect on the quality of wildlife habitat. Likewise, road surface erosion and sedimentation and vehicle-generated dust would decrease along this 1.4-mile segment. As a result, the condition of wildlife habitat and vegetation along this stretch of Moose-Wilson Road would realize some limited levels of beneficial effect. Adjacent plants, insects, and bird communities would be the greatest long-term beneficiaries to this paving action. However, construction noise and activity during the paving operation would result in short-term, adverse effects on wildlife behavior and habitat condition in this area from increased human presence/activity and considerable construction noise disturbances. In addition, visitor vehicle speeds may increase after paving this segment, resulting in possible modest increases in vehicle noise disturbances to wildlife and mortality risks to wildlife crossing the road.

Moose-Wilson Road Realignment. Under alternative C, the existing alignment of Moose-Wilson Road would generally be maintained for most of the road's length, with the exception of a realignment of the northernmost segment between the Murie Ranch Road junction and Teton Park Road. Additionally, the segment of the road between Death Canyon Road and Sawmill

Ponds Overlook would be reconstructed to restore local hydrological patterns and wetland connectivity. Most notably, the existing alignment of Moose-Wilson Road and associated human use along it would continue to disturb wildlife, fragment wildlife habitat, and contribute to daily and seasonal alterations of wildlife movement and habitat connectivity. At a corridorwide scale, Moose-Wilson Road runs relatively parallel to the Snake River. Therefore, the human activity along the road would continue to cause disturbances and obstacles for wildlife moving between the higher elevation montane coniferous forests to the west and the lower elevation riparian woodlands of the Snake River to the east (whether it be on a daily, weekly, or seasonal basis).

Aside from this broader scale effect on wildlife movement, the human use and traffic along the existing Moose-Wilson Road alignment would also continue to have adverse effects on specific high wildlife use areas in the corridor. One of the most notable areas of habitat and wildlife disturbance caused by Moose-Wilson Road activity is the road segment that traverses the beaver pond wetland and adjacent shrub habitat to the southwest of Sawmill Ponds Overlook. Under alternative C, despite improved management of vehicle traffic and visitor use in the corridor, human disturbance impacts on bird foraging, roosting, and nesting, ungulate foraging, and bear foraging in this area would continue to some degree. With the continued use of the existing road alignment, continued impacts on grizzly and black bear activity in the shrub habitat in this area during autumn (i.e., berry patches) are of particular concern, as high concentrations of bears congregate in the shrub habitat along Moose-Wilson Road. By not realigning the road segment adjacent to the Sawmill Ponds wetlands and surrounding habitat, visitors would continue to have opportunities to experience wildlife close-up in this area. Because visitors frequently leave their vehicles and approach wildlife too closely, they often put themselves and the wildlife in unsafe situations. The physical alignment of the road (and the surrounding topography and vegetation) between Death Canyon Road and Sawmill Ponds Overlook makes achieving the parkwide standard of visitors being 100 yards away from bears and wolves difficult to maintain. For example, if visitors see wildlife from the road in this wetland habitat area, they are already likely less than 100 yards away. This would likely continue to result in behavioral disturbances to wildlife and possible unsafe situations for the visitors and wildlife. However, some of these impacts would be mitigated by temporary road closures, as currently implemented.

The road reconstruction and drainage improvement between Death Canyon Road and Sawmill Ponds Overlook could affect up to 1.5 miles of the Moose-Wilson Road alignment. Through this action, portions of the road adjacent to the wetlands would be reconstructed to improve wetland functions, correct drainage issues, improve road conditions, as well as provide improved wildlife safety mitigation measures (e.g., road sightlines). In addition to making the road more sustainable, it should also improve the hydrological conditions that are integral to the functional qualities of the large wetland complex to the east of the road. This would be realized primarily by restoring hydrological connectivity between upstream areas and downstream wetlands, to the extent possible (e.g., via additional culverts). As a result, this action could have localized, beneficial effects on wetland habitat conditions for a wide range of wildlife species that forage or breed in and around this wetland complex. More specifically, beaver activity in this area would benefit from more natural hydrological conditions, which could not only benefit beavers, but also benefit other wildlife such as birds and amphibians that rely on beaver ponds as habitat in various life stages and/or for seasonal behavior. So, while alternative C does not offer the same degree of habitat connectivity benefits from the southern realignment associated with alternatives B and D, the reconstruction of the road segment to improve hydrological connectivity between Death Canyon Road and Sawmill Ponds Overlook would still have appreciable long-term beneficial effects on wetland habitat for a wide variety of species in this area.

Also, under alternative C, the proposed realignment of the northernmost segment of Moose-Wilson Road (and relocation of the Moose Entrance Station and four-way intersection with Teton Park Road) would remove Moose-Wilson Road from its current proximity to the Snake River riparian corridor and would substantially improve habitat connectivity for wildlife using the river corridor for north and south movements. Long-term, beneficial effects to wildlife behavior and habitat accessibility and connectivity would result from reducing habitat fragmentation from the existing road and moving high traffic volumes and associated visitor use up and out of the riparian zone. However, sagebrush habitat along the new northern alignment would be displaced and/or altered by this alignment change. Also, construction activities associated with the new road construction and the restoration of the old road (and associated noise, human presence, excavation, etc.) would have several short-term, adverse impacts on wildlife behavior, habitat connectivity, water quality, vegetation, and other ecological attributes that affect wildlife. These impacts would affect a relatively small area of the corridor (northernmost portion).

Overall, from a wildlife habitat perspective, this element of alternative C would offer some wildlife benefits by improving wetland complex conditions (via drainage improvements) and realigning the northernmost road segment away from the Snake River riparian zone. However, because Moose-Wilson Road would retain its existing alignment through the balance of the corridor, and most importantly, would continue to fragment high quality wetland habitat from montane forest habitat, the benefits to wildlife from this element of alternative C are considerably less than that of alternative B. Thus, given the importance of this habitat and its connectivity, the use and alignments through the wetland-shrub habitat under this alternative would continue to adversely alter the Ecological Communities and Wildlife fundamental resource and value.

Turnouts and Parking. Under alternative C, strategically located designated turnouts and parking would be provided, along with design solutions that deter opportunistic, user-created parking in other areas. In addition, the alternative would include increased use of park staff and volunteers to assist in maintaining parking management during high wildlife activity periods. These parking management strategies would reduce wildlife behavior disturbances from human activities associated with randomly parked vehicles along the road corridor, and in turn, would maintain wildlife movement and migration patterns. Although Moose-Wilson Road would still fragment habitat in the corridor, these measures would mitigate the severity of the ongoing fragmentation as it would reduce random parking and human activity in areas that are critical for wildlife movement across and along the road. These parking management strategies would also maintain natural vegetation communities and reduce the spread of noxious weeds by reducing the numbers and frequency of vehicles parking in undesignated areas, which contributes to improved habitat quality conditions along the Moose-Wilson corridor. However, conversely, by providing official turnouts for up to 120 vehicles, visitors driving through the corridor may actually be encouraged to stop along the road if they see wildlife when otherwise they would continue driving at slow speeds. This possible increase in vehicle stopping (and/or visitors leaving their cars) due to designated turnouts could have an adverse effect on wildlife behavior. Also, in areas around the designated parking locations, localized areas of vegetation trampling and habitat disturbance from people getting out of parked vehicles and wandering off-road could be expected. Thus, collectively, these strategies would have long-term, corridorwide beneficial and adverse effects on wildlife and wildlife habitat, particularly during high wildlife activity periods such as late summer and autumn.

Bicycle Use. Under alternative C, cyclists would continue to share Moose-Wilson Road with motor vehicle traffic. Bicycle use on Moose-Wilson Road and other roads in the corridor would continue to cause intermittent disturbance to wildlife behavior and habitat conditions. Because the overall numbers and percentages of bicycle use on these roads is slight relative to motor vehicles on the same roads, the adverse effects would likely not be as extensive as the disturbances from motor vehicles and their occupants who leave their vehicles. However, with increased information sharing on how Moose-Wilson Road connects other regional multiuse paths and improved cycling conditions and facilities being provided along Moose-Wilson Road (e.g., paving unpaved road section, lower speed limit, bike racks, facilitated transitions to and from existing paths, installed safety edge on road), it is likely that bicycle use in the corridor would increase an appreciable amount over time. Increased bicycle use along Moose-Wilson Road would increase frequency and degree of the above-noted adverse effects on wildlife behavior and habitat due to the associated increase of human activity, noise, and the off-road/off-bike pedestrian activity that would result. However, this potential adverse effect from increased bike usage along Moose-Wilson Road would be very minor relative to the substantial adverse effects on wildlife from a separated multiuse pathway and its use, as described under alternative D.

Commercial Activity. Various authorized commercial activity would continue to be allowed and administered under alternative C, which would continue to have intermittent and concentrated adverse effects on wildlife behavior in the vicinity of commercial group activities. Habitat conditions would also continue to be adversely affected in areas where commercial groups tend to congregate and/or frequent. Guided groups that seek wildlife viewing or occur in the vicinity of wildlife activity would continue to introduce clusters of human activity disturbances in proximity to wildlife and wildlife habitat for both short and long durations. However, the commercial outfitters are closely regulated by the park to maintain appropriate distances. Guided horseback use in the corridor would continue to result in wildlife and habitat disturbances. Guided skiing and snowshoeing would also continue to affect wintering wildlife in the corridor. Behavioral disturbances to wintering wildlife from winter use is of particular concern because of the other natural stressors on wintering wildlife (weather, limited food sources, etc.). Aside from these corridorwide, adverse effects on wildlife and wildlife habitat, the prohibition of taxi use and other nonpark-dependent commercial traffic, as well as site-specific special events, would have beneficial effects on wildlife habitat by reducing vehicle traffic and concentrated human activity, respectively. In addition, the road-based tours that focus on corridor-specific, resource-based interpretation would inform visitors on the ecological values of wildlife and habitat in the corridor and educate visitors on appropriate human behavior.

Death Canyon. Under alternative C, proposed management of the Death Canyon area would have both beneficial and adverse effects on wildlife behavior and habitat conditions. The most notable management change would involve the relocation of the Death Canyon Trailhead and parking area approximately 1.0 mile to a site downhill and closer to Moose-Wilson Road. The abandoned road segment and parking area would be restored to natural conditions and converted to a trail. The new parking area capacity (approximately 80–90 vehicles) would be a substantial increase from the existing parking lot size. These changes would have notable beneficial effects on wildlife by bringing the trailhead (and its human activity) considerably closer to the high-use of the Moose-Wilson corridor, thus resulting in a relatively large reduction in habitat fragmentation caused by Death Canyon Road and its use. The much larger designated parking area would also improve surrounding habitat conditions by reducing the amount of vegetation impacts and weed infestation associated with highly dispersed, user-created parking along Death Canyon Road. The restoration of the existing parking area would also increase available habitat area.

The adverse effects of the proposed Death Canyon management under alternative C would primarily relate to the continued use of the Death Canyon Road and Trailhead, despite the 1.0-mile relocation. Although traffic and visitor use volumes in the corridor would be managed by the vehicle time sequencing system of alternative C during peak visitation periods, vehicle traffic and human activity at the proposed Death Canyon Trailhead and Death Canyon Road would continue to cause disturbances to wildlife behavior and fragment habitat for over 0.5 mile from the main corridor of human disturbance in the project area (i.e., along Moose-Wilson Road). The highest levels of habitat disturbance in this area would continue from mid-May through October (i.e., when Moose-Wilson Road and Death Canyon Road remain open). In winter, considerably lower levels of wildlife disturbances would occur in the Death Canyon area from backcountry visitor use. Additionally, the notable shift of the Death Canyon parking area could possibly result in shifting visitor use patterns that might bring increased human activity to other areas, such as in and around White Grass Ranch. If these use pattern shifts occur, increases in human noise and presence could adversely affect wildlife behavior in these adjacent areas. Also, some small, localized adverse effects would also result from the new, larger parking area southeast of the existing trailhead that displaces a relatively larger area of habitat in a currently less disturbed area. Construction activities associated with the new parking area construction and the restoration of the abandoned road and parking area would also have short-term, adverse effects on wildlife and habitat. Construction activities and associated noise, human presence, and excavation would have several short-term impacts on wildlife behavior, habitat connectivity, vegetation cover, and other ecological attributes that affect wildlife. However, these construction impacts would affect a relatively small area of the corridor.

Winter Access and Use. Under alternative C, management of winter access and use in the Moose-Wilson corridor would be similar to current management (alternative A) and would have beneficial and adverse effects on wildlife and wildlife habitat. Snow plowing operations and vehicle traffic along plowed portions of Moose-Wilson Road (between the Moose Entrance and Death Canyon Road junction and between the Granite Canyon Entrance and Granite Canyon Trailhead) would continue to disturb wintering wildlife in the vicinity of these accessible areas. Winter recreational use along unplowed portions of the road (Death Canyon Road junction to Granite Canyon) and in surrounding backcountry areas would also continue to disturb wintering wildlife behavior under alternative C. The above-mentioned road activity (visitor vehicles, plowing operations) and other winter recreational uses in unplowed areas would continue to fragment habitat that connects the montane forests to the west and important Snake River riparian corridor to the east during winter months when active wildlife are already stressed by harsh weather conditions, deep snow, and scarce food sources. However, conversely, relative to the May–October months, the closed, unplowed section of Moose-Wilson Road (Death Canyon Road junction to Granite Canyon Trailhead) would continue to contribute to a substantial reduction in vehicle use and human use in the corridor, and thus substantial reductions in wildlife disturbances and habitat fragmentation. Thus, compared to the primary visitor season, this winter management of the corridor would continue to provide seasonal beneficial effects on wildlife behavior and habitat conditions.

Visitor Use and Experience. The management of visitor use and experience under alternative C would continue much of the management strategies of alternative A, but would also include enhancements that provide visitors with improved pre-visit information, providing a sense of arrival experience that cues visitors that they are entering a unique area, and providing low-impact, self-discovery interpretive media that focuses on the unique natural and cultural resources of the corridor. These proposed management strategies would have long-term, beneficial effects by reducing impacts on wildlife habitat (e.g., reduced plant trampling) and wildlife behavior (e.g., reduced disturbances to wildlife activity) by informing visitors of the importance of ecological protection, sensitive areas, and appropriate visitor behavior. However, continued concentrated and dispersed visitor use in the frontcountry and dispersed visitor use in the backcountry would continue to have adverse effects that result from disturbed wildlife behavior and degraded habitat conditions in the vicinity of designated trail routes and visitor concentration areas (particularly during times of peak visitor use).

Horse Use. Under alternative C, management of equestrian use in the Moose-Wilson corridor would have both adverse and beneficial effects on wildlife and wildlife habitat. Outside the Poker Flats area, unsustainable horse trails would be removed and/or rerouted and a limited number of road crossings would be provided. These actions would minimize impacts on habitat accessibility and connectivity and reduce habitat quality degradation from localized reductions in human activity disturbances to wildlife and vegetation trampling. Also, human disturbances to wildlife and habitat from equestrian activity in areas around the Granite Canyon Trailhead (and equestrian trails to the west) would likely decrease due to decreased equestrian use resulting from the removal of horse trailer parking at this trailhead under this alternative. However, the continued equestrian use on the horse trail system throughout other areas of the corridor would continue to have adverse effects on wildlife and wildlife habitat under alternative C. Human activity associated with equestrian use would continue to cause behavioral disturbances to wildlife, particularly in proximity to the equestrian parking trailheads in the corridor (Poker Flats, Sawmill Ponds Overlook, and Death Canyon Road junction). Equestrian use in the Poker Flats area and other heavily used equestrian areas of the corridor would continue to result in habitat quality degradation from off-trail vegetation trampling and social trail development that further fragments previously intact habitat.

Best Management Practices, Monitoring Guidelines, and Mitigation Measures. As part of all action alternatives, the park would implement best management practices, monitoring guidelines, and mitigation measures to protect the area's wildlife habitat and to limit disturbances from proposed actions and visitor use that would occur under each alternative. Among other strategies, these wildlife management practices and measures would include assessing population counts and trends of various mammal and bird species (including grizzly bears), monitoring "indicator" wildlife species for effects of human use in the corridor, actively educating park visitors on habitat value and ways to reduce undesirable human-wildlife encounters, employing area closures during critical wildlife activity periods, minimizing noise and light disturbances to wildlife from visitor use and/or park operations, coordinating construction projects to minimize effects on wildlife behavior, and working with other resource management agencies on controlling the spread of nonnative species. All of these best management practices, monitoring guidelines, and mitigation measures would result in short- and long-term, beneficial effects on wildlife in the corridor, as they would collectively minimize adverse effects from other proposed actions and ongoing future uses. These efforts would further foster the holistic approach to ecological management, of which wildlife management plays an integral role.

> Overall, alternative C would have both beneficial and adverse effects on wildlife and wildlife habitat in the corridor. The most substantial beneficial impacts from alternative C management actions would relate to the improved traffic and visitor use volume management, the northern realignment of Moose-Wilson Road, and the relocation of the Death Canyon Trailhead. During peak visitation periods, the vehicle sequencing would likely reduce disturbances to wildlife behavior and habitat condition from traffic and parked cars, vehicle-wildlife collisions, unsafe human-wildlife encounters, and large concentrations of visitors in high-use wildlife areas. The Death Canyon Trailhead relocation would notably reduce habitat fragmentation by moving high levels of human disturbances closer to the high-use area of the Moose-Wilson corridor. The northern realignment would remove the road and its high visitor use/traffic from the Snake River riparian corridor, an important corridor for north-south wildlife movement and habitat connectivity. Another beneficial effect of this alternative would be the reconstruction of the segment between Death Canyon Road and Sawmill Ponds Overlook to improve hydrological connectivity, which would improve wetland habitat. Other beneficial effects of alternative C would result from closing one equestrian parking area and controlling roadside parking. Monitoring guidelines, best management practices, and mitigation measures would also protect habitat conditions and mitigate some adverse effects. The most notable adverse effect of alternative C would involve the continued use of the existing Moose-Wilson Road alignment that fragments the high-use wetland and shrub habitat between Sawmill Ponds Overlook and Death Canyon Road from montane forest habitat to the west. Continued human activity along the road would also continue to cause noise and human presence disturbances on wildlife activity along the road corridor, most notably bear behavior during the berry season in the shrub habitats (although some of these impacts would be mitigated by temporary road closures). This use along the existing alignment through the wetland-shrub habitat would continue to adversely alter the Ecological Communities and Wildlife fundamental resource and value. The traffic management system could also result in increases in vehicle and visitor use disturbances to crepuscular wildlife behavior in the mornings and evenings (i.e., if local visitors learn the traffic control system and adjust travel/visit times). Also, by providing designated turnouts for up to 120 vehicles, visitors driving through may actually be encouraged to stop along the road corridor if they see wildlife (as opposed to driving through slowly), which could increase behavioral disturbances. Other adverse effects would also include construction activity disturbances to wildlife behavior for the development of the northern road realignment, road reconstruction between Sawmill Ponds Overlook and Death Canyon Road, Death Canyon Trailhead, and paving the unpaved road segment.

Cumulative Effects. A variety of other actions have altered, and would continue to alter wildlife habitat within and outside the project area. Inside the project area, past and ongoing development of park infrastructure, such as roads, parking areas, and visitor activity areas, has displaced wildlife habitat and/or degraded habitat quality in the corridor. The most notable past action in the project would involve the development and/or upgrade of multiple roads, including Moose-Wilson Road. The use of these roads over past decades has introduced disturbances to wildlife behavior and have fragmented otherwise intact habitat. Also, the Moose and Granite Entrance Station developments, along with the facility reuse development and use at White Grass Ranch and Murie Ranch have introduced areas of increased human activity, which continue to introduce human noise and visual disturbances to wildlife habitat and behavior. The LSR Preserve development introduced similar adverse effects due to high levels of human use and disturbances in the area (although the LSR Preserve visitor carrying capacity management helps to mitigate these effects). All of these past and ongoing park facility developments and use in the corridor have collectively caused considerable long-term adverse impacts on wildlife habitat in the corridor. In general, these adverse effects have mostly been in the form of habitat fragmentation and associated impediments to habitat accessibility, use, and connectivity.

Outside the project area, other NPS and non-NPS actions have and would continue to alter wildlife habitat and disturb wildlife behavior (also see cumulative impacts scenario section). Residential, commercial development, and tourism development on private land throughout the area has had substantial adverse effects on wildlife behavior and habitat. This includes Teton Village to the south of the park, areas around Jackson, and a large number of rural residential properties dispersed throughout the region. This high density and low density land use and development has increased considerably over the past couple of decades and continues to fragment large habitat areas and introduce substantial movement impediments to wildlife attempting to migrate to and from pockets of intact habitat on a daily or seasonal basis. In addition, transportation infrastructure in the area has also contributed notable impediments to wildlife movement, disturbances to wildlife behavior (e.g., lights, noise), and fragmentation to wildlife habitat. Such transportation facilities include local and regional highways, the Jackson Hole Airport, as well as development of park roads to the north of the corridor. Other development plans and projects at other high-use areas within the park (to the north) have also contributed to wildlife disturbance and habitat fragmentation. Collectively, actions such as these contribute substantial adverse effects to wildlife habitat and wildlife behavior in the region. The adverse effects involve the disruption of foraging, roosting, breeding, and migrating wildlife behaviors for many species that also occupy the project area.

When the effects of alternative C on wildlife and habitat are added to these other past, ongoing, and likely future effects, a substantial, long-term, cumulative adverse effect would continue to occur. However, the incremental effect of alternative C added to the adverse effects of these other actions in the area would be minimal.

Conclusion. Alternative C would have both beneficial and adverse effects on wildlife and wildlife habitat in the corridor. The most substantial beneficial impacts from alternative C management actions would relate to the improved traffic and visitor use volume management, the northern realignment of Moose-Wilson Road, and the relocation of the Death Canyon Trailhead. During peak visitation periods, the vehicle sequencing would likely reduce disturbances to wildlife behavior and habitat condition from traffic and parked cars, vehicle-wildlife collisions, unsafe human-wildlife encounters, and large concentrations of visitors in high-use wildlife areas. The Death Canyon Trailhead relocation would notably reduce habitat fragmentation by shifting high levels of human disturbances closer to the high-use area of the Moose-Wilson corridor. The northern realignment would remove the road and its high visitor use/traffic from the Snake River riparian corridor, an important corridor for north-south wildlife movement and habitat connectivity. Another beneficial effect of this alternative would be the reconstruction of the segment between Death Canyon Road and Sawmill Ponds Overlook to improve hydrological connectivity, which would improve wetland habitat. Other beneficial effects of alternative C would result from closing one equestrian parking area and controlling roadside parking. Monitoring guidelines, best management practices, and mitigation measures would also protect habitat conditions and mitigate some adverse effects. The most notable adverse effect of alternative C would involve the continued use of the existing Moose-Wilson Road alignment that fragments the high-use wetland and shrub habitat between Sawmill Ponds Overlook and Death Canyon Road from montane forest habitat to the west. Continued human activity along the road would also continue to cause noise and human presence disturbances on wildlife activity, most notably, bear behavior during the berry season in the shrub habitats (although some of these impacts would be mitigated by temporary road closures). This use along the existing alignment through the wetland-shrub habitat would continue to adversely alter the Ecological Communities and Wildlife fundamental resource and value. The traffic management system could also result in increases in vehicle and visitor use disturbances to crepuscular wildlife behavior in the mornings and evenings (i.e., if local visitors learn the traffic control system and adjust travel/visit times). Also, by providing designated turnouts for up to 120 vehicles, visitors driving through may actually be encouraged to stop along the road corridor if they see wildlife (as opposed to driving through slowly), which could increase behavioral disturbances. Other adverse effects would include construction activity disturbances to wildlife behavior for the development of the northern road realignment, road reconstruction between Sawmill Ponds Overlook and Death Canyon Road, Death Canyon Trailhead, and paving the unpaved road segment. Collectively across all beneficial and adverse effects, alternative C would not offer as much benefit to wildlife and habitat as alternative B. However, because the most notable adverse effects on wildlife from alternative C would be limited to a relatively localized portion of the corridor (generally between Sawmill Ponds Overlook and Death Canyon Road), the adverse impacts on wildlife and wildlife habitat would not likely be significant.

When the effects of alternative C on wildlife and habitat are added to the effects of other past, ongoing, and likely future actions, a substantial, long-term, cumulative adverse effect would continue to occur. However, the incremental effect of alternative C, added to the adverse effects of the other actions in the area would be minimal.

Alternative D

Traffic Management along Moose-Wilson Road. Under alternative D, traffic volumes and patterns along Moose-Wilson Road (and thus in the overall corridor) would be substantially modified by implementing a corridor access reservation system that regulates vehicle traffic times and volumes. The system would also provide pre-visit information to visitors while in the process of reserving their access days and/or times. This traffic management strategy would likely have beneficial effects on wildlife over the long term by reducing disturbances to wildlife behavior and habitat connectivity by maintaining a set number of vehicles in the corridor at any given time, particularly during peak visitor use periods and peak wildlife use periods. In addition to reductions in wildlife disturbances from vehicular traffic, the reservation system management strategy would also result in reductions in out-of-vehicle visitor use in the corridor due to the managed volume of vehicles accessing the corridor (relative to projected increases in use under the no-action alternative). Collectively, these changes in traffic and visitor use levels and patterns in the corridor (particularly during peak periods) would likely reduce disturbances to wildlife behavior and habitat conditions from traffic and parked cars, vehicle-wildlife collisions, unsafe human-wildlife encounters, large concentrations of visitors in high-use wildlife areas, and dispersed recreation. In addition, alternative D includes a reduction in speed limit along Moose-Wilson Road from 25 mph to 20 mph. This modification could result in a reduction in wildlife being startled by fast-moving vehicles around blind curves and could also reduce the risk of wildlife mortality from vehicle-wildlife collisions. On a corridorwide scale, under traffic management strategies of alternative D, impacts such as ongoing habitat fragmentation, wildlife disturbances, and habitat degradation over time would likely decrease, resulting in considerable long-term, beneficial effects.

However, despite the above-described reductions in adverse effects under the vehicle access reservation system, the implementation of this traffic management strategy could possibly have adverse effects on wildlife behavior and habitat conditions in the vicinity of Moose-Wilson Road during the morning and evening hours before and after the peak visitation period, when many vehicle reservations may be filled. As the public and visitors get accustomed to the reservation system over time, some degree of morning and evening pulse of traffic could occur during busy periods. If this occurs, it would have some adverse effects on the behavior of crepuscular wildlife along Moose-Wilson Road in mornings and late afternoons or early evenings because crepuscular species are much more active during these periods. Historically, crepuscular species have benefited from lower traffic volumes in the corridor during the early morning and early evening hours. Several of the prominent wildlife species of the corridor are crepuscular (e.g., bears, moose, deer). If this traffic phenomenon occurs, several species may be forced to rely on lower quality foraging habitat/areas than they would otherwise choose (e.g., along Moose-Wilson corridor and wetlands).

Physical Characteristics of Moose-Wilson Road. Many of the physical characteristics of Moose-Wilson Road would remain unchanged under alternative D. Most notably, the 1.4-mile unpaved segment of the road would remain unpaved. This unpaved section would continue to be treated with dust abatement chemicals such as magnesium chloride. The condition of wildlife habitat and vegetation along the unpaved section would thus continue to be adversely affected by road surface erosion and sedimentation, vehicle-generated dust, and the migration of MgCl into the surrounding soils and water. Adjacent plants, insects, and bird communities could be most affected.

Moose-Wilson Road Realignment. Two large-scale realignments of Moose-Wilson Road would also occur under alternative D, which would include restoration of the current alignments to natural conditions. Most notably, the southern realignment between the Death Canyon Road junction and Sawmill Ponds Overlook would result in substantial long-term, beneficial effects to wildlife habitat connectivity and habitat condition, particularly in the vicinity of the wetland complex to the southwest of Sawmill Ponds Overlook (despite some adverse effects to sagebrush habitat in new realignment area described below). This wetland complex habitat and surrounding shrub habitat is one of the most biodiverse, robust habitats in the corridor. Its connectivity and proximity to protective forested areas to the west makes this habitat even more valuable to an abundance of wildlife species. Removing Moose-Wilson Road (and its traffic and human use) from this low-lying wetland habitat at the base of the steeper montane forests to the west would considerably reduce habitat fragmentation in this transition area, greatly improve bear and moose habitat quality (wetlands and adjacent shrub habitat), and improve habitat availability and connectivity for many other mammal and bird species. For example, road impediments to beaver activity and associated dynamic beaver pond processes would be eliminated. In addition, the improved hydrological connectivity of the wetlands with their tributary streams and seeps (resulting from removing this segment of road) would likely improve wetland habitat conditions for other wildlife, such as amphibians, that are very dependent on high-quality wetland habitat. This realignment would also likely reduce the risk of human-grizzly bear interactions by eliminating and restoring sections of road that currently dissect high-use areas for bears (near wetlands and shrub/berry habitat), a high visitor use area frequented by wildlife viewers and photographers due to easy access along the road. These beneficial effects of this realignment would primarily be localized and mostly confined to this wetland complex area and would be most important during the fall berry-producing months when bear activity in the area peaks. However, given the connectivity of this important wetland habitat to surrounding montane habitats and its value to a multitude of species throughout the year (for foraging, breeding, roosting, etc.), the beneficial effects would also extend beyond this localized area and beyond the late summer and autumn months.

Also under alternative D, a realignment of the northernmost segment of Moose-Wilson Road would occur, along with relocation of the Moose Entrance Station, realignment of the four-way intersection with Teton Park Road, and the development of a corridor entrance station (reservation system information, kiosk, fee station, turnaround, etc.). These northern realignment and development changes would remove Moose-Wilson Road from its current proximity to the Snake River riparian corridor and would substantially improve habitat connectivity for wildlife using the river corridor for north and south movements. Long-term, beneficial effects on wildlife behavior and habitat accessibility and connectivity would result from reducing habitat fragmentation from the existing road and moving high traffic volumes and associated visitor use away from the riparian zone. However, adverse effects to sagebrush habitat and the different assemblage of wildlife species that use it would also occur (as described below).

However, regardless of these two realignments that would benefit wildlife relative to the current condition, it is important to note that Moose-Wilson Road and associated human use along it would continue to disturb wildlife behavior, fragment wildlife habitat, and contribute to daily and seasonal alterations of wildlife movement and habitat connectivity. At a corridorwide scale, Moose-Wilson Road runs relatively parallel to the Snake River. Therefore, the human activity along the road would continue to cause disturbances and obstacles for wildlife moving between the higher elevation montane coniferous forests to the west and the lower elevation riparian woodlands of the Snake River to the east (whether it be on a daily, weekly, or seasonal basis).

The proposed southern and northern realignments of Moose-Wilson Road would result in new road alignments through the sagebrush meadows to the southeast of the beaver pond wetlands and to the northwest of the Snake River riparian corridor, respectively. The development of these new roads would have long-term, adverse effects on the quality and connectivity of sagebrush habitat in both of these previously undeveloped areas. Native vegetation and habitat would be permanently removed along the lengths of these new roads and in the areas around the new and relocated entrance stations on the north end. Some wetland habitat would also be altered and/or removed in the vicinity of Sawmill Ponds Overlook due to the new southern realignment, which would reduce or degrade available wetland habitat for birds, amphibians, and other aquatic species. Also, randomly parked vehicles and associated pedestrian use would likely cause degradation of vegetation and habitat for varying distances on both sides of the new road alignments (e.g., social trail development, trampled roadside vegetation).

Dispersed pedestrian recreation originating from these new road alignments could also be expected and would result in disturbances to wildlife behavior in the adjacent sagebrush habitat and possibly beyond (e.g., Snake River riparian habitat, beaver pond wetland habitat). Construction activities associated with the new road alignment and the restoration of the old road (and associated noise, human presence, excavation, etc.) would have several short-term, adverse impacts on wildlife behavior, habitat connectivity, water quality, vegetation, and other ecological attributes that affect wildlife. These impacts would affect a relatively large area of the corridor (throughout lengths of all road modifications) and would generally affect a different habitat type and assemblage of species than those habitat/species that benefit from improved wetland habitat connectivity (noted above).

However, overall, from a wildlife habitat perspective, the beneficial effects of these two road realignments (noted above) outweigh these adverse effects of two new alignments due to the importance of restoring the quality of the wetland area habitat and shrub habitat and improving connectivity to adjacent habitats. Given the importance of these habitat values, the proposed southern and northern realignments under this alternative would greatly benefit the Ecological Communities and Wildlife fundamental resource and value (despite the adverse effects of the realignments on the sagebrush habitat and assemblage of species that use it).

Turnouts and Parking. Under alternative D, strategically located designated turnouts and parking would be provided, along with design solutions that deter opportunistic, user-created parking in other areas. In addition, the alternative would include increased use of park staff to assist in maintaining parking management during high wildlife activity periods. These parking management strategies would reduce wildlife behavior disturbances from human activities associated with randomly parked vehicles along the road corridor, and in turn, would maintain wildlife movement and migration patterns. Although Moose-Wilson Road would still fragment habitat in the corridor, these measures would mitigate the severity of the ongoing fragmentation as it would reduce random parking and human activity in areas that are critical for wildlife movement across and along the road. These parking management strategies would also maintain natural vegetation communities and reduce the spread of noxious weeds by reducing the numbers and frequency of vehicles parking in undesignated areas, which contributes to improved habitat quality conditions along the Moose-Wilson corridor. However, conversely, by providing official turnouts for up to 120 vehicles, visitors driving through may actually be encouraged to stop along the road corridor if they see wildlife when they would otherwise continue driving through at slow speeds. This possible increase in vehicles stopping (and/or visitors leaving their cars) due to designated turnouts could have an adverse effect on wildlife behavior. Also, in areas around the designated parking locations, localized areas of vegetation trampling and habitat disturbance from people getting out of parked vehicles and wandering off-road could be expected. Thus, collectively, these strategies would have long-term, corridorwide beneficial and adverse effects on wildlife and wildlife habitat, particularly during high wildlife activity periods such as late summer and autumn.

Bicycle Use. Relative to the current level and area of effect on wildlife habitat from traffic and human activities in the corridor, the proposed multiuse pathway under alternative D would cause a significant increase in habitat fragmentation and wildlife disturbance. The main source for this impact would be the introduction of a second primary human travel corridor through the project area. In addition to the Moose-Wilson Road disturbance corridor, wildlife and wildlife habitat in the project area would be adversely affected by human disturbances on and along an additional swath of land. Although the proposed pathway would parallel the existing and realigned Moose-Wilson Road for much of its length, the pathway would be offset up to 150 feet from the road. From a wildlife habitat perspective (across most avian species and medium and large mammal species), this would effectively result in a substantial increase in the width of the main human travel/activity corridor, increasing from roughly a 30-foot width (along disturbance corridor of Moose-Wilson Road) to upwards of a 200-foot width of disturbance (when the disturbance corridor of the road, pathway, and moderately disturbed offset area in between). This substantial widening of the Moose-Wilson Road/pathway disturbance corridor would have notable adverse effects on wildlife trying to use habitat along this corridor. More importantly, the increase in fragmentation width would considerably increase disturbances to wildlife trying to move laterally through this area (moving between the montane forests to the west and the Snake River riparian and sagebrush flats to the east). For many wildlife species, including bears, the farther the pathway is offset from the roadway, the greater the overall width of human effect on habitat availability would be (MacHutchon 2014). In addition, the pathway's alignment around the LSR Preserve would result in two separated disturbance corridors for the length around the Preserve, with the corridors being separated by roughly 0.5 mile. This second, separated disturbance/activity corridor would have even greater adverse effects on wildlife movement, behavior, and habitat connectivity relative to the impacts along the other segments described above. Under alternative D, wildlife using this area in the vicinity of the eastern end of the LSR Preserve (and/or trying to move through this area in their daily or seasonal migrations between the montane forests and Snake River riparian zone or sagebrush flats) would encounter two separate impediments or stressors associated with the human road use and human pathway use, respectively. Both of the separated linear corridors would have respective zones of influence on habitat due to the human use in these corridors. As a result, there is an even greater potential for habitat fragmentation because the habitat accessibility, use, and connectivity between the two separate corridors could be considerably diminished for various species, including bears (MacHutchon 2014).

In addition to the increased habitat fragmentation and hindered wildlife movement effects introduced by the proposed pathway, other adverse effects on wildlife would include a potential for increased numbers of human-wildlife interactions (e.g., moose, black bear, grizzly bear, elk) and removal of native plants and associated habitat displaced by the pathway (please refer to the "Federally Listed Species" section for more information related to human-grizzly bear interaction effects). More than 20 acres of existing habitat would be removed over the length of the pathway. Also, with all human use along the multiuse pathway being nonmotorized pedestrian or bicycle use, the likelihood of humans startling wildlife as they traverse the pathway is high. This would cause increased stressors on wildlife and could result in defensive wildlife reactions to humans. This potential effect is of particular concern since pathway bicyclists often travel quietly and at relatively high speeds, greatly increasing the potential for surprising wildlife and/or defensive behavior. Furthermore, studies indicate that humans who are not in vehicles (biking, walking, nature viewing) can have notably different and potentially greater impact on wildlife behavior than humans in motor vehicles on designated roadways (Knight and Cole 1995). Thus, wildlife behavior disturbances along the pathway might be greater due to the type of visitor use along this path, relative to the more vehicular-type use along Moose-Wilson Road.

Construction activities associated with the multiuse pathway (and associated noise, human presence, excavation, etc.) would have several short-term impacts on wildlife behavior, habitat connectivity, water quality, vegetation, and other ecological attributes that affect wildlife. These impacts would affect a large area of the corridor (throughout the full north-south length of the corridor) and would repeat over multiple construction seasons until completion. Also, it is important to note that some multiuse pathway segments would be built in conjunction with the construction of the Moose-Wilson Road realignments (i.e., pathway segments that parallel the realignment segments of Moose-Wilson Road). Thus, construction impacts on wildlife and habitat from pathway construction would be much more noticeable and standalone for the pathway segments in other areas of the corridor.

Collectively, and relative to the existing habitat disturbances and fragmentation in the corridor, the proposed multiuse pathway under alternative D would result in significant net increases in ecological disturbances, habitat loss, and fragmentation in the corridor from introducing a dual transportation corridor development (i.e., pathway and roadway). This effect would notably diminish the quality and integrity of the Ecological Communities and Wildlife fundamental resource and value.

Commercial Activity. Various authorized commercial activity would continue to be allowed and administered under alternative D, which would continue to have intermittent and concentrated adverse effects on wildlife behavior in the vicinity of commercial group activities. Habitat condition would also continue to be adversely affected in areas where commercial groups tend to congregate and/or frequent. Guided groups that seek wildlife viewing or occur in the vicinity of wildlife activity would continue to introduce clusters of human activity disturbances in proximity to wildlife and wildlife habitat for both short and long durations. However, the commercial outfitters are closely regulated by the park to maintain appropriate distances. Under alternative D, guided bike tours along the proposed multiuse pathway would be considered. These tours could carry some of the above-mentioned adverse effects into the currently undisturbed open sagebrush areas along the trail route. Guided horseback use in the corridor would continue to result in wildlife and habitat disturbances. Guided skiing and snowshoeing would also continue to affect wintering wildlife in the corridor, with possible increases in guided ski/snowshoe tours on the groomed trails in the corridor under this alternative. Behavioral disturbances to wintering wildlife from winter use is of particular concern because of the other natural stressors on wintering wildlife (weather, deep snow, limited food sources, etc.). Aside from these corridorwide, adverse effects on wildlife and wildlife habitat, the prohibition of nonpark-dependent commercial traffic, as well as site-specific special events, would have small beneficial effects on wildlife habitat by reducing vehicle traffic and concentrated human activity, respectively. In addition, the road-based tours that focus on corridor-specific, resource-based interpretation would inform visitors about the ecological values of wildlife and habitat in the corridor and educate visitors on appropriate human behavior.

Death Canyon. Under alternative D, the proposed management of the Death Canyon area would have both beneficial and adverse effects on wildlife behavior and habitat conditions. The beneficial effects associated with these alternative D management actions would be localized and would involve the merging of Death Canyon and White Grass Ranch traffic onto a shared road and restoring the abandoned section of Death Canyon Road. In this localized area, the amount of habitat fragmentation resulting from road use and maintenance would decrease and effective habitat area would be increased with the restoration effort. Also, the large increase in trailhead parking availability would improve surrounding habitat conditions by reducing the amount of vegetation impacts and weed infestation associated with user-created parking along Death Canyon Road (which is currently pervasive).

The adverse effects of proposed Death Canyon management under alternative D would primarily relate to the continued heavy human activity and vehicle traffic a relatively long distance from the main corridor of human disturbance in the project area (Moose-Wilson corridor). Although traffic and visitor use volumes in the overall corridor would be managed by the access reservation system of alternative D during peak visitation periods, considerable levels of wildlife/habitat disturbance near the trailhead and along the access roads would continue to occur upwards of 1.25 miles from Moose-Wilson Road and in proximity to undeveloped backcountry and wilderness lands to the west. The highest levels of wildlife disturbance and habitat fragmentation in this area would continue from mid-May through October (i.e., when Moose-Wilson Road and trailhead access roads would remain open). In winter, considerably lower levels of wildlife disturbances would occur in the Death Canyon area from backcountry visitor use. In addition, notable localized adverse effects would also result from the new, larger parking area near the existing trailhead that displaces a much larger area of effective habitat in a currently less disturbed area (to accommodate parking for 100 vehicles, an increase from about 20). Construction activities associated with the new parking area construction and the restoration of the abandoned road and parking area would also have short-term, adverse effects on wildlife and habitat. Construction activities and associated noise, human presence, and excavation would have several short-term impacts on wildlife behavior, habitat connectivity, vegetation cover and other ecological attributes that affect wildlife. However, these construction impacts would affect a relatively small area of the corridor.

Winter Access and Use. Under alternative D, the management of winter access and use in the Moose-Wilson corridor would have beneficial and adverse effects on wildlife and wildlife habitat. One change in winter use management under this alternative involves increasing the length of unplowed Moose-Wilson Road. Under alternative D, the road would remain unplowed from Granite Canyon Trailhead to Sawmill Ponds Overlook (compared to Granite Canyon to Death Canyon Road junction, as currently managed under alternative A). This change would reduce impacts on wintering wildlife behavior from vehicle traffic, visitor use, and park operations (e.g., plowing), particularly along and around the segment between the Death Canyon Road junction and Sawmill Ponds Overlook. In addition, since some backcountry areas would be more difficult for visitors to reach due to the notable pulling back of road access (e.g., Death Canyon backcountry area), some reductions in dispersed backcountry winter use could be expected under this alternative. This reduction in human disturbances (e.g., noise, human presence) in the backcountry would have beneficial effects on wildlife and habitat. However, snow plowing operations and vehicle traffic along plowed portions of Moose-Wilson Road (between the corridor's Moose Entrance and Sawmill Ponds Overlook and between the Granite Canyon Entrance and Granite Canyon Trailhead) would continue to disturb wintering wildlife in the vicinity of these accessible areas. Likewise, winter recreational use along unplowed portions of the road and in surrounding backcountry areas would also disturb wintering wildlife behavior under alternative D. Under this alternative, grooming the unplowed segment of Moose-Wilson Road would occur, which could attract increased winter use through the corridor. Grooming would increase adverse effects from the above-mentioned road activity (visitor vehicles, plowing operations) and winter recreational uses in unplowed areas would continue to fragment habitat that connects the montane forests to the west and important Snake River riparian corridor to the east during winter months when active wildlife are already stressed by harsh weather conditions, deep snow, and scarce food sources. However, conversely, relative to the May–October months, the closed, unplowed section of Moose-Wilson Road (Murie

Ranch Road junction to Granite Canyon Trailhead) would continue to contribute to a substantial reduction in vehicle use and human use in the corridor, and thus substantial reductions in wildlife disturbances and habitat fragmentation. Thus, compared to the primary visitor season, this winter management of the corridor would continue to provide seasonal beneficial effects on wildlife behavior and habitat conditions.

Visitor Use and Experience. The management of visitor use and experience under alternative D would continue much of the management strategies of alternative A, but would also include enhancements that provide visitors with a sense of arrival experience that cues visitors that they are entering a unique area, and providing low-impact, self-discovery interpretive media that focuses on the unique natural and cultural resources of the corridor. These proposed management strategies would have long-term, beneficial effects by reducing impacts on wildlife habitat (e.g., reduced plant trampling) and wildlife behavior (e.g., reduced disturbances to wildlife activity) by informing visitors of the importance of ecological protection, sensitive areas, and appropriate visitor behavior. However, continued concentrated and dispersed visitor use in the frontcountry and dispersed visitor use in the backcountry would continue to have adverse effects that result from disturbances to wildlife and degraded habitat conditions in the vicinity of designated trail routes and visitor concentration areas (particularly during times of peak visitor use). Also, under alternative D, wildlife viewing areas and short nature trails would be developed along the new Moose-Wilson Road alignment to the east of the beaver pond wetland area. These visitor amenities would create designated high visitor use areas and attract associated human disturbances and activities in proximity to some of the corridor's most diverse, sensitive, and heavily used wildlife habitat areas. This would result in further habitat quality degradation, loss, and fragmentation in the newly developed road corridor through the sagebrush flats. In addition, wildlife behavior disturbances would result from visitor activity on and off designated trails near the wildlife viewing areas. Introducing high visitor use concentration (viewing areas and trails) in proximity to sensitive and dynamic habitats would likely adversely alter the Ecological Communities and Wildlife fundamental resource and value. Conversely, these viewing area amenities could also have some limited beneficial effect by concentrating human presence/activities, and thus aid in containing wildlife disturbances and impacts on habitat accessibility and connectivity (as compared to dispersed human activity along the length of the realigned road corridor.

Horse Use. Under alternative D, management of equestrian use in the Moose-Wilson corridor would have both adverse and beneficial effects on wildlife and wildlife habitat. Outside the Poker Flats area, unsustainable horse trails would be removed and/or rerouted and a limited number of road crossings would be provided. These actions would minimize impacts on habitat accessibility and connectivity and reduce habitat quality degradation from localized reductions in human activity disturbances to wildlife and vegetation trampling. However, continued equestrian use on the horse trail system throughout other areas of the corridor would continue to have adverse effects on wildlife and wildlife habitat under alternative D. Human activity associated with equestrian use would continue to cause behavioral disturbances to wildlife within proximity to the four existing equestrian parking trailheads in the corridor (Poker Flats, Sawmill Ponds Overlook, Death Canyon Road junction, and Granite Canyon Trailhead). Equestrian use in the Poker Flats area and other heavily used equestrian areas of the corridor would continue to result in habitat quality degradation from off-trail vegetation trampling and social trail development that further fragments previously intact habitat.

Best Management Practices, Monitoring Guidelines, and Mitigation Measures. As part of all action alternatives, the park would implement best management practices, monitoring guidelines, and mitigation measures to protect the area's wildlife habitat and to limit disturbances from proposed actions and visitor use that would occur under each alternative. Among other strategies, these wildlife management practices and measures would include assessing population counts and trends of various mammal and bird species (including the grizzly bear), monitoring "indicator" wildlife species for effects from human use in the corridor, actively educating park visitors on habitat value and ways to reduce undesirable human-wildlife encounters, employing area closures during critical wildlife activity periods, minimizing noise and light disturbances to wildlife from visitor use and/or park operations, coordinating construction projects to minimize effects on wildlife behavior, and working with other resource management agencies on controlling the spread of nonnative species. All of these best management practices, monitoring guidelines, and mitigation measures would result in short- and long-term, beneficial effects on wildlife in the corridor, as they would collectively minimize adverse effects from other proposed actions and ongoing future uses. These efforts would also further foster the holistic approach to ecological management, of which wildlife management plays an integral role.

> Overall, alternative D would have both beneficial and adverse effects on wildlife and wildlife habitat in the corridor. The most substantial beneficial impact from alternative D management actions would relate to the two realignments of Moose-Wilson Road that would substantially reduce habitat fragmentation and substantially improve wetland and shrub habitat quality between Sawmill Ponds Overlook and Death Canyon Road. By removing the main visitor use and travel corridor from these high quality habitat areas, human noise and presence disturbances to wildlife foraging behavior in these areas would be greatly reduced (despite causing adverse effects to sagebrush habitat). The northern realignment would also restore daily and seasonal wildlife movement to, from, and along the Snake River riparian corridor. These realignment actions would greatly benefit the Ecological Communities and Wildlife fundamental resource and value. Other beneficial effects of alternative D would include reductions in disturbances to wildlife behavior and habitat condition from managed traffic/visitor volumes during peak periods (via reservation system), lengthening the unplowed road segment in winter near the wetland complex, and controlling roadside parking. Monitoring guidelines, best management practices, and mitigation measures would also protect habitat conditions and mitigate some adverse effects. However, by far, the most notable adverse effects of alternative D on wildlife habitat and behavior would be the significant net increases in ecological disturbances, habitat loss, and fragmentation in the corridor from introducing a second primary human use corridor through the length of the project area (i.e., multiuse pathway). Relative to existing levels of wildlife habitat disturbance and fragmentation in the corridor, this action would substantially widen the existing disturbance corridor where the pathway parallels Moose-Wilson Road and create a completely new, separate disturbance corridor where the pathway goes around the LSR Preserve. This effect would notably diminish the quality and integrity of the Ecological

Communities and Wildlife fundamental resource and value. Another appreciable adverse effect would be the expansion of the Death Canyon Trailhead/parking area in its existing location, resulting in continuing and likely increased habitat fragmentation a relatively long distance from the primary human use corridor in the project area (Moose-Wilson Road). The traffic management strategy (reservation system) could also increase in vehicle and visitor use disturbances to crepuscular wildlife behavior in the mornings and evenings (i.e., pre/post peak reservation periods). Also, by providing designated turnouts for up to 120 vehicles, visitors driving through may actually be encouraged to stop along the road corridor if they see wildlife (as opposed to driving through slowly), which could increase behavioral disturbances. Other adverse effects would also include short-term construction activity disturbances to wildlife behavior for several large construction projects, and fragmentation of sagebrush habitat from the two road realignments.

Cumulative Effects. A variety of other actions have altered, and would continue to alter wildlife habitat within and outside the project area. Inside the project area, past and ongoing development of park infrastructure, such as roads, parking areas, and visitor activity areas, has displaced wildlife habitat and/or degraded habitat quality in the corridor. The most notable past action in the project area would involve the development and/or upgrade of multiple roads, including Moose-Wilson Road. The use of these roads over past decades has introduced disturbances to wildlife behavior and have fragmented otherwise intact habitat. Also, the Moose and Granite Entrance Station developments, along with the facility reuse development and use at White Grass Ranch and Murie Ranch have introduced areas of increased human activity, which continues to introduce human noise and visual disturbances to wildlife habitat and behavior. The LSR Preserve development introduced similar adverse effects due to the increased levels of human use and disturbances in the area (although the LSR Preserve visitor carrying capacity management helps to mitigate these effects). All of these past and ongoing park facility developments and use in the corridor have collectively caused considerable, long-term adverse impacts on wildlife habitat in the corridor. In general, these adverse effects have mostly been in the form of habitat fragmentation and associated impediments to habitat accessibility, use, and connectivity.

Outside the project area, other NPS and non-NPS actions have and would continue to alter wildlife habitat and disturb wildlife behavior (also see cumulative impacts scenario section). Residential, commercial development, and tourism development on private land throughout the area has had substantial adverse effects on wildlife behavior and habitat. This includes Teton Village to the south of the park, areas around Jackson, and a large number of rural residential properties dispersed throughout the region. This high density and low density land use and development has increased considerably over the past couple of decades and continues to fragment large habitat areas and introduce substantial movement impediments to wildlife attempting to migrate to and from pockets of intact habitat on a daily or seasonal basis. In addition, transportation infrastructure in the area have also contributed notable impediments to wildlife movement, disturbances to wildlife behavior (e.g., lights, noise), and fragmentation of wildlife habitat. Such transportation facilities include local and regional highways, the Jackson Hole Airport, as well as development of park roads to the north of the corridor. Other development plans and projects at other high-use areas within the park (to the north) have also contributed to wildlife disturbance and habitat fragmentation. Collectively, actions such as these contribute substantial adverse effects on wildlife habitat and wildlife behavior in the region. The adverse effects involve the disruption of foraging, roosting, breeding, and migrating wildlife behaviors for many species that also occupy the project area.

When the effects of alternative D on wildlife and habitat are added to these other past, ongoing, and likely future effects, a substantial, long-term, cumulative adverse effect would continue to occur. However, the incremental effect of alternative D added to the adverse effects of these other actions in the area would be relatively small.

Conclusion. Alternative D would have both beneficial and adverse effects on wildlife and wildlife habitat in the corridor. The most substantial beneficial impact from alternative D management actions would relate to the two realignments of Moose-Wilson Road that would substantially reduce habitat fragmentation and substantially improve wetland and shrub habitat quality between Sawmill Ponds Overlook and Death Canyon Road (despite causing adverse effects to sagebrush habitat). By removing the main visitor use and travel corridor from these high-quality habitat areas, human noise and presence disturbances to wildlife foraging behavior in these areas would be greatly reduced. The northern realignment would also restore daily and seasonal wildlife movement to, from, and along the Snake River riparian corridor. These realignment actions would greatly benefit the Ecological Communities and Wildlife fundamental resource and value. Other beneficial effects of alternative D would include reductions in disturbances to wildlife behavior and habitat condition from managed traffic/visitor volumes during peak periods (via a reservation system), lengthening the unplowed road segment in winter near the wetland complex, and controlling roadside parking. Monitoring guidelines, best management practices, and mitigation measures would also protect habitat conditions and mitigate some adverse effects. However, by far, the most notable adverse effects of alternative D on wildlife habitat and behavior would be the significant net increases in ecological disturbances, habitat loss, and fragmentation in the corridor by introducing a second primary human use corridor through the length of the project area—the multiuse pathway. Relative to existing levels of wildlife habitat disturbance and fragmentation in the corridor, this action would substantially widen the existing disturbance corridor where the pathway parallels Moose-Wilson Road and creates a completely new, separate disturbance corridor where the pathway goes around the LSR Preserve. This effect would notably diminish the quality and integrity of the Ecological Communities and Wildlife fundamental resource and value. Another appreciable adverse effect would be the expansion of the Death Canyon Trailhead / parking area in its existing location, resulting in continuing and likely increased habitat fragmentation a relatively long distance from the primary human use corridor in the project area (Moose-Wilson Road). The traffic management strategy (reservation system) could also increase in vehicle and visitor use disturbances to crepuscular wildlife behavior in the mornings and evenings (i.e., pre/post peak reservation periods). Also, by providing designated turnouts for up to 120 vehicles, visitors driving through may actually be encouraged to stop along the road corridor if they see wildlife (as opposed to driving through slowly), which could increase behavioral disturbances. Other adverse effects would also include short-term construction activity disturbances to wildlife for several large construction projects, and fragmentation of sagebrush habitat from the two road realignments. Collectively, although alternative D does offer a substantial benefit to wildlife habitat due to the road realignment, relative to other alternatives, alternative D would likely have the greatest adverse effect on wildlife and habitat, primarily due to the substantial net increase in habitat fragmentation and disturbance caused by the multiuse pathway through the extent of the corridor. These adverse effects on wildlife and wildlife habitat from alternative D would likely be significant.

When the effects of alternative D on wildlife and habitat are added to the effects of other past, ongoing, and likely future actions, a substantial, long-term, cumulative adverse effect would continue to occur. However, the incremental effect of alternative D added to the adverse effects of the other actions in the area would be relatively small.

FEDERALLY LISTED AND CANDIDATE WILDLIFE SPECIES

Methods and Assumptions for Analyzing Impacts

The effects of the alternatives on three federally listed species (grizzly bear, Canada lynx, gray wolf) and one candidate species (greater sage-grouse) in the project area were analyzed based on impacts resulting from visitor use patterns and construction and maintenance of developments associated with each alternative. (Impacts on State of Wyoming species of special concern / greatest conservation need are generally analyzed under the "Wildlife and Wildlife Habitat" impact topic and are not analyzed individually here.) Impacts were identified based on anticipated increases or decreases in populations of these species, behavioral disturbances, and possible habitat loss, alteration, fragmentation, or restoration in the corridor. Information on known populations and habitats in the area was compared with the sites of proposed developments and other actions in the alternatives. The impact analysis was based on the knowledge and best professional judgment of planners, resource specialists, data from park records, and studies of similar actions and impacts when applicable. Much of the grizzly bear impact analysis was based on information in MacHutchon's 2014 human-bear interaction risk assessment that was prepared for this project. Also, general wildlife habitat impact information can be used to supplement the following analyses of individual species (see the "Wildlife and Wildlife Habitat" section).

The following impact analysis questions were considered to identify the potential impacts of each alternative:

1. Would individual animals or the viability of listed species populations and/or habitats be affected by the alternatives?
2. What degree of physical habitat fragmentation would occur under each alternative (e.g., related to habitat connectivity, wildlife movement/migration, etc.)?
3. What degree of sensory-based behavioral disturbances would occur under each alternative (e.g., noise and visual disturbances from human activities/uses)?
4. What degree of physical habitat removal, alteration, or restoration would occur under each alternative?
5. Would there be any incidental take that would occur under the alternatives?

All of the assumptions described for the "Wildlife and Wildlife Habitat" impact topic also apply to the federally listed and candidate species being analyzed. In addition, it is assumed in this analysis that:

- No changes occur to the current federal status of the species being analyzed.
- All of the mitigation measures applicable to federally listed wildlife species described in chapter 2 would be implemented.

The following analysis examines the potential impacts of the alternatives in accordance with the National Environmental Policy Act. A separate biological assessment is being prepared that will analyze the effects of the preferred alternative with greater detail about the grizzly bear, Canada lynx, gray wolf, and greater sage-grouse in accordance with the Endangered Species Act. The biological assessment will be included as an appendix in the final environmental impact statement.

Alternative A (No Action)

Grizzly Bear. No ongoing or new actions would be taken that would affect grizzly bear habitat in the project area under alternative A. However, the continuing use of the roads by the public and NPS personnel, including ongoing routine maintenance work, would continue to affect the behavior of individual bears in the project area, particularly for bears that forage along Moose-Wilson Road between the Sawmill Ponds and Death Canyon Road in the late summer and fall. Several studies indicate that human activity on roads can alter individual grizzly bear foraging and use activity patterns, causing some bears to move to less productive habitats, or permanently displace some bears (Archibald et al. 1987; Mattson et al. 1987; McLellan and Shackleton 1988; Kasworm and Manley 1990; Mace et al. 1996, as cited In MacHutchon 2014). MacHutchon (2014) noted that the high level of traffic and recreational activity in the Moose-Wilson corridor are already probably limiting the availability of seasonally important foods for some bears. This would continue to be the case under alternative A, and with increased traffic likely in the future, the potential and degree of this impact would likely increase. This impact would be mitigated in part by park managers continuing to closely monitor the presence of grizzly bears in the area, using park staff and volunteers to keep visitors from feeding or approaching the bears and temporarily closing Moose-Wilson Road to public use. At times some bears may still avoid using this area and be displaced to other areas with less high-quality forage. Bears may also shift to feeding along the road at night when people are not present, as has been documented in other areas (Northrup et al. 2012; Schwartz et al. 2010, as cited In MacHutchon 2014). If grizzly bears continue to expand their range southward, future bear numbers, and possible impacts on bears, would increase in the project area, although temporary road closures would continue to be effective measures to avoid/minimize impacts when bears are foraging along the road.

With increased numbers of both grizzly bears and visitors using the Moose-Wilson Road area, the potential for more nonfood-conditioned human habituated bears that forage along the road may also increase. This, in turn, could increase the potential for vehicle collisions with bears, resulting in injury and bear mortality. With park managers continuing to closely manage the road, taking steps such as removing road-killed carcasses and enforcing speed limits and closing the road when bears are foraging along the road, the potential for such collisions would be very small. It also should be noted that all of the above conservation measures far exceed what occurs for other roads in and near the park.

Increased numbers of nonfood-conditioned human habituated bears and people on Moose-Wilson Road could also increase the potential for undesirable human-bear encounters. Herrero et al. (2005) reported that habituated bears found near roads are more likely to encounter food associated with people and become human-food conditioned, and despite regulations are more likely to be approached by people for better photographs or viewing. Habituated bears generally tolerate people in proximity without being aggressive, but habituated bears can still injure people (MacHutchon 2014). Although it has not happened at the park to date on Moose-Wilson Road, with increased numbers of human-bear encounters (particularly if visitors behave inappropriately around bears or approach sows with cubs) there would be the potential for bears being shot in defense of life and property by visitors or removed by managers. With continued monitoring for the presence of bears in the area by park staff and volunteers and continued management of people rather than direct management of bears, the chances for such an incident resulting in bear mortalities is considered small. With projected increases in traffic and visitor use in the corridor and the increases in grizzly bears in the area, the potential for grizzly bear mortalities may increase in the future. However, the potential for bears being lethally removed would be true regardless of any action the National Park Service would take under this alternative.

Under alternative A, visitors may continue to park their vehicles along Moose-Wilson Road, largely wherever they want, in spite of directions to the contrary, particularly if there is a chance to see a bear close-up. With more vehicles likely driving on the road in the future, and increased numbers of vehicles turning off all along the road, the potential would likely increase for some bears to be disturbed and their behavior altered by the frequent stopping and starting of vehicles in proximity to them. However, instituting road closures when grizzly bears are foraging would help minimize the potential for these impacts occurring.

Wildlife photography would be another activity that can alter bear behavior, particularly when individuals or groups of photographers are in proximity to bears in the corridor. This persistent human presence may alter the behavior of or displace some wary bears, as well as increase the potential for habituation of bears to people. However, enforcement of park regulations that prohibit approaching bears closer than 100 yards, and the closure of the road if bears are foraging along the road would avoid or minimize this potential impact.

Bicycle use along Moose-Wilson Road may also be affecting grizzly bears. Bicyclists can ride almost as fast as vehicles on Moose-Wilson Road and are quiet. As a result, they can result in a sudden encounter with bears, startling a bear, and changing its behavior (e.g., charging a rider or fleeing). This has not been documented along Moose-Wilson Road, but has been documented with mountain bikes on trails (Schmor 1999 as cited In MacHutchon 2014).

Other Species. Canada lynx, gray wolf, and greater sage-grouse have been documented in the project area. No new or ongoing actions would be taken under alternative A that would affect their habitat. The general effects of the Moose-Wilson corridor developed areas and visitors on these species would be the same as generally described in the "Wildlife and Wildlife Habitat" impact analysis section. No known wolf or lynx dens or sage-grouse leks would be directly or indirectly affected. If a wolf den or rendezvous site were established in the project, area, the implementation of a seasonal 1-mile closure around the site, as stated in the mitigation measures section, would be expected to avoid impacts. Individual animals would likely continue to avoid the roads and developed area and adjacent habitats. Individual animals may occasionally move through the area, during the time of day and season when most visitors are driving along the road. There would always be the potential for a vehicle to collide with and injure or kill an animal crossing the road, but the likelihood would be low due to the low speed limits on this road. The behavior of individual animals, their distribution, and use of habitats in the project area would continue to be altered due to the presence of people, but no substantial changes to lynx, wolf, or sage-grouse numbers, distributions, reproduction, or habitat use would occur in the project area due to this alternative.

Overall, no ongoing or new actions would occur under alternative A that would affect the habitat of the grizzly bear, Canada lynx, gray wolf, or greater sage-grouse. No ongoing or new actions would affect key foraging, breeding, sheltering, or denning areas or migration/movement corridors. However, noise from visitors, traffic, the presence of humans, and other disturbances associated with visitor use in the Moose-Wilson corridor would continue to have the potential to affect the behavior and foraging habits of grizzly bears along Moose-Wilson Road, particularly from Sawmill Ponds Overlook to Death Canyon Road in the late summer and fall. There would be a very small chance for individual animals to be involved in a collision with a vehicle or a bear being removed by managers or killed by visitors in defense of life and property. But with park managers continuing to monitor for the presence of listed species along the road and taking action when grizzly bears are known to be present, these impacts should be avoided and minimized to the maximum extent possible. No significant impacts on the number, reproduction, or distribution would occur to any of these species in the project area under alternative A.

Cumulative Effects.

Nonfederal Actions— Many actions within and outside the project area have substantially altered the habitat and populations of grizzly bear, Canada lynx, wolf, and greater sage-grouse in the area. All of these species are sensitive to the presence of people and generally avoid people and developments. The past development of residences, infrastructure and presence of people in the area likely have substantially altered the habitat use and behavior of all the above-listed and candidate species. Developments have resulted in the permanent loss of habitat and affected the ability of the species to move north-south and east-west along the Snake River corridor to connect to suitable habitats. Continued tourism, commercial activity, and residential development in Teton County have altered and disrupted foraging, migration, and breeding behavior of these species in this area and would likely continue to do so in the future. Other activities occurring in the region that have and are likely to continue to affect the species and their habitats include timber management, wildfire management, grazing, winter recreation, and trapping of furbearers (in the case of lynx). Wintering sage-grouse habitat in the Jackson Hole area has been altered and eliminated and may be limiting sage-grouse population growth (Holloran and Anderson 2004 as cited In NPS 2006). Within the corridor, continuing and increasing numbers of visitors, as well as noise due to such activities as periodic dredging of the irrigation ditches and maintenance along the utility corridor would be expected to continue to limit the presence of all of the species in the area.

Outside the project area, other ongoing and reasonably foreseeable non-NPS actions would continue to alter potential habitat of the species. Construction of planned residential and commercial developments, such as the Teton Village expansion, would result in the permanent loss of potential habitat for grizzly bears, wolves, and the greater sage-grouse. (Canada lynx would generally not be found in these lower elevation areas.) However, most of these developments would occur in areas where human activities and infrastructure already occur, in areas where vegetation already has been disturbed and which these species would tend to avoid.

Although elk hunting does not occur in the Moose-Wilson corridor, elk hunting in the park has resulted in the rare shooting of a grizzly bear in defense of life and property. This potential would continue in the future, with the possible loss of additional bears.

Federal Actions— Within Moose-Wilson corridor, noise from continuing periodic maintenance of park infrastructure and the presence of people would be expected to continue to affect the behavior and presence of grizzly bears, wolves, and the greater sage-grouse in the area. Outside the project area, improvements being made in the Jenny Lake area and development of multiuse pathways in the park (including construction of part of the multiuse pathway system near Jenny Lake) would also result in the permanent loss of potential habitat for grizzly bears, wolves, and the greater sage-grouse.

Overall, when the effects of alternative A are added to these other ongoing and likely future effects of federal and nonfederal actions, there would be the potential for a long-term, cumulative adverse effect on the grizzly bear, Canada lynx, gray wolf, and greater sage-grouse in the area. However, the increment of alternative A added to the adverse effects of the other actions occurring in the area would be small.

Conclusion (Including ESA Determination of Effects).

Grizzly Bear— No new actions would occur in alternative A that would affect the habitat of the grizzly bear. No new actions would measurably affect key foraging, breeding, sheltering, or denning habitats. However, continuing noise from visitors and traffic and the presence of humans in the Moose-Wilson corridor would continue to have the potential to affect the behavior and foraging of grizzly bears along Moose-Wilson Road, particularly from Sawmill Ponds Overlook to Death Canyon Road in late summer and fall. With park managers continuing to monitor for the presence of grizzly bears along the road, and taking action when bears are present (e.g., closing the road), most impacts would be avoided. There would continue to be a chance for individual animals to be involved in a collision with a vehicle, but given the slow speed of vehicles and the likelihood the road would be temporarily closed if a grizzly was foraging along the road, this possibility is considered to be low. Because significant reductions in population numbers, reproduction or distribution would not likely occur in the project area and because grizzly bears have been increasing in numbers in the area in spite of the road, alternative A would not be considered to have a significant impact on the grizzly bear. There would be the potential for a cumulative adverse impact when the effects of alternative A are added to other past, ongoing, and likely future actions in the area, but alternative A would add a very small increment to the overall adverse cumulative impact. Although there is a low probability, there is still a risk that one or more bears may be lost, which would be considered an adverse effect under the Endangered Species Act. Consequently, alternative A may affect, and is likely to adversely affect, grizzly bears in the project area.

Other Species—No new actions would occur under alternative A that would affect the habitat of the Canada lynx, gray wolf, or greater sage-grouse in the project area. No new actions would affect key foraging, breeding, sheltering, or denning areas of lynx and wolves, or sage-grouse leks and key foraging and nesting areas. No significant changes to the number, reproduction, or distribution of lynx, wolves and greater sage-grouse in the project area would occur. Instituting a 1-mile area closure around a wolf den or rendezvous site, if they occur in the project area, would minimize impacts on these sites. However, continuing noise from visitors, traffic, and the presence of humans and other disturbances associated with visitor use in the Moose-Wilson corridor would continue to have the potential to affect the behavior and foraging habits of individual lynx, wolves, and sage-grouse. The behavior of individual wolves and sage-grouse crossing the road corridor could be affected by the presence of people. There also would continue to be a chance for an individual animal to be involved in a collision with a vehicle, but the limited number of these rare animals in the area and the slow speed of vehicles make this possibility unlikely. Thus, alternative A would not have a significant effect on the Canada lynx, gray wolf, and greater sage-grouse in the project area. There would be the potential for a cumulative adverse impact on the lynx, wolf, and greater sage-grouse when the effects of alternative A are added to other past, ongoing, and likely future actions in the area, but alternative A would add a very small increment to the overall adverse cumulative impact. Although there is a low probability, there is still a risk that one or more lynx, wolves, or sage-grouse may be lost, which would be considered an adverse effect under the Endangered Species Act. Consequently, alternative A may affect, and is likely to adversely affect, the lynx, gray wolf, and greater sage-grouse in the project area.

Alternative B

Grizzly Bear. Alternative B would both beneficially and adversely affect grizzly bears in several ways due to construction activities, new management actions being proposed, and changes in visitor use of the corridor. All of the proposed construction would occur in areas where grizzly bears may be present at times, particularly in the area from the LSR Preserve north to the Moose Entrance Station—areas with good forage value for grizzly bears in the late summer and fall. Construction noise and activity could temporarily alter bear activity in these areas, especially during late summer and fall, over multiple construction seasons, with some bears being displaced during the construction periods. However, some of the potential human-bear issues that could occur with construction personnel (e.g., leaving garbage and other attractants) would be avoided with the application of the mitigation measures described in the alternatives. In addition, the timing restrictions on construction activities at twilight and nights would enable grizzly bears to continue using the area during higher use periods.

The development and use of some infrastructure under alternative B would not be expected to affect grizzly habitat and populations, including changes being proposed in the Poker Flats area and Death Canyon Road, and paving the southern part of Moose-Wilson Road. These areas have little forage value for grizzly bears and they are infrequently seen in these areas (MacHutchon 2014).

Other facility development components of alternative B would result in the loss of some foraging habitat for grizzly bears such as the new parking areas and road access in the LSR Preserve.

Of all the actions proposed in alternative B, one of the most notable impacts on grizzly bears would be the two proposed realignments of Moose-Wilson Road. Realigning the northernmost segment of Moose-Wilson Road would have a, long-term, beneficial effect on bears in the project area, removing a development that has created a barrier of human activity for grizzly bears and other wildlife moving east to west and along the Snake River floodplain (MacHutchon 2014). This action would decrease habitat fragmentation and increase the ability of bears to more effectively use the riparian corridor for movement and foraging.

Likewise, the southern realignment of the road between Sawmill Ponds Overlook and the Death Canyon Road junction would enable bears to forage in an area with many productive fruit-bearing shrubs and productive patches of grasses and other forbs that are used by bears without human disturbance. Both the wetland complex on the southeast side of the road and the mixed tall deciduous shrubland and open aspen forest vegetation communities on the northwest side of the road are well used by bears, particularly in late summer and fall. This is the area where the majority of grizzly bears have been observed in the Moose-Wilson corridor. The area where the road would be relocated is sagebrush shrubland, which is considered to have very low forage value and is infrequently used by bears (MacHutchon 2014).

Several other management actions in alternative B would beneficially affect grizzly bears. Vehicle speed is an important factor contributing to vehicle-wildlife collisions (Gunther et al. 1998 as cited In MacHutchon 2014). Lowering the speed limit would reduce the potential for bears being startled by vehicles and may also give drivers more reaction time, possibly leading to a reduction in the potential for collisions. Establishing designated turnout areas and limiting the areas where people can stop along the road would reduce the potential for bears being disturbed by constant starting and stopping of traffic all along the road. However, it is also possible that the new designated turnouts along Moose-Wilson Road would encourage people to stop when they see bears and leave their vehicles to observe the animals as opposed to continue slowly driving through the area (which would have an adverse effect due to potential increases in disturbances and avoidance responses in bears). Providing visitors with more information prior to their visits, including information on the presence of grizzly bears and appropriate behavior, would help reduce human-bear interactions and disturbance of bear activity. Periodically thinning and clearing roadside vegetation would also reduce the likelihood of bears feeding in areas where people are driving vehicles and parking, as well as increase visibility and reduce blind spots, which would reduce the potential for bear-vehicle collisions and disturbance of bear activity. The removal or rerouting of some unsustainable horse trails could eventually result in restoration of some small amount of habitat bears may use, depending on the location of the trails, reduce one source of habitat fragmentation and reduce potential disturbance of bear activity.

The traffic management action in alternative B could have some positive and adverse effects on grizzly bears. As discussed in the wildlife impact section, the gate closure traffic management strategy over time would limit the potential increase in through-traffic levels during periods of peak use, primarily during the summer. With a limit on vehicular traffic during peak use periods, the potential for increased human-bear interactions and resulting disturbance and possible displacement of bears would be likely avoided—a long-term, beneficial effect. The beneficial effect would be stronger if high traffic conditions were limited by the gate during the spring and fall, when bears are more likely to be present along the road.

However, the gate closure may also have the effect of increasing traffic levels during morning and early evening periods as the public and visitors learn to adapt to the gate closures. Early mornings and evenings are also the time when crepuscular wildlife (i.e., grizzly bears) are typically more active and would be foraging along the road. Although increased traffic levels at these times may not affect some nonfood-conditioned human habituated bears, the change in traffic use would increase the potential for disturbance of some bears in the area, possibly resulting in the displacement of some bears as well as increase the small potential for bear-vehicle collisions. On the other hand, if the road were closed to public use when grizzly bears are known to be in the area, this impact can be avoided.

Although visitor use levels under alternative B would be more managed and not rise as high at peak times as they would under alternative A, the presence of vehicles and visitors in the Moose-Wilson corridor would continue to affect grizzly bears in the area. As in alternative A, continuing use of the roads, including ongoing regular maintenance work, would continue to affect the behavior of individual bears in the project area, particularly the bears that forage along Moose-Wilson Road between Sawmill Ponds Overlook and Death Canyon Road in late summer and fall. As in alternative A, there would be the potential for some bears to be temporarily or permanently displaced to other areas with less high-quality forage or shifting their activity along the road to nighttime. In addition, there would still be the slight chance for vehicle collisions with bears, resulting in injury and death. But with park managers closely monitoring use of the road, using park staff and volunteers to keep visitors from feeding or approaching bears, and closing the road when bears are foraging along the road, and with slow vehicle speeds, the likelihood of collisions occurring would be very small. There also would be the potential for bear encounters with visitors, which could result in bears being removed by managers or shot by visitors in defense of life and property. However, this possibility would be true regardless of any of the actions park managers take under alternative B. Continuing management of people rather than direct management of bears under alternative B likely would continue to reduce the potential for management mortalities of bears.

As in all of the alternatives, under alternative B wildlife photographers could affect the behavior of grizzly bears in the corridor. Individuals or groups of photographers may be in proximity to bears. This persistent human presence may alter the behavior of or displace some wary bears, as well as increase the potential for habituation of bears to people. However, enforcement of park regulations that prohibit approaching bears closer than 100 yards and the closure of the road if bears are foraging along the road would avoid or minimize this potential impact.

Under alternative B it is likely that bicycle use along the road would increase. A bicyclist can ride almost as fast as vehicles on Moose-Wilson Road and are quiet. As a result, they can have a sudden encounter with bears, startling a bear, and changing its behavior (e.g., charging a rider or fleeing). This has not been documented along Moose-Wilson Road, but has been documented with mountain bikes on trails (Schmor 1999 as cited In MacHutchon 2014).

Overall, alternative B would result in a number of potential changes in grizzly bear behavior along Moose-Wilson Road, particularly along the stretch between the LSR Preserve and the Moose Entrance Station. The most notable effect of alternative B would be a substantial beneficial effect due to the two realignments of sections of Moose-Wilson Road. Other beneficial effects would result due to limiting the increase in numbers of vehicles driving the road during peak use periods, reducing vehicle speeds, increasing information to visitors about bears using the road, periodic thinning of roadside vegetation, and the removal of some horse trails. These actions would provide more space where bears can forage without people being present and reduce potential disturbance of bears when they are present.

Alternative B would also have several adverse effects on grizzly bears. The construction of new infrastructure would result in the loss of some foraging habitat. Increased levels of bicyclists, and possibly the gate closure traffic management strategy, if it were to cause higher traffic pulses in the mornings and evenings in the fall, could result in changes in bear behavior due to increased noise and presence of people, possibly resulting in temporary or permanent displacement of some bears from high-value foraging areas. The new designated turnouts along Moose-Wilson Road could encourage people to stop when they see wildlife (as opposed to continue driving through slowly) altering the behavior of bears. With continued use of the road by vehicles, there would also continue to be a chance for bear-vehicle collisions. But with park managers closely monitoring use of the road, closing the road when bears are foraging, and with slower vehicle speeds, the likelihood of collisions occurring would be unlikely.

Other Species. Canada lynx, wolf, and greater sage-grouse have been documented in the project area. The general effects of the developments and actions proposed in alternative B would be the same as generally described in the "Wildlife and Wildlife Habitat" impact analysis section. No known lynx or wolf dens or sage-grouse leks would be directly or indirectly affected by the actions proposed under the alternative. If a wolf den were established in the project area, the implementation of a seasonal 1-mile closure around the site, as stated in the mitigation measures section, would be expected to avoid impacts. There would be some loss of potential forested lynx and wolf habitat, including habitat possibly used occasionally as travel corridors. Considering suitable lynx habitat that would be lost due to new Moose-Wilson Road segments, turnouts, and changes to the Death Canyon parking area (~2.7 acres), and areas of habitat that would be restored within suitable lynx habitat due to rehabilitation of Moose-Wilson Road segments and the existing Death Canyon parking area (~3.9 acres), alternative B would result in a net total of about 1.2 acres of suitable lynx foraging habitat being restored. Although some suitable habitat would be lost, with the low densities of snowshoe hares in the project area, the loss of about 4 acres of forage habitat would not have a significant effect on lynx in the area. Likewise, the actions in alternative B would not prevent wolves from using other nearby suitable habitat.

Depending on the location, construction of a new parking area for Death Canyon Trailhead could adversely affect wolf use of a traditional homesite in the project area. This site currently receives little human use. If the new parking area were to increase visitor use activity in the vicinity of the rendezvous site, it would result in the wolves being displaced from this area. Although the wolves may be able to establish another rendezvous site elsewhere potentially, if the wolves abandon this area it would be an adverse behavioral impact. However, with the establishment of a seasonal closure around a potentially occupied wolf den or known rendezvous site, the risk of site abandonment would be minimized substantially.

The proposed reroute of the road south of the Sawmill Ponds would result in the loss of occupied greater sage-grouse habitat, although sage-grouse use is unknown in this area. The relocation of the northernmost segment of Moose-Wilson Road would result in the loss of approximately 3.95 acres in the core sage-grouse area, which is used by sage-grouse in the spring, summer, and fall for nesting and brood-rearing, and has been documented to be used in the winter as well. About 2.1 acres of sagebrush in the core habitat would be restored with the removal of the existing road segment, which could eventually be used by the sage-grouse. (It is also important to note that other disturbed core sage-grouse habitat in the park [i.e., Kelly Hayfields] is currently being restored.) Construction activities would be several miles away from the occupied lek sites and would not occur during the time when the sage-grouse would be present on the leks.

The behavior of individual lynx, wolves, and sage-grouse could be altered due to the presence of people and the construction and use of new developments. Lynx and wolves that may occasionally use or move through the area could be affected and change their behavior due to the new developments (parking areas, turnouts, road realignments). However, lynx and wolves may already avoid this area due to the presence of existing infrastructure and people. There also would be the potential for a vehicle to collide with and injure or kill an individual lynx, wolf, or sage-grouse crossing the road, but the likelihood of this occurrence would be small given the slow speed of the vehicles.

Cumulative Effects.

Non-Federal Actions— Past development of residences, infrastructure, and increasing numbers of people in Teton County have substantially altered the habitat, use, and behavior of the grizzly bear, Canada lynx, gray wolf, and greater sage-grouse in the area. Developments have resulted in the permanent loss of habitat and affected the ability of the species to move north-south and east-west along the Snake River corridor to connect to suitable habitats. Continued tourism, commercial activity, and residential development in the area have altered foraging, migration, and breeding behavior of the species in this area and would likely continue to do so in the future. Other activities occurring in the region that have and are likely to continue to affect the species and their habitats include timber management, fire management, grazing, winter recreation, and trapping of furbearers (in the case of Canada lynx). Wintering sage-grouse habitat in the Jackson Hole area has also been altered and eliminated and may be limiting sage-grouse population growth (Holloran and Anderson 2004 as cited In NPS 2006). Within the corridor, continuing and increasing numbers of visitors, as well as noise due to such activities as periodic dredging of the irrigation ditches and maintenance of the utility corridor, would be expected to continue to limit the presence of all of the species in the area.

Outside the project area, other ongoing and reasonably foreseeable non-NPS actions would continue to alter potential habitat of the species. Construction of planned residential and commercial developments, such as the Teton Village expansion, would result in the permanent loss of potential habitat for grizzly bears, gray wolves, and greater sage-grouse. (Canada lynx would generally not be found in these lower elevation areas.) However, most of these new developments would occur in areas where vegetation and prey populations have already been altered, which these listed species would tend to avoid.

Although elk hunting does not occur in the corridor, elk hunting in the park has resulted in the rare shooting of a grizzly in defense of life and property. This potential would continue in the future, with the possible loss of additional bears.

Federal Actions— Within the Moose-Wilson corridor noise from continuing periodic maintenance of park infrastructure and the presence of people would be expected to continue to affect the behavior and presence of grizzly bears, wolves, and the greater sage-grouse in the area. Outside the project area improvements being made in the Jenny Lake area, and development of multiuse pathways in the park (including construction of part of the multiuse pathway system near Jenny Lake) also would result in the permanent loss of potential habitat for grizzly bears, wolves, and the greater sage-grouse.

Overall, when the beneficial and adverse effects of alternative B are added to these other past, ongoing, and likely future effects, there would be the potential for a long-term, cumulative adverse effect on the grizzly bear, Canada lynx, gray wolf, and greater sage-grouse in the area. However, alternative B would add a beneficial increment (primarily due to the effects of the road realignments, slower speed limits, and the limits placed on increases in visitors driving Moose-Wilson Road) to the adverse effects of the other actions occurring in the area.

Conclusion (Including ESA Determination of Effects).

Grizzly Bear— Alternative B would have both beneficial and adverse effects on grizzly bears in the project area. Alternative B would have a beneficial impact on grizzly bears due to the two proposed realignments of Moose-Wilson Road, which would increase the ability of bears to use the riparian corridor for movement and foraging. Instituting the road gate closure strategy, which would limit the increase in the number of vehicles driving along the road during peak use periods, also would be a beneficial effect on the grizzly. Other beneficial effects would result from reducing vehicle speeds, providing more information about the species to visitors, periodic thinning of roadside vegetation, and removal of some horse trails. These actions would provide more space for bears to forage without people being present and reduce potential disturbance of bears when people are present.

Alternative B would result in the loss of some grizzly bear habitat. Increased numbers of bicyclists and the gate closure management strategy would result in some changes to grizzly bear behavior and use patterns, including possible temporary or permanent displacement of bears from high-value foraging areas to lower quality habitats. Also, the new designated turnouts along Moose-Wilson Road could encourage people to stop when they see bears (as opposed to continue driving through slowly), altering the behavior of bears. And there would continue to be a chance for grizzly bears to be involved in a collision with a vehicle but with park managers closely monitoring use of the road, closing the road when bears are foraging, and with slow vehicle speeds, the likelihood of collisions occurring would be unlikely.

Overall, because alternative B would not be expected to substantially change use of the corridor by grizzly bears and not substantially alter bear numbers, distribution, and reproduction, the alternative would not significantly affect grizzly bears. There would be the potential for a cumulative adverse impact when the effects of alternative B are added to other past, ongoing, and likely future actions in the area, but alternative B would add a small beneficial increment to the overall adverse cumulative impact. Although it is a low probability, there is still a risk that one or more bears may be lost under alternative B, which would be considered an adverse effect under the Endangered Species Act. Consequently, alternative B may affect, and is likely to adversely affect, grizzly bears in the project area.

Other Species— Most of the actions in alternative B would not affect suitable habitat of the Canada lynx, gray wolf, and greater sage-grouse in the project area. The alternative would result in a net increase of about 1.2 acres of suitable lynx foraging habitat. Under alternative B, some greater sage-grouse habitat in the core habitat area would be lost due to realignment of the northernmost part of the road and some additional occupied sage-grouse habitat would be lost with the other realignment south of Sawmill Ponds Overlook (although use by sage-grouse is unknown there). Although there would be a net loss of approximately 1.85 acres of core sage-grouse habitat due to alternative B, when the ongoing Kelly Hayfields habitat restoration effort occurring in the park is factored in, there would be no net loss of core sage-grouse habitat in Grand Teton National Park. None of the actions in alternative B would affect known occupied leks or affect known key foraging, breeding, or denning areas for lynx and wolves. The location of the new Death Canyon parking area would increase human use in an area used by wolves as a rendezvous site, which would result in wolves abandoning this site. But the implementation of a seasonal closure around this site would substantially reduce the likelihood of this potential impact.

As in all of the alternatives, the behavior of individual wolves and sage-grouse crossing the road corridor could be affected by noise from vehicles and the presence of people under alternative B. There also would continue to be a chance for a lynx, wolf, or sage-grouse to be involved in a collision with a vehicle, but the slow speed of vehicles makes this possibility unlikely.

Overall, no significant changes in the number, distribution or reproduction of Canada lynx, gray wolf, or greater sage-grouse would be expected in the project area as a result of alternative B. Likewise, alternative B would not likely reduce use of the project area by these species. Thus, alternative B would not have a significant effect on the Canada lynx, gray wolf, or greater sage-grouse. There would be the potential for a cumulative adverse impact on the three species when the effects of alternative B are added to other past, ongoing, and likely future actions in the area, but alternative B would add a small beneficial increment to the overall adverse cumulative impact. Although it is a low probability, there is still a risk that one or more lynx, wolves, or sage-grouse may be lost under alternative B, which would be considered an adverse effect under the Endangered Species Act. Consequently, alternative B may affect, and is likely to adversely affect, the lynx, gray wolf, and greater sage-grouse in the project area.

Alternative C (NPS Preferred)

Grizzly Bear. Alternative C would both beneficially and adversely affect grizzly bears in several ways due to construction activities, new management actions being proposed, and changes in visitor use of the corridor. All of the proposed construction would occur in areas where grizzly bears may be present at times, particularly in the area from the LSR Preserve north to the Moose Entrance Station—areas with good forage value for grizzly bears in late summer and fall. Construction noise and activity could temporarily alter bear activity in these areas, especially in the late summer and fall, over multiple construction periods, with some bears being displaced during the construction periods. However, some of the potential human-bear issues that could occur with construction personnel (e.g., leaving garbage and other attractants) would be avoided with the application of the mitigation measures described in the alternatives. In addition, the timing restrictions on construction activities at twilight and nights, would enable bears to still use the area during higher use periods.

Construction of several of the developments would not be expected to affect grizzly habitat and populations, including changes being proposed in the Poker Flats area, Granite Canyon Entrance, and Death Canyon Road, and the paving of the southern part of Moose-Wilson Road. These areas have little forage value for grizzly bears, which are rarely seen in these areas (MacHutchon 2014).

Realigning the northernmost segment of Moose-Wilson Road would remove a development that has created a barrier of human activity for grizzly bears and other wildlife moving east to west and along the Snake River floodplain (MacHutchon 2014). This action would decrease habitat fragmentation and increase the ability of bears to more effectively use the riparian corridor for movement and foraging, which would be a beneficial effect on bears in the project area.

Several other management actions in alternative C would also beneficially affect grizzly bears. Vehicle speed is an important factor contributing to vehicle-wildlife collisions (Gunther et al. 1998 as cited in MacHutchon 2014). Lowering the speed limit would reduce the potential for bears being startled by vehicles and may also give drivers more reaction time, possibly leading to a reduction in the potential for collisions. Establishing designated turnout areas and limiting the areas where people can stop along the road would reduce the potential for bears being disturbed by constant starting and stopping of traffic all along the road. However, it is possible that the new designated turnouts along Moose-Wilson Road could encourage people to stop when they see bears, and get out of their vehicles to observe the animals, as opposed to continue driving through slowly (which would have an adverse effect due to potential increased disturbance and avoidance responses in bears). Providing visitors with more information prior to their visits, including information on the presence of grizzly bears and appropriate behavior, would reduce human-bear interactions and disturbance of bear activity. Periodic thinning and clearing of roadside vegetation would also reduce the likelihood of bears feeding in areas where people are driving vehicles and parking, as well as increase visibility and reduce blind spots, which would reduce the potential for bear-vehicle collisions and disturbance of bear activity. The removal or rerouting of some unsustainable horse trails could eventually result in the restoration of some small amount of habitat bears may use, depending on the location of the trails, reduce one source of habitat fragmentation, and reduce potential disturbance of bear activity.

The traffic management action in alternative C could have some positive and adverse effects on grizzly bears. As discussed in the "Wildlife and Wildlife Habitat" impact section, the traffic sequencing management strategy, limiting the number of vehicles entering the corridor at any one time during peak use periods, would limit the potential increase in through-traffic levels during periods of peak use, primarily during the summer. With a limit on the potential increase in vehicular traffic during peak use periods, the potential for increased human-bear interactions and resulting disturbance and possible displacement of bears would likely be reduced—a long-term, beneficial effect. The beneficial effect would be greater if high traffic conditions were limited during the spring, late summer, and fall when bears are more likely to be present along the road. There is also the potential that some drivers may switch the times they drive the road to mornings and early evenings to avoid the queues, albeit fewer numbers than would be expected in alternative B. Early mornings and evenings are also the time when crepuscular wildlife like grizzly bears are typically more active and would be foraging along the road. Although increased traffic levels at these times may not affect some nonfood-conditioned human habituated bears, more vehicles driving the road at these times would increase the potential for disturbance of some grizzly bears in the area, possibly resulting in the displacement of some bears as well as increase the small potential for bear-vehicle collisions. However, instituting a closure of the road when bears are foraging along the road would avoid this potential impact.

Although visitor use levels under alternative C would be more managed and not rise as high at peak times as they would under alternative A, the presence of vehicles and visitors in the Moose-Wilson corridor would continue to affect grizzly bears in the area. As in alternative A, continuing use of the roads, including ongoing routine maintenance work, would continue to affect the behavior of individual bears in the project area, particularly the bears that forage along Moose-Wilson Road between Sawmill Ponds Overlook and Death Canyon Road in the late summer and fall. The existing alignment of Moose-Wilson Road would be maintained through the bear high-use area under this alternative. Continued monitoring for grizzly bears foraging in the area, using park staff and volunteers to keep visitors from feeding or approaching the bears, and temporarily closing the road when grizzly bears are foraging in the area would mitigate disturbance of bear activity by people. But there still would be the potential for some bears to be temporarily or permanently displaced to other areas with less high-quality forage, or shifting their activity along the road to nighttime. In addition, there would be the chance for vehicle collisions with bears, resulting in injury and death. But with park managers closely monitoring use of the road, closing the road when bears are foraging, and with slow vehicle speeds, the likelihood of collisions occurring would be small. There also would be the potential for encounters with visitors who get out of their vehicles, which could result in bears being removed by managers or shot by visitors in defense of life and property. However, this possibility would be true regardless of any of the actions park managers take under alternative C. Continuing management of people rather than direct management of bears under alternative C would likely continue to reduce the potential for management mortalities of bears.

As in all of the alternatives, under alternative C, wildlife photographers could affect the behavior of grizzly bears in the corridor. Individuals or groups of photographers may be in proximity to bears. This persistent human presence may alter the behavior of or displace some wary bears, as well as increase the potential for habituation of bears to people. However, enforcement of park regulations that prohibit approaching bears closer than 100 yards and the closure of the road if bears are foraging along the road would avoid or minimize this potential impact.

Under alternative C, it is likely that bicycle use along the road would increase (see the wildlife impacts discussion). Bicyclists are almost as fast as vehicles on Moose-Wilson Road and are quiet. As a result, they can have a sudden encounter with bears, startling a bear and changing its behavior (e.g., charging a rider or fleeing). This has not been documented along Moose-Wilson Road, but has been documented with mountain bikes on trails (Schmor 1999 as cited In MacHutchon 2014).

Overall, alternative C would result in a number of potential changes in grizzly bear behavior along Moose-Wilson Road, particularly along the stretch between the LSR Preserve and the Moose Entrance Station. The realignment of the north section of Moose-Wilson Road would decrease habitat fragmentation in this area and be a beneficial effect on the bears. Other beneficial effects would result due to limiting the increase in numbers of vehicles driving the road during peak use periods through traffic sequencing, reducing vehicle speeds, , increasing information to visitors about bears using the road, periodic thinning of roadside vegetation, and the removal of some horse trails. These actions would provide more space where bears can forage without people being present, and reduce potential disturbance of bears when they are present. On the other hand, increased noise from increased numbers of bicyclists, and possibly the traffic sequencing management strategy (if it were to cause increased pulses of traffic in mornings and evenings in the fall) could result in changes in bear behavior and possible temporary or permanent displacement of some bears from high value foraging areas. Also, the new designated turnouts along Moose-Wilson Road could encourage people to stop when they see bears (as opposed to continue driving through slowly) altering the behavior of bears. With continued use of the road by vehicles, albeit in smaller numbers during peak periods, there would also continue to be a small potential for bear-vehicle collisions. But with park managers closely monitoring use of the road, closing the road when bears are foraging, and with slow vehicle speeds, the likelihood of collisions occurring would be unlikely.

Other Species. Canada lynx, gray wolf, and greater sage-grouse have been documented in the project area. The general effects of the developments and actions proposed in alternative C would be the same as generally described in the wildlife and wildlife habitat impact analysis section. No known lynx or wolf dens or sage-grouse leks would be directly or indirectly affected by the actions proposed under the alternative. There would be some loss of potential forested lynx and wolf habitat, including habitat possibly used occasionally as travel corridors. A total of about 1.7 acres of suitable lynx habitat would be lost due to the construction of the new Death Canyon parking area and turnouts along Moose-Wilson Road, while about 2.8 acres would be restored due to replanting the existing Death Canyon parking area and conversion of the existing road to a trail. Overall, alternative C would result in a net increase of about 1.1 acres of suitable lynx habitat. Although some suitable lynx habitat would be lost, with the low densities of snowshoe hares in the project area, the loss of habitat would have little effect on lynx in the area. Likewise, the actions in alternative C would not prevent wolves from using other nearby suitable habitat.

Alternative C would result in the loss of some sage-grouse habitat. The relocation of the northernmost segment of Moose-Wilson Road would result in the loss of approximately 3.95 acres in the core sage-grouse area, which is used by sage-grouse in the spring, summer, and fall for nesting and brood-rearing, and has been documented to be used in the winter as well. Some sage-grouse may be displaced by this new segment. Approximately 2.1 acres of sagebrush in the core habitat would be restored with the removal of the existing northern road segment, which could eventually be used by the sage-grouse. (It is also important to note that other disturbed core sage-grouse habitat in the park [i.e., Kelly Hayfields] is currently being restored.) None of the areas that would be affected by construction are known to be major winter concentration areas. Construction activities would be several miles away from the occupied lek sites and would not occur during the time when the sage-grouse would be present.

The behavior of individual Canada lynx, gray wolves, and sage-grouse could be altered due to the presence of people and the construction and use of the new developments. Lynx and wolves that may occasionally move through the area could be affected and change their behavior due to the construction and use of new developments (parking areas, turnouts, realignment of roads). But lynx and wolves may already avoid this area due to the presence of existing infrastructure and people. There also would be the potential for a vehicle to collide with and injure or kill a lynx, wolf, or sage-grouse crossing the road, but the likelihood would be very small that this would occur given the slow speed of the vehicles.

Cumulative Effects.

Non-Federal Actions— Past development of residences, infrastructure, and increasing numbers of people in Teton County have substantially altered the habitat, use, and behavior of the grizzly bear, Canada lynx, gray wolf, and greater sage-grouse in the area. Developments have resulted in the permanent loss of habitat and affected the ability of the species to move north-south and east-west along the Snake River corridor to connect to suitable habitats. Continued tourism, commercial activity, and residential development in the area have altered foraging, migration, and breeding behavior of the species in this area and would likely continue to do so in the future. Other activities occurring in the region that have and are likely to continue to affect the species and their habitats include timber management, fire management, grazing, winter recreation, and trapping of furbearers (in the case of lynx). Wintering sage-grouse habitat in the Jackson Hole area has also been altered and eliminated and may be limiting sage-grouse population growth (Holloran and Anderson 2004 as cited In NPS 2006). Within the corridor, continuing and increasing numbers of visitors, as well as noise due to such activities as periodic dredging of the irrigation ditches and maintenance of the utility corridor, would be expected to continue to limit the presence of all of the species in the area.

Outside the project area, other ongoing and reasonably foreseeable non-NPS actions would continue to alter potential habitat of the species. Construction of planned residential and commercial developments, such as the Teton Village expansion, would result in the permanent loss of potential habitat for grizzly bears, gray wolves, and greater sage-grouse. (Canada lynx would generally not be found in these lower elevation areas.) However, most of these new developments would occur in areas where vegetation and prey populations have already been altered, which these listed species would tend to avoid.

Although elk hunting does not occur in the corridor, elk hunting in the park has resulted in the rare shooting of a grizzly in defense of life and property. This potential would continue in the future, with the possible loss of additional bears.

Federal Actions— Within the Moose-Wilson corridor noise from continuing periodic maintenance of park infrastructure and the presence of people would be expected to continue to affect the behavior and presence of grizzly bears, gray wolves, and the greater sage-grouse in the area. Outside the project area improvements being made in the Jenny Lake area, and development of multiuse pathways in the park (including construction of part of the multiuse pathway system near Jenny Lake) also would result in the permanent loss of potential habitat for grizzly bears, gray wolves, and the greater sage-grouse.

Overall, when the beneficial and adverse effects of alternative C are added to these other past, ongoing, and likely future effects, there would be the potential for a long-term, cumulative adverse effect on the grizzly bear, Canada lynx, gray wolf, and greater sage-grouse in the area. However, alternative C would add a beneficial increment (primarily due to the road segment realignment, limits placed on visitors driving Moose-Wilson Road and slower speed limits) to the adverse effects of the other actions occurring in the area.

Conclusion (Including ESA Determination of Effects).

Grizzly Bear— Alternative C would have both beneficial and adverse effects on grizzly bears in the project area. The proposed realignment of the northern segment of Moose-Wilson Road and limiting the increase in numbers of vehicles driving the road during peak use periods via a traffic management sequencing strategy would reduce the potential for human-bear interactions and thus would have beneficial effects on grizzly bears. Other beneficial effects would result from reducing vehicle speeds, providing more information to visitors about the bears, periodic thinning of roadside vegetation, and closure of some horse trails. These actions would provide more space where bears can forage without people being present, and reduce potential disturbance of bears when people are present.

Conversely, as in alternative A, the continued use of the existing Moose-Wilson Road alignment between Sawmill Ponds Overlook and Death Canyon Road would continue to cause behavioral disturbances to grizzly bears, particularly late summer and fall foraging. Also, the new designated turnouts along Moose-Wilson Road could encourage people to stop when they see bears (as opposed to continue driving through slowly) altering the behavior of bears. Actions under alternative C would also result in the loss of some grizzly bear habitat, and there would continue to be a chance for grizzly bears to be involved in a collision with a vehicle, although with park managers closely monitoring use of the road, closing the road when bears are foraging along the road, and with slow vehicle speeds, the likelihood of collisions occurring would be unlikely. None of the actions being proposed would affect known key grizzly bear breeding or denning areas.

Overall, because alternative C would not be expected to substantially change grizzly bear use of the corridor and not substantially change bear numbers, distribution, or reproduction, the alternative would not result in significant impacts on the grizzly bears in the project area. There would be the potential for a cumulative adverse impact when the effects of alternative C are added to other past, ongoing, and likely future actions in the area, but alternative C would add a small beneficial increment to the overall adverse cumulative impact. Although it is a low probability, there is still a risk that one or more bears may be lost, which would be considered an adverse effect under the Endangered Species Act. Consequently, alternative C may affect, and is likely to adversely affect, grizzly bears in the project area.

Other Species— Most of the actions in alternative C would not affect suitable habitat of the Canada lynx, gray wolf, and greater sage-grouse in the project area. The alternative would result in a net increase of about 1.1 acres of suitable lynx forage habitat. There would be a net loss of approximately 1.85 acres of greater sage-grouse core habitat due to realignment of the northernmost part of the road. None of the actions in alternative C would affect known sage-grouse leks or affect known key foraging, breeding, or denning areas for lynx and wolves.

As in all of the alternatives, the behavior of wolves and sage-grouse crossing the road corridor could be affected by the presence of people under alternative C. There also would continue to be a chance for a lynx, wolf, or sage-grouse to be involved in a collision with a vehicle, but the slow speed of vehicles makes this possibility unlikely.

Overall, no significant changes in the number, distribution, or reproduction of Canada lynx, gray wolves, or greater sage-grouse would be expected in the project area as a result of alternative C. Likewise, alternative C would not likely reduce use of the project area by these species. Thus, alternative C would not have a significant effect on Canada lynx, gray wolves, or greater sage-grouse. There would be the potential for a cumulative adverse impact on the three species when the effects of alternative C are added to other past, ongoing, and likely future actions in the area, but alternative C would add a small beneficial increment to the overall adverse cumulative impact. Although it is a low probability, there is still a risk that one or more lynx, wolves, or sage-grouse may be lost, which would be considered an adverse effect under the Endangered Species Act. Consequently, alternative C may affect, and is likely to adversely affect, the lynx, gray wolf, and greater sage-grouse in the project area.

Alternative D

Grizzly Bear. Alternative D would affect grizzly bears in several ways due to construction activities, new management actions being proposed, and changes in visitor use of the corridor. There likely would be both beneficial and adverse impacts on the bears. All of the proposed construction would occur in areas where grizzly bears may be present at times, particularly in the area from the LSR Preserve north to the Moose Entrance Station—areas with good forage value for grizzly bears in late summer and fall. Construction noise and activity could temporarily alter bear activity in these areas, especially in the late summer and fall, over multiple construction seasons, with some bears being displaced during the construction periods. However, some of the potential human-bear issues that could occur with construction personnel (e.g., leaving garbage and other attractants) would be avoided or minimized with the application of the mitigation measures described in the alternatives. In addition, the timing restrictions on construction activities at twilight and nighttime would enable bears to still use the area during higher use periods.

Construction and use of some of the infrastructure would not be expected to affect grizzly habitat and populations, including changes being proposed in the Poker Flats area, and White Grass / Death Canyon Roads. These areas have little forage value for grizzly bears and they are infrequently seen in these areas (MacHutchon 2014).

However, the construction and long-term use of the new multiuse pathway in alternative D would have a substantial adverse effect on grizzly bears in the area. Pathways can have some of the same effects on bears and their habitat as a road, although the magnitude of the effects may vary. But two separate corridors of human activity in the project area (Moose-Wilson Road and pathway) generally would have more impact on bears than one corridor (MacHutchon 2014). There would be a loss of habitat along the length of the pathway. Some bears may be displaced during construction activities, particularly in the late summer and fall. In addition, the presence of the pathway plus the road would increase fragmentation of bear habitat—there would be a larger area where bears would encounter people. The effect of this fragmentation would depend on how far the pathway is from the road. The farther the pathway is from the road, the greater the area that would be affected. In addition to potential habitat lost within the combined road and pathway corridor, there would be displacement of bears in a zone of influence along either side of this corridor. MacHutchon (2014) observed that if in places there are two separate linear corridors, each with a zone of influence on either side of them, there would be a greater potential for habitat fragmentation and a greater potential for habitats between the corridors to no longer be used, or used substantially less, by bears. Some wary bears that are sensitive to the presence of people may avoid using this larger area, or they may use the area when people are not present, such as at night. Other bears may habituate to human activity along the pathway and road, and would continue to use this habitat. Bears may be attracted to the pathway if nonnative and native plants like common dandelion, grasses, chokecherry, serviceberry, and black hawthorn grow along the pathway right-of-way, as is considered likely (MacHutchon 2014).

In addition to changes in bear behavior, the pathway would increase the potential risks of grizzly bear mortality or injury. It is likely that park managers would not be able to patrol the pathway as well as the road and monitor for the presence of bears foraging along the pathway. Thus, use of the pathway by hikers and bikers would increase the chances of bears encountering people. In addition, although periodic brushing of vegetation along the pathway would occur, if some shrubs and trees grow thickly along portions of the pathway, the vegetation would reduce visibility, which in turn would increase the chances of a surprise human-bear encounter. The risk of surprise encounters would particularly be true for bicyclists, who travel quickly and quietly, especially in heavily forested sections where sight lines and visibility would be reduced. Aside from the potential risk of human injury, this also increases the chances of a bear being removed by managers or shot by visitors in defense of life and property. If a bear were to injure a bicyclist, it would also increase the chance that the bear may have to be removed. If the bear was a reproductive female, its loss would have a greater impact on the bear population.

Depending on their location, the development of two new roadside parking areas north of the Death Canyon Road-Moose-Wilson Road junction for wildlife viewing in alternative D could affect the behavior of some bears. A number of behavioral changes have been identified due to bear wildlife viewing areas, including spatial and/or temporal displacement of bears, and changes in foraging efficiency (including changes in foraging bout length, the number of foraging bouts, vigilance rates, and capture of prey rates) (Marshall 2007 as cited In MacHutchon 2014). The presence of wildlife viewers can also displace dominant bears, who are often the least tolerant of human activity, from high-quality foraging areas, creating a "temporal refuge of high-quality resources for subordinate bears (Nevin and Gilbert 2005a, b; Rode et al. 2006, as cited In MacHutchon 2014).

Although visitor use levels under alternative D would be more managed and not rise as high at peak times as they would under alternative A, the presence of vehicles and visitors in the Moose-Wilson corridor would continue to affect grizzly bears in the area. As in alternative A, noise from visitors and vehicles on the roads and ongoing routine maintenance work would continue to affect the behavior of bears in the project area, particularly the bears that forage along Moose-Wilson Road between Sawmill Ponds Overlook and Death Canyon Road in the late summer and fall. Continued monitoring for grizzly bears foraging in the area, using park staff and volunteers to keep visitors from feeding or approaching the bears, and temporarily closing the road to traffic when grizzly bears are present in the area would mitigate disturbance of bear activity by people. But there still would be the potential for some bears to be temporarily or permanently displaced to other areas with less high-quality forage, or shifting their activity along the road to nighttime. In addition, there still would be the chance for vehicle collisions with bears resulting in injury and death. But with park managers closely monitoring use of the road, closing the road when bears are foraging along the road, and with vehicle driving at slow speeds, the likelihood of collisions occurring would be unlikely. There also would be the potential for encounters with visitors resulting in bears being removed by managers or shot by visitors in defense of life and property. Having the road plus a multiuse pathway would likely have a higher risk of bears eventually being removed by managers or shot by visitors because park staff would not be able to monitor visitors and bears as well on the pathway compared to the road.

As in all of the alternatives, under alternative D wildlife photographers can affect the behavior of grizzly bears in the corridor. Individuals or groups of photographers may be in proximity to bears. This persistent human presence may alter the behavior of or displace some wary bears, as well as increase the potential for habituation of bears to people. However, enforcement of park regulations that prohibit approaching bears closer than 100 yards and the closure of the road if bears are foraging along the road would avoid or minimize this potential impact.

Alternative D potentially would also have some beneficial effects on grizzly bears in the area. One of the most notable impacts of alternative D would be the two proposed road alignments. Realigning the northernmost segment of Moose-Wilson Road would have a long-term, beneficial effect on bears in the project area, removing a development that has created a barrier of human activity for grizzly bears and other wildlife moving east to west and along the Snake River floodplain (MacHutchon 2014). This action would decrease habitat fragmentation and increase the ability of bears to more effectively use the riparian corridor for movement and foraging.

Likewise, the realignment of the road between Sawmill Ponds Overlook and the Death Canyon Road junction would enable bears to forage undisturbed in an area with many productive fruit-bearing shrubs, grasses, and other forbs preferred by bears. Both the wetland complex on the southeast side of the road and the mixed tall deciduous shrubland and open aspen forest vegetation communities on the northwest side of the road are well used by bears, particularly in late summer and fall, and is the area where the majority of grizzly bears sightings have occurred in the Moose-Wilson corridor. The proposed relocation area is sagebrush shrubland, which has low forage value and is infrequently used by bears (MacHutchon 2014).

The reservation system in alternative D could potentially have both beneficial and some possibly adverse effects on grizzly bears. The reservation system would result in a considerable reduction in levels of traffic during periods of peak use, primarily during the summer, as discussed in the “Wildlife and Wildlife Habitat” impact section. With a limit on the potential increase in vehicular traffic during peak use periods, the potential for increased human-bear interactions and disturbance and possible displacement of bears would likely be avoided—a long term, beneficial effect. The beneficial effect would be stronger if high traffic conditions were limited by the reservation system during the spring, late summer, and fall months, when bears are more likely to be present along the road. But if this occurs it is also possible that over time some visitors (particularly local residents) would shift their use to mornings and early evenings when there would be more opportunities to drive the road without needing a reservation. Early mornings and evenings are also the time when crepuscular wildlife like grizzly bears are typically more active and would be foraging along the road. Although increased traffic levels at these times may not affect some nonfood-conditioned human habituated bears, the change in traffic use would increase the potential for disturbance of some grizzly bears in the area, possibly resulting in the displacement of some bears as well as increase the small potential for bear-vehicle collisions. On the other hand, if the road were closed to public use when bears are foraging, this impact can be avoided.

Various other management actions in alternative D would beneficially affect grizzly bears: Providing visitors with more information prior to their visit about the presence of grizzly bears and appropriate visitor behavior, periodic thinning and clearing of roadside vegetation, and closure or rerouting of some unsustainable horse trails would reduce the potential for undesirable human-bear encounters and disturbance of bears as well as possible bear-vehicle collisions. Establishing designated turnout areas and limiting the areas where people can stop along the road would reduce the potential for bears being disturbed by constant starting and stopping of traffic all along the road. However, it is also possible that the new designated turnouts along Moose-Wilson Road would encourage people to stop when they see bears and leave their vehicles to observe the animals, as opposed to continue driving through slowly (which could result in increased disturbance and avoidance responses in bears).

Overall, alternative D would result in a number of potential changes in grizzly bear behavior along Moose-Wilson Road, particularly along the stretch between the LSR Preserve and the Moose Entrance Station. The presence of Moose-Wilson Road and the multiuse pathway as two distinct corridors of human activity would have the largest impact on bears of all the alternatives being considered, resulting in a substantial, adverse effect on bears in the corridor area. The construction and use of the pathway and new roadside parking areas would result in the loss of some foraging habitat, and possible displacement of bears from the area or to times when people are not present (at night). Increased levels of bicyclists, and possibly the reservation traffic management strategy, if it were to cause increased pulses of traffic in mornings and evenings, could result in changes in bear behavior and possible temporary or permanent displacement of some bears. Also, the new designated turnouts along Moose-Wilson Road could encourage people to stop when they see bears (as opposed to continue driving through slowly) altering the behavior of bears. With continued use of the road by vehicles, there would also continue to be a chance for bear-vehicle collisions, but with careful monitoring, closing the road when bears are foraging along the road, and with slow vehicle speeds, the likelihood of collisions occurring would be unlikely. Alternative D would also have several beneficial effects: the two proposed road realignments would have a substantial long-term beneficial impact on grizzly bears in the area once construction is completed. Limiting the increase in numbers of vehicles driving along the road during peak use periods, increasing information about bears to visitors using the road, periodic thinning of roadside vegetation, and the closure of some horse trails, would also provide more space where bears can forage without people being present and reduce potential disturbance of bears when they are present.

Other Species. Canada lynx, gray wolf, and greater sage-grouse have been documented in the project area. The general effects of the developments and actions proposed in alternative D would be the same as generally described in the wildlife and wildlife habitat impacts analysis section. No known Canada lynx or gray wolf dens or greater sage-grouse leks would be directly or indirectly affected by the actions proposed under alternative D. There would be some loss of potential forested lynx and wolf habitat, including habitat possibly used occasionally as travel corridors. A total of about 7.8 acres of suitable foraging lynx habitat would be lost due to construction of the multiuse pathway, expansion of the Death Canyon parking area, and the new road segments and turnouts along Moose-Wilson Road, while about 5 acres of suitable lynx habitat would be restored due to replanting parts of the Moose-Wilson and Death Canyon Roads. Overall, alternative D would result in a net loss of about 2.8 acres of suitable lynx foraging habitat. Although some suitable lynx habitat would be lost, with the low densities of snowshoe hares in the project area, the loss of habitat would have little effect on lynx in the area. Likewise, the actions in alternative D would not prevent wolves from using other nearby suitable habitat.

The proposed reroute of the road south of Sawmill Ponds is in an area of occupied greater sage-grouse habitat. The reroute would result in the loss of occupied greater sage-grouse habitat, although sage-grouse use is unknown in this area. The relocation of the northernmost segment of Moose-Wilson Road and development of the pathway would result in the loss of approximately 8.0 acres in the core sage-grouse area, which is used by sage-grouse in the spring, summer, and fall for nesting and brood-rearing, and has been documented to be used in the winter as well. Some sage-grouse may be displaced by this new segment. About 2.1 acres of sagebrush in the core habitat would be restored with the removal of the existing road segment, which could eventually be used by the sage-grouse. Construction activities would be several miles away from the occupied lek sites and would not occur during the time when the sage-grouse would be present on the leks.

The behavior of Canada lynx, gray wolves, and greater sage-grouse could be altered due to the presence of people and the construction and use of the new developments. Lynx and wolves that may occasionally use or move through the area could be affected and change their behavior due to the new developments (multiuse pathway, turnouts, realignment of roads). But lynx and wolves may already avoid this area due to the presence of existing infrastructure and people. There would also be the potential for a vehicle to collide with and injure or kill a lynx, wolf, or sage-grouse while crossing the road, but the likelihood would be minimal, given the slow speed of the vehicles.

Under alternative D, part of Moose-Wilson Road may be groomed for winter use. If this occurs, the compacted snow route may allow coyotes to make greater use of the area. In the past, periods of deep snow has prevented coyotes from making much use of the area in winter. It is possible that if coyotes increase their use of the area, there could be increased competition with lynx for prey like the snowshoe hare, which might have a detrimental effect on the lynx (Burnell et al. 2006; Burghardt Dowd 2010; Gese et al. 2013).

Cumulative Effects.

Non-Federal Actions— Past development of residences, infrastructure and increasing numbers of people in Teton County have substantially altered the habitat, use, and behavior of the grizzly bear, Canada lynx, gray wolf, and greater sage-grouse in the area. Developments have resulted in the permanent loss of habitat and affected the ability of the species to move north-south and east-west along the Snake River corridor to connect to suitable habitats. Continued tourism, commercial activity, and residential development in the area have altered foraging, migration, and breeding behavior of the species in this area, and would likely continue to do so in the future. Other activities occurring in the region that have and are likely to continue to affect the species and their habitats include timber management, fire management, grazing, winter recreation, and trapping of furbearers (in the case of lynx). Wintering greater sage-grouse habitat in the Jackson Hole area also has been altered and eliminated and may be limiting sage-grouse population growth (Holloran and Anderson 2004 as cited In NPS 2006). Within the corridor, continuing and increasing numbers of visitors, as well as noise due to such activities such as periodic dredging of the irrigation ditches and maintenance of the utility corridor, would be expected to continue to limit the presence of all of the species in the area.

Outside the project area, other ongoing and reasonably foreseeable non-NPS actions would continue to alter potential habitat of the species. Construction of planned residential and commercial developments, such as the Teton Village expansion, would result in the permanent loss of potential habitat for grizzly bears, gray wolves, and greater sage-grouse. (Canada lynx would generally not be found in these lower elevation areas.) However, most of these new developments would occur in areas where vegetation and prey populations have already been altered, and which these listed species would tend to avoid.

Although elk hunting does not occur in the corridor, elk hunting in the park has resulted in the rare shooting of a grizzly in defense of life and property. This potential would continue in the future, with the possible loss of additional bears.

Federal Actions— Within the Moose-Wilson corridor noise from continuing periodic maintenance of park infrastructure and the presence of people would be expected to continue to affect the behavior and presence of grizzly bears, gray wolves, and the greater sage-grouse in the area. Outside the project area improvements being made in the Jenny Lake area, and development of multiuse pathways in the park (including construction of part of the multiuse pathway system near Jenny Lake) also would result in the permanent loss of potential habitat for grizzly bears, gray wolves, and the greater sage-grouse.

Overall, when the beneficial and adverse effects of alternative D are added to these other past, ongoing, and likely future effects, there would be the potential for a long-term, cumulative adverse effect on the grizzly bear, Canada lynx, gray wolf, and greater sage-grouse in the area. Alternative D would add an appreciable increment to the negative effects on the grizzly bear of the other actions occurring in the area, largely due to the construction and use of the multiuse pathway, and a small negative increment to the adverse cumulative effects on the lynx, wolf, and sage-grouse.

Conclusion (Including ESA Determination of Effects).

Grizzly Bear— Of all the alternatives being considered, alternative D would result in the greatest loss of grizzly bear habitat and have the highest potential for disturbance and alteration of grizzly bear behavior, largely due to noise from construction and long-term use of the multiuse pathway, resulting in a long-term, adverse impact on bears in the area. Increased levels of bicyclists, and possibly the reservation system strategy, would result in some changes to bear behavior and use patterns, including possible temporary or permanent displacement of bears from high-quality foraging areas to lower quality habitats. Also, the new designated turnouts along Moose-Wilson Road could encourage people to stop when they see bears (as opposed to continue driving through slowly), altering the behavior of bears. There would be a chance for a grizzly bear to be involved in a collision with a vehicle, but with park managers closely monitoring use of the road, closing the road when bears are foraging along the road, and with slow vehicle speeds, the likelihood of collisions occurring would be unlikely. Compared to current conditions, use of the multiuse pathway by bicyclists and hikers would increase the risk of surprise encounters and bears consequently being moved, injured, or killed, would be considerably higher in alternative D.

Alternative D would also have several beneficial effects on grizzly bears. The two proposed road realignments would improve the ability of bears to use the riparian corridor for movement and foraging and thus have a long-term, beneficial effect on grizzly bears once construction is completed. Other beneficial effects would result from limiting the increase in numbers of vehicles driving the road during peak use periods via a reservation system, providing visitors with more information about the species, periodic thinning of roadside vegetation, and closure of some horse trails. These actions would provide more space where bears can forage without people being present, and reduce potential disturbance of bears when they are present.

Overall, although alternative D would have some beneficial effects, it nevertheless could result in a significant adverse impact on grizzly bears in the project area due to increased habitat fragmentation from construction and use of the pathway, loss of foraging habitat and possible spatial and/or temporal displacement of bears in the corridor, and the increased potential for human-bear encounters that would in turn increase the potential for bears being removed by managers or shot by visitors in defense of life and property. There would be the potential for a cumulative adverse impact on grizzly bears when the effects of alternative D are added to other past, ongoing, and likely future actions in the area, with alternative D adding an appreciable increment to the overall cumulative impact due to construction and use of the pathway. With a higher potential for bears being injured or killed compared to current conditions, as well as the increase in habitat fragmentation, alternative D may affect, and is likely to adversely affect, grizzly bears in the project area.

Other Species— Most of the actions in alternative D would not affect the suitable habitat of the Canada lynx, gray wolf, and greater sage-grouse in the project area. The alternative would result in a net loss of about 2.8 acres of suitable lynx habitat. There also would be a net loss of approximately 5.9 acres of greater sage-grouse core habitat due to realignment of the northernmost part of the road and some additional occupied sage-grouse habitat would be lost with the other realignment south of Sawmill Ponds Overlook (although use by sage-grouse is unknown there). However, no actions in alternative D would affect known occupied sage-grouse leks, or affect known key foraging, breeding, or denning areas for lynx and wolves.

As in all of the alternatives, the behavior of wolves and sage-grouse crossing through the road corridor could be affected by noise from vehicles and the presence of people under alternative D. There also would continue to be a chance for a lynx, wolf, or sage-grouse to be involved in a collision with a vehicle, but the slow speed of vehicles makes this possibility unlikely.

Overall, no significant changes in the number, distribution, or reproduction of Canada lynx, gray wolf, or greater sage-grouse would be expected in the project area as a result of alternative D. Likewise, alternative D would not likely reduce use of the project area by these species. Thus, alternative D would not have a significant effect on the Canada lynx, gray wolf, or greater sage-grouse. There would be the potential for a cumulative adverse impact on the three species when the effects of alternative D are added to other past, ongoing, and likely future actions in the area, with alternative D adding a small negative increment to the overall adverse cumulative impact due to construction and use of the pathway. Although it is a low probability, there is still a risk that one or more lynx, wolves, or sage-grouse may be lost under alternative D, which would be considered an adverse effect under the Endangered Species Act. Consequently, alternative D may affect, and is likely to adversely affect, the lynx, gray wolf, and greater sage-grouse in the project area.

WETLANDS

Methods and Assumptions for Analyzing Impacts

This section addresses potential impacts on wetlands. The impact analyses considered a variety of factors that could affect wetlands, either beneficially or adversely. In general, the effects of the alternatives on wetlands in the project area were analyzed based on impacts resulting from changes to NPS development and infrastructure (e.g., roads, trails, and structures), commercial and private vehicle use, and visitor use levels and patterns associated with each alternative. To accomplish this, the following three impact analysis questions were considered to identify the potential impacts of each alternative:

Impact Analysis Questions.

1. How much physical displacement or alteration of delineated wetlands occur under each alternative?
2. What changes to wetland hydrology occur under each alternative (to individual wetlands and to wetland complexes)?
3. How would wetland functional values be affected by each alternative (for individual wetlands and wetland complexes)?

General Assumptions.

The following assumptions were considered in concert with the above impact analysis questions when assessing the effects of each alternative management strategy:

- Intact wetland hydrology is integral to wetland existence and wetland quality.

- Earthwork grading and roadway/pathway development typically alter natural surface sheetflow patterns, resulting in an increase in point releases, altered storm hydrographs, and changes to locations and volumes of surface water that may feed wetlands.
- An increase in impervious layers (e.g., paved road/pathway) can alter adjacent wetland hydrology. Increasing the impervious surface creates more potential for increased storm runoff volumes and nonpoint source pollutants to enter wetlands.
- Compacted soil substrate from roadway/pathway development and other features can alter groundwater flows that feed wetlands.
- Temporary stormwater management mitigation during construction can have short-term beneficial effects on wetlands.
- Analysis of impacts will be complicated by changes in wetlands related to beaver activity in the area.
- Each wetland and wetland complex possesses a unique combination of functional values.
- Functional values of wetlands can be altered by physical landscape alterations, changes in surface and groundwater patterns, the level and type of adjacent human uses and activities, and changes to adjacent plant communities.
- Roadway/pathway design features could help to mitigate some adverse effects on wetland values and wetland hydrology.
- Effective mitigation measures would be employed to minimize impacts on wetland values and wetland hydrology; however, even with these measures some unavoidable changes would occur to wetland values and hydrology in the corridor.

Alternative A (No Action)

Traffic Management along Moose-Wilson Road. Under alternative A, traffic management along Moose-Wilson Road would remain as it is currently managed. Traffic volume growth, traffic flow congestion, and resulting visitation volumes in the corridor would not be actively addressed (other than during periodic road closures due to wildlife activity along the road). Likewise, the current speed limit on Moose-Wilson Road (25 mph) would remain and the road's winter closure dates would remain unchanged. With these current and anticipated increases in traffic and visitor use in the future, the potential for continued impacts on wetlands in proximity to Moose-Wilson Road would continue and potentially increase, particularly in the wetland complex area between Death Canyon Road and the Sawmill Ponds Overlook. These impacts would be associated with various aspects of vehicle use and out-of-vehicle visitor activity. In these areas, social trail development from visitor use along and in wetlands in high-use areas would continue to trample wetland vegetation, resulting in degraded wetland plant communities and possible introduction of nonnative species. Wetland habitat would continue to be adversely affected by noise and human activity in these areas. Also, wetland water quality could be adversely affected by the generation of vehicle-related pollutants along all road segments in the corridor.

Physical Characteristics of Moose-Wilson Road. The physical characteristics of Moose-Wilson Road would also remain unchanged under alternative A. Most notably, the 1.4-mile unpaved road segment would remain unpaved. The unpaved section would continue to be treated with dust abatement chemicals such as magnesium chloride, which could migrate to downstream wetland areas. In addition, continued erosion of portions of the unpaved road segment could contribute sediment loading to downstream wetland areas. Both of these effects could have some adverse effects on wetland water quality in downstream areas. However, no notable wetland area has been identified or delineated in immediate proximity to the unpaved segment, so the effect would be limited.

Moose-Wilson Road Realignment. Under alternative A, the existing alignment of Moose-Wilson Road and the existing location of culverts and ditches along the road would continue to have long-term, adverse impacts on wetland hydrology and natural hydrological flow patterns, volumes, and velocities, most particularly where the road passes through the dynamic hydrological area and wetland complex between Death Canyon Road and the Sawmill Ponds Overlook. Referencing the 2012 wetland delineation study conducted by North Wind Resource Consulting, LLC (see the “Affected Environment” chapter), wetland areas 1, 4, and 5 would continue to be most affected by the road’s obstruction to wetland hydrology. These previous (but continually maintained) alterations to the landscape would continue to alter the natural flow of surface water and groundwater and thus have substantial effects on downstream wetland functions. The continued maintenance of the road in this area under alternative A would continue to alter the natural flow regime that connects the Reserve Creek and Stewart Draw drainages with the downstream wetlands, where the steeper, hilly terrain meets the sagebrush flats (which is where the existing road alignment runs). Although attempts would continue to be made to maintain both the road and the hydrological connectivity in this area via best management practices, the road would continue to be an inherent obstacle to natural water flow patterns and thus continue to alter wetland condition and function. Also, the existing road alignment encourages higher levels of out-of-vehicle visitor use (e.g., social trail for wildlife viewing) in proximity to this sensitive wetland complex (once again, namely wetland areas 4 and 5 from 2012 delineation). As a result, trampled wetland vegetation, degraded wetland plant communities, and a possible introduction of nonnative species from high levels of visitors use would be expected to continue. Wetland habitat values would also continue to be adversely affected by noise and human activity in the area and wetland water quality would continue to be adversely affected by the generation of vehicle-related pollutants along this road segment.

Turnouts and Parking. The vehicle turnout and parking management of alternative A, as well as opportunistic, unauthorized parking along the road, would continue to have limited adverse impacts on wetlands from sediment loading (if vegetation is displaced) and runoff of vehicle-related pollutants to the downstream roadside wetlands. In addition, with this random, opportunistic roadside parking continuing along the length of Moose-Wilson Road, associated out-of-vehicle visitor use would likely continue to contribute to social trail development in high-use areas that are in proximity to wetlands. This would continue to result in the trampling of wetland vegetation, degraded wetland plant communities, possible introduction of nonnative species, and disturbed wetland habitat. As vehicle use in the corridor continues to increase, it is likely these impacts on wetlands would also increase under alternative A. The wetland areas that would be most affected by these continued impacts would be wetland areas 1, 4, and 5, as identified in the 2012 wetland delineation report by North Wind Resource Consulting, LLC (see “Affected Environment” chapter). These particular wetlands are in proximity to areas of high wildlife use and thus, high visitor parking/use.

Bicycle Use. Under alternative A, cyclists would continue to share Moose-Wilson Road with motor vehicle traffic. Bike use on Moose-Wilson Road and other roads would continue to be nearly inconsequential to wetlands, although some limited and localized adverse impacts may be realized from visitors dismounting bikes and trampling wetland vegetation.

Commercial Activity. Authorized commercial activity would continue to be allowed and administered under alternative A, which would continue to have relatively limited and localized adverse impacts on wetlands through the possibility of visitors on commercial tours, including guided horseback riding tours, trampling wetland vegetation, and disturbing wetland habitat, particularly in areas where commercial groups tend to congregate and/or frequent.

Death Canyon. Under alternative A, the current management of the Death Canyon area could continue to have some adverse effects on wetlands from erosion, sedimentation, and vehicle-related pollutants from vehicle use and user-created parking along the unpaved Death Canyon Road from May through October, as well as visitor trampling of wetland vegetation in this area. However, wetland conditions are not prevalent in the primarily visitor use and access areas of the Death Canyon area (other than near the junction of Death Canyon Road with Moose-Wilson Road); therefore, these adverse effects would likely continue to be limited and isolated.

Winter Access and Use. The continued management of winter access and use in the Moose-Wilson corridor would continue to have limited adverse effects on wetlands under alternative A. Snow plowing operations and vehicle traffic along plowed portions of Moose-Wilson Road (between the Moose Entrance and Death Canyon Road junction and between the Granite Canyon Entrance and Granite Canyon Trailhead) would continue to produce vehicle-related pollutant runoff that adversely affects wetland water quality conditions. Also, snow storage in the plowed sections of Moose-Wilson Road would continue to be a source for sediment loading into adjacent wetlands, particularly in the area between Death Canyon Road and Sawmill Ponds Overlook. Vehicle use in plowed areas, snow plowing operations, and winter recreational use along unplowed portions of the road would also continue to disturb wintering wildlife using wetland habitat for foraging in the wetland complex in this area. Wetland areas 1, 4, and 5 delineated in the 2012 study by North Wind Resource Consulting, LLC, would be most affected by this continued winter use management (see the "Affected Environment" chapter). These particular wetlands are very close to continued plowed areas, as well as winter parking and snow storage areas (e.g., near Death Canyon Road junction and at Sawmill Ponds Overlook).

Visitor Use and Experience / Education and Interpretation. Continued information and education and use of backcountry patrols would continue to result in limited beneficial impacts on wetlands through the reduction of potential visitor impacts on wetland water quality, vegetation trampling, and wetland habitat disturbance.

Horse Use. Equestrian use in the Moose-Wilson corridor would continue to have limited adverse effects on wetlands under alternative A. Wetland vegetation trampling and wetland habitat disturbance by visitors and horses would continue to occur in dispersed areas of the corridor and near wetlands in proximity to the equestrian parking infrastructure (and nearby trails), such as the Sawmill Ponds Overlook and the Death Canyon Road junction. Small, isolated palustrine wetlands in the Poker Flats area are also being adversely affected by social trial development associated with equestrian use. Wetland areas 1, 4, and 5 delineated in the 2012 study by North Wind Resource Consulting, LLC, would be most affected by this continued use and parking (see the "Affected Environment" chapter). These particular wetlands are in proximity to equestrian parking at Sawmill Ponds Overlook and the Death Canyon Road junction.

Best Management Practices. As a continuation of existing management under alternative A, the park would implement best management practices to protect wetland resources. These practices are based on NPS *Management Policies 2006* and intend to protect the area's wetlands and to limit disturbances from current management actions and ongoing visitor use. Among other strategies, these wetland management practices and measures would include detailed wetland delineations in any locations affected by management actions, active management of erosion and sedimentation to protect water quality during construction and maintenance activities, revegetation plans to restore disturbed wetland plant communities, monitoring indicator species for effects from human use, and working with other resource management agencies on controlling the spread of nonnative plants. All of these best management practices would result in short- and long-term, beneficial effects on wetlands in the corridor, as they would collectively minimize adverse effects from ongoing corridor management and ongoing visitor uses.

> Overall, the continuation of corridor management under alternative A would continue several existing adverse effects on wetlands and would likely result in an increase in these effects as traffic and corridor visitation increase in the future (as projected). The most notable continuing adverse effect of alternative A would involve the continued use and maintenance of the existing Moose-Wilson Road alignment that bisects the drainage connectivity of the corridor's largest and most sensitive wetland complex and the upstream Reserve Creek and Stewart Draw drainages (between Death Canyon Road and Sawmill Ponds Overlook). As built, this road would continue to have substantial effects on wetland hydrology. The continued high levels of vehicle traffic and associated visitor use (e.g., social trail for wildlife viewing) along this wetland complex would result in a continuation of trampled wetland vegetation, degraded wetland plant communities, disturbed wetland habitat, and potential threats of the introduction of nonnative plants. Other adverse effects from alternative A would include increasing threats from vehicle-generated pollutants on wetland water quality, wetland vegetation impacts from unmanaged roadside parking and use, and sediment loading and winter wetland habitat disturbance from winter snow plowing. Collectively, alternative A would result in a considerable, long-term, adverse effect on wetlands, particularly in the large wetland complex between Death Canyon Road and Sawmill Ponds Overlook. Alternative A would likely have the greatest overall adverse effect on wetlands compared to the other three alternatives.

Cumulative Effects. A variety of other actions have altered, and would continue to alter, wetlands within and outside the project area. Inside the project area, past development of park infrastructure, such as roads and parking areas, has altered wetlands in the project area in past decades. Most notably, aside from removing small areas of wetlands in localized areas, these past alterations have also affected natural wetland hydrological patterns in the project area, which also had various effects on other wetland functions (e.g., biomass processing, water filtration, etc.). Also in the project area, wetlands would continue to be altered by continued management and use of several irrigation ditches and diversion structures in the corridor. This irrigation infrastructure has effects on local hydrology, which affects wetland dynamics (draining some areas, and bringing water to other areas). Aside from on-site ditch/diversion management, changing water rights and deliveries could continue to affect local hydrology and wetlands in the project area in the future. Also, the past development of the levee system in the project area along the Snake River by the US Army Corps of Engineers has altered natural flooding patterns in the project area and eliminated the naturally occurring floodplain. (Snake River flooding has also been modified by the Jackson Lake Dam—see below.) As a result, wetland generation and sustenance from annual Snake River flood events no longer occurs in the project area, a substantial, long-term, adverse effect on wetlands.

Outside the project area, other NPS and non-NPS actions have and would continue to alter wetlands and/or wetland hydrology (also see cumulative impacts section). On a large scale, the continued operation of Jackson Lake Dam would have considerable effects on natural hydrological patterns of the Snake River, and thus continue affecting the development, evolution, and sustenance of riparian wetlands along the Snake River. Various other improvements have or would result in long-term, adverse effects on wetlands in the area (from displacing wetlands to altering wetland hydrology, wetland functions, etc.). These projects include improvements being made in the Jenny Lake area, development of a multiuse pathway system outside the project area (including construction of a section of the multiuse pathway system near Jenny Lake), and construction of planned residential and commercial developments on private property (e.g., Teton Village expansion). Many of these projects also have short-term construction-related adverse effects from altered hydrology and sediment loading.

When the effects of alternative A on wetlands are added to these other past, ongoing, and likely future effects, a substantial, long-term, cumulative adverse effect on wetlands would continue to occur. However, the incremental effect of alternative A added to the adverse effects of these other actions occurring in the area would be minimal.

Conclusion. Alternative A would result in a continuation of several existing adverse effects on wetlands in the corridor and would likely result in an increase in these effects as traffic and corridor visitation increase in the future (as projected). The most notable continuing adverse effect of alternative A would involve the continued use and maintenance of the existing Moose-Wilson Road alignment that bisects the drainage of the corridor's largest and most sensitive wetland complex and the upstream Reserve Creek and Stewart Draw drainages (between Death Canyon Road and Sawmill Ponds Overlook). As built, this road would continue to have substantial effects on wetland hydrology. Also, the continued high levels of vehicle traffic and associated visitor use (e.g., social trails for wildlife viewing) along this wetland complex would result in a continuation of trampled wetland vegetation, degraded wetland plant communities, disturbed wetland habitat, and potential threats of the introduction of nonnative plants. Other adverse effects from alternative A would include increasing threats from vehicle-generated pollutants on wetland water quality, wetland vegetation impacts from unmanaged roadside parking and use, and sediment loading and winter wetland habitat disturbance from winter snow plowing. Collectively, alternative A would result in a considerable, long-term, adverse effect on wetlands, particularly in the large wetland complex between Death Canyon Road and Sawmill Ponds Overlook. Alternative A would likely have the greatest overall adverse effect on wetlands compared to the other three alternatives. However, although the most notable adverse effects to wetlands under this alternative would continue to be substantial in the area between Sawmill Ponds Overlook and Death Canyon Road, given the somewhat localized nature of these effects relative to the project area's overall hydrological regime and wetland complexes, the continuing adverse impacts on wetlands under alternative A would not likely be significant.

When the effects of alternative A are added to the effects of other past, present, and likely future actions in the region, there likely would be a substantial, long-term, adverse cumulative impacts on wetlands. Alternative

A would add a small increment to the overall adverse cumulative impact in the area.

Alternative B

Traffic Management along Moose-Wilson Road. Under alternative B, traffic management along Moose-Wilson Road (and thus in the overall corridor) would be substantially modified by including a gate system that closes the road to through-traffic during periods of peak use (e.g., peak hours during peak season). During gate closure periods, this traffic management strategy would likely have some beneficial effects on wetlands by limiting vehicular traffic, and thereby reducing vehicle-related pollutants in surface runoff throughout the corridor over the long term. However, these reductions in vehicle-related pollutants would be relatively minor compared to the total vehicle-related pollutants that would continue to occur. Even though the proposed traffic control gate system would reduce peak use in the corridor in the future, a relatively large volume of vehicle traffic would continue in the corridor, and thus, the potential for impacts on some wetlands in proximity to Moose-Wilson Road would continue (e.g., wetlands south of Sawmill Ponds Overlook). These impacts would be associated with various aspects of vehicle use and out-of-vehicle visitor use. In these areas, social trail development from visitor use along and in wetlands in high-use areas could continue to trample wetland vegetation, resulting in degraded wetland plant communities and possible introduction of nonnative species. Wetland habitat would continue to be adversely affected by noise and human activity in these areas. Also, wetland water quality could be adversely affected by the generation of vehicle-related pollutants along all road segments in the corridor.

Physical Characteristics of Moose-Wilson Road. Under alternative B, some physical characteristics of Moose-Wilson Road would also be modified. One of the most notable changes to physical characteristics, as it relates to wetlands, would be paving the 1.4-mile segment of currently unpaved roadway. As a result of this action, this road segment would no longer need to be treated with dust abatement chemicals such as magnesium chloride, which means migration of MgCl to surrounding hydrological systems would cease, resulting in a potential beneficial effect on the wetland water quality in this area of the corridor. Likewise, road surface erosion and vehicle-generated dust would decrease along this 1.4-mile segment, resulting in a decrease in contributions of sediment loading to downstream wetland areas. However, no notable wetland area has been identified or delineated in immediate proximity to the existing unpaved segment, so the beneficial effect to wetlands would be limited. Also, while roadbed grading and preparation for paving could result in some short-term, adverse effects such as erosion and sedimentation and incidental disturbance to wetlands by construction activities, overall, paving the unpaved road section would realize some limited levels of beneficial effect for wetlands.

The development of Moose-Wilson corridor design standards to be applied to design and maintenance of the roads, parking areas, and turnouts would result in limited beneficial impacts on wetlands adjacent to implemented road and parking designs. These potential improvements to the road/parking could reduce erosion, sedimentation, and vehicle-related pollution runoff into adjacent wetlands.

Moose-Wilson Road Realignment. Under alternative B, two large-scale realignments of Moose-Wilson Road would occur, primarily resulting in beneficial effect to wetlands in the corridor; however, some adverse effects would occur as well. Most notably, the southern realignment between the Death Canyon Road junction and Sawmill Ponds Overlook (and the restoration of the current road alignment) would remove a major impediment to the natural hydrological conditions in this area of the corridor. The hydrological connectivity of the Stewart

Draw and Reserve Creek drainages with downstream wetlands would be restored, largely as a result of the alignment, and additionally benefitted through the construction of appropriate drainage features. Wetland areas 4 and 5 in the 2012 wetland delineation report (see the "Affected Environment" section) would benefit substantially from this realignment. In this area of the corridor, this southern realignment action would restore surface and groundwater hydrological patterns and other natural processes that are integral to wetland function and condition (e.g., wetland dynamics associated with beaver activity, surface water filtration, biomass cycling, and groundwater recharge and discharge). Wetland water quality of wetland areas 4 and 5 would also improve, as much of this wetland complex would no longer be immediately downstream of Moose-Wilson Road and its associated pollution and sediment-loading attributes. Also, the road would no longer fragment the wetland habitat connectivity from the forested and montane habitat to the west.

The proposed realignment of the northernmost segment of Moose-Wilson Road (and relocation of the Moose Entrance Station and four-way intersection with Teton Park Road, and construction of appropriate drainage features) would further offset the road and these developments from the Snake River riparian corridor and its associated wetlands. This would result in a reduction in pollutants and sediment-loading in the adjacent wetlands and would further buffer wetland habitat from human activity and vehicle traffic, a notable, localized beneficial effect to wetlands. However, the beneficial effects of this northern realignment on wetlands would be relatively small when compared to the beneficial effects from the southern realignment.

The northern and southern realignments under alternative B would also have some adverse effects on wetlands. Most directly, some short segments of the southern realignment route would likely require the loss and/or modification of a small, northernmost extent of wetland area 4 south of the Sawmill Ponds Overlook (see 2012 wetland delineation information in the "Affected Environment" chapter). Specific wetland acreages directly affected cannot be discerned until detailed grading and construction plans would be developed. In addition, the southern extent of wetland area 3 and portions of wetland area 1 could also be affected by development of the southern realignment. Even if avoidance of these two wetland areas is maximized in the design and construction of the realignment, some adverse effects would still be likely (from vehicle pollutants, alterations to local wetland hydrology, sediment loading from road/ditches, and human disturbances to wetland habitat). All of these adverse effects would be long term and notable. Also, although proposed bridges along the newly realigned segments of the road would maintain natural stream hydrology, both realignments would have long-term effects on local surface and groundwater hydrology (e.g., sheetflow to channelized flow) in previously undisturbed areas to the east and could cause some alterations to wetland hydrology for downstream wetlands. Additionally, limited short-term adverse impacts on wetland hydrology, wetland water quality, and other wetland functions would result from construction activities related to the road realignments, primarily related to erosion/sedimentation and temporary alterations in local drainage patterns to accommodate construction activities, construction staging, etc.

However, overall, the beneficial effects of these two road realignments (noted above) outweigh the adverse effects due to the importance of restoring hydrological connectivity and reducing fragmentation of this unique and sensitive wetland complex (wetland areas 4 and 5) and its other ecological values. Given the importance of these natural system values, the proposed realignments under this alternative (most notably the southern realignment) would greatly benefit the Aquatic Resources fundamental resource and value. Compared to the other alternatives, this would have the most substantial beneficial effect on wetlands within the Moose-Wilson corridor (similar to alternative D).

Turnouts and Parking. In alternative B, officially designated parking turnouts would be constructed along Moose-Wilson Road to accommodate up to 120 vehicles. The new designated parking turnouts would result in beneficial impacts on wetland habitat in proximity to Moose-Wilson Road through the reduction of erosion, sediment loading, and wetland water quality threats associated with random, user-created parking. In addition, the improved control of roadside parking along Moose-Wilson Road would reduce impacts on wetlands from associated out-of-vehicle visitor use such as social trail development in high-use areas that trample wetland vegetation, degrade wetland plant communities, introduce nonnative species, and disturb wetland habitat. While the construction of these parking improvements would result in limited, short-term, and localized erosion and sedimentation impacts from construction activities (sediment loading, vegetation trampling, etc.), the overall impact to wetlands from these actions is beneficial. However, some opportunistic, unauthorized parking along the road could still continue under this alternative, and thus, some of the above effects would continue in isolated areas. The wetland areas that would be most affected by these actions and impacts would be wetland areas 1 and 4, as identified in the 2012 wetland delineation report by North Wind Resource Consulting, LLC (see the "Affected Environment" section). These particular wetlands are adjacent to areas of high wildlife use and thus, high visitor parking/use.

Bicycle Use. Under alternative B, cyclists would continue to share Moose-Wilson Road with motor vehicle traffic, although the transition from the existing multiuse pathways on the south and north ends of the corridor would be facilitated, and road markers and bike facilities such as bike racks would be provided. Bike use on Moose-Wilson Road and other roads would continue to be nearly inconsequential to wetlands, although some limited and isolated adverse impacts may be realized from visitors dismounting bikes and trampling wetland habitat.

Commercial Activity. Authorized commercial activity would continue to be allowed and administered under alternative B, which would continue to have relatively limited and localized adverse impacts on wetlands from the possibility of visitors on commercial tours, including guided horseback riding tours, trampling wetland vegetation, and disturbing wetland habitat, particularly in areas where commercial groups tend to congregate and/or frequent. Taxis and all other nonpark-dependent commercial traffic would be prohibited in the corridor, which would result in some limited beneficial impacts on wetlands from the reduction of some vehicle-related pollutants.

Death Canyon. Under alternative B, the Death Canyon Trailhead would be relocated approximately 0.4 mile from its current location, with the abandoned section of the trailhead access road converted to a trail. A parking lot would be constructed to provide parking for approximately 60 vehicles. These actions would reduce the extent and number of user-created parking disturbances along Death Canyon Road (as well as the length of the road disturbance itself). Thus, impacts on downstream wetlands and riparian areas associated with adjacent streams would be reduced, resulting in a limited, long-term, and localized beneficial effect on downstream wetlands from reductions in erosion, sediment loading, vehicle pollutants, and wetland vegetation trampling. However, short-term, localized, and limited adverse impacts on downstream wetlands could result from construction activities associated with the new Death Canyon Trailhead, relocation of restroom and parking lot through erosion and sediment loading. Also, some continued user-created parking could still be expected in some areas along Death

Canyon Road (despite the enlarged parking area), which would have isolated continuing adverse effects on wetlands. Because wetland conditions are not prevalent in the Death Canyon area (with the exception of near the junction with Moose-Wilson Road), these adverse effects would likely continue to be limited and very isolated.

Winter Access and Use. Winter access and use would continue to be allowed under alternative B. However, the extent of the unplowed road section would be extended to the Murie Ranch Road junction. This action would result in notable, long-term, beneficial effects in the wetlands between Death Canyon Road junction and Sawmill Ponds Overlook. During the winter closure periods and the spring snowmelt, reductions in vehicle-related pollution runoff and sediment loading from snow storage areas into these downstream wetlands would be expected. In addition, the elimination of snow plowing in this segment of Moose-Wilson Road (between Murie Ranch Road and Death Canyon Road) would likely reduce the amount of winter visitor activity along and around the sensitive wetland complex (even with the proposed realignment under this alternative), thus resulting in a beneficial effect on wetland habitat. However, continued snow plowing operations and vehicle traffic in other segments of the corridor, along with continued winter recreational use in unplowed areas, would continue to have limited, adverse effects on wetland water quality and wetland habitat. The greatest effect of these actions would be the beneficial effect on the large, sensitive wetland complex noted above. Wetland areas 1 and 4 delineated in the 2012 study by North Wind Resource Consulting, LLC, would be most beneficially affected by these changes in winter use management (see the “Affected Environment” chapter). These particular wetlands are very close to areas that would no longer be plowed or given winter vehicle access.

Visitor Use and Experience / Education and Interpretation. Under alternative B, corridor-entry information, education, interpretive exhibits, and the use of backcountry patrols would continue to result in limited beneficial impacts on wetlands throughout the corridor from the reduction of potential visitor impacts on wetland water quality, vegetation trampling, and wetland habitat disturbance.

Horse Use. Equestrian use in the Moose-Wilson corridor would continue to have limited adverse effects on wetlands under alternative B. Wetland vegetation trampling and wetland habitat disturbance by visitors and horses would continue to occur in dispersed areas of the corridor and near wetlands in proximity to the equestrian parking infrastructure. For example, wetland area 1 identified in the 2012 study by North Wind Resource Consulting, LLC, is in immediate proximity to the Death Canyon Road junction equestrian parking area. However, elimination of two horse trailer parking areas would likely reduce equestrian use and associated impacts in areas around the Sawmill Ponds Overlook and Granite Canyon Trailhead. Given the amount of wetlands in proximity to Sawmill Ponds Overlook (to the south), this management change could have a notable beneficial effect on the above impacts in this area. Wetland areas 4 and 5 delineated in the 2012 study by North Wind Resource Consulting, LLC, would be most beneficially affected by these changes in equestrian use management (see the “Affected Environment” chapter). These particular wetlands are in proximity to Sawmill Ponds Overlook, which would no longer allow horse trailer parking. The wetlands associated with the Granite Creek drainage to the west of the Granite Canyon Trailhead could also benefit from this closure to equestrian parking at the trailhead. Additionally, the removal/rerouting of trails with resource impacts and the establishment of newly aligned horse trail routes would also have limited and localized beneficial impacts in areas where trails are removed or rerouted to avoid wetlands.

Best Management Practices, Monitoring Guidelines, and Mitigation Measures. As part of all action alternatives, the park would implement best management practices, monitoring guidelines, and mitigation measures to protect the area's wetlands and to limit disturbances from proposed actions and visitor use that would occur under each alternative. Among other strategies, these wetland management practices and measures would include detailed wetland delineations in any locations affected by management actions, active management of erosion and sedimentation to protect water quality during construction activities, revegetation plans to restore disturbed wetland plant communities, monitoring indicator species for effects from human use, and working with other resource management agencies on controlling the spread of nonnative plants. All of these best management practices, monitoring guidelines, and mitigation measures would result in short- and long-term, beneficial effects on wetlands in the corridor because they would collectively minimize adverse effects from other proposed actions and ongoing future uses. These efforts would also foster the holistic approach to ecological management, of which wetland management plays an integral role.

> Overall, the most substantial impact from alternative B management actions on wetlands would relate to the two realignments of Moose-Wilson Road, which would improve wetland hydrology, wetland habitat, water quality, and other important wetland functions. Most notably, the southern realignment would remove the road and its heavy visitor use from fragmenting wetland hydrology and habitat for the largest and most sensitive wetland complex in the project area. This action would have a substantial beneficial effect on wetlands that would directly support the Aquatic Resources fundamental resource and value. Other beneficial effects would include improved wetland water quality and wetland vegetation conditions from closing two equestrian parking areas, paving the unpaved road segment, improved traffic management, lengthening the unplowed road segment in winter, and controlling roadside parking. Monitoring guidelines, best management practices, and mitigation measures would also protect wetland conditions. The most notable adverse effect of alternative B would involve direct, localized wetland impacts or loss associated with the southern road realignment (at north and south portions of the realignment). Other adverse effects from alternative B would include potential threats to wetland water quality and native wetland plant communities from ground disturbances associated with various constructions projects, most notably the two road realignments. However, collectively across all beneficial and adverse effects, and relative to other alternatives, alternative B would offer the greatest benefit to wetlands, primarily due to the realignment around the large wetland complex and the fact that it does not include large expansions in development.

Cumulative Effects. A variety of other actions have altered, and would continue to alter, wetlands within and outside the project area. Inside the project area, past development of park infrastructure, such as roads and parking areas, has altered wetlands in the project area in past decades. Most notably, aside from removing small areas of wetlands in localized areas, these past alterations have also affected natural wetland hydrological patterns in the project area, which also had various effects on other wetland functions (e.g., biomass processing, water filtration, etc.). Also in the project area, wetlands would continue to be altered by continued management and use of several irrigation ditches and diversion structures in the corridor. This irrigation infrastructure has effects on local hydrology, which affects wetland dynamics (draining some areas and bringing water to other areas). Aside from on-site ditch/diversion management, changing water rights and deliveries could continue to affect local hydrology and wetlands in the project area in the future. Also, the past development of the levee system in the project area along the Snake River by the US Army Corps of Engineers has altered natural flooding patterns in the project area and eliminated the naturally occurring floodplain (granted that Snake River flooding has also been modified by the Jackson Lake Dam; see below). As a result, wetland generation and sustenance from annual Snake River flood events no longer occurs in the project area, a considerable, long-term, adverse effect on wetlands.

Outside the project area, other NPS and non-NPS actions have and would continue to alter wetlands and/or wetland hydrology (also see cumulative impacts scenario section). At a large scale, the continued operation of Jackson Lake Dam would continue to have considerable effects on natural hydrological patterns of the Snake River, and thus continue to affect the development, evolution, and sustenance of riparian wetlands along the Snake River. Also, various other improvements have or would result in long-term, adverse effects on wetlands in the area (from displacing wetlands to altering wetland hydrology, wetland functions, etc.). These projects include improvements being made in the Jenny Lake area, development of multiuse pathway system outside the project area (including construction of part of the multiuse pathway system near Jenny Lake), and construction of planned residential and commercial developments on private property (e.g., Teton Village expansion). Many of these projects also have short-term construction-related adverse effects from altered hydrology and sediment loading.

When the effects of alternative B on wetlands are added to these other past, ongoing, and likely future effects, a substantial, long-term, cumulative adverse effect on wetlands would continue to occur. However, the incremental effect of alternative B added to the adverse effects of these other actions occurring in the area would be small and mostly beneficial due to the restoration of wetland hydrology and enhancement of wetland conditions.

Conclusion. Alternative B would result in various beneficial and adverse effects on wetlands in the corridor. The most substantial impact from alternative B management actions on wetlands would relate to the two realignments of Moose-Wilson Road that would improve wetland hydrology, wetland habitat, water quality, and other important wetland functions. Most notably, the southern realignment would remove the road and its heavy visitor use from fragmenting wetland hydrology and habitat for the largest and most sensitive wetland complex in the project area. This action would have a substantial beneficial effect on wetlands that would greatly benefit the Aquatic Resources fundamental resource and value. Other beneficial effects would include improved wetland water quality and wetland vegetation conditions from closing two equestrian parking areas, paving the unpaved road segment, improved traffic management, lengthening the unplowed road segment in winter, and controlling roadside parking. Monitoring guidelines, best management practices, and mitigation measures would also protect wetland conditions. The most notable adverse effect of alternative B would involve localized wetland impacts or loss associated with the southern road realignment (at north and south portions of the realignment). Other adverse effects from alternative B would include potential threats to wetland water quality and native wetland plant communities from ground disturbances associated with various construction projects, most notably the two road realignments. However, collectively across all beneficial and adverse effects, and relative to other alternatives, alternative B would offer the greatest benefit to wetlands, primarily due to the realignment around the large wetland complex. Also, the most notable adverse effects on wetlands under this alternative (from the southern road realignment) would not likely be significant due to the relatively localized nature of the effects on wetlands.

When the effects of alternative B are added to the effects of other past, present, and likely future actions in the region, there likely would be a substantial, long-term, adverse cumulative impacts on wetlands. Alternative B would add a small increment to the overall adverse cumulative impacts in the area, and much of this increment would be beneficial.

Alternative C (NPS Preferred)

Traffic Management along Moose-Wilson Road. Under alternative C, traffic management along Moose-Wilson Road (and thus in the overall corridor) would be substantially modified by including a vehicle time sequencing system that addresses increases in traffic and volume-related congestion during periods of peak use (e.g., peak hours during peak season). During these controlled/queued periods, this traffic management strategy would likely have some beneficial effects on wetlands by limiting vehicular traffic, and thereby reducing vehicle-related pollutants in surface runoff throughout the corridor over the long term. However, these reductions in vehicle-related pollutants would be relatively minor compared to the total vehicle-related pollutants that would continue to occur. Even though the proposed vehicle time sequencing system would maintain current use levels to avoid future increases in use in the corridor, a relatively large volume of vehicle traffic would continue in the corridor, and thus the potential for adverse impacts on wetlands in proximity to Moose-Wilson Road would continue (e.g., the extensive wetland complex between Death Canyon Road junction and Sawmill Ponds Overlook, which are wetland areas 1, 4, and 5 of the 2012 wetland delineation report noted in the "Affected Environment" chapter). These adverse impacts on wetlands would be associated with various aspects of vehicle use and out-of-vehicle visitor use. In these areas, social trail development from visitor use along and in wetlands in high-use areas could continue to trample wetland vegetation, resulting in degraded wetland plant communities and possible introduction of nonnative species. Wetland habitat would continue to be adversely affected by noise and human activity in these areas. Also, wetland water quality could be adversely affected by the generation of vehicle-related pollutants along all road segments in the corridor.

Physical Characteristics of Moose-Wilson Road. Under alternative C, some physical characteristics of Moose-Wilson Road would also be modified. One of the most notable changes to physical characteristics, as it relates to wetlands, would be paving the 1.4-mile segment of currently unpaved roadway. As a result of this action, this segment would no longer need to be treated with dust abatement chemicals such as magnesium chloride, which means migration of MgCl to surrounding hydrological systems would cease, resulting in a potential beneficial effect on wetland water quality in this area of the corridor. Likewise, road surface erosion and vehicle-generated dust would decrease along this 1.4-mile segment, resulting in a decrease in contributions of sediment loading to downstream wetland areas. However, no notable wetland area has been identified or delineated in immediate proximity to the existing unpaved road segment, so the beneficial effect to wetlands would be limited. Also, while roadbed grading and preparation for paving could result in some short-term, adverse effects such as erosion and sedimentation and incidental disturbance to wetlands by construction activities, overall, paving the unpaved portion would realize some limited levels of beneficial effect for wetlands.

The development of Moose-Wilson corridor design standards to be applied to design and maintenance of the roads, parking areas, and turnouts would result in limited beneficial impacts on wetlands adjacent to implemented road and parking designs. These potential improvements to the road/parking could reduce erosion, sedimentation, and vehicle-related pollutant runoff into adjacent wetlands.

Moose-Wilson Road Realignment. Under alternative C, the existing alignment of Moose-Wilson Road would generally be maintained for most of the road's length, with the exception of a realignment of the northernmost segment between the Murie Ranch Road junction and Teton Park Road. Additionally, the segment of the road between Death Canyon Road and Sawmill Ponds Overlook would be reconstructed to restore local hydrological patterns and wetland connectivity, and would include appropriate drainage features. This reconstruction and drainage improvement could affect up to 1.5 miles of the Moose-Wilson Road alignment. In addition to making the road more sustainable and resilient to changing natural processes, it could also improve the hydrological conditions that are integral to the functional qualities of the large wetland complex to the east of the road. Some aspects of hydrological connectivity of the Stewart Draw and Reserve Creek drainages with downstream wetlands would be restored or at least improved. Referencing the 2012 wetland delineation study conducted by North Wind Resource Consulting, LLC (see the "Affected Environment" chapter), wetland areas 1, 4, and 5 would be affected by this improvement. The restoration of natural surface flow patterns, velocities, and volumes that feed these wetlands would be considered and targeted in the reconstruction. This improved wetland hydrology could result in multiple secondary beneficial effects (e.g., downstream wetland dynamics, surface water filtration, biomass cycling, and groundwater recharge and discharge). However, the extent of the above beneficial effects would also depend on site-specific hydrologic factors (e.g., seep/spring locations) and road improvement design. The improvements of the road and drainage in this area could also have some adverse effects on the hillside to the west of the road (via destabilization from excavation) and downstream wetlands (via erosion and sedimentation) if regrading and long-term stabilization of the hillside is necessary to accommodate the drainage improvements. In addition, the existing alignment of the road would continue to route higher levels of visitor use (e.g., social trail for wildlife viewing) adjacent to this sensitive wetland complex. As a result, trampled wetland vegetation, degraded wetland plant communities, and the possible introduction of nonnative species from relatively high levels of visitors use along the road corridor would be expected to continue. Wetland habitat values would also continue to be adversely affected by noise and human activity in this area, and wetland water quality would continue to be adversely affected by the generation of vehicle-related pollutants along this road segment and immediately upstream of the wetlands.

While alternative C does not offer the same degree of wetland benefits from the southern realignment associated with alternatives B and D, the reconstruction of the road segment to improve hydrological connectivity between Death Canyon Road and Sawmill Ponds Overlook would still have appreciable long-term beneficial effects on wetland areas 1, 4, and 5 and some of their ecological functions.

Also, under alternative C, the proposed realignment of the northernmost segment of Moose-Wilson Road (and relocation of the Moose Entrance Station and four-way intersection with Teton Park Road) would further offset the road and these developments from the Snake River riparian corridor and its associated wetlands. This would result in a reduction in pollutants and sediment-loading in the adjacent wetlands and would further buffer wetland habitat from human activity and vehicle traffic, a notable, localized beneficial effect to wetlands. This northern realignment would also have some limited, short-term, adverse impacts on wetland hydrology, wetland water quality, and other wetland functions from the construction activities related to the road realignment and entrance station relocation. These temporary effects would primarily relate to erosion/ sedimentation and temporary alterations in local drainage patterns to accommodate construction activities, construction staging, etc.

Turnouts and Parking. In alternative C, officially designated parking turnouts would be constructed along Moose-Wilson Road to accommodate up to 120 vehicles. The new designated parking turnouts would result in beneficial impacts on wetland habitat in proximity to Moose-Wilson Road through the reduction of erosion, sediment loading, and wetland water quality threats associated with random, user-created parking. In addition, the improved control of roadside parking along Moose-Wilson Road would reduce impacts on wetlands from associated out-of-vehicle visitor use, such as social trail development in high-use areas that trample wetland vegetation, degrade wetland plant communities, introduce nonnative species, and disturb wetland habitat. While construction of these parking improvements would result in limited, short-term, and very localized erosion and sedimentation impacts from construction activities (sediment loading, vegetation trampling, etc.), the overall impact to wetlands from these actions is beneficial. However, some opportunistic, unauthorized parking along the road could still continue under this alternative, and thus, some of the above effects would continue in isolated areas. The wetland areas that would be most affected by these actions and impacts would be wetland areas 1, 4, and 5 as identified in the 2012 wetland delineation report by North Wind Resource Consulting, LLC (see the “Affected Environment” chapter). These particular wetlands are very close to areas of high wildlife use, and thus, high visitor parking/use.

Bicycle Use. Under alternative C, cyclists would continue to share Moose-Wilson Road with motor vehicle traffic, although the transition from the existing multiuse pathways on the south and north ends of the corridor would be facilitated, and road markers and bike facilities such as bike racks would be provided. Bike use on Moose-Wilson Road and other roads would continue to be nearly inconsequential to wetlands, though some very limited and isolated adverse impacts may be realized from visitors dismounting bikes and trampling wetland habitat.

Commercial Activity. Authorized commercial activity would continue to be allowed and administered under alternative C, which would continue to have relatively limited and localized adverse impacts on wetlands through the possibility of visitors on commercial tours, including guided horseback riding tours, trampling wetland vegetation, and disturbing wetland habitat, particularly in areas where commercial groups tend to congregate and/or frequent. Taxis and all other nonpark-dependent commercial traffic would be prohibited in the corridor, which would result in some limited beneficial impacts on wetlands through the reduction of some vehicle-related pollutants.

Death Canyon. Under alternative C, the Death Canyon Trailhead would be relocated approximately 1.0 mile from its current location, with the abandoned section of the trailhead access road converted to a trail. A parking lot would be constructed to provide parking for approximately 80 to 90 vehicles. These actions would reduce the extent and number of the user-created parking disturbances along Death Canyon Road (as well as the length of the road disturbance itself). Thus, impacts on downstream wetlands and riparian areas associated with adjacent streams would be reduced, resulting in a limited, long-term, and localized beneficial effect on downstream wetlands from reductions in erosion, sediment-loading, vehicle pollutants, and wetland vegetation trampling. However, short-term, localized, and limited adverse impacts on downstream wetlands could result from construction activities associated with the new Death Canyon Trailhead, relocation of the restroom, and parking lot through erosion and sediment loading. Also, some continued user-created parking could still be expected in some areas along Death Canyon Road (despite the enlarged parking area), which would have isolated continuing adverse effects on wetlands. But, because wetland conditions are not prevalent in the Death Canyon area (with the exception of near the junction with Moose-Wilson Road), these adverse effects would likely continue to be limited and isolated.

Winter Access and Use. Alternative C would maintain much of the winter use management that currently exists in the corridor and would continue to have limited adverse effects on wetlands. Snow plowing operations and vehicle traffic along plowed portions of Moose-Wilson Road (between the Moose Entrance and Death Canyon Road junction and between the Granite Canyon Entrance and Granite Canyon Trailhead) would continue to produce vehicle-related pollutant runoff that adversely affects wetland water quality conditions. Also, snow storage in the plowed sections of Moose-Wilson Road would continue to be a source for sediment loading into adjacent wetlands, particularly in the area between Death Canyon Road and Sawmill Ponds Overlook. Vehicle use in plowed areas, snow plowing operations, and winter recreational use along unplowed portions of the road would continue to disturb wintering wildlife using wetland habitat for foraging in the wetland complex in this area. Wetland areas 1, 4, and 5 delineated in the 2012 study by North Wind Resource Consulting, LLC, would be most affected by this continued winter use management (see the “Affected Environment” chapter). These particular wetlands are close to plowed areas, as well as winter parking and snow storage areas (e.g., near Death Canyon Road junction and at Sawmill Ponds Overlook).

Visitor Use and Experience / Education and Interpretation. Under alternative C, corridor-entry information, education, interpretive exhibits, and the use of backcountry patrols would continue to result in limited beneficial impacts on wetlands throughout the corridor from the reduction of potential visitor impacts on wetland water quality, vegetation trampling, and wetland habitat disturbance.

Horse Use. Equestrian activity in the Moose-Wilson corridor would continue to have limited adverse effects on wetlands under alternative C. Wetland vegetation trampling and wetland habitat disturbance by visitors and horses would continue to occur in dispersed areas of the corridor and near wetlands in proximity to the equestrian parking infrastructure such as the Sawmill Ponds Overlook and the Death Canyon Road junction equestrian parking. Wetland areas 1, 4, and 5 delineated in the 2012 study by North Wind Resource Consulting, LLC, would be most affected by this continued use and parking (see the “Affected Environment” chapter). However, the elimination of one horse trailer parking area in the corridor (at Granite Canyon Trailhead) would likely reduce equestrian use and associated impacts in this area and could benefit the vegetation, habitat, and water quality in nearby wetlands. Wetlands associated with the Granite Creek drainage to the west of the trailhead would benefit the most from this management change. Additionally, the removal/rerouting of trails with resource impacts and the establishment of newly aligned horse trail routes would also have limited and localized beneficial impacts in areas where trails are removed or rerouted to avoid wetlands.

Best Management Practices, Monitoring Guidelines, and Mitigation Measures. As part of all action alternatives, the park would implement best management practices, monitoring guidelines, and mitigation measures to protect the area’s wetlands and to limit disturbances from proposed actions and visitor use that would occur under each alternative. Among other strategies, these wetland management practices and measures would include detailed wetland delineations in any locations affected by management actions, active management of erosion and sedimentation to protect water quality during construction activities, revegetation plans to restore disturbed wetland plant communities, monitoring indicator species for effects from human use, and working with other resource management agencies on controlling the spread of nonnative plants. All of these best management practices, monitoring guidelines, and mitigation measures would result in short- and long-term, beneficial effects on wetlands in the corridor, as they would collectively minimize adverse effects from other proposed actions and ongoing future uses. These efforts would also further foster the holistic approach to ecological management, of which wetland management plays an integral role.

> Overall, the most substantial change and impact from alternative C management actions on wetlands would relate to the northern realignment that would relocate Moose-Wilson Road farther away from Snake River riparian wetlands and the reconstruction of Moose-Wilson Road between Death Canyon Road and Sawmill Ponds Overlook to improve hydrological connectivity between upstream drainages (Reserve Creek and Stewart Draw drainages) and the large wetland complex in that area. Other beneficial effects would include improved wetland water quality and wetland vegetation condition from closing one equestrian parking areas, paving the unpaved segment, improved traffic management, and controlling roadside parking. Monitoring guidelines, best management practices, and mitigation measures would also protect wetland conditions. The most notable adverse effect of alternative C would involve the continuation for routing high levels of vehicle traffic and associated visitor use (e.g., social trail for wildlife viewing) very close to the large, sensitive wetland complex, which would result in some continuation of trampled wetland vegetation, degraded wetland plant communities, disturbed wetland habitat, and potential threats of the introduction of nonnative plants. Other adverse effects from alternative C would include potential threats to wetland water quality and native wetland plant communities from ground disturbances associated with various constructions projects (most notably the north road realignment and reconstruction south of Sawmill Ponds Overlook), as well as the continuation of current winter use impacts. In addition, the drainage improvements between Death Canyon Road and Sawmill Ponds Overlook could increase some short- and long-term sedimentation to downstream wetlands if hillside excavation is needed to accommodate the drainage improvements. But, collectively, across all beneficial and adverse effects, alternative C would offer an appreciable improvement to wetland conditions relative to alternative A. However, this alternative would not accomplish as much overall beneficial effect on wetlands as alternative B, namely due to the continuation of the existing Moose-Wilson Road alignment through the corridor's largest and most sensitive wetland complex.

Cumulative Effects. A variety of other actions have altered, and would continue to alter, wetlands within and outside the project area. Inside the project area, past development of park infrastructure such as roads and parking areas has altered wetlands in the project area in past decades. Most notably, aside from removing small areas of wetlands in localized areas, these past alterations have also affected natural wetland hydrological patterns in the project area, which also had various effects on other wetland functions (e.g., biomass processing, water filtration, etc.). Also in the project area, wetlands would continue to be altered by continued management and use of several irrigation ditches and diversion structures in the corridor. This irrigation infrastructure has effects on local hydrology, which affects wetland dynamics (draining some areas, and bringing water to other areas). Aside from on-site ditch/diversion management, changing water rights and deliveries could continue to affect local hydrology and wetlands in the project area in the future. Also, the past development of the levee system in the project area along the Snake River by the US Army Corps of Engineers has altered natural flooding patterns in the project area and eliminated the naturally occurring floodplain (granted that Snake River flooding has also been modified by the Jackson Lake Dam; see below). As a result, wetland generation and sustenance from annual Snake River flood events no longer occurs in the project area, a considerable, long-term, adverse effect on wetlands.

Outside the project area, other NPS and non-NPS actions have and would continue, to alter wetlands and/or wetland hydrology (also see cumulative impacts scenario section). At a large scale, the continued operation of the Jackson Lake Dam would continue to have considerable effects on natural hydrological patterns of the Snake River, and thus continue affecting the development and sustenance of riparian wetlands along the Snake River. Also, various other improvements have or would result in long-term, adverse effects on wetlands in the area (from displacing wetlands to altering wetland hydrology, wetland functions, etc.). These projects include improvements being made in the Jenny Lake area, development of multiuse pathway system outside the project area (including construction of part of the multiuse pathway system near Jenny Lake), and construction of planned residential and commercial developments on private property (e.g., Teton Village expansion). Many of these projects also have short-term construction-related adverse effects from altered hydrology and sediment loading.

When the effects of alternative C on wetlands are added to these other past, ongoing, and likely future effects, a substantial, long-term, cumulative adverse effect on wetlands would continue to occur. However, the incremental effect of alternative C added to the adverse effects of these other actions occurring in the area would be small. Alternative C would also contribute some beneficial effects due to the improvement of wetland hydrology.

Conclusion. Alternative C would result in various beneficial and adverse effects on wetlands in the corridor. The most substantial change and beneficial impact from alternative C management actions on wetlands would relate to the northern realignment that would relocate Moose-Wilson Road farther away from Snake River riparian wetlands and the reconstruction of Moose-Wilson Road between Death Canyon Road and Sawmill Ponds Overlook to improve hydrological connectivity between upstream drainages (Reserve Creek and Stewart Draw drainages) and the large wetland complex in that area. Other beneficial effects would include improved wetland water quality and wetland vegetation condition from closing one equestrian parking areas, paving the unpaved segment, improved traffic management, and controlling roadside parking. Monitoring guidelines, best management practices, and mitigation measures would also protect wetland conditions. The most notable adverse effect of alternative C would involve the continuation for routing high levels of vehicle traffic and associated visitor use (e.g., social trail for wildlife viewing) very close to the large, sensitive wetland complex, which would result in some continuation of trampled wetland vegetation, degraded wetland plant communities, disturbed wetland habitat, and potential threats of the introduction of nonnative plants. Other adverse effects from alternative C would include potential threats to wetland water quality and native wetland plant communities from ground disturbances associated with various constructions projects (most notably the north road realignment and reconstruction south of Sawmill Ponds Overlook), as well as the continuation of current winter use impacts. In addition, the drainage improvements between Death Canyon Road and Sawmill Ponds Overlook could increase some short- and long-term sedimentation to downstream wetlands if hillside excavation is needed to accommodate the drainage improvements. But, collectively, across all beneficial and adverse effects, alternative C would offer an appreciable improvement to wetland conditions relative to alternative A. However, this alternative would not accomplish as much overall beneficial effect on wetlands as alternative B, namely due to the continuation of the existing Moose-Wilson Road alignment through the corridor's largest and most sensitive wetland complex. Although the most notable adverse effects to wetlands under alternative C would continue to be considerable in the area between Sawmill Ponds Overlook and Death Canyon Road, given the relatively localized nature of these effects, these adverse impacts on wetlands would not likely be significant.

When the effects of alternative C are added to the effects of other past, present, and likely future actions in the region, there likely would be a substantial, long-term, adverse cumulative impact on wetlands. Alternative C would add a small increment to the overall adverse cumulative impact in the area, with some of this increment being beneficial.

Alternative D

Traffic Management along Moose-Wilson Road. Under alternative D, traffic management along Moose-Wilson Road (and thus in the overall corridor) would be substantially modified by including a reservation system that addresses increases in traffic and volume-related congestion during periods of peak use (e.g., peak hours during peak season). During these reservation system periods, this traffic management strategy would likely have some beneficial effects on wetlands by limiting vehicular traffic, and thereby reducing vehicle-related pollutants in surface runoff throughout the corridor over the long term. However, these reductions in vehicle-related pollutants would be relatively minor compared to the total vehicle-related pollutants that would continue to occur. Even though the proposed reservation system would reduce peak use in the corridor in the future, a relatively large volume of vehicle traffic would continue in the corridor, and thus the potential for impact to some wetlands in proximity to Moose-Wilson Road would continue (e.g., wetlands just south of the Sawmill Ponds Overlook). These impacts on wetlands would be associated with various aspects of vehicle use and out-of-vehicle visitor use. In these areas, social trail development from visitor use along and in wetlands in high-use areas could continue to trample wetland vegetation, resulting in a degraded wetland plant communities and possible introduction of nonnative species. Wetland habitat would continue to be adversely affected by noise and human activity in these areas. Also, wetland water quality could be adversely affected by the generation of vehicle-related pollutants along all road segments in the corridor.

Physical Characteristics of Moose-Wilson Road. Most of the physical characteristics of Moose-Wilson Road would remain unchanged under alternative D. Most notably, the 1.4-mile unpaved road segment would remain unpaved. This unpaved section would continue to be treated with dust abatement chemicals such as magnesium chloride, which could migrate to downstream wetland areas. In addition, continued erosion of portions of the unpaved segment could contribute sediment loading into downstream wetland areas. Both of these effects could have some adverse effects on wetland water quality in downstream areas. However, no notable wetland area has been identified or delineated in immediate proximity to the unpaved segment, so the effect would be limited.

Also, the development of Moose-Wilson corridor design standards to be applied to design and maintenance of the roads, parking areas, and turnouts would result in limited beneficial impacts on wetlands adjacent to implemented road and parking designs. These potential improvements to the road/parking could reduce erosion, sedimentation, and vehicle-related pollutants run-off into adjacent wetlands.

Moose-Wilson Road Realignment. Under alternative D, two large-scale realignments of Moose-Wilson Road would occur, primarily resulting in beneficial to wetlands in the corridor, granted that some adverse effects would occur as well. Most notably, the southern realignment between the Death Canyon Road junction and the Sawmill Ponds Overlook (and the restoration of the current road alignment) would remove a major impediment to the natural hydrological conditions in this area of the corridor. The hydrological connectivity of the Stewart Draw and Reserve Creek drainages with downstream wetlands would be restored, largely as a result of the realignment and additionally benefitted through the construction of appropriate drainage features. Wetland areas 4 and 5 in the 2012 wetland delineation report (see the "Affected Environment") would benefit substantially from this realignment. In this area of the corridor, this southern realignment action would restore surface and groundwater hydrological patterns and other natural processes that are integral to wetland function and condition (e.g., wetland dynamics associated with beaver activity, surface water filtration, biomass cycling, and groundwater recharge and discharge). Wetland water quality of wetland areas 4 and 5 would also improve, as much of this wetland complex would no longer be immediately downstream of Moose-Wilson Road and its associated pollution and sediment-loading attributes. Also, the road would no longer fragment the wetland habitat connectivity from the forested and montane habitat to the west.

The proposed realignment of the northernmost segment of Moose-Wilson Road (and relocation of the Moose Entrance Station and four-way intersection with Teton Park Road, and construction of appropriate drainage features) would further offset the road and these developments from the Snake River riparian corridor and its associated wetlands. This would result in a reduction in pollutants and sediment loading in the adjacent wetlands and would further buffer wetland habitat from human activity and vehicle traffic, a notable, localized beneficial effect to wetlands. However, the beneficial effects of this northern realignment on wetlands would be relatively small when compared to the beneficial from the southern realignment.

The northern and southern realignments under alternative D would also have some adverse effects on wetlands. Most directly, some short segments of the southern realignment route would likely require the loss and/or modification of a small, northernmost extent of wetland area 4 just south of the Sawmill Ponds Overlook (see 2012 wetland delineation information in the "Affected Environment" chapter). Specific wetland acreages affected by this cannot be discerned until detailed grading and construction plans would be developed. In addition, the southern extent of wetland area 3 and portions of wetland area 1 could also be affected by development of the southern realignment. Even if avoidance of these two wetland areas is maximized in the design and construction of the realignment, some adverse effects to their condition would still be likely (from vehicle pollutants, alterations to local wetland hydrology, sediment-loading from road/ditches, and human disturbances to wetland habitat). All of these adverse effects would be long-term and notable. Also, although proposed bridges along the newly realigned segments of the road would maintain natural stream hydrology, both realignments would have long-term effects on local surface and groundwater hydrology (e.g., sheetflow to channelized flow) in previously undisturbed areas to the east and could cause some alterations to wetland hydrology for downstream wetlands. Additionally, limited short-term adverse impacts on wetland hydrology, wetland water quality, and other wetland functions would result from construction activities related to the road realignments, primarily related to erosion/sedimentation and temporary alterations in local drainage patterns to accommodate construction activities, construction staging, etc.

However, overall, the beneficial effects of these two road realignments (noted above) outweigh these adverse effects of two new realignments due to the importance of restoring hydrological connectivity and reducing fragmentation of this unique and sensitive wetland complex (wetland areas 4 and 5) and its other ecological values. Given the importance of these natural system values, the proposed realignments under this alternative (most notably the southern realignment) would greatly benefit the Aquatic Resources fundamental resource and value. Compared to the other alternatives, this would have the most substantial beneficial effect on wetlands within the Moose-Wilson corridor (similar to alternative B).

Turnouts and Parking. In alternative D, officially designated parking turnouts would be constructed along Moose-Wilson Road to accommodate up to 120 vehicles. The new designated parking turnouts would result in beneficial impacts on wetland habitat in proximity to Moose-Wilson Road through the reduction of erosion, sediment loading, and wetland water quality threats associated with random, user-created parking. In addition, the improved control of roadside parking along Moose-Wilson Road would reduce impacts on wetlands from associated out-of-vehicle visitor use, such as social trail development in high-use areas that trample wetland vegetation, degrade wetland plant communities, introduce nonnative species, and disturb wetland habitat. While the construction of these parking improvements would result in limited, short-term, and very localized erosion and sedimentation impacts from construction activities (sediment loading, vegetation trampling, etc.), the overall impact to wetlands from these actions is beneficial. However, some opportunistic, unauthorized parking along the road could still continue under this alternative, and thus, some of the above effects would continue is isolated areas. The wetland areas that would be most affected by these actions and impacts would be wetland areas 1, 4, and 5, as identified in the 2012 wetland delineation report by North Wind Resource Consulting, LLC (see the “Affected Environment” chapter). These particular wetlands are very close to areas of high wildlife use, and thus, high visitor parking/use.

Bicycle Use. Relative to the current level and area of effect on wetlands from bicycle and pedestrian uses in the in the corridor, the proposed multiuse pathway under alternative D would cause a considerable increase in adverse effects on wetlands. The main source for this impact would be the introduction of a second primary transportation corridor through the project area. Wetland habitat quality, wetland vegetation, and wetland hydrology would be affected by disturbances on and along an additional swath of developed land. Although the proposed pathway would parallel the existing and realigned Moose-Wilson Road for much of its length, the pathway would be offset up to 150 feet from the road. This would effectively result in a substantial increase in the width of the main human travel, landscape disturbance corridor, and hydrological alternations increasing from roughly a 30-foot width (along disturbance corridor of Moose-Wilson Road) to upwards of a 200 foot width of disturbance (when the disturbance corridor of the road, pathway, and moderately disturbed offset area in between).

The most notable effect from this dual development corridor on wetlands would occur in segments of the pathway corridor that need to traverse through or along existing wetlands, particularly the pathway alignment between Death Canyon Road and Sawmill Ponds Overlook. In this area, the proposed pathway development would displace or alter some of the wetland functions of wetland areas 1, 3, and the northern portions of wetland area 4 (as delineated in the 2012 wetland study by North Wind Resource Consulting, LLC; see the "Affected Environment" chapter). Given the spatial constraints in some of these areas, it is possible that some wetland filling and removal would be necessary to allow for pathway development. However, this would need to be determined via specific field alignment surveying and wetland boundary delineations. But, even if wetland filling would be avoided by site-specific pathway alignment routing, these wetlands would still likely be affected by pathway development in their immediate vicinity. In which case, the pathway would likely alter surface and groundwater hydrology that is tributary to and affects adjacent wetland hydrology (e.g., altered surface flow patterns, increased runoff volume and velocity from impervious surface). Likewise, the pathway could also remove hydrophytic wetland vegetation that may exist beyond delineated wetland perimeters and increase the threat for nonnative plant infestations occurring in and around wetlands.

In addition, once built, the visitor use along the pathway (i.e., biking, walking) would also contribute notable adverse effects on wetlands. These effects would include altered wetland habitat from human activity in proximity to these adjacent wetlands and the potential for wetland vegetation trampling from unofficial social trails that would radiate from certain points along the pathway alignment. Other adverse effects on wetlands from the proposed multiuse pathway would be short-term and be associated with pathway construction activities. These would include temporary impacts on wetland hydrology, wetland water quality, wetland habitat, and other wetland functions from construction-associated erosion/ sedimentation, wetland vegetation trampling, and temporary alterations in local drainage patterns to accommodate construction activities and construction staging.

Collectively, these impacts on wetlands from the multiuse pathway under alternative D would be relatively substantial, short term and long term, and adverse, and occur in wetlands along multiple segments of the pathway, most notably between Death Canyon Road and Sawmill Ponds Overlook.

Commercial Activity. Authorized commercial activity would continue to be allowed and administered under alternative D, which would continue to have relatively limited and localized adverse impacts on wetlands through the possibility of visitors on commercial tours, including guided horseback riding tours, trampling wetland vegetation and disturbing wetland habitat, particularly in areas where commercial groups tend to congregate and/or frequent.

Death Canyon. Under alternative D, the Death Canyon Trailhead parking area would remain in its current location but be enlarged considerably to accommodate 100 vehicles. A notable portion of the existing Death Canyon Road would be removed and restored. Also, a new 0.4-mile connector road between the trailhead and White Grass Ranch would be developed. These actions would reduce the extent and number of the user-created parking disturbances along Death Canyon Road and/or White Grass Ranch Road (as well as the length of road disturbance itself). Thus, impacts on downstream wetlands and riparian areas associated with adjacent streams would be reduced, resulting in a limited, long-term, and localized beneficial effect on downstream wetlands from reductions in erosion, sediment-loading, vehicle pollutants, and wetland vegetation trampling. However, short-term, localized, and limited adverse impacts on downstream wetlands could result from construction activities associated with the enlarged Death Canyon Trailhead parking area and new connector road through erosion and sediment loading. Also, some continued user-created parking could still be expected in some areas along the Death Canyon Road or White Grass Ranch Road (despite the enlarged parking area), which would have isolated adverse effects on wetlands. But, because wetland conditions are not prevalent in the Death Canyon area (with the exception of near the junction with Moose-Wilson Road), these adverse effects would likely continue to be limited and very isolated.

Winter Access and Use. Winter access and use would continue to be allowed under alternative D. However, the extent of the unplowed portion would be extended to the Sawmill Ponds Overlook. This action would result in an appreciable, long-term, beneficial effect on the wetlands between the Death Canyon Road junction and the Sawmill Ponds Overlook. During the winter closure periods and the spring snowmelt, some reductions in vehicle-related pollutant runoff and sediment loading from snow storage areas into these downstream wetlands could be expected. In addition, the removal of plowing in this segment of Moose-Wilson Road (Sawmill Ponds Overlook and Death Canyon Road) could reduce the amount of winter visitor activity along and around the sensitive wetland complex (even with the proposed realignment under this alternative), thus resulting in a beneficial effect on wetland habitat. However, continued snow plowing operations and vehicle traffic in other segments of the corridor, along with continued winter recreational use in unplowed areas, would continue to have limited, adverse effects on wetland water quality and wetland habitat. The newly proposed grooming of the unpaved portions of the road would likely increase winter recreation use in the unplowed segments. But the greatest effect of these actions would be the beneficial effect on the large, sensitive wetland complex noted above from the removal of plowing between Sawmill and Death Canyon Road. Wetland areas 1 and 4 delineated in the 2012 study by North Wind Resource Consulting, LLC, would be most beneficially affected by these changes in winter use management (see the "Affected Environment" chapter) due to their proximity to areas that would no longer be plowed or given winter vehicle access.

Visitor Use and Experience / Education and Interpretation. Under alternative D, corridor-entry information, education, interpretive exhibits, and the use of backcountry patrols would continue to result in very limited beneficial impacts on wetlands throughout the corridor from the reduction of potential visitor impacts on wetland water quality, vegetation trampling, and wetland habitat disturbance. However, this alternative would also include the development of two wildlife viewing areas (and associated nature trails) along the newly proposed southern realignment route of Moose-Wilson Road. These developments in previously undisturbed areas could have notable, long-term, localized, adverse effects on nearby wetlands from directing high concentrations of visitor activity relatively close to high-quality wetland conditions. Impacts could relate to human disturbances to wetland habitat and wetland vegetation trampling from unofficial social trails that might extend in or nearer to the wetlands from the new designated viewing areas and nature trails. Wetland areas 3 and 4, as identified in the 2012 wetland delineation by North Wind Resource Consulting, LLC, would be most affected by this adverse impact given their relative proximity to the proposed viewing area sites (see the "Affected Environment" chapter).

Horse Use. Equestrian use in the Moose-Wilson corridor would continue to have limited adverse effects on wetlands under alternative D. Wetland vegetation trampling and wetland habitat disturbance by visitors and horses would continue to occur in dispersed areas of the corridor and near wetlands in proximity to the equestrian parking infrastructure, such as the Sawmill Ponds Overlook and the Death Canyon Road junction equestrian parking. Wetland areas 1, 4, and 5 delineated in the 2012 study by North Wind Resource Consulting, LLC, would be most affected by this continued use and parking (see the "Affected Environment" chapter). However, the removal/rerouting of trails with resource impacts and the establishment of newly aligned horse trail routes would also have limited and localized beneficial impacts in areas where trails are removed or rerouted to avoid wetlands.

Best Management Practices, Monitoring Guidelines, and Mitigation Measures. As part of all action alternatives, the park would implement best management practices, monitoring guidelines, and mitigation measures to protect the area's wetlands and to limit disturbances from proposed actions and visitor use that would occur under each alternative. Among other strategies, these wetland management practices and measures would include detailed wetland delineations in any locations affected by management actions, active management of erosion and sedimentation to protect water quality during construction activities, revegetation plans to restore disturbed wetland plant communities, monitoring indicator species for effects from human use, and working with other resource management agencies on controlling the spread of nonnative plants. All of these best management practices, monitoring guidelines, and mitigation measures would result in short- and long-term, beneficial effects on wetlands in the corridor, as they would collectively minimize adverse effects from other proposed actions and ongoing future uses. These efforts would also further foster the holistic approach to ecological management, of which wetland management plays an integral role.

> Overall, the most substantial beneficial impact and change from alternative D management actions on wetlands would relate to the two realignments of Moose-Wilson Road that would improve wetland hydrology, wetland habitat, water quality, and other important wetland functions. Most notably, the southern realignment would remove the road and its heavy visitor use from fragmenting wetland hydrology and habitat for the largest and most sensitive wetland complex in the project area. This action would have a substantial beneficial effect on wetlands that would directly support the Aquatic Resources fundamental resource and value. Other beneficial effects would include improved wetland water quality and wetland vegetation condition from improved traffic management, lengthening the unplowed segment in winter, and controlling roadside parking. Monitoring guidelines, best management practices, and mitigation measures would also protect wetland conditions. The most notable adverse effects of alternative D would involve a substantial increase in hydrological disturbance from a second, parallel disturbance corridor (multiuse path) and localized wetland impacts and loss associated with the southern road realignment and pathway (in the vicinity of the north and south portions of the realignment). Other adverse effects from alternative D would include potential threats to wetland water quality and native wetland plant communities from new wildlife viewing area developments and ground disturbances associated with other construction projects in previously undisturbed areas, most notably the two road realignments and pathway. Collectively, and relative to other alternatives, alternative D would offer a considerable benefit to wetlands, primarily due to the realignment around the large wetland complex. However, the overall benefit would not be as great as alternative B, namely due to the considerable

adverse effects associated with the multiuse pathway.

Cumulative Effects. A variety of other actions have altered, and would continue to alter, wetlands within and outside the project area. Inside the project area, past development of park infrastructure, such as roads and parking areas, has altered wetlands in the project area in past decades. Most notably, aside from removing small areas of wetlands in localized areas, these past alterations have also affected natural wetland hydrological patterns in the project area which also had various effects on other wetland functions (e.g., biomass processing, water filtration, etc.). Also in the project area, wetlands would continue to be altered by continued management and use of several irrigation ditches and diversion structures in the corridor. This irrigation infrastructure has effects on local hydrology, which affects wetland dynamics (draining some areas, and bringing water to other areas). Aside from onsite ditch/diversion management, changing water rights and deliveries could continue to affect local hydrology and wetlands in the project area in the future. Also, the past development of the levee system in the project area along the Snake River by the US Army Corps of Engineers has altered natural flooding patterns in the project area and eliminated the naturally occurring floodplain (granted that Snake River flooding has also been modified by the Jackson Lake Dam; see below). As a result, wetland generation and sustenance from annual Snake River flood events no longer occurs in the project area, a considerable, long-term, adverse effect on wetlands.

Outside the project area, other NPS and non-NPS actions have and would continue, to alter wetlands and/or wetland hydrology (also see cumulative impacts scenario section). At a large scale, the continued operation of the Jackson Lake Dam would continue to have considerable effects on natural hydrological patterns of the Snake River, and thus continue affecting the development, evolution, and sustenance of riparian wetlands along the Snake River. Also, various other improvements have or would result in long-term, adverse effects on wetlands in the area (from displacing wetlands to altering wetland hydrology, wetland functions, etc.). These projects include improvements being made in the Jenny Lake area, development of multiuse pathway system outside the project area (including construction of part of the multiuse pathway system near Jenny Lake), and construction of planned residential and commercial developments on private property (e.g., Teton Village expansion). Many of these projects also have short-term construction-related adverse effects from altered hydrology and sediment loading.

When the effects of alternative D on wetlands are added to these other past, ongoing, and likely future effects, a substantial, long-term, cumulative adverse effect on wetlands would continue to occur. However, the incremental effect of alternative D added to the adverse effects of these other actions occurring in the area would be small. Alternative D would contribute notable beneficial and adverse effects, mainly from the restored wetland hydrology and the disturbances from the proposed multiuse pathway development, respectively.

Conclusion. Alternative D would result in various beneficial and adverse effects on wetlands in the corridor. The most substantial beneficial impact and change from alternative D management actions on wetlands would relate to the two realignments of Moose-Wilson Road that would improve wetland hydrology, wetland habitat, water quality, and other important wetland functions. Most notably, the southern realignment would remove the road and its heavy visitor use from fragmenting wetland hydrology and habitat for the largest and most sensitive wetland complex in the project area. This action would have a substantial beneficial effect on wetlands that would greatly benefit the Aquatic Resources fundamental resource and value. Other beneficial effects would include improved wetland water quality and wetland vegetation condition from improved traffic management, lengthening the unplowed segment in winter, and controlling roadside parking. Monitoring guidelines, best management practices, and mitigation measures would also protect wetland conditions. The most notable adverse effects of alternative D would involve a substantial increase in hydrological disturbance from a second, parallel transportation corridor (multiuse pathway) and localized wetland impacts and loss associated with the southern road realignment and pathway (in the vicinity of the north and south portions of the realignment). Other adverse effects from alternative D would include potential threats to wetland water quality and native wetland plant communities from new wildlife viewing area developments and ground disturbances associated with other construction projects in previously undisturbed areas, most notably the two road realignments and pathway. Collectively, and relative to other alternatives, alternative D would offer a considerable benefit to wetlands, primarily due to the realignment around the large wetland complex. However, the overall benefit would not be as great as alternative B, namely due to the considerable adverse effects associated with the multiuse pathway's disturbance on natural hydrological patterns through the extent of the corridor. However, the adverse effects on wetlands from the southern road realignment and pathway would not likely be significant due to the relatively isolated and localized nature of the effects on wetlands.

When the effects of alternative D are added to the effects of other past, present, and likely future actions in the region, there likely would be a substantial, long-term, adverse cumulative impact on wetlands. Alternative D would add a small increment to the overall adverse cumulative impact in the area, with some of this increment being beneficial.

HYDROLOGY

Methods and Assumptions for Analyzing Impacts

This section addresses potential impacts on hydrology and the natural hydrological system in the project area. The impact analyses considered a variety of factors that could affect hydrology, either beneficially or adversely. In general, the effects of the alternatives on hydrology in the project area were analyzed based on impacts resulting from changes to NPS development and infrastructure (e.g., roads, pathways, and structures), commercial and private vehicle use, and visitor use types, levels, and patterns associated with each alternative. To accomplish this, the following impact analysis question was considered to identify the potential impacts of each alternative:

Impact Analysis Question.

1. How would water flows, velocities, and patterns of the local hydrology be affected by each alternative (surface flows and groundwater flows)?

General Assumptions.

The following assumptions were considered in concert with the above impact analysis question when assessing the effects of each alternative management strategy:

- Earthwork grading and roadway/pathway development typically alter natural surface sheetflow patterns, resulting in an increase in point releases, channelized flow along ditches, altered storm hydrographs, and changes to locations and volumes of surface water flows.
- An increase in impervious layers (e.g., paved roadway/pathway) can alter local hydrology by reducing groundwater infiltration, increasing the run-off coefficient (i.e., rate of

run-off), and increase downstream flow volumes. Collectively, this increases storm runoff volumes and speeds.

- Compacted soil substrate from roadway/pathway development, motor vehicle use, and other features can alter groundwater flows.
- Construction activities can alter local surface flow patterns and run-off speeds/volumes. However, temporary stormwater management mitigation during construction can have short-term beneficial effects on protecting local hydrology.
- Roadway/pathway design features could mitigate some hydrology effects.
- Effective mitigation measures would be employed to minimize impacts on hydrology; however, even with these measures some unavoidable changes would occur to hydrology in the corridor.
- Existing and increasing variability in seasonal runoff volumes affecting the project area requires planning for, and consideration of, extreme events in the evaluation of impacts for each alternative. This would include both surface water and the inputs from local springs.

Alternative A (No Action)

Traffic Management along Moose-Wilson Road. Two-way travel between Moose and the Granite Canyon Entrance would continue to be allowed and administered from early/mid-May through October 31 under alternative A, which would continue to be nearly inconsequential to stream hydrology and natural hydrological flow patterns, volumes, and velocities (surface and groundwater).

Physical Characteristics of Moose-Wilson Road. The unpaved portion of Moose-Wilson Road would remain unpaved under alternative A and would be graded and treated for dust abatement several times per year. The continuing effects of this unpaved segment on local hydrology would be quite minor and primarily only relate to altered natural hydrological flow patterns, volumes, and velocities due to the compacted gravel surface (less pervious) and channelized surface flows.

Moose-Wilson Road Realignment. Under alternative A, the existing alignment of Moose-Wilson Road, including the paved and unpaved portions of the road, as well as the existing location of culverts and ditches, would continue to have long-term, adverse impacts on stream hydrology and natural hydrological flow patterns, volumes, and velocities (surface and groundwater). These previous (but continually maintained) alterations to the landscape would continue to alter the natural flow path of surface water (e.g., natural sheetflow continuing to be intercepted and channelized along ditches and other road improvements). The volume and velocity of surface flows would also continue to be adversely affected by these artificial channels, culverts, and other artificial features. The fact that Moose-Wilson Road runs generally perpendicular to the corridor wide flow pattern (generally northwest to southeast) is an inherent impediment to natural flows and thus an adverse effect. Most notably, Moose-Wilson Road crosses through a very dynamic and important hydrological system as it passes along the edge of the large wetland area between Sawmill Ponds Overlook and Death Canyon Road. Essentially, the road structure greatly alters the connectivity of the Reserve Creek and Steward Draw drainages with the downstream wetland complex. The continued maintenance of the road in this area under alternative A would continue to alter natural flow regime where the steeper hilly terrain meets the sagebrush flats (which is where the existing road alignment runs). Although attempts would continue to be made to maintain both the road and the hydrological connectivity in this area via best management practices, the road would continue to be an inherent obstacle to natural surface and groundwater flow.

Turnouts and Parking. Existing parking lots and roadside turnouts would generally remain in their current size and locations under alternative A, with the exception of newly created unofficial roadside turnouts created by visitors under this alternative. These parking features would continue to adversely impact natural hydrological flow patterns and stream hydrology in particular areas where parking features are in relative proximity to streams. In localized areas, surface runoff flow volumes and velocities, as well as groundwater flows under compacted parking areas, would continue to be affected.

Bicycle Use. Under alternative A, cyclists would continue to share Moose-Wilson Road with motor vehicle traffic. Bike use on Moose-Wilson Road and other roads would continue to be nearly inconsequential to stream hydrology and natural hydrological flow patterns, volumes, and velocities (surface and groundwater).

Commercial Activity. Authorized commercial activity would continue to be allowed and administered under alternative A, which would continue to be nearly inconsequential to stream hydrology and natural hydrological flow patterns, volumes, and velocities (surface and groundwater).

Death Canyon. Under alternative A, the current and continued management of the Death Canyon area would continue to have localized, adverse effects on surface and groundwater hydrology. The unpaved Death Canyon Road, the Death Canyon Trailhead parking area, and other official and user-created parking along this corridor would continue to alter natural flow patterns, volumes, and velocities by converting natural sheetflow to channelized flow and increasing surface run-off speeds and volumes in compacted areas (and thus reducing groundwater infiltration). Surface and groundwater flows that are tributary to nearby streams could also be affected, thus having an effect on local stream hydrology. Although some best management practices could mitigate some of these adverse effects, the ongoing maintenance of the Death Canyon Road in its current alignment, as well as the location of culverts and ditches that support its ongoing maintenance would continue to adversely impact natural hydrological conditions along its length.

Winter Access and Use. The continued management of winter access and use in the Moose-Wilson corridor would continue to have relatively inconsequential effects on stream hydrology and natural hydrological flow patterns, volumes, and velocities (surface and groundwater).

Visitor Use and Experience / Education and Interpretation. The continued management of visitor use and experience in the Moose-Wilson corridor would continue to have relatively inconsequential effects on stream hydrology and natural hydrological flow patterns, volumes, and velocities (surface and groundwater).

Horse Use. The continued management of horse use in the Moose-Wilson corridor would continue to have relatively inconsequential effects on stream hydrology and natural hydrological flow patterns, volumes, and velocities (surface and groundwater).

Best Management Practices. Under this alternative, the park would continue to implement best management practices to reduce erosion, sedimentation, and compaction, and to control surface runoff from parking areas, roads, stormwater sewer outfalls, and other ground-disturbing activities. Additionally, where stream and river channels cross or flow along roads, trails, or other human created features, the park would continue to seek management solutions that allow the continuation of natural hydrologic processes to the extent possible, while also minimizing bank erosion. These efforts would continue to reduce some adverse impacts on local hydrology and thus would continue offer limited, localized beneficial effects on hydrology.

> Overall, alternative A would continue to have ongoing, long-term adverse effects on hydrology. The continued use and maintenance of previous alterations to the landscape (i.e., roads, parking areas, trails, and other developments) would continue to impede and alter the natural hydrology of the project area. The most notable adverse effect would continue to relate to Moose-Wilson Road's effect on the natural flow patterns, as the road generally runs perpendicular to the natural northwest-to-southeast surface flow patterns in the corridor. The most affected local hydrology in the project area would be the drainage and wetland connectivity between Sawmill Ponds Overlook and Death Canyon Road.

Cumulative Effects. A variety of other past, ongoing, and reasonably foreseeable future actions have and would continue to alter hydrology within and outside the project area.

Past construction and maintenance of park infrastructure has altered hydrology inside the project area. These facilities include NPS and other federal infrastructure (e.g., roads, trails, bridges, the network of numerous irrigation ditches, the US Army Corps of Engineers levee system, entrance stations and fee collection kiosks, parking lots and turnouts, restrooms, trailheads, etc.). These facilities have and would continue to alter natural surface flow patterns, run-off volumes and velocities, as well as groundwater flow in areas. Outside the project area, other NPS and non-NPS actions also have and would continue to alter hydrology. These actions include improvements being made in the Jenny Lake area, development of multiuse pathways outside the project area, construction of planned residential and commercial developments, such as the Teton Village expansion. Most notably, the construction and operation of the Jackson Lake Dam from 1907 to present and the management of irrigation ditches and diversion structures by water rights owners continue to have substantial impacts, particularly to the natural flow regime of the Snake River. Collectively, all of the these built features have and would continue to have substantial, adverse effects on the natural hydrology in the region.

When the effects of alternative A are added to these other past, ongoing, and reasonably foreseeable future effects, there would be the potential for a substantial, long-term, cumulative adverse effect on the hydrology in the area. However, the incremental effect of alternative A effects being added to the above adverse effects would be relatively small.

Conclusion. Alternative A would continue to have ongoing long-term, adverse effects on hydrology. The continued use and maintenance of previous alterations to the landscape (i.e., roads, parking areas, trails, and other developments) would continue to impede and alter the natural hydrology of the project area. The most notable adverse effect would continue to relate to Moose-Wilson Road's effect on the natural flow patterns, as the road generally runs perpendicular to the natural northwest-to-southeast surface flow patterns in the corridor. The most affected local hydrology in the project area would be the drainage and wetland connectivity between Sawmill Ponds Overlook and Death Canyon Road. However, although the most notable adverse effects to hydrology would continue to be substantial in the area between Sawmill Ponds Overlook and Death Canyon Road, given the somewhat localized nature of these effects relative to the project area's overall hydrological regime, the continuing adverse impacts on hydrology under alternative A would not likely be significant.

When the effects of alternative A are added to the other past, ongoing, and reasonably foreseeable future effects on hydrology in the area, there would be the potential for a substantial, long-term, cumulative adverse effect on the hydrology in the area. However, the incremental effect of adding alternative A effects to the above adverse effects described in the cumulative impact section would be relatively small.

Alternative B

Traffic Management along Moose-Wilson Road. Under alternative B, traffic management strategies would include the provision of traveler alerts, reduction of speed limit, and restriction of through traffic during peak use periods via the use of gate system in the LSR Preserve. Most of these management strategies would be generally inconsequential to stream hydrology and natural hydrological flow patterns, volumes, and velocities (surface and groundwater). However, the proposed gate system in the LSR Preserve would necessitate the development of a new access road and parking lot arrangement on either side of the gate to accommodate vehicles when the gate is closed. These developments may alter adjacent wetland hydrology given the change in flow patterns. Additionally, new impervious surfaces from a paved surface would reduce infiltration to groundwater, increase runoff volumes and velocities, and alter flow patterns (altering downstream hydrology, soil erosion, and sedimentation). Groundwater flows along and across these new impervious surfaces may also be adversely affected by soil compaction from construction activities. The new access road and parking reconfiguration would have localized, short-term and long-term, adverse effects on surface water hydrology.

Physical Characteristics of Moose-Wilson Road. Under alternative B, some physical characteristics of Moose-Wilson Road would be modified. One of the most notable changes to physical characteristics, as it relates to hydrology, would be the paving of the 1.4-mile segment of currently unpaved roadway. As a result of this action, some adverse effects could be realized due to the increase of impervious surfaces, including the reduction of surface water infiltration into the groundwater through the inability of the water to penetrate the paved surface; the increase of surface runoff volumes and velocities; and the potential alteration of surface flow patterns as water would likely be channeled into a ditch off the paved roadway and released downstream farther away from its natural flow pattern. This adverse effect would be relatively minor compared to the existing altered hydrology from the unpaved, but compacted, gravel road. It would also only be realized in the upstream and downstream vicinity of the 1.4-mile stretch that would be paved.

Moose-Wilson Road Realignment. Two large-scale realignments of Moose-Wilson Road would also occur under alternative B, resulting in both beneficial and adverse impacts on hydrology. Most notably, the southern realignment between the Death Canyon Road junction and the Sawmill Ponds Overlook, construction of appropriate drainage features, and the restoration of the current road alignment would remove a major impediment to the natural hydrological conditions in this area of the corridor. Under this alternative, the Reserve Creek and Stewart Draw drainages would be reconnected with the downstream wetland complex. This action would result in substantial long-term, beneficial effects by restoring surface and groundwater hydrology patterns, which would also benefit wetland functions and aquatic habitat connectivity, particularly in the vicinity of the wetland complex to the southwest of Sawmill Ponds Overlook.

Also under alternative B, a realignment of the northernmost segment of Moose-Wilson Road would occur, along with a relocation of the Moose Entrance Station, realignment of the four-way intersection with Teton Park Road, and construction of appropriate drainage features. These realignment and development changes would remove Moose-Wilson Road from its current proximity to the Snake River riparian corridor. However, the beneficial effects of this northern realignment would be very minor compared to the beneficial hydrological effects from the southern realignment.

The northern and southern realignments under alternative B would also have some adverse effects on hydrology. Although proposed bridges along the newly realigned segments of the road would maintain natural stream hydrology, both realignments would have long-term effects on local surface hydrology and natural flow patterns (e.g., sheetflow to channelized flow) in previously undisturbed areas and alter adjacent wetland hydrology given the change in flow patterns. Additionally, new impervious surfaces from a paved surface would reduce infiltration to groundwater, increase runoff volumes and velocities, and alter flow patterns (altering downstream hydrology, soil erosion, and sedimentation). Groundwater flows along and across new alignment areas may also be adversely affected by soil compaction from construction activities. Given the length of the two realignment sections, these alterations to local hydrology would be considerable. Additionally, limited, short-term, adverse impacts on surface hydrology would result from construction activities related to the road realignments, primarily related to temporary alterations in local drainage patterns to accommodate construction activities, construction staging, etc. Lastly, as described under alternative A and despite the two realignments under this alternative, the overall alignment of the entire Moose-Wilson Road would continue to have some long-term, adverse impacts on the natural hydrological system of the corridor because Moose-Wilson Road generally runs perpendicular to the corridorwide flow pattern, and thus continues to alter surface sheetflow in many areas.

However, overall, from a hydrological perspective, the beneficial effects of these two road realignments (noted above) outweigh these adverse effects of two new alignments due to the importance of restoring hydrological connectivity to this unique and important drainage corridor and its other ecological values. Given the importance of these natural system values, the proposed realignments under this alternative (most notably the southern realignment) would greatly benefit the Aquatic Resources fundamental resource and value. Compared to the other alternatives, this would have the greatest beneficial effect on hydrology within the Moose-Wilson corridor.

Turnouts and Parking. In alternative B, officially designated parking turnouts would be constructed along Moose-Wilson Road to accommodate up to 120 vehicles. The new impervious surfaces from the parking turnouts, as well as the reconfiguration of access and parking at LSR Preserve (see traffic management section above), would result in notable, long-term, adverse impacts on localized hydrology through the reduction of infiltration to groundwater, increase of surface runoff volumes and velocities, and alterations of natural flow patterns. Additionally, limited short-term adverse impacts on surface hydrology would result from construction activities related to parking lot and turnout construction, primarily related to temporary alterations in local drainage patterns to accommodate construction activities, construction staging, etc.

Bicycle Use. Under alternative B, cyclists would continue to share Moose-Wilson Road with motor vehicle traffic, though the transition from the existing multiuse pathways on the south and north ends of the corridor would be facilitated, and road markers and bike facilities such as bike racks would be provided. Bike use on Moose-Wilson Road and other roads would continue to be nearly inconsequential to hydrology.

Commercial Activity. Authorized commercial activity would continue to be allowed and administered under alternative B, with some modifications from current management. However, these activities would be nearly inconsequential to stream hydrology and natural hydrological flow patterns, volumes, and velocities (surface and groundwater).

Death Canyon. Under alternative B, the Death Canyon Trailhead would be relocated approximately 0.4 mile from its current location, with the abandoned section of the trailhead access road converted to a trail. A parking lot would be constructed to provide parking for approximately 60 vehicles. The compacted surface of the new parking area would reduce infiltration to groundwater and increase runoff volumes and velocities. Flow patterns through and around the newly graded parking area would also be altered, with drainage diversions converting some localized sheetflow to channelized flow. Additionally, limited short-term, adverse impacts on surface hydrology would result from construction activities for the new Death Canyon Trailhead, relocation of restroom, and parking lot, primarily related to temporary alterations in local drainage patterns to accommodate construction activities, construction staging, etc.

Winter Access and Use. Winter access and use would continue to be allowed under alternative B and the unplowed length of Moose-Wilson Road would be lengthened from the Granite Canyon Trailhead to the Murie Ranch Road junction. These continuing and new winter use management strategies under alternative B would be relatively inconsequential to stream hydrology and natural hydrological flow patterns, volumes, and velocities (surface and groundwater).

Visitor Use and Experience / Education and Interpretation. Visitor services, uses, and experiences would continue to be allowed and administered under alternative B, with some modifications from current management. However, these activities would be nearly inconsequential to stream hydrology and natural hydrological flow patterns, volumes, and velocities (surface and groundwater).

Horse Use. Horse use would continue to be allowed and administered under alternative B, with some modifications from current management. However, these activities would be nearly inconsequential to stream hydrology and natural hydrological flow patterns, volumes, and velocities (surface and groundwater).

Best Management Practices, Monitoring Guidelines, and Mitigation Measures. As part of this alternative, the park would implement best management practices, monitoring guidelines, and impact mitigation to protect the area's hydrological resources. In alternative B, the park would continue and possibly enhance the current ongoing monitoring programs in place by park staff and partners. For example, the park would continue to monitor human use areas for signs of disturbance to water features and associated native vegetation. The park would also aim to reduce erosion, sedimentation, and compaction, and to control surface runoff from parking areas, roads, stormwater sewer outfalls, and other ground-disturbing activities, thereby reducing adverse impacts on hydrology as a result of actions of alternative B. For example, where stream and river channels cross of flow along roads, trails, or other human created features, the park would continue to seek solutions that allow the continuation of natural river processes, while also minimizing bank erosion. One example includes placing limits on ground-disturbing activities in the vicinity of wetlands and streambanks and clearly delineating boundaries with temporary fencing. If development is performed, streambanks and other hydrological features would be returned to their natural contours to the extent possible. All of these best management practices, monitoring guidelines, and mitigation measures would result in long-term beneficial effects on hydrological resources, as they would collectively minimize adverse effects from other proposed actions and ongoing future uses.

> Overall, the proposed management strategies under alternative B would have both beneficial and adverse impacts on hydrology within the Moose-Wilson corridor. The most notable beneficial effects on hydrology would relate to the removal of a major impediment to the natural hydrological system in the vicinity of the wetland complex between the Sawmill Ponds Overlook and Death Canyon Road. The natural hydrological connectivity of this wetland complex with the uplands to the west (Reserve Creek and Steward Draw drainages) would be restored via the southern realignment of Moose-Wilson Road. Not only would this action restore surface and groundwater flow patterns, but it would also benefit wetland functions and aquatic systems to the east of the existing road alignment. This would result in substantial, beneficial impacts on hydrology and would support the Aquatic Resources fundamental resource and value of the corridor. Another notable beneficial effect would involve the restoration of approximately 0.4-mile of Death Canyon Road. The adverse impacts of alternative B would primarily result from increases of impervious surfaces from paving and alterations to natural flow patterns in previously undisturbed areas where parking and roads are developed (most notably the two realignments of Moose-Wilson Road). Short-term, adverse impacts on local hydrology would also result from construction activities associated with these developments.

Cumulative Effects. A variety of other past, ongoing, and reasonably foreseeable future actions have and would continue to alter hydrology within and outside the project area.

Past construction and maintenance of park infrastructure has altered hydrology inside the project area. These facilities include NPS and other federal infrastructure (e.g., roads, trails, bridges, the network of numerous irrigation ditches, the US Army Corps of Engineers levee system, entrance stations and fee collection kiosks, parking lots and turnouts, restrooms, trailheads, etc.). These facilities have and would continue to alter natural surface flow patterns, run-off volumes and velocities, as well as groundwater flow in areas. Outside the project area, other NPS and non-NPS actions also have and would continue to alter hydrology. These actions include improvements being made in the Jenny Lake area, development of multiuse pathways outside the project area, construction of planned residential and commercial developments, such as the Teton Village expansion. Most notably, the construction and operation of the Jackson Lake Dam from 1907 to present and the management of irrigation ditches and diversion structures by water rights owners continue to have substantial impacts, particularly to the natural flow regime of the Snake River. Collectively, all of the built features have and would continue to have substantial, adverse effects on the natural hydrology in the region.

When the effects of alternative B are added to these other past, ongoing, and reasonably foreseeable future effects, there would be the potential for a substantial, long-term, cumulative adverse effect on the hydrology in the area. However, the incremental effect of alternative B effects being added to the above adverse effects would be small and mostly beneficial due to the road realignment around wetlands and associated hydrology.

Conclusion. Alternative B would have both beneficial and adverse impacts on hydrology within the Moose-Wilson corridor. The most notable beneficial effects on hydrology would relate to the removal of a major impediment to the natural hydrological system in the vicinity of the wetland complex between the Sawmill Ponds Overlook and Death Canyon Road. The natural hydrological connectivity of this wetland complex with the uplands to the west (Reserve Creek and Stewart Draw drainages) would be restored via the southern realignment of Moose-Wilson Road. Not only would this action restore surface and groundwater flow patterns, but it would also benefit wetland functions and aquatic systems to the east of the existing road alignment. This would result in substantial, beneficial impacts on hydrology and would greatly benefit the Aquatic Resources fundamental resource and value of the corridor. Another notable beneficial effect would involve the restoration of approximately 0.4-mile of Death Canyon Road. The adverse impacts of alternative B would primarily result from increases of impervious surfaces from paving and alterations to natural flow patterns in previously undisturbed areas where parking and roads are developed (most notably the two realignments of Moose-Wilson Road). Short-term, adverse impacts on local hydrology would also result from construction activities associated with these developments. The most notable effects on hydrology under this alternative (from increases of impervious surfaces and alterations to natural flow patterns in previously undisturbed areas where parking and roads are developed) would not likely be significant due to the relatively localized nature of the effects on hydrology (i.e., in the area immediately surrounding the two realignments of Moose-Wilson Road, the Death Canyon parking area, and adjacent areas).

When the effects of alternative B are added to the other past, ongoing, and reasonably foreseeable future effects in the area, there would be the potential for a substantial, long-term, cumulative adverse effect on the hydrology. However, the incremental effect of alternative B effects being added to these other adverse effects would be small and mostly beneficial due to the road realignment around wetlands and associated hydrology.

Alternative C (NPS Preferred)

Traffic Management along Moose-Wilson Road. Under alternative C, traffic management strategies would include the provision of traveler alerts, reduction of speed limit, and limiting the number of vehicles entering the corridor at any one time during peak use periods through timed sequencing techniques. These management strategies would be relatively inconsequential to stream hydrology and natural hydrological flow patterns, volumes, and velocities (surface and groundwater).

Physical Characteristics of Moose-Wilson Road. Under alternative C, some physical characteristics of Moose-Wilson Road would be modified. One of the most notable changes to physical characteristics, as it relates to hydrology, would be the paving of the 1.4-mile segment of currently unpaved roadway. As a result of this action, some adverse effects could be realized due to the increase of impervious surfaces, including the reduction of surface water infiltration into the groundwater through the inability of the water to penetrate the paved surface; the increase of surface runoff volumes and velocities; and the potential alteration of surface flow patterns as water would likely be channeled into a ditch off the paved roadway and released downstream farther away from its natural flow pattern. This adverse effect would be relatively minor compared to the existing altered hydrology from the unpaved, but compacted, gravel road. It would also only be realized in the upstream and downstream vicinity of the 1.4-mile stretch that would be paved.

Moose-Wilson Road Realignment. The realignment of the northernmost segment of Moose-Wilson Road and the reconstruction of the segment between Sawmill Ponds Overlook and Death Canyon Road in alternative C would result in both beneficial and adverse impacts on hydrology. Most notably, the reconstruction of the portion of the road between Sawmill Ponds Overlook and the Death Canyon Road (~1.5 miles) adjacent to the wetlands to correct drainage issues and improve road conditions, and the construction of appropriate drainage features, would alleviate some impediments to the natural hydrological conditions in this area of the corridor. This action would result in notable long-term, beneficial effects by improving and/or restoring surface and groundwater hydrology flow patterns associated with the Reserve Creek and Stewart Draw drainages, which would also benefit wetland functions and aquatic habitat connectivity, particularly in the vicinity of the wetland complex to the south and southwest of Sawmill Ponds Overlook. However, this reconstruction would not provide the same benefits to hydrology as the full realignment of this segment would, as called for in alternatives B and D.

Also under alternative C, a realignment of the northernmost segment of Moose-Wilson Road would occur, along with a relocation of the Moose Entrance Station, realignment of the four-way intersection with Teton Park Road, and construction of appropriate drainage features. These realignment and development changes would remove Moose-Wilson Road from its current proximity to the Snake River riparian corridor. As a result, some localized hydrological flow patterns would be restored in the areas along the existing alignment through the riparian zone.

The northern realignment and southern reconstruction under alternative C would also have some adverse effects on hydrology. The northern realignment would have relatively appreciable, long-term, adverse effects on localized surface hydrology and natural flow patterns (e.g., sheetflow to channelized flow) in previously undisturbed areas given the changes in flow patterns caused by the road structure. There is potential for some limited adverse effects to local hydrology through alteration of flow pattern if regrading and long-term stabilization of the hillside to the west of the road is necessary to accommodate drainage improvements. These potential adverse effects depend on site-specific hydrologic factors (e.g., seep/spring locations) and road improvement design. Additionally, new impervious surfaces from the paved surface would reduce infiltration to groundwater, increase runoff volumes and velocities, and alter flow patterns (altering downstream hydrology, soil erosion, and sedimentation). Groundwater flows along and across the new alignment area could also be adversely affected by soil compaction from construction activities. Additionally, limited, short-term adverse impacts on local surface hydrology would result from construction activities related to the northern road realignment as well as the southern reconstruction area between Sawmill Ponds Overlook and Death Canyon Road, primarily related to temporary alterations in local drainage patterns to accommodate construction activities, construction staging, etc. Lastly, as described under alternative A and despite the northern realignment under this alternative, the overall alignment of the entire Moose-Wilson Road would continue to have some long-term, adverse impacts on the natural hydrological system of the corridor because Moose-Wilson Road generally runs perpendicular to the corridor wide flow pattern, and thus continues to alter surface sheetflow in many areas.

However, overall, from a hydrological perspective, the beneficial effects of the northern road realignment and southern road reconstruction (noted above) outweigh the adverse effects due to the importance of improving some of the hydrological connectivity to this unique and important drainage corridor and its other ecological values. However, the improvement of hydrological conditions under alternative C would not be to the extent provided by the southern road realignment in alternatives B and D.

Turnouts and Parking. Under alternative C, officially designated parking turnouts would be constructed along Moose-Wilson Road to accommodate up to 120 vehicles. The new impervious surfaces from the parking would result in relatively minor, long-term, adverse impacts on localized hydrology through the reduction of infiltration to groundwater, increase of surface runoff volumes and velocities, and alterations of natural flow patterns. Additionally, very limited and localized short-term adverse impacts on surface hydrology would result from construction activities related to parking and turnout construction, primarily related to temporary alterations in local drainage patterns to accommodate construction activities, construction staging, etc. The installation of a vault toilet at Granite Canyon Trailhead, and potentially at both the north and south corridor entrances, would be done within existing disturbed areas, resulting in very limited and localized adverse impacts on hydrology.

Bicycle Use. Under alternative C, cyclists would continue to share Moose-Wilson Road with motor vehicle traffic and the transition from the existing multiuse pathways on the south and north ends of the corridor would be facilitated, along with the paving of the unpaved portion of Moose-Wilson Road. Bike use on Moose-Wilson Road and other roads would continue to be nearly inconsequential to hydrology.

Commercial Activity. Authorized commercial activity would continue to be allowed and administered under alternative C, with some modifications from current management. However, these activities would be nearly inconsequential to stream hydrology and natural hydrological flow patterns, volumes, and velocities (surface and groundwater).

Death Canyon. In alternative C, the Death Canyon Trailhead and parking area would be relocated downhill to the southeast approximately 1.0 mile from its current location, with the abandoned section of the trailhead access road converted to a trail. A new parking lot would be constructed to provide parking for approximately 80 to 90 vehicles at the new trailhead location. The restoration of portions of the existing road and parking area would have minor, long-term beneficial effects on local hydrology by allowing the restoration of local surface flow patterns in these areas. However, minor, localized, long-term, adverse effects would result from the compacted surface of the new, larger parking area that would reduce infiltration to groundwater and increase runoff volumes and velocities. Flow patterns through and around the newly graded parking area would also be altered, with drainage diversions converting some localized sheetflow to channelized flow. Additionally, limited short-term, adverse impacts on surface hydrology would result from construction activities for the new Death Canyon Trailhead, relocation of restroom, and parking lot, primarily related to temporary alterations in local drainage patterns to accommodate construction activities, construction staging, etc.

Winter Access and Use. Winter access and use would continue to be allowed under alternative C and the unplowed length of Moose-Wilson Road would remain between Granite Canyon Trailhead and the Death Canyon Road junction. These continuing and new winter use management strategies under alternative C would be relatively inconsequential to stream hydrology and natural hydrological flow patterns, volumes, and velocities (surface and groundwater).

Visitor Use and Experience / Education and Interpretation. Visitor services, uses, and experiences would continue to be allowed and administered under alternative C, with some modifications from current management. However, these activities would be nearly inconsequential to stream hydrology and natural hydrological flow patterns, volumes, and velocities (surface and groundwater).

Horse Use. Horse use would continue to be allowed and administered under alternative C, with some modifications from current management. However, these activities would be nearly inconsequential to stream hydrology and natural hydrological flow patterns, volumes, and velocities (surface and groundwater).

Best Management Practices, and Monitoring Guidelines, and Mitigation Measures. As part of this alternative, the park would implement best management practices, monitoring guidelines, and mitigation to protect the area's hydrological resources. In alternative C, the park would continue and possibly enhance the current ongoing monitoring programs in place by park staff and partners. For example, the park would continue to monitor human use areas for signs of disturbance to water features and associated native vegetation. The park would also aim to reduce erosion, sedimentation, and compaction, and to control surface runoff from parking areas, roads, stormwater sewer outfalls, and other ground-disturbing activities, thereby reducing adverse impacts on hydrology as a result of actions of alternative C. For example, where stream and river channels cross or flow along roads, trails, or other human created features, the park would continue to seek solutions that allow the continuation of natural river processes, while also minimizing bank erosion. One example includes placing limits on ground-disturbing activities in the vicinity of wetlands and streambanks and clearly delineating boundaries with temporary fencing. If development is performed, streambanks and other hydrological features would be returned to their natural contours to the extent possible. All of these best management practices, monitoring guidelines, and mitigation measures would result in long-term beneficial effects on hydrological resources, as they would collectively minimize adverse effects from other proposed actions and ongoing future uses.

Overall, the proposed management strategies under alternative C would have both beneficial and adverse impacts on hydrology within the Moose-Wilson corridor. The most notable beneficial effects on hydrology would relate to the reconstruction of Moose-Wilson Road between Sawmill Ponds Overlook and Death Canyon Road to improve drainage conditions and restore some aspects of hydrological connectivity between the Reserve Creek and Stewart Draw drainages and the downstream wetlands. This action would also benefit the wetland hydrology downstream (to the east) of the road alignment. This would result in considerable, long-term, beneficial impacts on hydrology. However, the improvement of hydrological conditions under alternative C would not be to the extent provided by the southern road realignment in alternatives B and D. Another notable beneficial effect would involve the restoration of approximately 1.0-mile of Death Canyon Road. The adverse impacts of alternative C would primarily result from increases of impervious surfaces (e.g., road paving), alterations to local surface hydrology and natural flow patterns in previously undisturbed areas where road and parking development occurs (e.g., northern realignment, Death Canyon parking area), potential regrading and long-term stabilization of the hillside to the west of the road, and short-term impacts resulting from construction activities.

Cumulative Effects. A variety of other past, ongoing, and reasonably foreseeable future actions have and would continue to alter hydrology within and outside the project area.

Past construction and maintenance of park infrastructure has altered hydrology inside the project area. These facilities include NPS and other federal infrastructure (e.g., roads, trails, bridges, the network of numerous irrigation ditches, the US Army Corps of Engineers levee system, entrance stations and fee collection kiosks, parking lots and turnouts, restrooms, trailheads, etc.). These facilities have and would continue to alter natural surface flow patterns, run-off volumes and velocities, as well as groundwater flow in areas. Outside the project area, other NPS and non-NPS actions also have and would continue to alter hydrology. These actions include improvements being made in the Jenny Lake area, development of multiuse pathways outside the project area, construction of planned residential and commercial developments, such as the Teton Village expansion. Most notably, the construction and operation of the Jackson Lake Dam from 1907 to present and the management of irrigation ditches and diversion structures by water rights owners continue to have substantial impacts, particularly to the natural flow regime of the Snake River. Collectively, all of the built features have and would continue to have substantial, adverse effects on the natural hydrology in the region.

When the effects of alternative C are added to these other past, ongoing, and reasonably foreseeable future effects, there would be the potential for a substantial, long-term, cumulative adverse effect on the hydrology in the area. However, the incremental effect of alternative C effects being added to the above adverse effects would be small and mostly beneficial due to the road realignment around wetlands.

Conclusion. Alternative C would have both beneficial and adverse impacts on hydrology within the Moose-Wilson corridor. The most notable beneficial effects on hydrology would relate to the reconstruction of Moose-Wilson Road between Sawmill Ponds Overlook and Death Canyon Road to improve drainage conditions and restore some aspects of hydrological connectivity between the Reserve Creek and Stewart Draw drainages and the downstream wetlands. This action would also benefit the wetland hydrology downstream (to the east) of the road alignment. This would result in considerable, long-term, beneficial impacts on hydrology. However, the improvement of hydrological conditions under alternative C would not be to the extent provided by the southern road realignment in alternatives B and D. Another notable beneficial effect would involve the restoration of approximately 1.0 mile of Death Canyon Road. The adverse impacts of alternative C would primarily result from increases of impervious surfaces (e.g., road paving), alterations to local surface hydrology and natural flow patterns in previously undisturbed areas where road and parking development occurs (e.g., northern realignment, Death Canyon parking area), potential regrading and long-term stabilization of the hillside to the west of the road, and short-term impacts resulting from construction activities. The most notable effects on hydrology under this alternative (from increases of impervious surfaces and alterations to natural flow patterns in previously undisturbed areas where parking and roads are developed) would not likely be significant due to the relatively localized nature of the effects on hydrology (i.e., in the area immediately surrounding the northern realignment of Moose-Wilson Road, the Death Canyon parking area, and adjacent areas).

When the effects of alternative C are added to the other past, ongoing, and reasonably foreseeable future effects in the area, there would be the potential for a considerable, long-term, cumulative adverse effect on the hydrology. However, the incremental effect of alternative C effects being added to these other adverse effects would be small and mostly beneficial due to the reconstruction of the existing road to improve hydrological connectivity.

Alternative D

Traffic Management along Moose-Wilson Road. Under alternative D, traffic management strategies would include the provision of traveler alerts and establishment of a reservation system during peak use periods. These management strategies would be relatively inconsequential to stream hydrology and natural hydrological flow patterns, volumes, and velocities (surface and groundwater).

Physical Characteristics of Moose-Wilson Road. In alternative D, the unpaved section of the road would remain unpaved and would be graded and treated for dust abatement several times per year. The continuing effects of this unpaved segment on local hydrology would be quite minor and primarily only relate to altered natural hydrological flow patterns, volumes, and velocities due to the compacted gravel surface (less pervious) and channelized surface flows.

Moose-Wilson Road Realignment. Two large-scale realignments of Moose-Wilson Road would also occur under alternative D, resulting in both beneficial and adverse impacts on hydrology. Most notably, the southern realignment between the Death Canyon Road junction and the Sawmill Ponds Overlook, construction of appropriate drainage features, and the restoration of the current road alignment would remove a major impediment to the natural hydrological conditions in this area of the corridor. Under this alternative, the Reserve Creek and Stewart Draw drainages would be reconnected with the downstream wetland complex. This action would result in substantial long-term, beneficial effects by restoring surface and groundwater hydrology patterns, which would also benefit wetland functions and aquatic habitat connectivity, particularly in the vicinity of the wetland complex to the southwest of Sawmill Ponds Overlook.

Also under alternative D, a realignment of the northernmost segment of Moose-Wilson Road would occur, along with a relocation of the Moose Entrance Station, realignment of the four-way intersection with Teton Park Road, and construction of appropriate drainage features. These realignment and development changes would remove Moose-Wilson Road from its current proximity to the Snake River riparian corridor. However, the beneficial effects of this northern realignment would be very minor compared to the beneficial hydrological effects from the southern realignment.

The northern and southern realignments under alternative D would also have some adverse effects on hydrology. Although proposed bridges along the newly realigned segments of the road would maintain natural stream hydrology, both realignments would have long-term effects on local surface hydrology and natural flow patterns (e.g., sheetflow to channelized flow) in previously undisturbed areas and alter adjacent wetland hydrology given the change in flow patterns. Additionally, new impervious surfaces from a paved surface would reduce infiltration to groundwater, increase runoff volumes and velocities, and alter flow patterns (altering downstream hydrology, soil erosion, and sedimentation). Groundwater flows along and across new alignments areas may also be adversely affected by soil compaction from construction activities. Given the length of the two realignment sections, these alterations to local hydrology would be considerable. Additionally, limited, short-term, adverse impacts on surface hydrology would result from construction activities related to the road realignments, primarily related to temporary alterations in local drainage patterns to accommodate construction activities, construction staging, etc. Lastly, as described under alternative A and despite the two realignments under this alternative, the overall alignment of the entire Moose-Wilson Road would continue to have some long-term, adverse impacts on the natural hydrological system of the corridor because Moose-Wilson Road generally runs perpendicular to the corridor wide flow pattern, and thus continues to alter surface sheetflow in many areas.

However, overall, from a hydrological perspective, the beneficial effects of these two road realignments (noted above) outweigh these adverse effects of two new alignments due to the importance of restoring hydrological connectivity to this unique and important drainage corridor and its other ecological values. Given the importance of these natural system values, the proposed realignments under this alternative (most notably the southern realignment) would greatly benefit the Aquatic Resources fundamental resource and value. Similar to alternative B, this would have the substantial beneficial effect on hydrology within the Moose-Wilson corridor. However, the proposed pathway under this alternative (analyzed below) would considerably offset some of these realignment benefits.

Turnouts and Parking. In alternative D, officially designated parking turnouts would be constructed along Moose-Wilson Road to accommodate up to 120 vehicles. The new impervious surfaces from the parking would result in relatively minor, long-term, adverse impacts on localized hydrology through the reduction of infiltration to groundwater, increase of surface runoff volumes and velocities, and alterations of flow patterns. The installation of a vault toilet at Sawmill Ponds Overlook and Granite Canyon Trailhead would be done within an existing disturbed area, resulting in very limited and localized adverse impacts on hydrology. Additionally, limited short-term adverse impacts on surface hydrology would result from construction activities related to parking lot and turnout construction, primarily related to temporary alterations in local drainage patterns to accommodate construction activities, construction staging, etc.

Bicycle Use. Relative to the current level and area of effect on hydrology from bicycle and pedestrian uses in the in the corridor, the proposed multiuse pathway under alternative D would cause a substantial increase in adverse effects on hydrology. The main source for this impact would be the introduction of a second primary development corridor (i.e., multiuse pathway) through the entire project area that parallels the existing and realigned Moose-Wilson corridor. Although proposed bridges along the proposed pathway would maintain natural stream hydrology, the new pathway would have substantial, long-term effects on local surface hydrology and natural flow patterns in most other previously undisturbed areas (e.g., converting sheetflow to channelized flow). Despite being aligned relatively parallel to the existing and realigned Moose-Wilson corridor, the pathway would be offset up to 150 feet from the road. This means that surface and groundwater flows would be altered by two development impediments in sequence as waters generally flow through the project area from northwest to southeast (toward the Snake River).

Additionally, new impervious surfaces from a paved surface would reduce infiltration to groundwater, increase runoff volumes and velocities, and alter flow patterns (altering downstream hydrology, soil erosion, and sedimentation). Groundwater flows along and across the pathway alignment could also be adversely affected by soil compaction resulting from the new, overlying pathway structure and initial construction activities. Additionally, notable, short-term, adverse impacts on surface hydrology would result from construction activities related to the pathway development, primarily related to temporary alterations in local drainage patterns to accommodate construction activities, construction staging, etc.

Collectively, the proposed multiuse pathway under alternative D would result in a substantial increase in hydrological alterations in the corridor and for most of the length of the corridor. This effect would notably diminish the quality and integrity of the Aquatic Resources fundamental resource and value.

Commercial Activity. Authorized commercial activity would continue to be allowed and administered under alternative D, with some modifications from current management. However, these activities would be nearly inconsequential to stream hydrology and natural hydrological flow patterns, volumes, and velocities (surface and groundwater).

Death Canyon. In alternative D, the Death Canyon Trailhead and parking area would remain in its current location but be enlarged considerably to accommodate 100 vehicles. A notable portion of the existing Death Canyon Road would be removed and restored. Also, a new 0.4-mile connector road between the trailhead and White Grass Ranch would be developed. The restoration of portions of the existing Death Canyon Road (i.e., by consolidating road use onto White Grass Ranch Road) would have considerable, long-term, beneficial effects on local hydrology by allowing the restoration of local surface flow patterns in these areas. However, various localized, long-term, adverse effects would also result from these actions. Surface flow patterns through and around the new, notably larger parking area and along the new connector road with White Grass Ranch would also be altered, with drainage diversions converting localized sheetflow to channelized flow. Also, the compacted surface of the new parking area and the new connector road would reduce infiltration to groundwater and increase runoff volumes and velocities. Additionally, limited short-term, adverse impacts on surface hydrology would result from construction activities for all of these improvements, primarily related to temporary alterations in local drainage patterns to accommodate construction activities, construction staging, etc.

Winter Access and Use. Winter access and use would continue to be allowed under alternative D and the unplowed length of Moose-Wilson Road would be lengthened from the Granite Canyon Trailhead to the Sawmill Ponds Overlook. These continuing and new winter use management strategies under alternative D would be nearly inconsequential to stream hydrology and natural hydrological flow patterns, volumes, and velocities (surface and groundwater).

Visitor Use and Experience / Education and Interpretation. Visitor services, uses, and experiences would continue to be allowed and administered under alternative D, with some modifications from current management. However, these activities would be nearly inconsequential to stream hydrology and natural hydrological flow patterns, volumes, and velocities (surface and groundwater). Additionally, short- and long-term, limited adverse impacts on surface hydrology (i.e., impeding natural flow patterns) would result from construction activities and establishment of two wildlife viewing areas and associated short nature trails.

Horse Use. Horse use would continue to be allowed and administered under alternative D, with some modifications from current management. However, these activities would be nearly inconsequential to stream hydrology and natural hydrological flow patterns, volumes, and velocities (surface and groundwater).

Best Management Practices, and Monitoring Guidelines, and Mitigation Measures. As part of this alternative, the park would implement best management practices, monitoring guidelines, and mitigation to protect the area's hydrological resources. In alternative D, the park would continue and possibly enhance the current ongoing monitoring programs in place by park staff and partners. For example, the park would continue to monitor human use areas for signs of disturbance to water features and associated native vegetation. The park would also aim to reduce erosion, sedimentation, and compaction, and to control surface runoff from parking areas, roads, stormwater sewer outfalls, and other ground-disturbing activities, thereby reducing adverse impacts on hydrology as a result of actions of alternative D. For example, where stream and river channels cross of flow along roads, trails, or other human created features, the park would continue to seek solutions that allow the continuation of natural river processes, while also minimizing bank erosion. One example includes placing limits on ground-disturbing activities in the vicinity of wetlands and streambanks and clearly delineating boundaries with temporary fencing. If development is performed, streambanks and other hydrological features would be returned to their natural contours to the extent possible. All of these best management practices, monitoring guidelines, and mitigation measures would result in long-term beneficial effects on hydrological resources, as they would collectively minimize adverse effects from other proposed actions and ongoing future uses.

> Overall, the proposed management strategies under alternative D would have both beneficial and adverse impacts on hydrology within the Moose-Wilson corridor. The most notable beneficial effects on hydrology would relate to the removal of a major impediment to the natural hydrological system in the vicinity of the wetland complex between the Sawmill Ponds Overlook and Death Canyon Road. The natural hydrological connectivity of this wetland complex with the uplands to the west (Reserve Creek and Steward Draw drainages) would be restored via the southern realignment of Moose-Wilson Road. Not only would this action restore surface and groundwater flow patterns, but it would also benefit wetland functions and aquatic systems to the east of the existing road alignment. This would result in substantial, long-term beneficial impacts on hydrology. Another notable beneficial effect would involve the restoration of a large portion of Death Canyon Road. However, conversely, the development of a second transportation corridor through the project area (i.e., the multiuse pathway) would have a substantial, long-term, adverse effect on the local hydrological system by introducing a second impediment to natural surface flows for the length of the corridor (e.g., converting sheetflows to channelized flows). Other adverse impacts of alternative D would primarily result from increases of impervious surfaces (pathway, turnouts, etc.) and other alterations to natural flow patterns in previously undisturbed areas where parking and roads are developed (most notably the two realignments of Moose-Wilson Road and the road improvements in the Death Canyon Trailhead area). Short-term, adverse impacts on local hydrology would also result from construction activities associated with these developments. Although the southern Moose-Wilson Road realignment would greatly benefit the Aquatic Resources fundamental resource and value of the corridor, the effects of the proposed pathway would conversely diminish the quality and integrity of this fundamental resource and value. The action of adding a multiuse pathway, acting as a second development impediment to surface and groundwater flows for the entire length of the corridor, represent the most substantial adverse impact to hydrology described in the range of alternatives.

Cumulative Effects. A variety of other past, ongoing, and reasonably foreseeable future actions have and would continue to alter hydrology within and outside the project area.

Past construction and maintenance of park infrastructure has altered hydrology inside the project area. These facilities include NPS and other federal infrastructure (e.g., roads, trails, bridges, the network of numerous irrigation ditches, the US Army Corps of Engineers levee system, entrance stations and fee collection kiosks, parking lots and turnouts, restrooms, trailheads, etc.). These facilities have and would continue to alter natural surface flow patterns, run-off volumes and velocities, as well as groundwater flow in areas. Outside the project area, other NPS and non-NPS actions also have and would continue to alter hydrology. These actions include improvements being made in the Jenny Lake area, development of multiuse pathways outside the project area, construction of planned residential and commercial developments, such as the Teton Village expansion. Most notably, the construction and operation of the Jackson Lake Dam from 1907 to present and the management of irrigation ditches and diversion structures by water rights owners continue to have substantial impacts, particularly to the natural flow regime of the Snake River. Collectively, all of the built features have and would continue to have substantial, adverse effects on the natural hydrology in the region.

When the effects of alternative D are added to these other past, ongoing, and reasonably foreseeable future effects, there would be the potential for a substantial, long-term, cumulative adverse effect on the hydrology in the area. However, the incremental effect of alternative D effects being added to the above adverse effects would be considerable due to the adverse effect of a second flow impediment being developed for the length of the corridor (i.e., multiuse pathway) and the beneficial effect of the southern realignment of Moose-Wilson Road.

Conclusion. Overall, the proposed management strategies under alternative D would have both beneficial and adverse impacts on hydrology within the Moose-Wilson corridor. The most notable beneficial effects on hydrology would relate to the removal of a major impediment to the natural hydrological system in the vicinity of the wetland complex between the Sawmill Ponds Overlook and Death Canyon Road. The natural hydrological connectivity of this wetland complex with the uplands to the west (Reserve Creek and Stewart Draw drainages) would be restored via the southern realignment of Moose-Wilson Road. Not only would this action restore surface and groundwater flow patterns, but it would also benefit wetland functions and aquatic systems to the east of the existing road alignment. This would result in substantial, long-term beneficial impacts on hydrology. Another notable beneficial effect would involve the restoration of a large portion of Death Canyon Road. However, conversely, the development of a second transportation corridor through project area (i.e., the multiuse pathway) would have a substantial, long-term, adverse effect on the local hydrological system by introducing a second impediment to natural surface flows for the length of the corridor (e.g., converting sheetflows to channelized flows). Other adverse impacts of alternative D would primarily result from increases of impervious surfaces (pathway, turnouts, etc.) and other alterations to natural flow patterns in previously undisturbed areas where parking and roads are developed (most notably the two realignments of Moose-Wilson Road and the road improvements in the Death Canyon Trailhead area). Short-term, adverse impacts on local hydrology would also result from construction activities associated with these developments. Although the southern Moose-Wilson Road realignment would greatly benefit the Aquatic Resources fundamental resource and value of the corridor, the effects of the proposed pathway would conversely diminish the quality and integrity of this fundamental resource and value. However, the adverse effects on wetlands from the southern road realignment and pathway would not likely be significant due to the relatively isolated and localized nature of the effects on hydrology (i.e., in the area immediately surrounding the two realignments of Moose-Wilson Road, the multiuse pathway, road improvements in the Death Canyon Trailhead area, and adjacent areas).

When the effects of alternative D are added to these other past, ongoing, and reasonably foreseeable future effects, there would be the potential for a substantial, long-term, cumulative adverse effect on the hydrology in the area. However, the incremental effect of alternative D effects being added to the above adverse effects would be considerable, mainly due to the adverse effect of a second flow impediment being developed for the length of the corridor (i.e., multiuse pathway) and the beneficial effect of the southern realignment of Moose-Wilson Road.

WATER QUALITY

Methods and Assumptions for Analyzing Impacts

This section addresses potential impacts on water quality in the project area. The impact analyses considered a variety of factors that could affect water quality, either beneficially or adversely. In general, the effects of the alternatives on water quality in the project area were analyzed based on impacts resulting from changes to NPS development and infrastructure (e.g., roads, pathways, and structures), commercial and private vehicle use, and visitor use types, levels, and patterns associated with each alternative. To accomplish this, the following two impact analysis questions were considered to identify the potential impacts of each alternative:

Impact Analysis Questions.

1. How would water quality be affected by erosion and sedimentation processes under each alternative?
2. How would water quality be affected by anthropogenic pollutants under each alternative, including vehicle-related pollutants and dust abatement pollutants (e.g., magnesium chloride)?

General Assumptions. The following assumptions were considered in concert with the above impact analysis questions when assessing the effects of each alternative management strategy.

- Alternations to surface flows are directly related to changes in potential for erosion and sedimentation, and thus, to changes in surface water quality.
- Increases in disturbed soils (i.e., during construction, and over the long-term in areas where revegetation is not successful) increase the potential for erosion and sediment loading.
- Effective mitigation measures would be employed to avoid/minimize erosion and sedimentation. However, erosion and sedimentation effects are still likely as a result of a built landscape and flow pattern alterations.
- Increased surface flow volumes and velocities increase the potential and degree of erosion and sedimentation. Flow and velocity increases can result from increases in impervious surfaces and increased channelization (relative to natural sheetflow conditions) due to landscape alterations and the built environment.
- Increasing the impervious surface creates more potential for storm runoff and nonpoint source pollutants to enter park surface water and groundwater systems.
- Water quality could be affected by the emissions/leaks of vehicles using the road and by uses of magnesium chloride, dust abatement and deicing agents on road surfaces.

- Anthropogenic pollutants in local waters can be controlled by reducing pollutant sources in the corridor and by controlling and treating surface runoff before it freely discharges into area surface water bodies. However, reducing pollutant sources is the most effective means to minimizing water quality degradation.
- Surface water discharges from roadway/pathway construction equipment may result in impacts on water quality. However, mitigation measures would be employed to minimize the potential for spills and discharges from construction machinery.

Alternative A (No Action)

Traffic Management along Moose-Wilson Road. Under alternative A, traffic management along Moose-Wilson Road would remain as it is currently managed. Traffic volume growth, traffic flow congestion, and resulting visitation volumes in the corridor would not be actively addressed (other than during very periodic road closures due to wildlife activity along the road). Likewise, the current speed limit on Moose-Wilson Road (25 mph) would remain and the road's winter closure dates would remain unchanged. This continued management would continue to result in various long-term, adverse effects on water quality throughout the corridor. Erosion, sedimentation, and the migration of magnesium chloride from dust abatement treatments along unpaved portions of the road and migration of vehicle-related pollutants along all segments of the road would continue to degrade water quality conditions. The greatest effect on water quality would occur in waters immediately adjacent to and downstream of the pollutant sources. It is important to note that the traffic volume on the road could be correlated to the degree of water quality degradation that occurs, as more traffic can require more MgCl treatments, more erosion in the unpaved section, and more vehicle pollutant sources. With projected increases in vehicular traffic and visitor use in the corridor in the future, these continuing impacts on water quality would likely increase over time if left unabated.

Physical Characteristics of Moose-Wilson Road. The physical characteristics of Moose-Wilson Road would also remain unchanged under alternative A. Most notably, the 1.4-mile unpaved road segment would remain unpaved. This unpaved section would continue to be treated with dust abatement chemicals such as MgCl. As a result of this continued management under alternative A, water quality downstream of the unpaved segment would continue to be adversely affected by road surface erosion and sedimentation, vehicle-generated dust, and the migration of MgCl into the surrounding soils and water into the long-term and in the area immediately surrounding the unpaved road segment.

Moose-Wilson Road Realignment. Moose-Wilson Road in its current alignment cuts through an important hydrological system in the corridor, where mountain streams and flows are tributary to the large wetland complex between Sawmill Ponds Overlook and Death Canyon Road. Under alternative A, the existing alignment of Moose-Wilson Road through this area would continue to introduce vehicle pollutant sources directly into the wetlands and connected hydrologic system adjacent to the road, resulting in long-term and modest adverse impacts on water quality in this area.

Turnouts and Parking. The opportunistic, unauthorized parking that occurs along roads in the corridor under alternative A would continue to have long-term, modest, and adverse impacts on water quality. Impacts would continue to result when unauthorized roadside parking tramples existing vegetation along roadways, rendering the surface more prone to erosion and sedimentation. Additionally, vehicle-related pollutants that accumulate in these areas would continue to run off into the adjacent hydrologic systems. Also, continued use and maintenance (grading) of unpaved roads and parking areas would continue to be a source of erosion and sediment loading into adjacent water features.

Bicycle Use. Under alternative A, cyclists would continue to share Moose-Wilson Road with motor vehicle traffic. Bike use on Moose-Wilson Road and other roads would continue to be nearly inconsequential to water quality.

Commercial Activity. Authorized commercial activity would continue to be allowed and administered under alternative A, which would continue to have long-term and modest adverse impacts on water quality through erosion and commercial vehicle-related pollutants from the roads, as well as horse waste from guided horseback riding tours along designated trails within the corridor.

Death Canyon. Under alternative A, the current management of the Death Canyon area would continue to have long-term, localized, and modest adverse effects on water quality through erosion and sedimentation from continued use and maintenance of the parking area and roadway (grading), and vehicle-related pollutants from vehicle use along Death Canyon Road. Also, a prevalence of user-created parking along the road would continue to denude roadside vegetation, resulting in an increased threat to water quality from erosion and sediment loading. As vehicle use in the corridor continues to increase as projected, it is likely these impacts on water quality in the Death Canyon area would also increase under alternative A.

Winter Access and Use. The continued management of winter access and use in the Moose-Wilson corridor would continue to have localized, adverse effects on water quality. Snow plowing operations and vehicle traffic along plowed portions of Moose-Wilson Road (between the Moose Entrance and Death Canyon Road junction and between the Granite Canyon Entrance and Granite Canyon Trailhead) would continue to produce vehicle-related pollutant runoff that adversely affects water quality. Also, snow storage areas in the plowed sections of Moose-Wilson Road would continue to be a source for sediment loading into adjacent water features during spring runoff.

Visitor Use and Experience / Education and Interpretation. Continued information sharing and use of backcountry patrols would continue to result in limited, beneficial impacts on water quality through the reduction of potential visitor impacts. These benefits could be realized through visitor information, education efforts, and enforcement regarding proper trash disposal, proper human waste disposal, and use of authorized parking areas within the corridor.

Horse Use. Equestrian use in the Moose-Wilson corridor would continue to have long-term, localized, and minor adverse effects on water quality under alternative A, as regular exposure of hydrologic systems to animal manure often results in greater occurrences of contamination of water with higher nitrate levels and fecal bacteria (Unc and Goss 2004). In particular, waste from horses would continue to adversely impact water quality within proximity to the four equestrian parking trailheads in the corridor (Poker Flats, Sawmill Ponds Overlook, Death Canyon Road junction, and Granite Canyon Trailhead) as well as in the Poker Flats area and other higher-use equestrian areas of the corridor. Additionally, there would be some continued small-scale and localized impacts on hydrology from horse trail stream crossings causing streambank erosion and sediment inputs to streams.

Best Management Practices. To lessen the adverse impact to water quality as a result of the continued management direction of alternative A, the National Park Service would continue to conduct periodic water quality monitoring of water bodies and waterways in the project area (including Phelps Lake, beaver ponds, the Snake River and its various tributaries) to ensure water quality remains in good condition. Additionally, the park would mitigate the effects of snow storage and stormwater runoff along park roads to avoid impacts on water quality of downstream bodies and implement revegetation for disturbed areas along and around water features, thus contributing a limited beneficial impact to water quality.

> Overall, the continued management strategies under alternative A would continue to result in various adverse effects on water quality throughout the corridor. These adverse effects would primarily relate to increasing threats from vehicle-generated pollutant migration from increased traffic volumes in the corridor (particularly along the wetland area between Sawmill Ponds Overlook and Death Canyon Road), continued dust abatement needs and MgCl migration from the unpaved segment of Moose-Wilson Road, sediment loading impacts from unmanaged roadside parking and use, sediment loading from winter snow plowing and storage, and horse manure in high equestrian use areas. Collectively, alternative A would result in a notable, long-term, adverse effect on water quality in the corridor.

Cumulative Effects. A variety of other past, ongoing, and reasonably foreseeable future actions have and would continue to affect water quality within and outside the project area.

Past actions and continuing actions that have and continue to affect water quality in and around the Moose-Wilson corridor include seepage from upstream wastewater treatment plants and other sanitary facilities inside and outside the park; fecal bacteria in surface runoff and in waterbodies from livestock on nearby grazing lands; leakage from campground sanitary facilities, inappropriate backcountry camping techniques; erosion and sediment loading from roads, trails, and grazing land; increased deposition of acidifying compounds (i.e., nitrogen and sulfur) from development in the region around the park; oil and road salt running off from paved areas into the water throughout the region; and petroleum-based pollutants from upstream oil and gas activities on USFS lands. Collectively, all of these uses and activities have had and would continue to have considerable, adverse effects on water quality in the region.

When the effects of alternative A are added to these other past and ongoing effects, there would be the potential for a considerable, long-term, cumulative adverse effect on the water quality in the area. However, the incremental effect of alternative A effects being added to the above adverse effects would be quite small.

Conclusion. Alternative A would continue to result in various adverse effects on water quality throughout the corridor. These adverse effects would primarily relate to increasing threats from vehicle-generated pollutant migration from increased traffic volumes in the corridor (particularly along the wetland area between Sawmill Ponds Overlook and Death Canyon Road), continued dust abatement needs and MgCl migration from the unpaved segment of Moose-Wilson Road, sediment loading impacts from unmanaged roadside parking and high-use area parking, sediment loading from winter snow plowing and storage, and horse manure in high equestrian use areas. Collectively, alternative A would result in a notable, long-term, adverse effect on water quality in the corridor. However, although the most notable adverse effects to water quality would continue to be substantial in the area between Sawmill Ponds Overlook and Death Canyon Road, as well as along the unpaved segment of Moose-Wilson Road, given the somewhat localized nature of these effects relative to the project area's overall hydrological regime, the continuing adverse impacts on water quality under alternative A would not likely be significant.

When the effects of alternative A are added to other past and ongoing effects from other uses and activities in the area, there would be the potential for a considerable, long-term, cumulative adverse effect on the water quality. However, the incremental effect of alternative A effects being added to the above adverse effects would be quite small.

Alternative B

Traffic Management along Moose-Wilson Road. Under alternative B, traffic management along Moose-Wilson Road (and thus in the overall corridor) would be substantially modified by including a gate system that closes the road to through-traffic during periods of peak use (e.g., peak hours during peak season). During gate closure periods, this traffic management strategy would likely have long-term, beneficial effects on water quality for the length of the project area by eliminating through traffic, and thereby reducing vehicle-related pollutants in surface runoff throughout the corridor. However, although future traffic volumes would be managed by this gate system management strategy during peak periods, the allowed traffic along Moose-Wilson Road would still have ongoing adverse effects on water quality. The migration of vehicle-related pollutants along all segments of the road would continue to degrade water quality conditions, particularly in areas adjacent to and downstream of the pollutant sources.

Physical Characteristics of Moose-Wilson Road. Under alternative B, some physical characteristics of Moose-Wilson Road would also be modified. One of the most notable changes to physical characteristics, as it relates to water quality, would be the paving of the 1.4-mile segment of currently unpaved roadway. As a result of this action, this segment would no longer need to be treated with dust abatement chemicals such as MgCl, which means migration of MgCl to surrounding hydrological systems would cease, resulting in a beneficial effect on the quality of water in and around this segment of the corridor. Likewise, road surface erosion and sedimentation and vehicle-generated dust would decrease along this 1.4-mile segment. While roadbed grading and preparation for paving would result in some localized, short-term, adverse effects such as erosions and sedimentation, overall, the paving of the unpaved portion would result in some long-term, beneficial effect for water quality.

The development of Moose-Wilson corridor design standards to be applied to design and maintenance of the roads, parking areas, and turnouts could result in limited beneficial impacts on water quality in localized areas where the standards correct erosion and sedimentation sources associated with vehicle use.

Moose-Wilson Road Realignment. Two large-scale realignments of Moose-Wilson Road would also occur under alternative B, resulting in considerable adverse impacts on water quality and some notable beneficial effects as well. The southern realignment between the Death Canyon Road junction and the Sawmill Ponds Overlook, the realignment of the northernmost segment of Moose-Wilson Road, and the relocation of the Moose Entrance Station and realignment of the four-way intersection with Teton Park Road would result in the introduction of vehicle-related pollutants from roadway surfaces into new, previously undisturbed areas. Vehicle pollutants (e.g., petroleum products) that are deposited along the newly aligned road would migrate into adjacent waters via stormwater runoff. This would degrade water quality conditions in new areas of the corridor, resulting in a long-term, adverse effect for the length of the two road realignment sections. Conversely, the abandoned segments of Moose-Wilson Road would no longer be a source for vehicle-related pollutants or the effects of road maintenance (such as increased erosion and sedimentation), a long-term, beneficial effect along the length of these abandoned sections. This beneficial effect is particularly noteworthy along the segment of the existing road that traverses the beaver pond wetland complex area. By realigning the road downstream of the wetland complex, the vehicle pollution source that currently migrates into the water of this sensitive wetland habitat would be removed, or at least reduced substantially. Also, limited, long-term, beneficial effects on water quality could be realized by appropriate drainage improvements. Improved drainage would likely result in reductions in erosion and sedimentation at various stormwater outfalls downstream of the road.

Additionally, areas along both realignments and associated bridge and drainage feature constructions could have considerable, short-term erosion and sedimentation impacts from the relatively large areas of earthwork and ground disturbance along the construction zones. These short-term erosion and sedimentation impacts would likely continue for subsequent years after the construction is complete until adequate ground cover vegetation is established. However, best management practices to protect water quality during construction would be applied in all construction efforts. These practices would minimize the adverse effects of erosion and sedimentation to some degree. Although, it would not be expected that these practices would fully prevent the noted adverse effects from occurring. Thus, sediment loading into waters downstream of the realignments could be expected for several years.

Turnouts and Parking. In alternative B, officially designated parking turnouts would be constructed along Moose-Wilson Road to accommodate up to 120 vehicles. The new parking turnouts would result in long-term, minor, beneficial impacts on water quality in several areas of the corridor through the reduction of erosion, sedimentation, and water quality threats caused by user-created parking as described under alternative A (i.e., reduced trampling of vegetation and resulting erosion from unauthorized roadside parking). However, construction activities and associated ground disturbances from these improvements would also result in erosion and sedimentation impacts, which would cause short-term, localized, adverse impacts on water quality until ground cover vegetation gets reestablished in disturbed areas. The reconfiguration of the access and parking at the LSR Preserve would be the most sizeable area of disturbance (and thus sedimentation effects on water quality) under this management strategy topic. However, the overall impact to water quality from these actions is beneficial and long-term.

Bicycle Use. Under alternative B, cyclists would continue to share Moose-Wilson Road with motor vehicle traffic and transitions from the existing multiuse pathways on the south and north ends of the corridor would be facilitated. Bike use on Moose-Wilson Road and other roads would continue to be relatively inconsequential to water quality.

Commercial Activity. Authorized commercial activity would continue to be allowed and administered under alternative B, resulting in continued localized, minor, adverse water quality impacts. The most notable contributor to water quality effects would result from horse waste and other ground disturbances from continued guided horseback riding tours. Taxis and all other nonpark-dependent commercial traffic would be prohibited in the corridor, which would result in some limited beneficial impacts on water quality through the reduction of some vehicle-related pollutants.

Death Canyon. Under alternative B, the Death Canyon Trailhead would be relocated approximately 0.4 mile from its current location, with the abandoned section of the trailhead access road converted to a trail. A new parking lot would be constructed to provide parking for approximately 60 vehicles. The closure and restoration of the existing lot would result in a limited and localized beneficial effect from a reduction in erosion and sedimentation in surface runoff. Additionally, by providing a parking area with a capacity of 60 vehicles, much of the unauthorized, user-created parking along the Death Canyon Road would be reduced. The associated adverse effects on water quality from unofficial parking would be reduced (i.e., reduced trampling of vegetation and resulting erosion, see alternative A analysis).

However, long-term and limited adverse impacts would be incurred from the permanent presence of the newly constructed unpaved parking lot, which would act as new source of sediment loading in surface runoff. Also, short-term, localized, and limited adverse impacts on water quality would result from erosion and sedimentation associated with construction activities and new ground disturbances for the new Death Canyon Trailhead, relocation of restroom, and parking lot. These short-term adverse impacts would last until ground cover vegetation gets established in the development areas. However, best management practices to protect water quality during construction would be applied in all construction efforts. These practices would minimize the adverse effects of erosion and sedimentation to some degree. Although, it would not be expected that these practices would fully prevent the noted adverse effects from occurring.

Winter Access and Use. Winter access and use would continue to be allowed under alternative B, including expansion of the unplowed portion of Moose-Wilson Road up to the Murie Ranch Road junction. This reduction of plowed areas (and associated winter vehicle use) in the northern segments of the corridor would result in reductions in adverse effects on water quality from vehicle pollutant migration from November through April. This would also result in an elimination of snow storage areas between Murie Ranch Road and Death Canyon Road, a notable contributor to sediment loading into adjacent waters during the spring snow melt. Given the proximity of this newly unplowed segment to the large wetland complex, this beneficial effect on water quality is noteworthy. However, the snow storage areas in the other sections of Moose-Wilson Road that would continue to be plowed would continue to be a limited source for sedimentation in downstream waters.

Visitor Use and Experience / Education and Interpretation. Under alternative B, information sharing and use of backcountry patrols would continue to result in limited, beneficial impacts on water quality through the reduction of potential visitor impacts. These benefits could be realized through visitor information, education efforts, and enforcement regarding proper trash disposal, proper human waste disposal, and use of authorized parking areas within the corridor.

Horse Use. Equestrian use in the Moose-Wilson corridor would continue to have adverse effects on water quality under alternative B. In particular, waste from horses would continue to adversely impact water quality within proximity to the equestrian parking trailheads in the corridor and along heavily used trails. Additionally, there would be some continued small-scale and localized impacts on water quality from horse trail stream crossings causing streambank erosion and sediment inputs to streams. However, elimination of two horse trailer parking areas under this alternative would likely reduce equestrian use and associated water quality impacts in areas around the Sawmill Ponds Overlook and Granite Canyon Trailhead. Given the immediate proximity of Sawmill Ponds Overlook to the large wetland complex to the south, this reduction in adverse effects is noteworthy. Likewise, such reductions in horse use impacts on water quality could also occur along the Granite Creek drainage to the west of the trailhead (given trail system in that area). Thus, a localized, beneficial effect on water quality in these two areas would result from this management action. Additionally, the removal/rerouting of trails with resource impacts and the establishment of newly aligned horse trail routes would mainly have beneficial, localized impacts on water quality in the rerouted areas, as horse manure and sedimentation sources would be removed from sensitive areas.

Best Management Practices, Monitoring Guidelines, and Mitigation Measures. As part of this alternative, the park would implement best management practices, monitoring guidelines, and mitigation to protect the area's water quality. To lessen the adverse impact to water quality as a result of the actions described in alternative B, the National Park Service would continue to conduct periodic water quality monitoring of water bodies and waterways in the project area (including Phelps Lake, beaver ponds, the Snake River and its various tributaries) to ensure water quality remains in good condition. Additionally, the park would mitigate the effects of snow storage and stormwater runoff along park roads to avoid impacts on water quality of downstream bodies and implement revegetation for disturbed areas along and around water features, thus contributing a limited beneficial impact to water quality. Where possible, a suite of construction related mitigation measures would be implemented in alternative B. These include limiting construction activities to periods of low precipitation to reduce the risk of accidental spills reaching surface and/or groundwater, inspection of construction equipment for leaks, use of materials on construction sites to contain potential water quality threats, and stormwater management techniques to minimize soil erosion and degradation in project areas.

> Overall, the proposed management strategies under alternative B would have both beneficial and adverse impacts on water quality within the Moose-Wilson corridor. Beneficial impacts on water quality would primarily be realized through substantial reductions in vehicle pollutant and sediment threats in a major wetland complex due to the southern road realignment, reduced sediment loading and an elimination of MgCl migration by paving the unpaved segment, establishing designated roadside turnouts, restoring a short segment of Death Canyon Road, a reduction in sediment loading from snow storage areas (due to more unplowed segments), and a reduction in waste from heavy equestrian use in multiple localized areas. These actions would result in substantial beneficial impacts on water quality. Adverse impacts would primarily result from continued vehicle-related pollutant migration within the corridor and sediment loading from several newly disturbed areas and construction activities associated with new developments within the corridor (two road realignments, Death Canyon parking area, etc.).

Cumulative Effects. A variety of other past, ongoing, and reasonably foreseeable future actions have and would continue to affect water quality within and outside the project area.

Past actions and continuing actions that have and continue to affect water quality in and around the Moose-Wilson corridor include seepage from upstream wastewater treatment plants and other sanitary facilities inside and outside the park; fecal bacteria in surface runoff and in waterbodies from livestock on nearby grazing lands; leakage from campground sanitary facilities, inappropriate backcountry camping techniques; erosion and sediment loading from roads, trails, and grazing land; increased deposition of acidifying compounds (i.e., nitrogen and sulfur) from development in the region around the park; oil and road salt running off from paved areas into the water throughout the region; and petroleum-based pollutants from upstream oil and gas activities on USFS lands. Collectively, all of these uses and activities have had and would continue to have considerable, adverse effects on water quality in the region.

When the effects of alternative B are added to these other past and ongoing effects, there would be the potential for a considerable, long-term, cumulative adverse effect on the water quality in the area. However, the incremental effect of alternative B effects being added to the above adverse effects would be quite small, and a good portion of this increment would be beneficial.

Conclusion. Alternative B would have both beneficial and adverse impacts on water quality within the Moose-Wilson corridor. Beneficial impacts on water quality would primarily be realized through substantial reductions in vehicle pollutant and sediment threats in a major wetland complex due to the southern road realignment, reduced sediment loading and an elimination of MgCl migration by paving the unpaved segment, establishing designated roadside turnouts, restoring a short segment of Death Canyon Road, a reduction in sediment loading from snow storage areas (due to more unplowed segments), and a reduction in nutrient and sediment loading from equestrian use in multiple localized areas due to improved equestrian trail management and the elimination of two horse trailer parking areas. These actions would result in substantial beneficial impacts on water quality. Adverse impacts would primarily result from continued vehicle-related pollutant migration within the corridor and sediment loading from several newly disturbed areas and construction activities associated with new developments within the corridor (two road realignments, Death Canyon parking area, etc.). These adverse effects on water quality under this alternative would not likely be significant due to the relatively localized nature of the effects on water quality (i.e., in the area immediately surrounding the two realignments of Moose-Wilson Road, the Death Canyon parking area, and adjacent areas).

When the effects of alternative B are added to past and ongoing effects from other actions and uses in the area, there would be the potential for a considerable, long-term, cumulative adverse effect on the water quality in the area. However, the incremental effect of alternative B effects being added to the above adverse effects would be quite small, and a good portion of this increment would be beneficial.

Alternative C (NPS Preferred)

Traffic Management along Moose-Wilson Road. Under alternative C, traffic management along Moose-Wilson Road (and thus in the overall corridor) would be substantially modified by including a timed sequencing technique that addresses increases in traffic and volume-related congestion during periods of peak use (e.g., peak hours during peak season) and provision of queuing lanes on the north and south ends of the corridor, as needed. During these timed sequencing periods, this traffic management strategy would likely have beneficial effects on water quality for the length of the project area by limiting vehicular traffic, and thereby reducing vehicle-related pollutants in surface runoff throughout the corridor. However, although future traffic volumes would be managed by this timed sequencing management strategy, the allowed traffic along Moose-Wilson Road would still have ongoing adverse effects on water quality. The migration of vehicle-related pollutants along all segments of the road would continue to degrade water quality conditions, particularly in areas adjacent to and downstream of the pollutant sources.

Physical Characteristics of Moose-Wilson Road. Under alternative C, some physical characteristics of Moose-Wilson Road would also be modified. One of the most notable changes to physical characteristics, as it relates to water quality, would be the paving of the 1.4-mile segment of currently unpaved roadway. As a result of this action, this segment would no longer need to be treated with dust abatement chemicals such as MgCl, which means migration of MgCl to surrounding hydrological systems would cease, resulting in a beneficial effect on the quality of water in and around this segment of the corridor. Likewise, road surface erosion and sedimentation and vehicle-generated dust would decrease along this 1.4-mile segment. While roadbed grading and preparation for paving would result in some localized, short-term, adverse effects such as erosions and sedimentation, overall, the paving of the unpaved portion would result in some levels of long-term, beneficial effect for water quality in this area.

The development of Moose-Wilson corridor design standards to be applied to design and maintenance of the roads, parking areas, and turnouts could result in limited beneficial impacts on water quality in localized areas where the standards correct erosion and sedimentation sources associated with vehicle use.

Moose-Wilson Road Realignment. The realignment of the northernmost segment of Moose-Wilson Road and the reconstruction of the segment between Sawmill Ponds Overlook and the Death Canyon Road in alternative C would result in both beneficial and adverse impacts on water quality. The road realignment would result in the introduction of vehicle-related pollutants from roadway surfaces into new, previously undisturbed areas. Vehicle pollutants (e.g., petroleum products) that are deposited along the newly aligned road would migrate into adjacent waters via stormwater runoff. This would degrade water quality conditions in new areas of the corridor, resulting in a long-term, adverse effect for the length of the northern road realignment section. Conversely, the abandoned segment of Moose-Wilson Road would no longer be a source for vehicle-related pollutants, a long-term, beneficial effect along the length of this abandoned section. Also, limited, long-term, beneficial effects on water quality could be realized by the proposed drainage improvements associated with the reconstruction of the road segment (~1.5 miles) between Sawmill Ponds Overlook and Death Canyon Road. Improved drainage would likely result in reductions in erosion and sedimentation at various stormwater outfalls downstream of the road. However, since Moose-Wilson Road realignment would continue to cut through an important hydrological system in the corridor, where Steward Draw and Reserve Creek feed the downstream wetland complex across the road, vehicle pollutants would continue to migrate directly into the adjacent wetlands, resulting in long-term and modest adverse impacts on water quality in this area.

Additionally, areas along the northern road realignment as well as the reconstructed segment between Sawmill Ponds Overlook and Death Canyon, and their associated drainage features, could have considerable, short-term, erosion and sedimentation impacts on adjacent water quality from the relatively large areas of earthwork and ground disturbance in the construction zones. These short-term erosion and sedimentation impacts would likely continue for subsequent years after the construction is complete until adequate ground cover vegetation is established. However, best management practices to protect water quality during construction would be applied in all construction efforts. These practices would minimize the adverse effects of erosion and sedimentation to some degree. Although, it would not be expected that these practices would fully prevent the noted adverse effects from occurring.

Turnouts and Parking. In alternative C, officially designated parking turnouts would be constructed along Moose-Wilson Road to accommodate up to 120 vehicles. The new parking turnouts would result in long-term, minor, beneficial impacts on water quality in several areas of the corridor through the reduction of erosion, sedimentation, and water quality threats caused by user-created parking as described under alternative A (i.e., reduced trampling of vegetation and resulting erosion from unauthorized roadside parking). The installation of a vault toilet at the Granite Canyon Trailhead, and potentially at both the north and south corridor entrances as needed, would be done within an existing disturbed area, and would result in the reduction of water quality threats from visitor waste in inappropriate locations. However, construction activities and associated ground disturbances from these improvements would also result in erosion and sedimentation impacts, which would cause short-term, localized, adverse impacts on water quality until ground cover vegetation gets reestablished in disturbed areas.

Bicycle Use. Under alternative C, cyclists would continue to share Moose-Wilson Road with motor vehicle traffic and transitions from the existing multiuse pathways on the south and north ends of the corridor would be facilitated. Bike use on Moose-Wilson Road and other roads would continue to be relatively inconsequential to water quality.

Commercial Activity. Authorized commercial activity would continue to be allowed and administered under alternative C, resulting in continued localized, minor, adverse water quality impacts. The most notable contributor to water quality effects would result from horse waste and other ground disturbances from continued guided horseback riding tours. Taxis and all other nonpark-dependent commercial traffic would be prohibited in the corridor, which would result in some limited beneficial impacts on water quality through the reduction of some vehicle-related pollutants.

Death Canyon. Under alternative C, the Death Canyon Trailhead would be relocated to the current end of pavement on the existing access road (i.e., the junction with White Grass Road). A parking lot would be constructed to provide parking for approximately 80–90 vehicles. The existing 1.0-mile unpaved portion of the trailhead access road would be converted to a trail. Short-term, localized, and limited adverse impacts on water quality would result from erosion and sedimentation associated with construction activities and new ground disturbances for the new Death Canyon Trailhead, relocation of restroom, and parking lot. These short-term adverse impacts would last until ground cover vegetation is established in the development areas. However, best management practices to protect water quality during construction would be applied in all construction efforts. These practices would minimize the adverse effects of erosion and sedimentation to some degree. Although, it would not be expected that these practices would fully prevent the noted adverse effects from occurring.

Limited, long-term, adverse impacts would result from the permanent presence of the newly constructed parking lot, which would act as new source of erosion and sedimentation in surface runoff in this localized area. Conversely, the closure and restoration of the existing lot and 1.0-mile of road would result in a limited and localized beneficial effect from a reduction in erosion and sedimentation in surface runoff. Additionally, by providing a parking area with a capacity of 80-90 vehicles, much of the unauthorized, user-created parking along the Death Canyon Road would be reduced. The associated adverse effects on water quality from unofficial parking would be reduced (i.e., reduced trampling of vegetation and resulting erosion, see alternative A analysis).

Winter Access and Use. The continued management of winter access and use in the Moose-Wilson corridor under alternative C would continue to have localized, adverse effects on water quality. Snow plowing operations and vehicle traffic along plowed portions of Moose-Wilson Road (between the Moose Entrance and Death Canyon Road junction and between the Granite Canyon Entrance and Granite Canyon Trailhead) would continue to produce vehicle-related pollutant runoff that adversely affects water quality. Also, snow storage areas in the plowed sections of Moose-Wilson Road would continue to be a source for sediment loading into adjacent water features during spring runoff. The snow storage and vehicle pollutant migration between Sawmill Ponds Overlook and Death Canyon Road would continue to have the most notable adverse effect on water quality due to the proximity of a large wetland complex immediately downstream of this road segment.

Visitor Use and Experience / Education and Interpretation. Under alternative C, information sharing and use of backcountry patrols would continue to result in limited, beneficial impacts on water quality through the reduction of potential visitor impacts. These benefits could be realized through visitor information, education efforts, and enforcement regarding proper trash disposal, proper human waste disposal, and use of authorized parking areas within the corridor.

Horse Use. Equestrian use in the Moose-Wilson corridor would continue to have adverse effects on water quality under alternative C. In particular, waste from horses would continue to adversely impact water quality within proximity to the equestrian parking trailheads in the corridor and along heavily used trails. Additionally, there would be some continued small-scale and localized impacts on water quality from horse trail stream crossings causing streambank erosion and sediment inputs to streams. However, elimination of one horse trailer parking area under this alternative would likely reduce equestrian use and associated impacts in areas around the Granite Canyon Trailhead. Reductions in horse use impacts on water quality could also occur along the Granite Creek drainage to the west of the trailhead (given trail system in that area). Thus, a localized, beneficial effect on water quality in this area would result from this management action. Additionally, the removal/rerouting of trails with resource impacts and the establishment of newly aligned horse trail routes would mainly have beneficial, localized impacts on water quality in the rerouted areas, as horse manure and sedimentation sources would be removed from sensitive areas.

Best Management Practices, Monitoring Guidelines, and Mitigation Measures. As part of this alternative, the park would implement best management practices, monitoring guidelines, and impact mitigation to protect the area's water quality. To lessen the adverse impact to water quality as a result of the actions described in alternative C, the National Park Service would continue to conduct periodic water quality monitoring of water bodies and waterways in the project area (including Phelps Lake, beaver ponds, the Snake River and its various tributaries) to ensure water quality remains in good condition. Additionally, the park would mitigate the effects of snow storage and stormwater runoff along park roads to avoid impacts on water quality of downstream bodies and implement revegetation for disturbed areas along and around water features, thus contributing a limited beneficial impact to water quality. Where possible, a suite of construction related mitigation measures would be implemented in alternative C. These include limiting construction activities to periods of low precipitation to reduce the risk of accidental spills reaching surface and/or groundwater, inspection of construction equipment for leaks, use of materials on construction sites to contain potential water quality threats, and stormwater management techniques to minimize soil erosion and degradation in project areas.

> Overall, the proposed management strategies under alternative C would have both beneficial and adverse impacts on water quality within the Moose-Wilson corridor. Beneficial impacts on water quality would primarily be realized through some reductions in sediment loading threats due to the improved drainage infrastructure between Sawmill Ponds Overlook and Death Canyon Road, reduced sediment loading and an elimination of MgCl migration by paving the unpaved segment, establishing designated roadside turnouts, restoring 1.0-

mile of Death Canyon Road, and a reduction in waste from heavy equestrian use in the vicinity of the Granite Canyon Trailhead. Adverse impacts would primarily result from continued vehicle-related pollutant migration within the corridor, vehicle pollutants introduced into previously undisturbed areas (realignment, Death Canyon parking area), and sediment loading from multiple newly disturbed areas and construction activities associated with new developments within the corridor.

Cumulative Effects. A variety of other past, ongoing, and reasonably foreseeable future actions have and would continue to affect water quality within and outside the project area.

Past actions and continuing actions that have and continue to affect water quality in and around the Moose-Wilson corridor include seepage from upstream wastewater treatment plants and other sanitary facilities inside and outside the park; fecal bacteria in surface runoff and in waterbodies from livestock on nearby grazing lands; leakage from campground sanitary facilities; inappropriate backcountry camping techniques; erosion and sediment loading from roads, trails, and grazing land; increased deposition of acidifying compounds (i.e., nitrogen and sulfur) from development in the region around the park; oil and road salt running off from paved areas into the water throughout the region; and petroleum-based pollutants from upstream oil and gas activities on USFS lands. Collectively, all of these uses and activities have had and would continue to have considerable, adverse effects on water quality in the region.

When the effects of alternative C are added to these other past and ongoing effects, there would be the potential for a considerable, long-term, cumulative adverse effect on the water quality in the area. However, the incremental effect of alternative C effects being added to the above adverse effects would be very small.

Conclusion. Alternative C would have both beneficial and adverse impacts on water quality within the Moose-Wilson corridor. Beneficial impacts on water quality would primarily be realized through some reductions in sediment loading threats due to the improved drainage infrastructure between Sawmill Ponds Overlook and Death Canyon Road, reduced sediment loading and an elimination of MgCl migration by paving the unpaved segment, establishing designated roadside turnouts, restoring 1.0 mile of Death Canyon Road, and a reduction in nutrient and sediment loading from equestrian use in the vicinity of the Granite Canyon Trailhead and other localized areas due to the elimination of horse trailer parking and improved equestrian trail management, respectively. Adverse impacts would primarily result from continued vehicle-related pollutant migration within the corridor, vehicle pollutants introduced into previously undisturbed areas (realignment, Death Canyon parking area), and sediment loading from multiple newly disturbed areas and construction activities associated with new developments within the corridor. These adverse effects on water quality under this alternative would not likely be significant due to the relatively localized nature of the effects on water quality (i.e., in the area immediately surrounding the northern realignment of Moose-Wilson Road, the Death Canyon parking area, and adjacent areas).

When the effects of alternative C are added to past and ongoing effects from other uses and activities in the area, there would be the potential for a considerable, long-term, cumulative adverse effect on the water quality in the area. However, the incremental effect of alternative C effects being added to the adverse effects would be very small.

Alternative D

Traffic Management along Moose-Wilson Road. Under alternative D, traffic management along Moose-Wilson Road (and thus in the overall corridor) would be substantially modified by including a reservation system that addresses increases in traffic and volume-related congestion during periods of peak use (e.g., peak hours during peak season). During these reservation system periods, this traffic management strategy would likely have beneficial effects on water quality for the length of the project area by limiting vehicular traffic, and thereby reducing vehicle-related pollutants in surface runoff throughout the corridor. However, although future traffic volumes would be managed by this reservation system management strategy, the allowed traffic along Moose-Wilson Road would still have ongoing adverse effects on water quality. The migration of vehicle-related pollutants along all segments of the road would continue to degrade water quality conditions, particularly in areas adjacent to and downstream of the pollutant sources.

Physical Characteristics of Moose-Wilson Road. In alternative D, the unpaved section of the road would remain unpaved and would be graded and treated for dust abatement several times per year. As a result of these management actions under alternative D, water quality downstream of the unpaved segment would continue to be adversely affected by road surface erosion and sedimentation, vehicle-generated dust, and the migration of MgCl into the surrounding soils and water into the long-term and in the area immediately surrounding the unpaved road segment.

The development of Moose-Wilson corridor design standards to be applied to design and maintenance of the roads, parking areas, and turnouts could result in limited beneficial impacts on water quality in localized areas where the standards correct erosion and sedimentation sources associated with vehicle use.

Moose-Wilson Road Realignment. Two large-scale realignments of Moose-Wilson Road would also occur under alternative D, resulting in considerable adverse impacts on water quality and some notable beneficial effects as well. The southern realignment between the Death Canyon Road junction and the Sawmill Ponds Overlook, the realignment of the northernmost segment of Moose-Wilson Road, and the relocation of the Moose Entrance Station and realignment of the four-way intersection with Teton Park Road would result in the introduction of vehicle-related pollutants from roadway surfaces into new, previously undisturbed areas. Vehicle pollutants (e.g., petroleum products) that are deposited along the newly aligned road would migrate into adjacent waters via stormwater runoff. This would degrade water quality conditions in new areas of the corridor, resulting in a long-term, adverse effect for the length of the two road realignment sections. Conversely, the abandoned segments of Moose-Wilson Road would no longer be a source for vehicle-related pollutants or the effects of road maintenance (such as increased erosion and sedimentation), a long-term, beneficial effect along the length of these abandoned sections. This beneficial effect is particularly noteworthy along the segment of the existing road that traverses the beaver pond wetland complex area. By realigning the road downstream of the wetland complex, the vehicle pollution source that currently migrates into the water of this sensitive wetland habitat would be removed, or at least reduced substantially. Also, limited, long-term, beneficial effects on water quality could be realized by appropriate drainage improvements. Improved drainage would likely result in reductions in erosion and sedimentation at various stormwater outfalls downstream of the road.

Additionally, areas along both realignments and associated bridge and drainage feature constructions could have considerable, short-term erosion and sedimentation impacts from the relatively large areas of earthwork and ground disturbance along the construction zones. These short-term erosion and sedimentation impacts would likely continue for subsequent years after the construction is complete until adequate ground cover vegetation is established. However, best management practices to protect water quality during construction would be applied in all construction efforts. These practices would minimize the adverse effects of erosion and sedimentation to some degree. Although, it would not be expected that these practices would fully prevent the noted adverse effects from occurring. Thus, sediment loading into waters downstream of the realignments could be expected for several years.

Turnouts and Parking. In alternative D, officially designated parking turnouts would be constructed along Moose-Wilson Road to accommodate up to 120 vehicles. The new parking turnouts would result in long-term, minor, beneficial impacts on water quality in several areas of the corridor through the reduction of erosion, sedimentation, and other water quality threats caused by user-created parking as described under alternative A (i.e., reduced trampling of vegetation and resulting erosion from unauthorized roadside parking). The installation of a vault toilet at Sawmill Ponds Overlook and Granite Canyon Trailhead would be done within an existing disturbed area, and would result in the reduction of water quality threats from visitor waste in inappropriate locations. These improvements would also result in erosion and sedimentation impacts from construction activities and ground disturbances, which would cause short-term, localized, adverse impacts on water quality until ground cover vegetation gets reestablished in disturbed areas. However, the overall impact to water quality from these actions is beneficial.

Bicycle Use. In alternative D, the construction of a multiuse pathway parallel to Moose-Wilson Road between Moose and the Granite Canyon Entrance and three associated bridges would have substantial short-term, adverse effects on local water quality along its full length. These construction-related adverse impacts on water quality would result from erosion and sediment loading from new ground disturbances for the pathway and would last until ground cover vegetation gets reestablished in the development areas. However, best management practices to protect water quality during construction would be applied in all construction efforts. These practices would minimize the adverse effects of erosion and sedimentation to some degree. Although, it would not be expected that these practices would fully prevent the noted adverse effects from occurring.

Additionally, the proposed multiuse pathway would also introduce some minor, long-term, adverse effects to water quality to a previously undisturbed area. Hikers and dismounted bicyclists using the multiuse pathway could trample vegetation on social trails and generate minor erosion and sedimentation impacts as well as generate human waste in random areas along the pathway. As possible, NPS staff would seek to educate visitors regarding resource impacts and proper waste disposal, which may alleviate some potential adverse impacts.

Commercial Activity. Authorized commercial activity would continue to be allowed and administered under alternative D, resulting in continued localized, minor, adverse water quality impacts. The most notable contributor to water quality effects would result from horse waste and other ground disturbances from continued guided horseback riding tours. Taxis would be allowed to provide transportation service in the corridor with appropriate permits, though all other nonpark-dependent commercial traffic would be prohibited. This reduction in commercial traffic and resulting vehicle-related pollutants would result in some very limited beneficial impacts on water quality.

Death Canyon. In alternative D, the actions proposed at Death Canyon would have both beneficial and adverse impacts on water quality. The removal and restoration of a large portion of the Death Canyon Road would reduce the road's adverse impacts on water quality, namely sediment loading from road runoff. Also, by providing a parking area with a capacity of 100 vehicles, the amount of unauthorized, user-created parking along the Death Canyon Road would likely decrease. The associated adverse effects on water quality from unofficial parking would be reduced (i.e., reduced trampling of vegetation and resulting erosion and sediment loading, see alternative A analysis). However, the proposed new connector road from White Grass to the trailhead would introduce water quality threats (e.g., sediment loading and vehicle related pollutants) to a previously undisturbed area. Additionally, limited adverse impacts would result from the expansion of the parking lot to accommodate 100 vehicles, which would be an increased disturbance area that is a long-term source of erosion and sedimentation in surface runoff.

Additionally, short-term, localized, and limited adverse impacts on water quality would result from erosion and sedimentation associated with construction activities and new ground disturbances for new connector road, White Grass Ranch road improvements, and the enlargement of the existing parking lot to accommodate 100 vehicles. These short-term adverse impacts would last until ground cover vegetation gets established in the development areas. However, best management practices to protect water quality during construction would be applied in all construction efforts. These practices would minimize the adverse effects of erosion and sedimentation to some degree. Although, it would not be expected that these practices would fully prevent the noted adverse effects from occurring.

Winter Access and Use. Winter access and use would continue to be allowed under alternative D, including expansion of the unplowed portion of Moose-Wilson Road up to the Sawmill Ponds Overlook. This reduction of plowing needs and other winter vehicle use in the northern segments of the corridor would result in reductions in adverse vehicle pollutant effects on water quality (from visitor vehicles and snowplow operations). Also, this change would result in a reduction in sediment loading into downstream water features between Sawmill Ponds Overlook and Death Canyon Road by eliminating snow storage in this area, which is a contributor to sediment loading in the spring snow melt. This is a notable beneficial effect given the proximity of the large wetland complex immediately adjacent to this newly unplowed segment. However, snow storage in areas along the plowed sections of Moose-Wilson Road would continue to be a limited source for sediment loading into adjacent water features during spring runoff.

Visitor Use and Experience / Education and Interpretation. Under alternative D, information sharing and use of backcountry patrols would continue to result in limited, beneficial impacts on water quality through the reduction of potential visitor impacts. These benefits could be realized through visitor information, education efforts, and enforcement regarding proper trash disposal, proper human waste disposal, and use of authorized parking areas within the corridor. Additionally, short-term, localized, and limited adverse impacts on water quality would result from construction activities for the establishment of two wildlife viewing areas and associated short nature trails (e.g., erosion and sedimentation).

Horse Use. Equestrian use in the Moose-Wilson corridor would continue to have long-term, localized, and minor adverse effects on water quality under alternative D (as described under alternative A). In particular, waste from horses would continue to adversely impact water quality within proximity to the four equestrian parking trailheads and their associated trails (Poker Flats, Sawmill Ponds Overlook, Death Canyon Road junction, and Granite Canyon Trailhead) as well as in the Poker Flats area and other heavily used equestrian areas of the corridor. Additionally, there would be some continued small-scale and localized impacts on water quality from horse trail stream crossings causing streambank erosion and sediment inputs to streams. However, the removal/ rerouting of trails with resource impacts and the establishment of newly aligned horse trail routes would mainly have beneficial, localized, impacts on water quality in the rerouted areas, as horse manure and sedimentation sources would be removed from sensitive areas.

Best Management Practices, Monitoring Guidelines, and Mitigation Measures. As part of this alternative, the park would implement best management practices, monitoring guidelines, and mitigation to protect the area's water quality. To lessen the adverse impact to water quality as a result of the actions described in alternative D, the National Park Service would continue to conduct periodic water quality monitoring of water bodies and waterways in the project area (including Phelps Lake, beaver ponds, the Snake River and its various tributaries) to ensure water quality remains in good condition. Additionally, the park would mitigate the effects of snow storage and stormwater runoff along park roads to avoid impacts on water quality of downstream bodies and implement revegetation for disturbed areas along and around water features, thus contributing a limited beneficial impact to water quality. Where possible, a suite of construction related mitigation measures would be implemented in alternative D. These include limiting construction activities to periods of low precipitation to reduce the risk of accidental spills reaching surface and/or groundwater, inspection of construction equipment for leaks, use of materials on construction sites to contain potential water quality threats, and stormwater management techniques to minimize soil erosion and degradation in project areas.

> Overall, the proposed management strategies under alternative D would have both beneficial and adverse impacts on water quality within the Moose-Wilson corridor. Beneficial impacts on water quality would primarily be realized through substantial reductions in vehicle pollutant and sediment threats in a major wetland complex due to the southern road realignment, establishing designated roadside turnouts that reduce erosion and sedimentation in unofficial parking spots, a reduction in sediment loading from snow storage areas (due to more unplowed areas), and larger parking capacity at Death Canyon and closure to a large segment of Death Canyon Road. These actions would result in considerable beneficial impacts on water quality. Adverse impacts would primarily result from continued vehicle-related pollutant migration within the corridor, continued long-term sediment loading and MgCl migration from the 1.4 mile unpaved segment, human waste in newly disturbed areas along the pathway, and considerable short-term sediment loading from several newly disturbed areas and construction activities associated with new developments within the corridor (two road realignments, multiuse pathway, larger Death Canyon parking area, wildlife viewing areas, etc.).

Cumulative Effects. A variety of other past, ongoing, and reasonably foreseeable future actions have and would continue to affect water quality within and outside the project area.

Past actions and continuing actions that have and continue to affect water quality in and around the Moose-Wilson corridor include seepage from upstream wastewater treatment plants and other sanitary facilities inside and outside the park; fecal bacteria in surface runoff and in waterbodies from livestock on nearby grazing lands; leakage from campground sanitary facilities, inappropriate backcountry camping techniques; erosion and sediment loading from roads, trails, and grazing land; increased deposition of acidifying compounds (i.e., nitrogen and sulfur) from development in the region around the park; oil and road salt running off from paved areas into the water throughout the region; and petroleum-based pollutants from upstream oil and gas activities on USFS lands. Collectively, all of these uses and activities have had and would continue to have considerable, adverse effects on water quality in the region.

When the effects of alternative D are added to these other past and ongoing effects, there would be the potential for a considerable, long-term, cumulative adverse effect on the water quality in the area. However, the incremental effect of alternative D effects being added to the above adverse effects would be relatively small.

Conclusion. Alternative D would have both beneficial and adverse impacts on water quality within the Moose-Wilson corridor. Beneficial impacts on water quality would primarily be realized through substantial reductions in vehicle pollutant and sediment threats in a major wetland complex due to the southern road realignment, establishing designated roadside turnouts that reduce erosion and sedimentation in unofficial parking spots, a reduction in sediment loading from snow storage areas (due to more unplowed areas), and larger parking capacity at Death Canyon and closure to a large segment of Death Canyon Road. Some small and very localized reductions in nutrient and sediment loading from improved equestrian trail management would also occur. These actions would result in considerable beneficial impacts on water quality. Adverse impacts would primarily result from continued vehicle-related pollutant migration within the corridor, continued long-term sediment loading and MgCl migration from the 1.4 mile unpaved segment, human waste in newly disturbed areas along the pathway, and considerable short-term sediment loading from several newly disturbed areas and construction activities associated with new developments within the corridor (two road realignments, multiuse pathway, larger Death Canyon parking area, wildlife viewing areas, etc.). However, the adverse effects on water quality as a result of these actions would not likely be significant due to the relatively isolated and localized nature of the effects on water quality (i.e., in the area immediately surrounding the two realignments of Moose-Wilson Road, the multiuse pathway, road improvements in the Death Canyon Trailhead area, and adjacent areas).

When the effects of alternative D are added to past and ongoing effects from other uses and activities in the area, there would be the potential for a considerable, long-term, cumulative adverse effect on the water quality in the area. However, the incremental effect of alternative D effects being added to these adverse effects would be relatively small.

VEGETATION

Methods and Assumptions for Analyzing Impacts

The effects of the alternatives on vegetation in the project area were analyzed based on impacts resulting from visitor use patterns, and construction and maintenance of developments associated with each alternative. Impacts were identified based on anticipated increases or decreases in native vegetation/vegetative communities, alteration, or restoration of native vegetation/vegetative communities in the corridor, and the potential for the spread of invasive noxious weeds and other nonnative plant species in the corridor. Information on current vegetation in the area was compared with the locations of proposed developments and other actions in the alternatives. The impact analysis was based on the knowledge and best professional judgment of planners, resource specialists, data from park records, and studies of similar actions and impacts when applicable. Acres, miles and percentages presented in the analysis are estimates and are based on the best available GIS information on the construction zones and development footprints. To help focus the analysis, the following impact analysis questions were considered to identify the potential impacts of each alternative:

Impact Analysis Questions.

1. What degree of alteration, loss, or fragmentation of native plant communities would occur under each alternative?

2. What level of invasive plant risk would be associated with each alternative? (disturbance areas, proximity to nonnative seed sources, etc.)

General Assumptions. The following assumptions were considered in concert with each of the above impact analysis questions when assessing the effects of each alternative management strategy:

- All construction impacts are limited to the identified construction zones.
- All of the vegetation mitigation measures described in chapter 2 would be implemented. But even with these measures with new developments and/or changes in visitor use some unavoidable changes would occur to vegetation in the corridor.
- Dust abatement would continue to be applied to unpaved parts of Moose-Wilson Road.
- Dust and dust abatement applications affect vegetation along the roadway.
- The larger the road/bike path corridor, the greater the potential for loss or fragmentation of native plant communities.
- The area of vegetation loss would depend on the design of the road (including shoulders) and multiuse path (length and width of road or multiuse path), type of vegetation removal (e.g., clear cutting or selective cutting), number of trees removed, cut/fill, and other factors.
- There would be both temporary and permanent impacts on vegetation due to construction.
- Visitors would continue to go off the road and trails, trampling vegetation and creating new unofficial trails.
- Ground disturbance due to construction and visitor use would increase the spread of invasive noxious weeds and other nonnative species.
- Increased use of the corridor would increase the potential for the introduction of nonnative species.

Alternative A (No Action)

Under alternative A, several adverse vegetation impacts would continue due to vehicle traffic, pedestrian and equestrian use, and ongoing maintenance in localized areas primarily along the Moose-Wilson and Death Canyon Roads. As noted in the "Affected Environment" chapter, the unpaved segment of Moose-Wilson Road has been widening over time, due to drivers avoiding potholes and wet and rutted areas, and due to continued road maintenance required to remove ruts and maintain a flat road surface, resulting in further vegetation damage and loss. Road widening would be expected to continue in localized areas, resulting in increased loss of vegetation, particularly with expected increased vehicle traffic.

There would continue to be roadside vegetation impacts due to visitors parking their vehicles in nondesignated turnouts and outside parking areas in the Moose-Wilson corridor. Impacts on vegetation near roadways and parking areas would result in trampling, breakage of plants, loss of productivity, and eventual loss of vegetation in certain areas. Roadside vegetation most likely to be damaged or lost would be grasses, shrubs, and seedlings primarily associated with the lodgepole pine and shrubland vegetation communities. Although park managers would continue to inform and educate visitors to park only in designated areas, under alternative A visitors would likely continue to turn off in nondesignated areas to view wildlife along Moose-Wilson Road. Visitors would also continue to park outside of the Death Canyon and Granite Canyon Trailhead parking areas when existing parking areas are at capacity, resulting in continuing vegetation damage and loss in the mixed conifer and sagebrush shrubland vegetation communities. Increased vehicle traffic in the corridor (as projected) would exacerbate these impacts. Undesignated roadside parking would be a considerable, ongoing adverse effect that is occurring at many areas along roads in the project area.

Although park staff would continue to inform and educate visitors about the reasons to stay on designated trails, under alternative A visitor-created trails would likely continue to be used, and possibly new ones created, at popular destinations in the corridor. Vegetation loss and damage due to hikers using or creating unofficial trails would be expected to continue at popular use areas, such as the Sawmill Ponds Overlook. Phelps Lake, and along the Death Canyon and Valley Trails. Unofficial horseback and hiker trails also would likely continue to be used and created in the Poker Flats area, resulting in vegetation trampling and loss. Again, any increase in visitor use in these areas over time would likely intensify these impacts.

Although magnesium chloride (MgCl) would be periodically applied to control dust along the unpaved portion of Moose-Wilson Road, some dust would still be generated by increased numbers of vehicles driving the road under alternative A. This dust can cover adjacent roadside vegetation, primarily in the lodgepole pine vegetation community, which may reduce their productivity and result in the loss of some plants.

With increasing numbers of vehicles and hikers, there is also an increasing potential for people to bring in and spread noxious weeds and invasive nonnative plants in the corridor. As noted in the “Affected Environment” chapter, all of the road segments have noxious weed and nonnative plant issues. Although park managers are working to control the spread of these nonnative species, they would likely continue to spread in the road corridor by vehicles, horses, and people. In addition, the threat of nonnative and noxious weed spreading is compounded by the amount of disturbed ground or denuded native vegetation from visitor use and park operations in the corridor. Thus, any ground or vegetation disturbances noted in this section could also be a contributing factor to the spread of nonnative plants, especially cheatgrass, spotted knapweed, and St. John’s wort.

Finally, impacts on vegetation would continue where periodic road maintenance activities temporarily disturb vegetation along roads and near work locations. Impacts may also continue to roadside vegetation due to the periodic application of magnesium chloride to suppress dust along the gravel portion of Moose-Wilson Road. As noted in the “Affected Environment” chapter, it is not known how or to what degree this action is damaging or altering the roadside vegetation.

In summary, under alternative A, roadside vegetation primarily associated with the lodgepole pine forest, mixed conifer, and shrubland vegetation communities would continue to be lost and altered due to visitor activities. These adverse impacts would be highly localized, site-specific, and relatively small. Most impacts would be limited to roadside vegetation and vegetation around parking areas. No new areas would be expected to experience substantial vegetation disturbance and loss under alternative A.

However, existing and new ground disturbances or denuded vegetation that would occur under this alternative would increase the threat for the spread of nonnative plants and noxious weeds. Park managers would be expected to continue to take actions to prevent vegetation damage and loss from worsening.

Cumulative Effects. A variety of actions have altered, and would continue to alter, vegetation within and outside the project area. Past development of park infrastructure has altered vegetation in the project area. Within the project area vegetation would continue to altered due to spoils from periodic dredging being deposited along irrigation ditches on the east side of the road. Periodic maintenance along the utility corridor that passes through the project area would continue to alter vegetation.
Outside the project area, other NPS and non-NPS actions have and would continue, to alter vegetation, as outlined in the cumulative impacts scenario. Improvements being made in the Jenny Lake area, development of multiuse pathways outside the project area (including construction of part of the multiuse pathway system near Jenny Lake), and construction of planned residential and commercial developments, such as the Teton Village expansion, all would result in the permanent loss of vegetation, primarily shrubland/sage brush and some woodlands, and short-term construction-related disturbance to vegetation. However, most of these developments would occur in areas where human activities and infrastructure already occur, in areas where vegetation already has been disturbed. Although mitigation measures would be expected to be implemented, native vegetation still would be adversely affected, such as through the clearing of vegetation and the spread of nonnative plants.

When the effects of alternative A are added to these other ongoing and likely future effects, there would be the potential for a long-term, cumulative adverse effect primarily on shrubland vegetation in the area. However, the increment of alternative A added to the adverse effects of the other actions occurring in the area would be small.

Conclusion. No major new vegetation disturbance would be expected as a result of alternative A. The alternative would continue to result in small, localized adverse impacts on vegetation in the corridor due to impacts of visitors, including drivers widening unpaved portions of Moose-Wilson Road and parking outside of designated turnouts and parking areas, and the use and creation of unofficial hiker and horse trails. These would all be ongoing adverse impacts, primarily affecting grasses, shrubs, and seedlings associated with lodgepole pine, mixed conifer, and shrubland vegetation communities along the roads, parking areas, and trails. The existing and new ground disturbances or denuded vegetation that would occur under this alternative would also increase the threat for the spread of nonnative plants and noxious weeds. The projected increased use and traffic levels would exacerbate these impacts under this alternative. The vegetation that would be lost or altered is relatively common in the project area and the impact would not affect the viability of the vegetative communities. There would not be a substantial alteration or loss of vegetation communities, or a major change in the distribution and abundance of native plant species in the project area. Thus, overall, alternative A would not have an adverse significant effect on vegetation in the corridor.

There would be the potential for an adverse cumulative effect to vegetation in the area when the effects of alternative A are added to other NPS and non-NPS actions likely to occur in the region, but alternative A would add a small increment to the overall cumulative impact.

Alternative B

Alternative B would have several adverse impacts on vegetation in the corridor.

Although the application of the vegetation mitigation measures, such as fencing construction areas and salvaging existing native vegetation as much as possible, would avoid and reduce potential vegetation impacts, there still would be adverse effects from construction of the new developments.

The largest adverse impact of alternative B on vegetation would result from the realignment of two segments of Moose-Wilson Road, which would result in the permanent loss of about 5.8 acres of vegetation, primarily willow shrublands, sagebrush shrubland, and lodgepole pine forest. These long, linear disturbances would fragment the existing native plant communities and would also provide corridors that nonnative plants, such as cheatgrass, spotted knapweed, and St. John's wort, would likely proliferate. Relative to the scale and impact of other existing developments in the corridor, the loss of native vegetation and increased threat for nonnative plants from the two realignments would be a substantial, long-term adverse impact in this localized area. In addition, another approximately 2.6 acres of vegetation in the construction zones along the new alignments would be temporarily affected, with vegetation being removed or altered (e.g., broken, crushed or trampled) due to construction activities. Although this disturbed area would be revegetated after construction is completed, nonnative plants like cheatgrass likely would also become established along the roadway—it is unlikely that the restored area's vegetation would be the same as pre-construction conditions. These linear disturbances and likely noxious weed invasions would have the potential to spread into adjacent lands, increasing the impacts on an area substantially larger than the initial disturbance area.

Alternative B would result in several other adverse impacts on vegetation in localized areas along the Moose-Wilson and Death Canyon Roads. Development of a new parking area, access road and roundabouts at the LSR Preserve would result in the permanent loss or alteration of about 2.0 acres of vegetation, primarily lodgepole pine forest. Development of the new Death Canyon Trailhead parking area would result in the permanent loss of about 0.4 acre of lodgepole pine forest, while the relocation of the Moose Entrance Station and realignment of the road at the entrance station would result in the permanent loss of about 1.0 acre of shrubland vegetation. A total of approximately 0.9 acre of lodgepole and shrubland vegetation also would be permanently lost or altered due to the establishment of turnouts that accommodate up to120 vehicles along Moose-Wilson Road. (The disturbance area may be smaller than this depending on how many of the turnouts would be designated in areas that have already been disturbed by visitor-created turnouts versus new areas that have not been disturbed.)

Additional short-term disturbance would occur to vegetation in the construction zones surrounding these work areas. The disturbance areas associated with the above development projects would depend on the site-specific terrain, and the actual design of the infrastructure (e.g., how much cut and fill work is needed), and cannot be estimated at this time. Also, in spite of mitigation efforts, with any ground disturbance there would still be the potential for the spread of some nonnative species, such as spotted knapweed and cheatgrass, in the area. As noted above, the two road realignments would greatly increase the potential for nonnative plant infestations in previously undisturbed areas. Thus, the disturbed areas associated with the proposed developments under this alternative greatly increase the potential for degraded vegetation communities in various areas of the corridor (i.e., if nonnative vegetation moves in or if soil erosion occurs before native vegetation is re-established).

Some vegetation trampling and breakage would continue under alternative B due to guided horseback riders going off trails (although less so than in alternative A due to the reasons noted below).

Alternative B also would have a number of long-term beneficial impacts on vegetation in the corridor. Paving the existing 1.4 miles of unpaved portion of Moose-Wilson Road would eliminate road widening that has occurred in this area, reducing the potential for additional grass and shrub vegetation being trampled and broken and for dust covering vegetation, reducing productivity. This action also would eliminate the need to apply MgCl to suppress dust, and thus stop the possible impact of this material on the adjacent roadside vegetation. Closure and replanting 0.6 mile of the road between Murie Ranch Road and near Sawmill Ponds Overlook and of 1.6 miles between Sawmill Ponds Overlook and the Death Canyon Road junction would in time result in the eventual restoration of about 5.8 acres of vegetation, primarily sagebrush shrubland, mixed deciduous shrubland, and some aspen and lodgepole forest. Closure and replanting the existing Death Canyon Trailhead parking area, converting part of the existing road to a trail, and shrinking the size of the remaining portion of the road would eventually result in the restoration of about 1.4 acres of mixed conifer forest vegetation. However, as noted above, it is likely that the disturbed areas would not be restored to the same natural, native condition of adjacent lands (due to nonnative plant infestations, soil erosion, etc.).

Several other actions in alternative B also would beneficially affect vegetation in the corridor. Development of the new parking turnouts along the Moose-Wilson and Death Canyon Roads, a larger parking areas at Death Canyon Trailhead, and placement of barriers is expected to substantially reduce visitors parking in nondesignated areas along roadsides, lessening the trampling of vegetation. Likewise, the application of barriers and signs at the Sawmill Ponds parking area and along the Death Canyon and Moose-Wilson Roads, which delineate parking areas, also should prevent parking in nondesignated areas. As a result, few, if any, new visitor-created parking areas would be expected under alternative B. With the reduction in these visitor-created parking areas, there would be a lower potential for the spread of noxious weeds and other nonnative plants. In addition, delineation of trails and routes for horses, would be expected to result in more visitors staying on existing official trails, and in turn substantially reducing the potential for the creation of new visitor-created trails. The removal/rerouting of trails with resource impacts due to horses and the elimination of horse trailer parking at Sawmill Ponds Overlook and Granite Canyon Trailhead would also reduce vegetation trampling and breakage. (However, rerouting horse trails could also result in increased loss and alteration of vegetation if the trails are located in previously undisturbed areas.)

Overall, alternative B would result in adverse and beneficial vegetation impacts in several areas along Moose-Wilson Road (existing and new alignments) and Death Canyon Road. There would be a permanent loss of a minimum of about 10.1 acres of vegetation, primarily lodgepole pine forest and shrubland, due to the development of new road segments, parking area, and turnouts along Moose-Wilson Road. The loss of vegetation due to the construction of two new Moose-Wilson Road realignments would be a substantial, long-term adverse impact on the native vegetation in this localized area. Additional vegetation around the infrastructure would also be disturbed in the short term due to construction activities, and although these areas would be replanted it is unlikely they would be restored to pre-construction condition. Thus, the threat of expanded infestation of nonnative plants and noxious weeds would greatly increase as a result of the above development disturbances in the short-term and long-term. Conversely, alternative B would also result in the eventual restoration of forest and shrub vegetation. The removal and revegetation of two road segments and the Death Canyon Trailhead parking area would beneficially affect approximately 7.2 acres of vegetation, primarily lodgepole pine forest, mixed conifer forest, and shrubland, in the long term. (However, it is unlikely that this restored vegetation would be the same as the pre-construction native vegetation.) In addition, developed turnouts and expanded parking at Death Canyon would result in a reduction in disturbance of vegetation due to visitors parking in nondesignated areas.

Cumulative Effects. As described under alternative A, a variety of actions have altered, and would continue to alter, vegetation within and outside the project area. Past development of park infrastructure has altered vegetation in the project area, such as development of the Moose visitor center and the southwest entrance facilities. Within the project area vegetation would continue to be altered due to spoils from periodic dredging being deposited along irrigation ditches on the east side of the road. Periodic maintenance along the utility corridor that passes through the project area also would continue to damage and alter vegetation.

Outside the project area other NPS and non-NPS actions have and would continue, to alter vegetation, as outlined in the cumulative impacts scenario. Improvements being made in the Jenny Lake area, development of multiuse pathways outside the project area (including construction of part of the multiuse pathway system near Jenny Lake), and construction of planned residential and commercial developments, such as the Teton Village expansion, all would result in the permanent loss of vegetation, primarily shrubland/sage brush and some woodlands, and short-term construction-related disturbance to vegetation. Most of these developments would occur in areas where human activities and infrastructure already occur, in areas where vegetation already has been disturbed. Although mitigation measures would likely be implemented, native vegetation still would be adversely affected, such as through the clearing of vegetation and the spread of nonnative plants. When the effects of alternative B are added to these other ongoing and likely future effects, there would be the potential for a long-term, cumulative adverse effect primarily on shrubland vegetation in the area. Alternative B would add an appreciable increment to the overall adverse cumulative impact to vegetation occurring in the area.

Conclusion. Alternative B would result in both adverse and beneficial impacts on vegetation along the Moose-Wilson and Death Canyon Roads. Relative to the project area, a small area of native vegetation would be permanently lost or altered. However, this disturbed area would be large relative to the limited disturbance that has occurred in the corridor. The largest adverse impact of the alternative would be due to the construction of the two new Moose-Wilson Road alignments, resulting in the permanent loss of vegetation in this area—a substantial, long-term, adverse impact to native vegetation in this localized area, primarily willow shrublands, sagebrush shrubland, and lodgepole pine forest. The development of a new Death Canyon Trailhead parking area and turnouts along Moose-Wilson Road would result in additional permanent loss of mixed conifer forest vegetation. Additional short-term disturbance of vegetation surrounding the infrastructure would occur due to construction activities, and although these areas would be expected to be revegetated it is unlikely they would be restored to pre-construction condition. Thus, there would be a substantially increased potential for the spread of nonnative species and noxious weeds due to new ground disturbances associated with the above developments (both in the short-term and long-term). Alternative B would also result in the eventual restoration of vegetation due to the removal and revegetation of two road segments and the existing Death Canyon Trailhead parking area, beneficially affecting shrubland, lodgepole pine, and mixed conifer forest vegetation in the long term (although this restored vegetation would not be the same as the native vegetation that grew here prior to the developments). In addition, there would be a reduction in disturbance of roadside vegetation primarily associated with the lodgepole pine vegetation community, due to the paving of the unpaved portion of

Moose-Wilson Road, and due to a reduction in visitors parking in nondesignated areas (due to development of turnouts and expanded Death Canyon Trailhead parking). Collectively, while alternative B would reduce some existing adverse impacts on vegetation, it would have a much greater adverse effect on vegetation than alternative C (due to the two Moose-Wilson Road realignments) and lower degree of adverse effect than alternative D (because alternative B does not include other large development expansions). These adverse vegetation impacts would diminish the quality and integrity of the Ecological Communities and Wildlife fundamental resource and value. Although the above-noted adverse effects would be considerable, there would not be a substantial alteration or loss of vegetation communities or a major change in the distribution and abundance of native plant species in the project area. Thus, overall, alternative B would not likely have a significant adverse effect on vegetation in the project area.

When the effects of alternative B are added to the effects of other past, present, and likely future National Park Service and other actions in the region, there likely would be a long-term, adverse cumulative impact on vegetation, primarily on shrubland vegetation. Alternative B would add an appreciable increment to the overall adverse cumulative impact to vegetation occurring in the area.

Alternative C (NPS Preferred)

Alternative C would have several adverse and beneficial impacts on vegetation in the corridor. Although the application of the vegetation mitigation measures, such as fencing construction areas and salvaging existing native vegetation as much as possible, would avoid and reduce potential vegetation impacts, there still would be adverse effects from construction of the new developments.

The largest adverse impact of alternative C on vegetation would be due to the realignment of the northernmost segment of Moose-Wilson Road, which would result in the permanent loss of about 1.2 acres of vegetation, primarily willow shrubland and sagebrush shrubland. This new linear corridor would fragment the existing native plant communities and would also provide a new route that nonnative plants could spread along. In addition, another approximately 0.5 acre of vegetation in the construction zones along the new alignment would be temporarily affected, with vegetation being removed or altered (e.g., broken, crushed or trampled) due to construction activities. Although this disturbed area would be revegetated after construction is completed, nonnative plants like cheatgrass likely would also become established along the roadway—it is unlikely that the restored area's vegetation would be the same as pre-construction conditions. These linear disturbances, and likely noxious weed invasions, would have potential to spread into adjacent lands, increasing the impacts on an area substantially larger than the initial disturbance area.

Alternative C would result in several other adverse impacts on vegetation in localized areas along the Moose-Wilson and Death Canyon Roads. Development of a new Death Canyon Trailhead parking area would result in the permanent loss of about 0.7 acre of vegetation, primarily lodgepole pine forest. Relocation of the Moose Entrance Station, and construction of the queuing lanes and turnarounds at the two entrance stations would result in the permanent loss of 1.4 acre of shrubland vegetation. A total of approximately 0.9 acre of lodgepole and shrubland vegetation also would be permanently lost or altered due to the establishment of turnouts for up to 120 vehicles along Moose-Wilson Road. (The disturbance area may be smaller than this depending on how many of the turnouts would be designated in areas that have already been disturbed by visitor-created turnouts versus new areas that have not been disturbed.) Additional short-term disturbance would occur to vegetation in the construction zones surrounding these work areas. The disturbance areas associated with the above development projects would depend on the site-specific terrain, and the actual design of the infrastructure (e.g., how much cut and fill work is needed), and cannot be estimated at this time. Also, in spite of mitigation efforts, with any ground disturbance there would still be the potential for the spread of some nonnative species, such as spotted knapweed, cheatgrass, and St. John's wort, in the area. The road realignment, in particular, would increase the potential for nonnative plant infestations in previously undisturbed areas. Thus, the disturbed areas associated with the proposed developments under this alternative increase the potential for degraded vegetation communities in various areas of the corridor (i.e., if nonnative vegetation moves in or if soil erosion occurs before native vegetation is re-established).

Some vegetation trampling and breakage would continue under alternative C due to horseback riders going off trails (although less so than in alternative A due to the reasons noted below).

Alternative C would also have a number of long-term beneficial impacts on vegetation in the corridor. Paving the existing unpaved 1.4-mile portion of Moose-Wilson Road would eliminate road widening that has occurred in this area, reducing the potential for additional grass, shrub, and seedlings primarily associated with the lodgepole pine vegetation community being trampled and broken and for dust covering vegetation, reducing productivity. This action also would eliminate the need to apply MgCl to suppress dust, and thus stop the possible impact of this material on the adjacent roadside vegetation. Closure and replanting 0.6 mile of the road between Murie Ranch Road and near Sawmill Ponds Overlook would in time result in the eventual restoration of about1.6 acres of vegetation, primarily mixed deciduous shrubland. Closure and replanting the existing Death Canyon Trailhead parking area, and converting 1 mile of the existing road to a trail, would eventually result in the restoration of about 2.8 acres of mixed conifer forest vegetation. However, as noted above, it is likely that the disturbed areas would not be restored to the same natural, native condition of adjacent lands (due to nonnative plant infestations, soil erosion, etc.).

Several other actions in alternative C also would beneficially affect vegetation in the corridor. Implementing a traffic sequencing/time sequencing system during peak use periods would limit the potential increase in traffic that would otherwise likely occur, which in turn would reduce the potential for visitors parking off the road, and thus decrease the potential for future vegetation crushing, breakage and loss. Development of the new parking turnouts along the Moose-Wilson and Death Canyon Roads, a notably larger Death Canyon parking area, and placement of barriers is also expected to substantially reduce visitors parking in nondesignated areas along the roadside, reducing the trampling of vegetation. Likewise, the application of barriers and signs at the Sawmill Ponds parking area, which delineate parking areas, also should prevent parking in nondesignated areas. As a result, few, if any, new visitor-created parking areas would be expected under alternative C. With the reduction in these visitor-created parking areas, there would be a lower potential for the spread of noxious weeds and other nonnative plants. In addition, delineation of trails and routes for horses would be expected to result in more visitors staying on existing official trails, and in turn substantially reducing the potential for the creation of new visitor-created trails. The removal/rerouting of trails with resource impacts due to horses would also reduce vegetation trampling and breakage. (However, rerouting horse trails could also result in increased loss and alteration of vegetation if the trails are located in previously undisturbed areas.)

Overall, alternative C would result in adverse and beneficial vegetation impacts in several areas along the Moose-Wilson and Death Canyon Roads. There would be a permanent loss of a minimum of about 4.3 acres of vegetation, primarily shrubland and some lodgepole pine forest, due to the development of a new northern Moose-Wilson Road segment, a new Death Canyon Trailhead parking area, and turnouts along Moose-Wilson Road. Additional vegetation around the new infrastructure would also be disturbed in the short term due to construction activities, and although these areas would be replanted it is unlikely they would be restored to pre-construction condition. Thus, the threat of expanded infestation of nonnative plants and noxious weeds would increase as a result of the above development disturbances in the short-term and long-term. Conversely, alternative C would result in a long-term beneficial impact to approximately 4.4 acres of vegetation, primarily lodgepole pine forest, mixed conifer forest, and shrubland due to the removal and revegetation of a Moose-Wilson Road segment, the Death Canyon Trailhead parking area, and part of Death Canyon Road. (However, it is unlikely that this restored vegetation would be the same as the pre-construction native vegetation.) In addition, there would be a reduction in disturbance of vegetation from visitors parking in nondesignated areas due to the initiation of a traffic sequencing system, the establishment of new turnouts, and a larger parking lot capacity at the new Death Canyon Trailhead.

Cumulative Effects. As described under alternative A, a variety of actions have altered, and would continue to alter, vegetation within and outside the project area. Past development of park infrastructure has altered vegetation in the project area, such as development of the Moose visitor center and the southwest entrance facilities. Within the project area vegetation would continue to be altered due to spoils from periodic dredging being deposited along irrigation ditches on the east side of the road. Periodic maintenance along the utility corridor that passes through the project area also would continue to damage and alter vegetation.

Outside the project area, other NPS and non-NPS actions have and would continue, to alter vegetation, as outlined in the cumulative impacts scenario. Improvements being made in the Jenny Lake area, development of multiuse pathways outside the project area (including construction of part of the multiuse pathway system near Jenny Lake), and construction of planned residential and commercial developments, such as the Teton Village expansion, all would result in the permanent loss of vegetation, primarily shrubland/sage brush and some woodlands, and short-term construction-related disturbance to vegetation. Most of these developments would occur in areas where human activities and infrastructure already occur, in areas where vegetation already has been disturbed. Although mitigation measures would likely be implemented, native vegetation still would be adversely affected, such as through the clearing of vegetation and the spread of nonnative plants. When the effects of alternative C are added to these other ongoing and likely future effects, there would be the potential for a long-term, cumulative adverse effect primarily on shrubland vegetation in the area. Alternative C would add an appreciable increment to the overall adverse cumulative impact to vegetation occurring in the area.

Conclusion. Alternative C would result in both adverse and beneficial impacts on vegetation along the Moose-Wilson and Death Canyon Roads. The largest adverse impact of the alternative would be due to the construction of the new Moose-Wilson Road alignment, resulting in the permanent loss of vegetation in this area, primarily lodgepole pine forest and shrubland. The development of a new Death Canyon Trailhead parking area and turnouts along Moose-Wilson Road would result in additional permanent loss of vegetation primarily lodgepole pine forest. Short-term disturbance of vegetation in the construction zones around the infrastructure would occur, and although these areas would be revegetated it is unlikely they would be restored to pre-construction condition. Thus, the threat of expanded infestation of nonnative plants and noxious weeds would increase as a result of the above development disturbances in the short-term and long-term. Conversely, alternative C also would result in the eventual restoration of vegetation due to the removal of one segment of Moose-Wilson Road and the existing Death Canyon Trailhead parking area, and conversion of the part of the Death Canyon Road to a trail. These actions would beneficially affect some shrubland, lodgepole pine, and mixed conifer forest vegetation in the long term (although this restored vegetation would not be the same as the pre-construction vegetation). In addition, there would be a reduction in disturbance of roadside vegetation from visitors parking in nondesignated areas due to the paving of the unpaved portion of Moose-Wilson Road, initiation of a traffic sequencing system, the establishment of new turnouts, and a larger parking lot capacity at the new Death Canyon Trailhead. Overall, alternative C would not result in a substantial alteration or loss of vegetation communities or a major change in the distribution and abundance of native plant species in the project area. Thus, alternative C would not likely have a significant adverse effect on vegetation in the project area. Collectively, alternative C would address various existing adverse effects on vegetation (relative to alternative A) and would have the least overall adverse effect on vegetation from proposed developments when compared to alternatives B and D.

When the effects of alternative C are added to the effects of other past, present, and likely future National Park Service and other actions in the region, there likely would be a long-term, adverse cumulative impact on vegetation, primarily on shrubland vegetation. Alternative C would add an appreciable increment to the overall adverse cumulative impact to vegetation occurring in the area.

Alternative D

Alternative D would have both adverse and beneficial impacts on vegetation in the corridor, but none of the effects would result in a significant adverse impact on overall vegetation in the corridor. The application of the vegetation mitigation measures, such as fencing construction areas and salvaging existing native vegetation as much as possible, would avoid and reduce potential vegetation impacts from the construction of new infrastructure. However, several adverse impacts would still occur.

The largest adverse impacts of alternative D on vegetation would result from the construction of the two new Moose-Wilson Road alignments and the multiuse pathway. The development of a new multiuse pathway would result in approximately 9.0 acres of vegetation being cleared and permanently altered, primarily lodgepole pine and sagebrush shrubland. Realignment of two segments of Moose-Wilson Road, including the actual alignment footprint, would result in the permanent loss of about 5.8 acres of vegetation, primarily willow shrublands, sagebrush and mixed deciduous shrublands, and some aspen and lodgepole pine forest. These long, linear disturbed areas would considerably fragment the existing intact native plant communities and would also provide disturbance corridors that nonnative plants, such as cheatgrass, spotted knapweed, and St. John's wort, would likely proliferate. The loss of native vegetation in these corridors would be a substantial, long-term adverse impact in the localized areas and would be the greatest adverse effect on vegetation relative to all other alternatives.

Another approximately 8.0 acres of vegetation along the two new alignments and the pathway would be temporarily affected, with vegetation being removed or altered (e.g., broken or trampled) due to construction activities. Although these disturbed areas would be expected to be revegetated once construction is completed, nonnative plants like cheatgrass likely would also become established along the roadways and pathway—it is unlikely they would be restored to pre-construction conditions after construction activities are completed. Given the scale of these road realignment and multiuse pathway disturbance zones, the short-term and long-term threat for nonnative plant infestation would greatly increase along the road realignments, pathway, and in the adjacent native vegetation communities as a result of these actions.

Although MgCl would be periodically applied to control dust along the unpaved portion of Moose-Wilson Road, some dust would still be generated by vehicles driving the road under alternative D. This dust can cover adjacent roadside vegetation, and may reduce their productivity and result in the loss of some plants.

Several other adverse impacts would occur to vegetation in localized areas under alternative D. A total of approximately 0.9 acre of lodgepole pine and shrubland vegetation also would be permanently lost or altered due to the establishment of turnouts for up to 120 vehicles along Moose-Wilson Road. (The disturbance area may be smaller than this depending on how many of the turnouts would be designated in areas that have already been disturbed by visitor-created turnouts versus new areas that have not been disturbed.) Lodgepole pine forest, mixed conifer forest, and sagebrush shrubland and mixed shrubland vegetation would also be removed or altered due to expansion of the Death Canyon Trailhead parking area(~0.7 acre of vegetation), construction of a new road segment between Death Canyon Road and White Grass Road (~1.6 acres), construction of two new roadside parking/wildlife viewing areas and associated nature trails for wildlife viewing along Moose-Wilson Road (~2.3 acres), and relocation of the Moose Entrance Station and construction of queuing lanes and turnarounds at the two entrance stations (~1.4 acres). Additional short-term disturbance would occur to vegetation in the construction zones surrounding these work areas. The disturbance area would depend on the terrain, and the actual design of the infrastructure (e.g., how much cut and fill work is needed), and cannot be estimated at this time. Also, in spite of mitigation efforts, with any ground disturbance there would still be the potential for the spread of some nonnative species, such as spotted knapweed, cheatgrass, and St. John's wort in the area. As noted above, the two road realignments and the pathway, in particular, would greatly increase the potential for nonnative plant infestations in previously undisturbed areas.

Some vegetation trampling and breakage would also continue due to horseback riders going off trails in alternative D (although less so than in alternative A due to the reasons noted below).

Closure and replanting 0.6 mile of the road between Murie Ranch Road and near Sawmill Ponds Overlook and of 1.6 miles between Sawmill Ponds Overlook and most of the Death Canyon Road would in time result in the eventual restoration of about 7.2 acres of vegetation, primarily lodgepole pine forest and some shrubland, which would be a beneficial effect on vegetation in the corridor. However, this restored vegetation would not be the same as the natural, native vegetation growing in undisturbed areas.

Several other actions would beneficially affect vegetation in the corridor. Implementing a traffic reservation system during peak use periods would limit the potential increase in traffic that would otherwise likely occur, which in turn would reduce the potential for visitors parking off the road, and thus decrease the potential for future vegetation crushing, breakage and loss. Development of the new parking turnouts, new parking areas along Moose-Wilson Road, the addition of barriers along the road, expansion of the Death Canyon Trailhead parking area, and improvements to delineate parking spaces at the Granite Canyon and Sawmill Ponds parking areas are expected to substantially reduce the number of vehicles parking in nondesignated areas. As a result, very few new visitor-created parking areas would be expected under alternative D. With the reduction in these visitor-created parking areas, there would be a lower potential for the spread of noxious weeds and other nonnative plants. In addition, delineation of trails and routes for horses, would be expected to result in more visitors staying on existing official trails, and in turn substantially reducing the potential for the creation of new visitor-created trails. The removal/rerouting of trails with resource impacts due to horses outside Poker Flats would also reduce vegetation trampling and breakage. (However, rerouting horse trails could also result in increased loss and alteration of vegetation if the trails are located in previously undisturbed areas.)

Overall, alternative D would result in substantial adverse impacts on vegetation in localized areas along Moose-Wilson Road due to the loss and alteration of lodgepole pine forest and shrubland vegetation communities caused by construction of the two new road alignments and the multiuse pathway. The development of new turnouts, expansion of the Death Canyon Trailhead parking area, a new road link between the Death Canyon and White Grass Roads, and two new parking/wildlife viewing areas and associated nature trails would result in additional permanent loss of native vegetation, primarily lodgepole pine and mixed conifer forest and shrubland. Altogether, about 21.7 acres of vegetation, primarily lodgepole pine forest, mixed conifer forest, and shrubland would be permanently lost or altered. Additional vegetation around the infrastructure would also be disturbed in the short term due to construction activities, and although these areas would be expected to be revegetated it is likely they would not be restored to pre-construction condition. Thus, there would be a greatly increased potential for the spread of nonnative species and noxious weeds due to new ground disturbances associated with the above developments (both in the short-term and long-term). Conversely, alternative D would also result in a long-term beneficial effect to approximately 7.2 acres of vegetation, primarily lodgepole pine and mixed conifer forest and shrubland, due to the removal and eventual revegetation of two road segments of Moose-Wilson Road and most of Death Canyon Road. (However, it is likely that this restored vegetation would not be the same as the pre-construction native vegetation.) Instituting a reservation system would reduce the potential increase in vehicles and visitors in the future, and thus decrease the potential for additional vegetation disturbance. In addition, there would be a reduction in disturbance of lodgepole pine and shrubland vegetation due to visitors parking in nondesignated areas as a result of new turnouts, expanded parking at the Death Canyon Trailhead, and new parking areas along the new alignment of Moose-Wilson Road.

Cumulative Effects. As described under alternative A, a variety of actions have altered, and would continue to alter, vegetation within and outside the project area. Past development of park infrastructure has altered vegetation in the project area, such as development of the Moose visitor center and the southwest entrance facilities. Within the project area vegetation would continue to be altered due to spoils from periodic dredging being deposited along irrigation ditches on the east side of the road. Periodic maintenance along the utility corridor that passes through the project area would also continue to damage and alter vegetation.

Outside the project area other NPS and non-NPS actions have and would continue, to alter vegetation, as outlined in the cumulative impacts scenario. Improvements being made in the Jenny Lake area, development of multiuse pathways outside the project area (including construction of part of the multiuse pathway system near Jenny Lake), and construction of planned residential and commercial developments, such as the Teton Village expansion, all would result in the permanent loss of vegetation, primarily shrubland/sage brush and some woodlands, and short-term construction-related disturbance to vegetation. Most of these developments would occur in areas where human activities and infrastructure already occur, in areas where vegetation already has been disturbed. Although mitigation measures would likely be implemented, native vegetation still would be adversely affected, such as through the clearing of vegetation and the spread of nonnative plants. When the effects of alternative D are added to these other ongoing and likely future effects, there would be the potential for a long-term, cumulative adverse effect primarily on shrubland vegetation in the area. Alternative D would add an appreciable increment to the overall adverse cumulative impact to vegetation occurring in the area.

Conclusion. Alternative D would have the largest adverse impact on vegetation of all the action alternatives. Relative to the project area, a small area of native vegetation would be permanently lost or altered. However, this disturbed area would be substantial relative to the limited disturbance that has occurred in the corridor. There would be a substantial long-term adverse impact in multiple localized areas due to the loss and alteration of native vegetation, primarily lodgepole pine forest and shrubland, caused by the development of two new Moose-Wilson Road realignments and the multiuse pathway. Altogether, these developments, plus new turnouts, expansion of the Death Canyon Trailhead parking area, a new road link between Death Canyon and White Grass Roads, and two new parking/wildlife viewing areas and associated nature trails, would result in the permanent loss of vegetation, primarily lodgepole pine forest, mixed conifer forest, and shrubland. Additional short-term disturbance of vegetation surrounding the infrastructure would occur due to construction activities, and although these areas would be expected to be revegetated, it is unlikely they would be restored to pre-construction condition. Thus, there would be a greatly increased potential for the spread of nonnative species and noxious weeds due to new ground disturbances associated with the above developments (both in the short term and long term). Conversely, alternative D would also beneficially affect some lodgepole pine, mixed conifer, and shrubland vegetation in the long term due to the removal and eventual revegetation of two segments of Moose-Wilson Road and Death Canyon Road (although this restored vegetation would not be the same as the pre-construction native vegetation). In addition, there would be a reduction in disturbance of roadside vegetation due to a substantial reduction in visitors parking in nondesignated areas as a result of new designated turnouts, expanded parking at the Death Canyon Trailhead, and new parking areas along the new alignment of Moose-Wilson Road. Collectively, while alternative D would address various existing adverse effects on vegetation, it would by far involve the greatest degree of adverse impacts on vegetation relative to all other alternatives mainly due to the multiuse pathway and two road realignment developments. These adverse vegetation impacts would substantially diminish the quality and integrity of the Ecological Communities and Wildlife fundamental resource and value. Although the above-noted adverse effects would be considerable, there would not be a substantial alteration or loss of vegetation communities or a major change in the distribution and abundance of native plant species in the overall project area. Thus, overall, alternative D would not have a significant adverse effect on vegetation in the project area.

SOILS

Methods and Assumptions for Analyzing Impacts

The effects of the alternatives on soils in the project area were analyzed based on impacts resulting from visitor use patterns and developments associated with each alternative. Impacts were identified based on anticipated soil loss, alteration, or restoration (from current conditions) of soils in the corridor. Potential for increased or decreased erosion were also identified. Information on soils was compared with the locations of proposed developments and other actions in the alternatives. The impact analysis was based on the knowledge and best professional judgment of planners, resource specialists, data from park records, and studies of similar actions and impacts when applicable. Acres, miles and percentages presented in the analysis are estimates and are based on the best available GIS information on the construction zones and development footprints. To help focus the analysis, the following impact analysis question was considered to identify the potential impacts of each alternative:

Impact Analysis Question.

1. What degree of native soil compaction, disturbance, loss, or soil restoration would occur under each alternative?

General Assumptions. The following assumptions were considered in concert with the above impact analysis question when assessing the effects of each alternative management strategy:

- All construction impacts are limited to the identified construction zones.
- All of the soil mitigation measures described in chapter 2 would be followed.
- Borrow and aggregate materials would be used from existing approved sources, requiring no new excavation.
- Dust abatement would continue to be applied to unpaved parts of Moose-Wilson Road.
- For new developments areas with sensitive soils or with slope stability issues would be avoided whenever possible.

Alternative A (No Action)

Under alternative A, vehicles driving on the paved portion of Moose-Wilson Road would have no effects on soils. However, several adverse soil impacts due to vehicular traffic, and pedestrian and equestrian uses would continue under alternative A in localized areas along the Moose-Wilson corridor. Most of these adverse impacts would occur on the edges of already disturbed areas, along Moose-Wilson Road and the other unpaved roads in the project area. Soils along these roads are previously disturbed through blading, compaction, other earthmoving activities required for road construction and routine maintenance, and use.

As noted in the “Affected Environment” chapter, the unpaved segment of Moose-Wilson Road and Death Canyon Road have been widening over time, due to visitors avoiding potholes and wet and rutted areas, resulting in further soil compaction and loss. Although routine maintenance would occur, the adverse effect of road widening would be expected to continue in localized places along the unpaved 1.4-mile portion of Moose-Wilson Road, particularly with expected increased vehicle traffic.

There would also continue to be adverse soil impacts due to visitors parking their vehicles in nondesignated turnouts and outside of parking areas in the Moose-Wilson corridor. As noted in the “Affected Environment” chapter, an estimated 2.0 acres of soil disturbance have already occurred in the corridor due to vehicles parking in nondesignated areas. Although park managers would continue to inform and educate visitors to park only in designated areas, under alternative A visitors would continue to pull off to view wildlife along the Death Canyon Road and Moose-Wilson Road. Visitors would also continue to park outside the Death Canyon and Granite Canyon Trailhead parking areas when they are full, resulting in continuing soil compaction, soil alteration, and soil loss (erosion) in areas along the roads that access these trailheads. Increased numbers of vehicles expected in the corridor in the future would exacerbate these adverse soil impacts in localized areas along the roads.

Although park staff would continue to inform and educate visitors about the reasons to stay on designated trails, under alternative A visitor-created trails would likely continue to be used, and possibly new ones created, at popular destinations in the corridor. Soil loss and alteration due to hikers using or creating unofficial trails would be expected to continue at the Sawmill Ponds Overlook and Phelps Lake, and likely would continue along the Death Canyon and Valley Trails. Unofficial horseback trails would also continue to be used and created in the Poker Flats area, resulting in soil compaction, topsoil alteration, and loss. An increase in hiking and/or equestrian use in these areas would likely intensify these impacts.

Finally, continued maintenance to prevent the widening of the unpaved portions of the roads, including occasional road rehabilitation and keeping the roadway, foreslope, and ditch properly shaped, would continue to alter topsoils. Periodic application of magnesium chloride to suppress dust along the unpaved portion of Moose-Wilson Road also may be altering soil chemistry.

In summary, topsoil would be expected to continue to be compacted, altered, or lost due to continuing vehicle, hiker, and equestrian use in alternative A These impacts would be highly localized along the roads and at the trailheads. Most impacts would be limited to the topsoil. No new areas would be expected to experience substantial soil erosion under alternative A. Park managers would be expected to continue to take actions to decompact, recontour, and seed areas to help minimize soil erosion and loss.

Cumulative Effects. A variety of actions have altered, and would continue to alter, soils within and outside the project area. Past development of park infrastructure has altered soils in the area. Within the project area soils would continue to be altered due to spoils from periodic dredging being deposited along irrigation ditches within the project area on the east side of Levee Road. Periodic maintenance along the utility corridor that passes through the project area would continue to compact and alter soil.

Outside the project area, other NPS and non-NPS actions have and would continue to alter soils as outlined in the cumulative impacts scenario (e.g., improvements being made in the Jenny Lake area, development of multiuse pathways outside the project area, construction of planned residential and commercial developments such as the Teton Village expansion).

However, none of the above actions would alter the soils being affected by visitors using the Moose-Wilson corridor. Thus, there would be no cumulative effects of other actions added to the effects of alternative A on soils.

Conclusion. Alternative A would result in the continued degradation of soils in small, localized areas in the corridor due to vehicles widening the unpaved portion of Moose-Wilson Road, parking alongside roads and outside parking areas, and the creation and use of unofficial hiking and equestrian trails. These would all be ongoing impacts, primarily affecting topsoils. The projected increased use levels in the corridor would exacerbate these impacts. Overall, alternative A would not likely result in significant adverse impacts because no major new soil disturbance or soil erosion would occur in the project area. Soil disturbance that would occur due to continuing visitor use would be localized in small areas along the corridor. No cumulative effects would occur to soils being affected in alternative A.

Alternative B

Alternative B would have both adverse and beneficial impacts on soils in the corridor.

The application of the soil mitigation measures would avoid and reduce potential soil impacts from the construction and maintenance of infrastructure. However, several adverse soil impacts would still occur. The largest adverse impact of alternative B on soils would be due to the realignment of two segments of Moose-Wilson Road, which would result in the permanent loss or alteration (e.g., compaction) of about 5.8 acres of soil. Relative to the amount of existing soil disturbances from other developments in the project area, the two realignments would have a substantial adverse effect on native soils. Development of a new parking area, access road, and roundabouts at the LSR Preserve to implement the gate closure traffic management strategy would result in the permanent loss or alteration of about 2.0 acres of soil. Although the soils along the unpaved segment of Moose-Wilson Road have already been altered by road use and maintenance, paving this segment of the road (with an impervious surface) would further alter soil conditions and processes. Paving this segment also would increase runoff and thus potentially affect soil erosion in the area. Development of the new Death Canyon Trailhead parking area would result in the permanent loss or alteration of about 0.4 acre of soil, while the relocation of the Moose Entrance Station and realignment of the road at the entrance station would result in the permanent loss or alteration of about 1.0 acre of soil. A total of approximately 0.9 acre of soil would be permanently lost or altered due to the establishment of turnouts for up to 120 vehicles along Moose-Wilson Road. (The disturbance area may be smaller than this depending on how many of the turnouts would be designated in areas that have already been disturbed by visitor-created turnouts versus new areas that have not been disturbed.)

The impacts of the above developments would vary depending on the topography and site-specific soils present where the ground excavation and construction occur. In addition to all of the above soil disturbances, the actual construction of the infrastructure would result in additional short-term disturbance to some soils around the infrastructure, primarily soil compaction and alteration of soil horizons during the construction period. Some soil erosion would likely occur until planted vegetation has fully been restored in these construction zone areas.

Even with the application of best management practices and mitigation measures, there likely would be additional soil erosion due to increased surface runoff from storms and ditch channelization of flows from the two new road alignments, parking areas, roundabouts, and other developments in previously undisturbed areas. In the case of the realignment of the two Moose-Wilson Road segments, topsoil erosion would be limited due to the road segments being in relatively flat terrain within or close to the historic floodplain, in soils less prone to erosion, most likely in Tetonville-Wilsonville fine sandy loams, Tineman gravelly loam, and Tineman association soil types. In areas with steeper slopes, such as in the vicinity of the LSR Preserve and the beginning of Death Canyon Road, soil types like the Taglake-Sebud association and Turnerville silt loam soil would pose higher erosion hazards. Careful site selection and design and the application of appropriate mitigation measures should help avoid substantial soil erosion due to proposed developments like the relocation of the Death Canyon Trailhead parking area and the new parking area, road, and roundabouts in the LSR Preserve.

Some soil compaction, soil erosion, and topsoil and alteration would also continue due to horseback riders going off trails (although less so than in alternative A due to the reasons noted below).

Alternative B would have a number of long-term beneficial impacts on soils in the corridor. Paving the existing 1.4 miles of the unpaved portion of Moose-Wilson Road would eliminate road widening that has occurred in this area, reduce the potential for soil erosion of roadbed soils, and eliminate the need to apply magnesium chloride to suppress dust, and thus stop the possible impact of this material on the adjacent soil chemistry. Closure, ripping, and decompaction of the ground (allowing moisture to infiltrate), treating the soil to make it productive, and replanting 0.6 mile of the road between Murie Ranch Road and near the Sawmill Ponds Overlook and of 2.4 miles between Sawmill Ponds Overlook and the Death Canyon Road junction would in time result in the eventual restoration of about 5.8 acres of soil. Closure, ripping, treating, and replanting the existing Death Canyon Trailhead parking area, converting part of the existing road to a trail, and shrinking the size of the remaining portion of the road would eventually result in the restoration of about 1.4 acres of soil.

Several other actions in alternative B also would beneficially affect soils. Development of the new parking turnouts along Moose-Wilson and Death Canyon Roads and the development of a larger Death Canyon parking area (for 60 vehicles) are expected to substantially reduce visitor parking in nondesignated areas off the roads. Likewise, the application of barriers and signs at the Sawmill Ponds Overlook parking area and along Death Canyon and Moose-Wilson Roads, which delineate parking and no-parking areas, should also prevent parking in nondesignated areas. As a result, only limited new visitor-created parking areas would be expected under alternative B. In addition, delineation of trails and routes for horses would be expected to result in more visitors staying on existing official trails, and in turn, substantially reducing the potential for the creation of new visitor-created trails. The removal/rerouting of trails with resource impacts due to horses outside of Poker Flats and the elimination of horse trailer parking at Sawmill Ponds Overlook and Granite Canyon Trailhead would also reduce soil compaction and soil alteration. (However, rerouting horse trails could also result in increased soil compaction if the trails are located in previously undisturbed areas.)

Overall, alternative B would result in a number of long-term, localized adverse soil impacts, primarily along Moose-Wilson Road (existing and new alignments). There would be a permanent loss or alteration of a minimum of about 10.1 acres of soil due to the development of new road segments, parking areas, and turnouts. The two Moose-Wilson Road realignments would constitute the largest adverse effect in the project area. Additional soils around the infrastructure would also be disturbed in the short term due to construction activities. And there would likely be some additional long-term soil erosion due to surface runoff and ditch channelization, primarily due to the two new road alignments. However, alternative B would also result in the eventual restoration of soils due to the removal of two segments of Moose-Wilson Road, the Death Canyon Trailhead parking area, and a small portion of Death Canyon Road, beneficially affecting approximately 7.2 acres of soil in the long term. Paving the 1.4 mile unpaved portion of Moose-Wilson Road would prevent widening of the road, which adversely affects adjacent soils. In addition, there would be a reduction in disturbance of soils from visitors parking in nondesignated areas, due to the establishment of new turnouts and a larger parking area at the Death Canyon Trailhead.

Cumulative Effects. As described under alternative A, a variety of actions have altered, and would continue to alter, soils within and outside the project area. These actions include periodic maintenance along irrigation ditches and the utility corridor in the project area and actions outside the project area, as outlined in the cumulative effects scenario (e.g., improvements being made in the Jenny Lake area, development of multiuse pathways outside the project area, construction of planned residential and commercial developments such as the Teton Village expansion). However, none of the above actions would affect the soils being affected by NPS and visitor actions in the Moose-

Wilson corridor under alternative B. Thus, there would be no cumulative effects of other actions on soils added to the effects of alternative B.

Conclusion. Alternative B would result in both short- and long-term, adverse and beneficial effects to soils primarily along Moose-Wilson Road (existing and new alignments) and Death Canyon Road. There would be a permanent loss or alteration of soil due to the development of two new road segments, the new Death Canyon parking area, and new turnouts. The development of the two Moose-Wilson Road realignments would be the largest adverse effect on soils in the project area. Relative to the project area, a small area of topsoil would be permanently lost. However, this disturbed area would be large relative to the limited disturbance that has occurred in the corridor. Additional short-term disturbance of soils surrounding the infrastructure would occur due to construction activities. There also would likely be some additional long-term topsoil erosion due to surface runoff and ditch channelization primarily due to the two new road alignments. However, the loss of topsoil would be limited because the realignment would occur in relatively flat terrain on soils with low erosive potential such as the Tetonville-Wilsonville fine sandy loams, Tineman gravelly loam, and Tineman association. Alternative B would also result in the eventual restoration of soils due to the removal of two road segments, and the Death Canyon Trailhead parking area, beneficially affecting soils in these areas in the long term. Paving the 1.4-mile unpaved segment of Moose-Wilson Road would prevent additional soil alteration and loss along the side of the road. In addition, there would be a reduction in disturbance of soils from visitors parking in nondesignated areas due to the establishment of new turnouts and a larger Death Canyon Trailhead parking area.

Overall, alternative B would not likely result in significant adverse impacts because no actions are being proposed that would result in major new soil disturbance or soil erosion in the project area. Although there would be some soil loss and alteration due to new construction and visitor use, these impacts would be localized in small areas along the corridor. Collectively, alternative B would remedy various continuing adverse effects on soils (under alternative A), but would have a much greater adverse effect on soils than alternative C due to the development of two Moose-Wilson Road realignments. However, the adverse effect on soils from alternative B wouldn't be nearly as great as alternative D because alternative B does not include other large development expansions. Because no past, present, or reasonably foreseeable NPS and non-NPS actions would affect soils in the project area, alternative B would not result in a cumulative impact to soils.

Alternative C (NPS Preferred)

Alternative C would have both adverse and beneficial impacts on soils in the corridor. The application of the soil mitigation measures would avoid and reduce potential soil impacts from the construction and maintenance of infrastructure. However, several adverse soil impacts would still occur. The largest adverse impact of alternative C on soils would be due to the realignment of the northernmost segment of Moose-Wilson Road, which would result in the permanent loss or alteration (e.g., compaction) of about 1.2 acres of soil. Development of a new Death Canyon parking area would result in the permanent loss or alteration of about 0.7 acre of soil. Relocation of the Moose Entrance Station and development of queuing lanes and turnarounds at the North and Granite Canyon Entrance Stations would result in the permanent loss or alteration of about 1.4 acres of soil. Although the soils along the unpaved segment of Moose-Wilson Road have already been altered by road use and maintenance, paving this segment of the road (with an impervious surface) would further alter soil conditions and processes. Paving this segment also would increase runoff and thus potentially affect soil erosion in the area. A total of approximately 0.9 acre of soil would also be permanently lost or altered due to the establishment of turnouts for up to 120 vehicles along Moose-Wilson Road. (The disturbance area may be smaller than this depending on how many of the turnouts would be designated in areas that have already been disturbed by visitor-created turnouts versus new areas that have not been disturbed.)

In addition to all of the above soil disturbances, the actual construction of the infrastructure would result in additional short-term disturbance to some soils around the developments, primarily soil compaction and alteration of soil horizons during the construction period. Some soil erosion would likely occur until planted vegetation has fully been restored in these construction zone areas. Also, even with the application of best management practices and mitigation measures, there likely would be some additional soil erosion due to surface runoff from storms and ditch channelization of flows from the new road alignment, parking area, and other developments in previously undisturbed areas.

The impacts of the above developments would vary depending on the topography and site-specific soils present where the ground excavation and construction occur. Most of the alterations to soils described above, including the realignment of the northern segment of Moose-Wilson Road and the new Death Canyon parking area, would occur in relatively level terrain in soil types such as the Tineman association, Tetonville-Wilson fine sandy loams, Tineman gravelly loam, and Tineman-Bearmouth gravelly loams, which would be less prone to erosion.

Some soil compaction, soil erosion, and topsoil and alteration would also continue due to horseback riders going off trails (although less so than in alternative A due to the reasons noted below).

Alternative C would also have a number of long-term beneficial impacts on soils in the corridor. Paving the existing 1.4 miles of the unpaved portion of Moose-Wilson Road would eliminate road widening that has occurred in this area, reduce the potential for soil erosion of roadbed soils, and eliminate the need to apply magnesium chloride to suppress dust, and thus stop the possible impact of this material on the adjacent soil chemistry. Closure, ripping, and decompaction of the ground (allowing moisture to infiltrate), treating the soil to make it productive, and replanting 0.6 mile of the road between Murie Ranch Road and near Sawmill Ponds Overlook, part of Death Canyon Road, and the Death Canyon Trailhead parking area would result in the eventual restoration of about 4.4 acres of soil.

Several other actions in alternative C would beneficially affect soils. Implementing a traffic sequencing system during peak use periods would limit the potential increase in traffic that would otherwise likely occur, which in turn would reduce the potential for visitors parking off the road, and thus decrease the potential for future soil compaction and loss. Development of the new parking turnouts along Moose-Wilson Road and the larger trailhead parking at Death Canyon (80–90 vehicles) are expected to substantially reduce visitor parking in nondesignated areas off the road. Likewise, the application of barriers and signs at the Sawmill Ponds parking area, which delineate parking areas, also should prevent parking in nondesignated areas. As a result, only limited new visitor-created parking areas would be expected under alternative C. In addition, delineation of trails and routes for horses would be expected to result in more visitors staying on existing official trails, and in turn substantially reducing the potential for the creation of new visitor-created trails. The removal/rerouting of trails with resource impacts due to horses outside of Poker Flats and the elimination of horse trailer parking at Granite Canyon Trailhead would also reduce soil compaction and soil alteration. (However, rerouting horse trails could also result in increased soil compaction if the trails are located in previously undisturbed areas.)

Overall, alternative C would result in a number of short- and long-term, localized, adverse and beneficial soil impacts, primarily along the Moose-Wilson and Death Canyon Roads. There would be a permanent loss or alteration of a minimum of about 4.2 acres of soil due to the development of a new northern Moose-Wilson Road segment, Death Canyon parking area, queuing lanes and turnarounds at the entrance stations, and turnouts. Additional soils around the infrastructure also would be disturbed in the short term due to construction activities. And there would likely be some additional long-term soil erosion due to surface runoff and ditch channelization, primarily due to the new road alignment. However, alternative C also would have several long-term beneficial effects on soil. The removal of one segment of Moose-Wilson Road, part of the Death Canyon Road, and the Death Canyon Trailhead parking area, would eventually result in the restoration of approximately 4.3 acres of soil in the long term. Paving the 1.4 mile unpaved portion of Moose-Wilson Road would prevent widening of the road, which adversely affects adjacent soils. Instituting a traffic sequencing system during peak use periods would reduce the potential for visitors parking off the road, and thus decrease the potential for future soil compaction and loss. In addition, there would be a reduction in disturbance of soils due to visitors parking in nondesignated areas, due to the establishment of new turnouts and a larger Death Canyon Trailhead parking area.

Cumulative Effects. As described under alternative A, a variety of actions have altered, and would continue to alter, soils within and outside the project area. These actions include periodic maintenance along irrigation ditches and the utility corridor within the project area and actions outside the project area, as outlined in the cumulative effects scenario (e.g., improvements being made in the Jenny Lake area, development of multiuse pathways outside the project area, construction of planned residential and commercial developments such as the Teton Village expansion). However, none of the above actions would affect the soils being affect by NPS and visitor actions in the Moose-Wilson corridor under alternative C. Thus, there would be no cumulative effects of other actions added to the effects of alternative C on soils.

Conclusion. Alternative C would result in both adverse and beneficial effects to soils primarily along the Moose-Wilson and Death Canyon Roads. There would be a permanent loss or alteration of soil due to the development of a new northern road segment, a new Death Canyon parking area, and turnouts. Additional short-term disturbance of soils surrounding the infrastructure would occur due to construction activities. There would likely be some additional long-term topsoil erosion due to surface runoff and ditch channelization primarily due to the two new road alignments. However, alternative C also would result in the eventual restoration of soils due to the removal of one segment of Moose-Wilson Road, part of Death Canyon Road, and the Death Canyon Trailhead parking area, beneficially affecting a soil in these areas in the long term. Paving the 1.4-mile unpaved segment of Moose-Wilson Road would prevent additional soil alteration and loss along the side of the road. Instituting a traffic sequencing system during peak use periods would reduce the potential for visitors parking off the road, and thus decrease the potential for future soil compaction and loss. In addition, there would be a reduction in disturbance of soils from visitors parking in nondesignated areas, due to the establishment of new turnouts and a larger Death Canyon Trailhead parking area.

Overall, alternative C would not likely result in significant adverse soil impacts because no actions are being proposed that would result in major new soil disturbance or soil erosion in the project area. Although there would be some soil loss and alteration due to new construction and visitor use, these impacts would be localized in small areas along the corridor. Collectively, alternative C would remedy various continuing adverse effects on soils (under alternative A) and would have the least overall adverse effect on soils from proposed developments when compared to alternatives B and D. Because no past, present, or reasonably foreseeable NPS and non-NPS actions would affect soils in the project area, alternative C would not result in a cumulative impact to soils.

Alternative D

Like the other action alternatives, alternative D would have both adverse and beneficial impacts on soils in the corridor. The application of the soil mitigation measures would avoid and reduce potential soil impacts from the construction of new infrastructure. However, several adverse impacts would still occur. The largest adverse impact of alternative D would be due to the development of the new 10-mile-long multiuse pathway. The construction of this new pathway would result in approximately 9.0 acres of soil being permanently lost or altered—a considerable, long-term, adverse impact in this localized area. Realignment of two segments of Moose-Wilson Road would also result in the permanent loss or alteration (e.g., compaction) of about 5.8 acres of soil. Relative to the amount of existing soil disturbances from other developments in the project area, the two road realignments would also have a substantial adverse effect on soils. A total of approximately 0.9 acre of soil would also be permanently lost or altered due to the establishment of turnouts for up to 120 vehicles along Moose-Wilson Road. (The disturbance area may be smaller than this depending on how many of the turnouts would be designated in areas that have already been disturbed by visitor-created turnouts versus new areas that have not been disturbed.) Several other developments in alternative D would result in the permanent loss or alteration of soil, including: expansion of the Death Canyon Trailhead parking area (~0.7 acre), construction of a new road segment between Death Canyon Road and White Grass Road (~1.6 acres), construction of two new roadside parking areas, viewing area, and nature trails for wildlife viewing along the new Moose-Wilson Road alignment (~ 2.3 acres), and relocation of the Moose Entrance Station and construction of the queuing lands and turnarounds at the two entrance stations (~ 1.4 acres).

The impacts of the above developments would vary depending on the topography and site-specific soils present where the ground excavation and construction occur. In addition to the above soil disturbance, the actual construction of the infrastructure would result in additional disturbance to soils around the facilities, including primarily soil compaction and alteration of soil horizons. Some soil erosion would likely occur until planted vegetation has fully been restored in these construction zone areas.

Even with the application of best management practices and mitigation measures there likely would be some additional soil erosion due to increased surface runoff from storms and ditch channelization of flows from the two new road alignments, multiuse pathway, parking areas, and other developments in previously undisturbed areas. In the case of the two Moose-Wilson Road segments and the new multiuse pathway, additional topsoil erosion would be limited because the new developments would occur in relatively flat terrain within or close to the historic floodplain, in soils that would be less prone to erosion, most likely in Tetonville-Wilsonville fine sandy loams, Tineman gravelly loam, and Tineman association soil types.

Like alternative A, in alternative D the unpaved 1.4-mile portion of Moose-Wilson Road would continue to be unpaved, resulting in continuing impacts on soils. As noted in the "Affected Environment" chapter, the unpaved segment of Moose-Wilson Road has been widening over time due to drivers avoiding potholes and wet and rutted areas, resulting in further soil compaction and loss. Although in alternative D the unpaved road segment would be stabilized and routine maintenance would occur, it is likely that drivers would still drive around ruts and potholes that form and would still widen the road in some areas. In addition, periodic application of magnesium chloride would continue to be needed to suppress dust along the gravel portion of Moose-Wilson Road (albeit less than in alternative A). This action may be affecting the area's soil chemistry.

Some soil compaction, soil erosion, and topsoil alteration would continue due to horseback riders going off trails (although less so than in alternative A due to the reasons noted below).

Alternative D also would have several long-term beneficial impacts on soils in the corridor. Closure, ripping, and decompaction of the ground (allowing moisture to infiltrate), treating the soil to make it productive, and replanting 0.6 mile of the road between Murie Ranch Road and near Sawmill Ponds Overlook and of 1.6 miles between Sawmill Ponds Overlook and the Death Canyon Road junction; most of the Death Canyon Road would in time result in the eventual restoration of about 7.3 acres of soil.

Several other actions in alternative D would beneficially affect soils. Implementing a traffic reservation system during peak use periods would reduce the potential increase in traffic that would otherwise likely occur, which in turn would reduce the need for visitors parking off the road, and thus decrease the potential for future soil compaction and loss. Development of the new parking turnouts and new parking areas and placement of barriers along Moose-Wilson Road, expansion of the Death Canyon Trailhead parking area (for 100 vehicles), and improvements to delineated parking spaces at the Granite Canyon and Sawmill Ponds parking areas, is expected to substantially reduce the number of visitors parking in nondesignated areas. As a result, only limited new visitor-created parking areas would be expected under alternative D. In addition, delineation of trails and routes for horses, would be expected to result in more visitors staying on existing official trails, and in turn substantially reducing the potential for the creation of new visitor-created trails. The removal/rerouting of trails with resource impacts due to horses outside of Poker Flats would also reduce soil compaction and soil alteration. (However, rerouting horse trails could also result in increased soil compaction if the trails are in previously undisturbed areas.)

Overall, alternative D would result in a number of long-term, localized adverse soil impacts, primarily along or near Moose-Wilson Road. There would be a permanent loss or alteration of a total of about 21.7 acres of soil due to the development of new realigned segments of Moose-Wilson Road, the multiuse pathway, parking areas, and turnouts. Relative to the amount of existing soil disturbances from other developments in the project area, the two road realignments and the multiuse pathway would have a considerable adverse effect on soils in localized areas. Additional soils around the infrastructure would be disturbed in the short term due to construction activities. And there would likely be some additional long-term soil erosion due to surface runoff and ditch channelization, primarily due to the multiuse pathway and two new road alignments. However, alternative D also would result in the eventual restoration of soils due to the removal of two road segments of Moose-Wilson Road and removal of part of Death Canyon Road. A total of 7.2 acres of soil would be eventually restored over the long term. Instituting a reservation system during peak use periods would also reduce the potential increase in vehicles and visitors in the future, which would decrease the number of visitors parking off the side of the road, and thus decrease the potential for additional soil disturbance. In addition, there would be a reduction in disturbance of soils from visitors parking in nondesignated areas due to the establishment of new turnouts and the expansion of the Death Canyon Trailhead parking area.

Cumulative Effects. As described under alternative A, a variety of actions have altered, and would continue to alter, soils within and outside the project area. These actions include periodic maintenance along irrigation ditches and the utility corridor within the project area and actions outside the project area, as outlined in the cumulative effects scenario (e.g., improvements being made in the Jenny Lake area, development of multiuse pathways outside the project area, construction of planned residential and commercial developments such as the Teton Village expansion). However, none of the above actions would affect the soils being affect by NPS and visitor actions in the Moose-Wilson corridor under alternative D. Thus, there would be no cumulative effects of other actions added to the effects of alternative D on soils.

Conclusion. Alternative D would result in both short- and long-term, adverse and beneficial soil impacts, primarily along Moose-Wilson Road (existing and new alignments) and Death Canyon Road. The development of new road segments, the multiuse pathway, parking areas, and turnouts in alternative D would result in the permanent loss or alteration of topsoil. In particular, the permanent loss of soil due to the construction of the multiuse pathway and the two road realignments would be considerable in these localized areas. Relative to the entire project area, a small area of topsoil would be permanently lost, but this disturbed area would be substantial relative to the limited disturbance that has occurred in the corridor. Additional short-term disturbance of soils surrounding the infrastructure would occur due to construction activities. There also would likely be some additional long-term soil erosion due to increased surface runoff and ditch channelization primarily from the multiuse pathway and the two new road alignments. However, the loss of topsoil would be limited because most of the larger soil alterations would occur in relatively flat terrain, on soils with low erosive potential like the Tetonville-Wilsonville fine sandy loams, Tineman gravelly loam, and Tineman association. Alternative D would also result in the eventual restoration of soil due to the removal of two segments of Moose-Wilson Road and part of Death Canyon Road. Instituting a reservation system during peak use periods would also reduce the potential for a future increase in vehicles and visitors in the area, which would decrease the number of visitors parking off the side of the road and thus decrease the potential for additional soil disturbance. In addition, there would be a reduction in disturbance of soils from visitors parking in nondesignated areas due to the establishment of new turnouts and the expansion of the Death Canyon Trailhead parking area.

Overall, alternative D would result in a considerable loss and alteration of soil in the corridor due primarily to the road relocations and pathway. These impacts would be concentrated in several areas along the corridor. However, from a project area standpoint alternative D would not likely result in significant adverse impacts because no actions are being proposed that would result in major new soil disturbance or soil erosion in the project area as a whole. Collectively, while alternative D would remedy various continuing adverse effects on soils (under alternative A), it would also involve the greatest degree of adverse impacts on soils relative to all other alternatives mainly due to the multiuse pathway and two road realignment developments. Because no past, present, or reasonably foreseeable NPS and non-NPS actions would affect soils in the project area, alternative D would not result in a cumulative impact to soils.

CULTURAL RESOURCES

METHODS AND ASSUMPTIONS FOR ANALYZING IMPACTS

In this environmental impact statement, impacts on cultural resources from actions proposed by each alternative are described in terms of type (beneficial or adverse), context, and duration consistent with the regulations of the Council on Environmental Quality that implement the National Environmental Policy Act. The impacts on historic structures, sites, and cultural landscapes are described in terms of the potential to diminish or protect the integrity and/or character-defining qualities that contribute to the national register eligibility of historic properties within the area of potential effect (e.g., the Moose-Wilson corridor, historic ranches, and access roads). The impacts on archeological resources are described in terms of the potential to diminish or protect the ability of archeological resources to yield information important in prehistory or history. The impacts on ethnographic resources are described in terms of the potential to diminish or protect the integrity of (and access to) resources and places having particular importance and value to traditionally associated tribes and groups. The impact analysis was primarily qualitative in nature based on the knowledge and best professional judgment of planners, resource specialists, tribal consultants, data from park records, and studies of similar actions and impacts as applicable.

The cultural resources impact analysis primarily includes discussion of the following:

- How would the historic character of the Moose-Wilson corridor and secondary access roads (e.g., White Grass / Death Canyon Roads) be affected by the proposed project alternatives? How would the proposed alternatives affect the character-defining qualities for which the road corridors were assessed as cultural landscapes and determined eligible for the National Register of Historic Places?
- To what extent would significant archeological and ethnographic resources be affected by ground disturbance or other actions proposed by the alternatives?

HISTORIC STRUCTURES, SITES, AND CULTURAL LANDSCAPES

Alternative A (No Action)

Under the no action alternative, the National Park Service would continue to carry out routine maintenance for the Moose-Wilson corridor, and would manage operations, traffic, and visitor use activities / services along the corridor in accordance with existing conditions and policies. In fulfillment of NPS management and policy objectives, the historic character of the road corridor would be preserved and there would be little potential for impacts on the road as a national register-eligible historic structure. Although increasing traffic congestion has diminished the historic driving experience to some extent, visitors along the road would generally continue to experience the feeling of remoteness and serenity imparted by the road's narrow, two-lane configuration through a rustic and grand natural setting. The road would be retained in its existing alignment and width, the currently unpaved portion of the road would remain unpaved and the limited number of designated roadside turnouts and parking areas would generally remain unmodified. Maintaining these existing conditions would have long-term beneficial impacts on the character of the Moose-Wilson corridor.

The character-defining qualities that contribute to the integrity of the road corridor's cultural landscape (location, design, workmanship, feeling, setting, and association) would be retained without substantial alteration. The road would continue to follow its current alignment, which has remained in place for the past 55 years (the northernmost 0.5 mile was realigned around 1960 to provide more direct access to the new NPS headquarters at Moose). Despite necessary maintenance and repairs to address erosion and vehicle use impacts, the road would continue to retain its designed scale and spatial arrangement as a narrow and largely undeveloped backcountry road. Elements of the natural setting through which the road passes (e.g., topography, vegetation, views, and vistas) have also remained largely unchanged from the period of significance and would continue to be managed to provide a rustic and overall wilderness setting.

The White Grass / Death Canyon Road would remain unaltered and its historic alignment and character along a densely timbered corridor would be similarly preserved. Continuation of the current NPS management approach for Moose-Wilson Road and White Grass / Death Canyon Road corridors would generally have long-term beneficial impacts on the historic character of these roads and their associated cultural landscapes by retaining their alignments and contributing design characteristics that reflect the period of historical significance. Limited short-term adverse impacts would be expected associated with routine maintenance such as repaving and regrading that could temporarily alter traffic patterns, require detours or introduce construction-related noise and visual disturbances. These adverse impacts would last only as long as the period of construction.

Cumulative Impacts. Other past, present, and reasonably foreseeable actions have altered, or have the potential to affect, the historic character and cultural landscape of the Moose-Wilson corridor. Prior to the 1936 to 1960 period of significance associated with NPS development of the road, segments of the earlier road that emerged in the latter 19th century were relocated in response to evolving historic land use and development such as the establishment and operation of homesteads and dude ranches. The National Park Service also modified the location of road segments and carried out necessary improvements to address administrative requirements and visitor use. The deteriorated Lake Creek Bridge was replaced with a more substantial structure in 2005. Unofficial development of roadside turnouts by visitor vehicles has also altered the designed appearance of the roadway. Despite these and other modifications, Moose-Wilson Road and White Grass / Death Canyon Roads retain overall good integrity and continue to follow their general alignments from the time of construction to reflect respective periods of significance (CLI 2014). The establishment of the LSR Preserve adversely altered the historical integrity of the former JY Ranch by removal of privately held historic ranch buildings. However, preservation and rehabilitation undertakings at the Murie Ranch Historic District and the White Grass Dude Ranch Historic District have preserved the cultural landscapes and contributing features of these important historic sites. These primarily past actions, as well as any necessary future road maintenance and associated construction have had (or could potentially result in) long- and short-term adverse and beneficial impacts on historic structures, sites and cultural landscape features.

The impacts associated with implementation of alternative A would have primarily long-term beneficial impacts on the historic character and cultural landscape associated with Moose-Wilson Road and the White Grass / Death Canyon Road corridors by retaining their alignments and contributing design characteristics that reflect the period of historical significance. Other past, present, and reasonably foreseeable actions have had (or would potentially result in) long- and short-term limited adverse impacts on historic structures, sites, and cultural landscape features. Consequently, the adverse and beneficial impacts of the other past, present, and reasonably foreseeable actions described above, in combination with the impacts of alternative A, would result in long-term, adverse cumulative impacts on historic structures, sites, and cultural landscapes. The limited adverse impacts associated with alternative A would not appreciably contribute to the overall adverse cumulative impact.

Conclusion. Alternative A would have a long-term beneficial impact on the historic character of the Moose-Wilson, White Grass, and Death Canyon Road corridors by retaining their current alignments and preserving the cultural landscape in its existing condition. Limited short-term adverse impacts would occur from ongoing NPS maintenance operations and continued visitor use that could inadvertently disturb historic properties, but these impacts would not diminish the character or integrity of the historic properties within the study area. Long-term adverse cumulative impacts on historic structures, sites, and cultural landscapes would result from implementation of alternative A in conjunction with other past, present, or reasonably foreseeable actions.

Alternative B

Under alternative B, two segments of Moose-Wilson Road would be relocated and the removed segments would be restored to natural conditions (a 0.6-mile section presently connecting to the Murie Ranch Road, and a 2.4 mile section between the Sawmill Ponds Overlook and the Death Canyon Road junction). Relocation of the Sawmill Ponds road section to the southeast would represent a marked deviation from the historical alignment that has remained intact over the past 55 years. Elements contributing to the road's historic character, such as patterns of circulation, spatial arrangement, topography, setting, and views/vistas, would be substantially altered along the rerouted segment. Although the width and slow, winding character representative of the historic road would be retained along the new relocated section, realignment would nevertheless diminish the overall integrity of Moose-Wilson Road with particular regard to its integrity of location, design, and setting, resulting in a long-term significant adverse impact.

The northernmost 0.6-mile section of Moose-Wilson Road would be relocated to connect with Teton Park Road. This action would restore the historic alignment that existed prior to the 1960 reroute that connected this section with the Moose visitor center, although both alignments were developed during the road's period of significance. Relocating this section of road would be carried out in a manner that provides consistency with the road's historic design and preserves contributing features of the cultural landscape. The existing unpaved portion of Moose-Wilson Road would be paved and reconstructed consistent with other portions of the road and would remain in its current alignment. These actions would have minimal adverse impacts on the overall character of the road and its cultural landscape.

Reconfiguration of access and parking near the Laurance S. Rockefeller Preserve would diminish the historic character of the road by altering the historic design and materials. Terminating visitor use of Moose-Wilson Road at the LSR Preserve during peak use periods, while serving to reduce traffic congestion, would nevertheless adversely affect patterns of visitor use and circulation that have remained in place from the period of significance. These actions would have long-term adverse impacts on the historic character and cultural landscape of Moose-Wilson Road.

Removal of a portion of Death Canyon Road past its intersection with White Grass Road would adversely affect the character, pattern of circulation, and use of that historic road segment, although a trail would be developed along the former road alignment. Relocation of the Death Canyon Trailhead and construction of a new parking area nearer White Grass Ranch would also alter the historic character and setting of the road corridor and would introduce new constructed features that would potentially intrude on the viewshed of White Grass Ranch. These actions would variously result in long-term adverse impacts on the historic character of Moose-Wilson Road and Death Canyon / White Grass Road corridors.

Also proposed under alternative B are measures to develop and implement road corridor design standards regarding the appropriate location and configuration of turnouts, parking areas, and other features in an effort to maintain design consistency and safety. The application of consistent design standards would help retain the historic character of the road and contributing cultural landscape elements. Other measures would be implemented, such as the placement of physical barriers and signage, to discourage the development of undesignated vehicle turnouts that can contribute to erosion, vegetation loss, and other resource disturbances along the road corridor. These actions would help ensure that consistent management approaches are implemented to protect the overall historic character and design of nonrelocated road sections, resulting in long-term beneficial impacts on the cultural landscape.

Visitors would be provided information through pre-visit media, interpretive programs, and publications regarding the need and requirements for protecting cultural resources and historic properties. Visitor education efforts would be initiated to discourage vandalism and would emphasize the significance and fragility of cultural resources along the Moose-Wilson corridor and how visitors can avoid or reduce inadvertent resource impacts. These management actions would further advance the protection of park cultural resources, resulting in long-term, beneficial impacts.

Limited short-term adverse impacts on the cultural landscape would be expected to be associated with routine maintenance such as repaving and regrading that could temporarily alter traffic patterns, require detours, or introduce construction-related noise and visual disturbances. These adverse impacts would last only as long as the period of construction.

Cumulative Impacts. Other past, present, and reasonably foreseeable actions have altered, or have the potential to affect, the historic character and cultural landscape of the Moose-Wilson corridor. Prior to the 1936 to 1960 period of significance associated with NPS development of the road, segments of the earlier road that emerged in the latter 19th century were relocated in response to evolving historic land use and development such as the establishment and operation of homesteads and dude ranches. The National Park Service also modified the location of road segments and carried out necessary improvements to address administrative requirements and visitor use. The deteriorated Lake Creek Bridge was replaced with a more substantial structure in 2005. Unofficial development of roadside turnouts by visitor vehicles has also altered the designed appearance of the roadway. Despite these and other modifications, Moose-Wilson Road and White Grass / Death Canyon Roads retain overall good integrity and continue to follow their general alignments from the time of construction to reflect respective periods of significance (CLI 2014). The establishment of the LSR Preserve adversely altered the historical integrity of the former JY Ranch by removal of privately held historic ranch buildings. However, preservation and rehabilitation undertakings at the Murie Ranch Historic District and the White Grass Dude Ranch Historic District have preserved the cultural landscapes and contributing features of these important historic sites. These primarily past actions, as well as any necessary future road maintenance and associated construction have had (or could potentially result in) long- and short-term adverse and beneficial impacts on historic structures, sites and cultural landscape features.

The impacts associated with implementation of alternative B would have short-term and significant long-term adverse impacts as well as beneficial impacts on the historic character and cultural landscape associated with Moose-Wilson, White Grass, and Death Canyon Road corridors. Other past, present, and reasonably foreseeable actions have had (or would potentially result in) long-term adverse and beneficial impacts on historic structures, sites, and cultural landscape features. Consequently, the adverse impacts of the other past, present, and reasonably foreseeable actions described above, in combination with the impacts of alternative B, would result in long-term adverse cumulative impacts on historic structures, sites, and cultural landscapes. The adverse impacts associated with alternative B would represent a substantial component of the overall adverse cumulative impact.

Conclusion. Under alternative B, significant long-term adverse impacts would occur from relocation of a 2.4-mile section of Moose-Wilson Road near Sawmill Ponds. Other adverse impacts would result from removal of a portion of Death Canyon Road and reconfiguration of parking and access near the LSR Preserve. These actions would substantially alter the historic character of the road corridor and its associated cultural landscape that have remained largely intact from the period of the road corridor's significance. Long-term beneficial impacts would result from instituting road corridor design standards and visitor education measures to protect cultural resources. Long-term adverse cumulative impacts on historic structures, sites, and cultural landscapes would result from implementation of alternative B in conjunction with other past, present, or reasonably foreseeable actions. In comparison with the other alternatives, alternative B would entail substantial loss of the historic character of the road corridor's cultural landscape and contributing features, primarily as a result of road realignment.

Alternative C (NPS Preferred)

Under alternative C, the segment of Moose-Wilson Road between the Sawmill Ponds Overlook and the Death Canyon Road junction would be retained in its existing alignment while the portion adjacent to wetlands would be reconstructed in its current alignment to improve natural drainage. These measures would help ensure that the overall historic character of the road and its associated cultural landscape are preserved without substantial modification. The road would continue to retain its designed scale and spatial arrangement as a narrow and largely undeveloped backcountry road. Elements of the natural setting through which the road passes (e.g., topography, vegetation, views, and vistas) would also remain largely unchanged from the period of significance and would continue to be managed to provide a rustic and overall wilderness setting. These measures would result in a long-term beneficial impact on the road corridor.

The need to implement necessary drainage improvements for the Moose-Wilson Road section by Sawmill Ponds, along with ongoing maintenance and repairs to the entire road to address erosion and vehicle use impacts, would result in limited adverse impacts on the road's historic design and workmanship. Short-term adverse impacts would be expected associated with routine maintenance, such as repaving and regrading, that could temporarily alter traffic patterns, require detours, or introduce construction-related noise and visual disturbances. These adverse impacts would last only as long as the period of construction.

The northernmost 0.6-mile section of Moose-Wilson Road would be relocated to the west to connect with Teton Park Road. This action would restore the historic alignment that existed prior to the 1960 reroute connecting this section with the Moose visitor center, although both alignments were developed during the road's period of significance. Relocating this section of road would be implemented in a manner that provides consistency with the road's historic design and preserves contributing features of the cultural landscape. The existing unpaved portion of Moose-Wilson Road would be paved and reconstructed consistent with other portions of the road and would remain in its current alignment. These actions would have minimal adverse impacts on the overall character of the road and its cultural landscape.

Removal of a portion of Death Canyon Road past the intersection with White Grass Road would adversely affect the character, pattern of circulation, and use of that historic road segment although a trail would be developed along the former road alignment. A new public vehicle parking area would be constructed at the junction of Death Canyon and White Grass Roads. Although the parking area would not be expected to visually intrude on the viewshed of the White Grass Dude Ranch Historic District, it would alter the historic design and setting of the road corridor. These actions would result in long-term adverse impacts on the historic character of the Death Canyon and White Grass Roads corridor.

Also proposed under alternative C are measures to develop and implement road corridor design standards regarding the appropriate location and configuration of turnouts, parking areas, and other features in efforts to maintain design consistency and safety. The application of consistent design standards would help retain the historic character of the road and contributing cultural landscape elements. Other measures would be implemented, such as the placement of physical barriers and signage, to discourage the development of undesignated vehicle turnouts that can contribute to erosion, vegetation loss, and other resource disturbances along the road corridor. These actions would help achieve consistent management and protection of the road corridor's overall historic character and design and would result in long-term beneficial impacts on the cultural landscape.

Strategies to limit the number of vehicles entering Moose-Wilson Road during peak use periods would help retain character-defining qualities of the roadway's cultural landscape, particularly the feeling it imparts to visitors of seclusion and serenity through a rustic and majestic natural setting. These strategies would have long-term beneficial impacts.

Visitors would be provided information through pre-visit media, interpretive programs, and publications regarding the need and requirements for protecting cultural resources and historic properties. Visitor education efforts would be carried out to discourage vandalism and would emphasize the significance and fragility of cultural resources along the Moose-Wilson corridor and how visitors can avoid or reduce inadvertent resource impacts. These management actions would further advance the protection of the park's cultural resources, resulting in long-term, beneficial impacts.

Preservation of the White Grass Ranger Station and its adaptive use as a backcountry cabin would be implemented in accordance with *The Secretary of the Interior's Standards for the Treatment of Historic Properties* (1995) with particular regard to the standards for rehabilitation. Because the repair and replacement of historic fabric associated with rehabilitation of the structure would be undertaken in accordance with the Secretary of the Interior's standards, any adverse impacts would be minimal and overall impacts would be long term and beneficial.

Cumulative Impacts. Other past, present, and reasonably foreseeable actions have altered, or have the potential to affect, the historic character and cultural landscape of the Moose-Wilson corridor. Prior to the 1936 to 1960 period of significance associated with NPS development of the road, segments of the earlier road that emerged in the latter 19th century were relocated in response to evolving historic land use and development such as the establishment and operation of homesteads and dude ranches. The National Park Service also modified the location of road segments and carried out necessary improvements to address administrative requirements and visitor use. The deteriorated Lake Creek Bridge was replaced with a more substantial structure in 2005. Unofficial development of roadside turnouts by visitor vehicles has also altered the designed appearance of the roadway. Despite these and other modifications, Moose-Wilson Road and White Grass / Death Canyon Roads retain overall good integrity and continue to follow their general alignments from the time of construction to reflect respective periods of significance (CLI 2014). The establishment of the LSR Preserve adversely altered the historical integrity of the former JY Ranch by removal of privately held historic ranch buildings. However, preservation and rehabilitation undertakings at the Murie Ranch Historic District and the White Grass Dude Ranch Historic District have preserved the cultural landscapes and contributing features of these important historic sites. These primarily past actions, as well as any necessary future road maintenance and associated construction have had (or could potentially result in) long- and short-term adverse and beneficial impacts on historic structures, sites and cultural landscape features.

The impacts associated with implementation of alternative C would have long- and short-term adverse impacts as well as beneficial impacts on the historic character and cultural landscape associated with Moose-Wilson Road, White Grass, and Death Canyon Road corridors. Other past, present, and reasonably foreseeable actions have had (or would potentially result in) long-term adverse and beneficial impacts on historic structures, sites, and cultural landscape features. Consequently, the adverse impacts of the other past, present, and reasonably foreseeable actions described above, in combination with the impacts of alternative C, would result in long-term adverse cumulative impacts on historic structures, sites, and cultural landscapes. The adverse impacts associated with alternative C would represent a small component of the overall adverse cumulative impact.

Conclusion. Under alternative C, long-term beneficial impacts would result primarily from retention of Moose-Wilson Road in its present alignment and instituting road corridor design standards and visitor education measures to protect cultural resources. Limited adverse impacts would result from drainage improvements and reconstruction of a segment of Moose-Wilson Road near Sawmill Ponds; these measures are necessary to retain the long-term functionality of the road but could slightly alter its existing materials and design. Other adverse impacts on the historic character of the road corridor would result from removal of a portion of Death Canyon Road and construction of a new parking area at the junction of Death Canyon and White Grass Roads. Long-term adverse cumulative impacts on historic structures, sites, and cultural landscapes would result from implementation of alternative C in conjunction with other past, present, or reasonably foreseeable actions. In comparison with the other alternatives, alternative C would best protect the historic character of the road corridor and contributing historic properties.

Alternative D

Under alternative D, two segments of Moose-Wilson Road would be relocated and the removed segments would be restored to natural conditions (a 0.6-mile section presently connecting to the Murie Ranch Road and a 2.4-mile section between the Sawmill Ponds Overlook and the Death

Canyon Road junction). Relocation of the Sawmill Ponds road section to the southeast would represent a marked deviation from the historical alignment that has remained intact over the past 55 years. Elements contributing to the road's historic character, such as patterns of circulation, spatial arrangement, topography, setting, and views / vistas, would be substantially altered along the rerouted segment. Although the width and slow, winding character representative of the historic road would be retained along the new relocated section, realignment would nevertheless diminish the overall integrity of Moose-Wilson Road with particular regard to its integrity of location, design, and setting, resulting in a long-term significant adverse impact.

A multiuse pathway would also be constructed along the Moose-Wilson corridor between Moose and the Granite Canyon entrance area. Although the exact alignment of the pathway has not been determined, it would generally be placed within 150 feet of the existing or realigned segments of the roadway. The route of the pathway would substantially depart from the road in the vicinity of the LSR Preserve. Placement of the pathway adjacent or close to the road would further diminish the road's historic character by the introduction of a new and continuous constructed feature (paved pathway), which did not exist during or after the road's period of significance. The pathway would substantially alter the designed appearance of the road corridor, change historic patterns of circulation, and widen the area of disturbance adjacent to the road with a corresponding loss of vegetation and other associated construction-related resource impacts that would change the historic setting and feeling of the corridor. The intensity of the adverse impact would be reduced in those instances where the pathway could be placed at a greater distance from the roadway. Placement of the pathway would therefore result in long- and short-term significant adverse impacts on the historic character and cultural landscape of the corridor.

The northernmost 0.6-mile section of Moose-Wilson Road would be relocated to connect with Teton Park Road. This action would restore the historic alignment that existed prior to the 1960 reroute connecting this section with the Moose visitor center, although both alignments were developed during the road's period of significance. Relocating this section of road would be carried out in a manner that provides consistency with the road's historic design and preserves contributing features of the cultural landscape. The existing unpaved portion of Moose-Wilson Road would remain in its current alignment and would be graded and treated for dust abatement as part of regular road maintenance. These actions would have minimal adverse impacts on the overall character of the road and its cultural landscape.

Extensive modifications to the White Grass / Death Canyon Roads would be undertaken including relocating a portion of Death Canyon Road to the existing alignment of White Grass Road, restoring the unused section to natural conditions and constructing a new connector road to the Death Canyon Trailhead. The existing parking area by the trailhead would be improved and expanded. These actions would substantially alter the historic character and cultural landscape of the Death Canyon / White Grass Roads, particularly by rerouting trail user traffic onto White Grass Road, which would disrupt access and operations of the Western Center for Historic Preservation and intrude on the historic setting of White Grass Ranch. Removal of a portion of Death Canyon Road and expansion of the trailhead parking area would further diminish patterns of historic circulation and the setting of the historic road corridor. These actions would result in significant long-term adverse impacts on the historic character of the Death Canyon and White Grass Road corridors.

Also proposed under alternative D are measures to develop and implement road corridor design standards regarding the appropriate location and configuration of turnouts, parking areas, and other features in efforts to maintain design consistency and safety. Other measures would be implemented, such as the placement of physical barriers and signage, to discourage the development of undesignated vehicle turnouts that can contribute to erosion, vegetation loss, and other resource disturbances along the road corridor. These actions would help achieve consistent management and protection of the road corridor's overall historic character and design and would result in long-term beneficial impacts on the cultural landscape.

Strategies to limit the number of vehicles entering Moose-Wilson Road during peak use periods would retain character-defining qualities of the roadway's cultural landscape, particularly the feeling it imparts to visitors of seclusion and serenity through a rustic and majestic natural setting. These strategies would have long-term beneficial impacts.

Visitors would be provided information through pre-visit media, interpretive programs, and publications regarding the need and requirements for protecting cultural resources and historic properties. Visitor education efforts would be carried out to discourage vandalism and would emphasize the significance and fragility of cultural resources along the Moose-Wilson corridor and how visitors can avoid or reduce inadvertent resource impacts. These management actions would further advance the protection of the park's cultural resources, resulting in long-term, beneficial impacts.

Limited short-term adverse impacts on the cultural landscape would be expected to be associated with routine maintenance, such as repaving and regrading, that could temporarily alter traffic patterns, require detours, or introduce construction-related noise and visual disturbances. These adverse impacts would last only as long as the period of construction.

Cumulative Impacts. Other past, present, and reasonably foreseeable actions have altered, or have the potential to affect, the historic character and cultural landscape of the Moose-Wilson corridor. Prior to the 1936 to 1960 period of significance associated with NPS development of the road, segments of the earlier road that emerged in the latter 19th century were relocated in response to evolving historic land use and development such as the establishment and operation of homesteads and dude ranches. The National Park Service also modified the location of road segments and carried out necessary improvements to address administrative requirements and visitor use. The deteriorated Lake Creek Bridge was replaced with a more substantial structure in 2005. Unofficial development of roadside turnouts by visitor vehicles has also altered the designed appearance of the roadway. Despite these and other modifications, Moose-Wilson Road and White Grass / Death Canyon Roads retain overall good integrity and continue to follow their general alignments from the time of construction to reflect respective periods of significance (CLI 2014). The establishment of the LSR Preserve adversely altered the historical integrity of the former JY Ranch by removal of privately held historic ranch buildings. However, preservation and rehabilitation undertakings at the Murie Ranch Historic District and the White Grass Dude Ranch Historic District have preserved the cultural landscapes and contributing features of these important historic sites. These primarily past actions, as well as any necessary future road maintenance and associated construction have had (or could potentially result in) long- and short-term adverse and beneficial impacts on historic structures, sites and cultural landscape features.

The impacts associated with implementation of alternative D would have short-term and significant long-term adverse impacts as well as beneficial impacts on the historic character and cultural landscape associated with Moose-Wilson Road and the White Grass / Death Canyon Road corridors. Other past, present, and reasonably foreseeable actions have had (or would potentially result in) long-term adverse and beneficial impacts on historic structures, sites, and cultural landscape features. Consequently, the adverse impacts of the other past, present, and reasonably foreseeable actions described above, in combination with the impacts of alternative D, would result in long-term adverse cumulative impacts on historic structures, sites, and cultural landscapes. The adverse impacts associated with alternative D would represent a substantial component of the overall adverse cumulative impact.

Conclusion. Under alternative D, significant adverse impacts would occur from relocation of a 2.4-mile section of Moose-Wilson Road near Sawmill Ponds and the construction of a multiuse pathway along the road corridor. The pathway would introduce a new and extensive constructed feature adjacent to the historic roadway and would adversely impact the historic character of the cultural landscape along the corridor particularly where the pathway would closely parallel the road. Other significant adverse impacts would result from removal of a portion of Death Canyon Road and other proposed changes to traffic patterns and parking along the White Grass / Death Canyon Road corridors. Long-term beneficial impacts would result from instituting road corridor design standards and visitor education measures to protect cultural resources. Long-term adverse cumulative impacts on historic structures, sites, and cultural landscapes would result from implementation of alternative D in conjunction with other past, present, or reasonably foreseeable actions. In comparison with the other alternatives, alternative D would have the greatest adverse impact on the historic character of the road corridor and contributing features of the cultural landscape, primarily as a result of road realignments and construction of the multiuse pathway.

ARCHEOLOGICAL RESOURCES

Alternative A (No Action)

Under the no action alternative, the National Park Service would continue to carry out routine maintenance for the Moose-Wilson corridor, and would manage operations, traffic and visitor use activities / services along the corridor in accordance with existing conditions and policies. In consideration of NPS management and policy objectives to preserve the historic character of the corridor, there would be little potential for impacts on archeological resources as a result of ground-disturbing construction or development actions. The existing alignment and width of the road would be retained, the currently unpaved portion of the road would remain unpaved, and officially designated parking areas and roadside turnouts would remain unmodified. There is a limited potential for known archeological sites and presently unidentified archeological resources to be affected by routine road maintenance, unofficial development of roadside turnouts by visitor vehicles, and other ground-disturbing activities. As necessary, NPS archeologists would survey project areas in advance of ground-disturbing road maintenance activities to provide avoidance or protection of important sites. Archeologists would also continue to routinely monitor the condition of known sites and would undertake appropriate protection and stabilization measures as necessary to avoid or reduce adverse site impacts possibly occurring from natural processes of erosion, park operations, visitor use (e.g., erosion inadvertently resulting from pedestrian and horse trails), the illegal removal of artifacts, and other factors. Any adverse effects would likely be long-term or permanent, localized, and (depending on the type and nature of potential impacts) would not be expected to compromise the overall integrity or informational potential of archeological resources.

Additional testing may be conducted for selected sites to address specific research questions and/or to assist determinations of site eligibility for listing in the National Register of Historic Places. Archeological resource management actions would be implemented in accordance with all pertinent laws and policies including consultation with the Wyoming State Historic Preservation Office, associated tribes, and other concerned parties under section 106 and section 110 of the National Historic Preservation Act. These management actions would further advance the documentation and protection of the park's archeological resources, resulting in long-term beneficial impacts.

Cumulative Impacts. Other past, present, and reasonably foreseeable actions have adversely affected, or have the potential to adversely affect, archeological resources throughout the Moose-Wilson corridor. Although historic land use and development (e.g., road construction and the operations of homesteads and dude ranches) have contributed to the historic archeological record, these activities have also inadvertently impacted prehistoric archeological resources such as site 48TE498 near Sawmill Ponds and the site in the vicinity of the LSR Preserve. NPS activities involving ground disturbance such as those associated with the rehabilitation and adaptive use of historic sites (e.g., Murie Ranch, White Grass Ranch) and activities associated with transferring the Laurance S. Rockefeller Preserve to the National Park Service may also have inadvertently disturbed archeological resources. Other proposed actions such as the NPS water system and wastewater improvements at Moose also have the potential to disturb presently unknown archeological resources because of ground disturbance. These actions have had (or could potentially result in) long-term or permanent adverse impacts on archeological resources that vary from minimal surface disturbance to significant loss of resource integrity depending on whether sites could be avoided, mitigated through data recovery, or are irretrievably lost.

The impacts associated with implementation of alternative A would have long-term or permanent, minimal adverse impacts. Beneficial impacts on the park's archeological resources would also result from continued professional NPS archeological management actions to document and protect resources. Other past, present, and reasonably foreseeable actions would result in long-term or permanent adverse impacts on archeological resources that would likely range from slight to significant in consideration of the degree to which site information is retained, disturbed or lost. Consequently, the adverse impacts of the other past, present, and reasonably foreseeable actions described above, in combination with the impacts of alternative A, would result in long-term or permanent adverse cumulative impacts on archeological resources. The impacts associated with alternative A would represent a small component of the adverse cumulative impact.

Conclusion. Continuation of current management along the Moose-Wilson corridor would result primarily in long-term beneficial impacts on archeological resources. Identified sites would be preserved and protected in accordance with NPS policies and guidelines. Long-term or permanent, localized, minimal adverse impacts could occur from natural erosion, visitor use, ongoing NPS maintenance operations, and other factors. Long-term or permanent, adverse cumulative impacts on archeological resources would result from implementation of alternative A in conjunction with other past, present, or reasonably foreseeable actions.

Alternative B

Under alternative B, two segments of the northern portion of Moose-Wilson Road would be realigned and existing alignments would be removed and restored to natural conditions. Significant and irreversible adverse impacts on archeological site 48TE498 would result from relocation of the road segment near Sawmill Ponds. Because of the topographical constraints placed on relocation of this section, the rerouted road would cross directly through the archeological site resulting in total loss of the site as a consequence of grading and construction activities. Preliminary estimates indicate that approximately 3,827 square yards (yd^2) (3,200 square meters [m^2]) of surface disturbance would occur from road construction within the boundaries of the archeological site. The extent of subsurface disturbance is presently unknown, but road excavations would obliterate archeologically important buried portions of the site throughout its length. Another extensive archeological site recently identified along Moose-Wilson Road near the LSR Preserve could also sustain significant adverse impacts by ground disturbance associated with parking and access improvements depending on the extent to which project designs could be modified to reduce impacts. The Sawmill Ponds and LSR Preserve sites are recognized as among the park's most important archeological resources, and proposed project actions would have significant and irreversible adverse effects on the sites by disturbing the integrity and exceptional information potential they retain in buried stratigraphic contexts regarding prehistoric occupation and use along this area of the park. Although archeological data recovery excavations would be carried out to recover as much information as possible from the sites before construction disturbance, these measures would not fully mitigate or recover the loss of information the sites retain in largely undisturbed, in situ conditions.

There is a potential for other presently unidentified archeological sites to be impacted by new construction for rerouted road segments or restoration of existing segments to natural conditions because of ground disturbance, earth moving, and revegetation activities. However, no significant sites were identified by archeological surveys of the northernmost portion of Moose-Wilson Road proposed for rerouting. Additionally, development of strategically located parking turnouts along Moose-Wilson Road as well as new parking areas and improvements (e.g., horse trailer parking, Sawmill Ponds parking, new parking areas on the White Grass / Death Canyon Roads) have the potential to impact archeological resources because of ground disturbance. However, all project areas would be archeologically surveyed and assessed as needed to ensure the avoidance or appropriate mitigation of identified significant sites. Continued allowance of horse use on designated horse trails could disturb potential archeological resources along the trails as a result of erosion, but existing trails and any new trail alignments would be surveyed and assessed as necessary to assist efforts to avoid or mitigate resource impacts. Slight or limited adverse impacts on archeological resources are anticipated from these actions.

As noted under alternative A, NPS archeologists would continue to systematically survey lands within the Moose-Wilson corridor as needed and would record newly identified sites and monitor the condition of other known sites (those not substantially disturbed or lost by project actions). Additional testing may be conducted for selected sites to address specific research questions and/or to assist determinations of site eligibility for listing in the National Register of Historic Places. Archeological resource management actions would be carried out in accordance with all pertinent laws and policies including consultation with the Wyoming State Historic Preservation Office, associated tribes, and other concerned parties under section 106 of the National Historic Preservation Act. Under alternative B, visitors would be provided information through pre-visit media, interpretive programs, and publications regarding the need and requirements for protecting archeological and other cultural resources. Visitor education efforts would be carried out to discourage vandalism and would emphasize the significance and fragility of cultural resources along the Moose-Wilson corridor and how visitors can avoid or reduce inadvertent resource impacts. Although far outweighed by the significant adverse impacts described above from road realignments, these management actions would advance the documentation and protection of the park's archeological resources, resulting in long-term beneficial impacts.

Cumulative Impacts. Other past, present, and reasonably foreseeable actions have adversely affected, or have the potential to adversely affect, archeological resources throughout the Moose-Wilson corridor. Although historic land use and development (e.g., road construction, the operations of homesteads and dude ranches) have contributed to the historic archeological record, these activities have also inadvertently impacted prehistoric archeological resources such as site 48TE498 near Sawmill Ponds and the site in the vicinity of the LSR Preserve. NPS activities involving ground disturbance such as those associated with the rehabilitation and adaptive use of historic sites (e.g., Murie Ranch, White Grass Ranch) and activities associated with transferring the Laurance S. Rockefeller Preserve to the National Park Service may also have inadvertently disturbed archeological resources. Although outside the study area, other proposed actions, such as the NPS water system and wastewater improvements at Moose, have the potential to disturb presently unknown archeological resources because of ground disturbance. These actions have had (or could potentially result in) long-term or permanent adverse impacts on archeological resources that vary from minimal surface disturbance to significant loss of resource integrity, depending on whether sites could be avoided, mitigated through data recovery, or are irretrievably lost.

The impacts associated with implementation of alternative B would have primarily long-term or permanent, significant and irreversible adverse impacts on archeological resources. Limited beneficial impacts on the park's archeological resources would also result from continued professional NPS archeological management actions and visitor outreach measures. Other past, present, and reasonably foreseeable actions would result in long-term or permanent adverse impacts on archeological resources that would likely range from slight to significant in consideration of the degree to which site information is retained, disturbed, or lost. Consequently, the adverse impacts of the other actions described above, in combination with the impacts of alternative B, would cumulatively result in long-term or permanent adverse impacts on archeological resources. The impacts associated with alternative B would represent a substantial component of the adverse cumulative impact.

Conclusion. Alternative B would primarily result in permanent, significant and irreversible adverse impacts on two of the park's most important prehistoric archeological sites (48TE498 and the site in the vicinity of the LSR Preserve) as a result of relocation of the Sawmill Ponds section of Moose-Wilson Road and parking / access improvements near the LSR Preserve. The exceptional informational potential of these sites would be permanently lost by the proposed actions. Potential adverse impacts on presently unidentified archeological resources could also result from other project actions (e.g., new construction for rerouted road segments, new horse trails), natural erosion, visitor use, ongoing NPS maintenance operations, and other factors. Long-term or permanent, adverse cumulative impacts on archeological resources would result from implementation of alternative B in conjunction with other past, present, or reasonably foreseeable actions. Compared with the other alternatives, alternative B would result in substantial adverse impacts on archeological resources primarily because of road realignments and development, but not to the extent as alternative D because of the multiuse pathway proposed under that alternative.

Alternative C (NPS Preferred)

Under alternative C, realignment of the northernmost segment of Moose-Wilson Road would entail new road construction and returning the existing 0.6-mile road section connecting to Murie Ranch Road to natural conditions. Archeological surveys and assessments of the proposed road realignment did not identify significant archeological resources. The segment of Moose-Wilson Road between Sawmill Ponds Overlook and the Death Canyon Road junction would be retained in its present alignment although the road would be reconstructed in its current alignment to correct drainage and improve road conditions. Retention of this section of the road would achieve avoidance of archeological site 48TE498 although monitoring would likely be required because of the need to reconstruct and improve the road segment. Development of new or improved parking areas would be designed to avoid the archeological site in the vicinity of the LSR Preserve and site 48TE1197 along White Grass / Death Canyon Roads. Long-term protection of these archeological sites would be achieved under this alternative, and only minimal adverse impacts are anticipated as a result of proposed project actions, visitor use, and ongoing park maintenance operations.

Development of strategically sited parking turnouts along Moose-Wilson Road, as well as new parking areas and improvements (e.g., horse trailer parking, Sawmill Ponds parking, new/improved parking areas on White Grass and Death Canyon Roads) have the potential to affect archeological resources because of ground disturbance. However, as needed, these project areas would be archeologically surveyed and assessed to ensure the avoidance or appropriate mitigation of identified significant sites. Continued allowance of horse use on designated horse trails could disturb potential archeological resources along the trails as a result of erosion, but existing trails and any new trail alignments would be surveyed and assessed as necessary to assist efforts to avoid or mitigate resource impacts. Slight or limited adverse impacts on archeological resources are anticipated from these actions.

As noted under alternative A, NPS archeologists would continue to systematically survey lands within the Moose-Wilson corridor as needed and would record newly identified sites and monitor the condition of known sites. Additional testing may be conducted for selected sites to address specific research questions and/or to assist determinations of site eligibility for listing in the National Register of Historic Places. Archeological resource management actions would be carried out in accordance with all pertinent laws and policies including consultation with the Wyoming State Historic Preservation Office, associated tribes, and other concerned parties under section 106 of the National Historic Preservation Act. Under alternative C, visitors would be provided information through pre-visit media, interpretive programs, and publications regarding the need and requirements for protecting archeological and other cultural resources. Visitor education efforts would be employed to discourage vandalism, would emphasize the significance and fragility of cultural resources along the Moose-Wilson corridor, and educate visitors to avoid or reduce inadvertent resource impacts. These management actions would further advance the documentation and protection of the park's archeological resources, resulting in long-term, beneficial impacts.

Cumulative Impacts. Other past, present, and reasonably foreseeable actions have adversely affected, or have the potential to adversely affect, archeological resources throughout the Moose-Wilson corridor. Although historic land use and development (e.g., road construction, the operations of homesteads and dude ranches) have contributed to the historic archeological record, these activities have also inadvertently impacted prehistoric archeological resources such as site 48TE498 near Sawmill Ponds and the site in the vicinity of the LSR Preserve. NPS activities involving ground disturbances such as those associated with the rehabilitation and adaptive use of historic sites (e.g., Murie Ranch, White Grass Ranch) and activities associated with transferring the Laurance S. Rockefeller Preserve to the National Park Service may also have inadvertently disturbed archeological resources. Although outside the study area, other proposed actions, such as the NPS water system and wastewater improvements at Moose, also have the potential to disturb presently unknown archeological resources because of ground disturbance. These actions have had (or could potentially result in) long-term or permanent adverse impacts on archeological resources that vary from minimal surface disturbance to significant loss of resource integrity depending on whether sites could be avoided, mitigated through data recovery, or are irretrievably lost.

The impacts associated with implementation of alternative C would have long-term or permanent, limited or minimal adverse impacts. Beneficial impacts on the park's archeological resources would also result from continued professional NPS archeological management actions and visitor outreach measures. Other past, present, and reasonably foreseeable actions have had or could potentially result in long-term or permanent adverse impacts on archeological resources that would likely range from slight to significant in consideration of the degree to which site information is retained, disturbed, or lost. Consequently, the adverse impacts of the other past, present, and reasonably foreseeable actions described above, in combination with the impacts of alternative C, would result in long-term or permanent adverse cumulative impacts on archeological resources. The adverse impacts associated with alternative C would represent a small component of the adverse cumulative impact.

Conclusion. Retention of the Sawmill Ponds section of Moose-Wilson Road would provide the greatest protection of archeological site 48TE498. Parking/road design measures would also be implemented to avoid or minimize disturbance to the site in the vicinity of the LSR Preserve and site 48TE1197 along White Grass and Death Canyon Roads. The integrity and important archeological information retained by these sites regarding prehistoric occupation of the area would be preserved in situ. Potential adverse impacts on presently unidentified archeological resources could also result from other project actions (e.g., new construction for rerouted road segments, new horse trails), natural erosion, visitor use, ongoing NPS maintenance operations, and other factors. Long-term or permanent, adverse cumulative impacts on archeological resources would result from implementation of alternative C in conjunction with other past, present, or reasonably foreseeable actions. Outside of the no-action alternative , alternative C would best protect archeological resources because it does not propose road realignments or substantial new construction that could impact known sites.

Alternative D

Under alternative D, two segments of the northern portion of Moose-Wilson Road would be realigned and existing alignments would be removed and restored to natural conditions. Significant and irreversible adverse impacts on archeological site 48TE498 would result from relocation of the road segment near Sawmill Ponds. Because of the topographical constraints placed on relocation of this section, the rerouted road would cross directly through the archeological site resulting in total loss of the site as a consequence of grading and construction activities. Preliminary estimates indicate that approximately 3,827 yd^2 (3,200 m^2) of surface disturbance would occur from road construction within the boundaries of the archeological site. The extent of subsurface disturbance is presently unknown, but road excavations would destroy archeologically important portions of the site throughout its length.

Development of a multiuse pathway would also adversely impact archeological resources because the pathway would require additional ground disturbance. In addition to the destruction of archeological site 48TE498 near Sawmill Ponds from road realignment, the multiuse pathway would also cross the site resulting in an estimated 2,272 yd^2 (1,900 m^2) of additional surface disturbance and an unknown amount of subsurface disturbance to buried portions of the site. The combined impacts of these actions would result in total loss of the site. The pathway would also cross the length of the site in the vicinity of the LSR Preserve with an estimated 4,425 yd^2 (3,700 m^2) of disturbance to that extensive site. Site 48 TE498 and the site near the LSR Preserve are recognized as among the park's most important archeological resources. Proposed project actions would cause significant damage and total loss of the sites and the exceptional information potential they retain in buried stratigraphic contexts regarding prehistoric occupation and use along this area of the park. Additional trampling along unpaved portions of the pathway and erosion associated with development of social trails would also present potential impacts on portions of known sites or presently unidentified sites. Construction of a spur road connecting the Death Canyon Trailhead and White Grass and Death Canyon Roads would also result in significant disturbance to archeological site 48TE1197 because of ground disturbance associated with road construction activities.

There is also a potential for other presently unidentified archeological sites to be impacted by new construction for rerouted road segments or restoration of existing segments to natural conditions because of ground disturbance, earth moving, and revegetation activities. Additionally, development of strategically located parking turnouts along Moose-Wilson Road as well as new parking areas and improvements (e.g., horse trailer parking, Sawmill Ponds parking, new parking areas on White Grass and Death Canyon Roads) have the potential to impact archeological resources because of ground disturbance. However, these project areas would be archeologically surveyed as needed and assessed to ensure the avoidance or appropriate mitigation of identified significant sites. Continued allowance of horse use on designated horse trails could disturb potential archeological resources along the trails as a result of erosion, but existing trails and any new trail alignments would be surveyed and assessed as necessary to assist efforts to avoid or mitigate resource impacts. Slight or limited adverse impacts on archeological resources are anticipated from these actions.

As noted under alternative A, NPS archeologists would continue to systematically survey lands within the Moose-Wilson corridor as needed and would record newly identified sites and monitor the condition of other known sites (those not substantially disturbed or lost by project actions). Additional testing may be conducted for selected sites to address specific research questions and/or to assist determinations of site eligibility for listing in the National Register of Historic Places. Archeological resource management actions would be carried out in accordance with all pertinent laws and policies including consultation with the Wyoming State Historic Preservation Office, associated tribes, and other concerned parties under section 106 of the National Historic Preservation Act. Under alternative D, visitors would be provided information through pre-visit media, interpretive programs, and publications regarding the need and requirements for protecting archeological and other cultural resources. Visitor education efforts would be carried out to discourage vandalism and would emphasize the significance and fragility of cultural resources along the Moose-Wilson corridor and how visitors can avoid or reduce inadvertent resource impacts. Although far outweighed by the significant adverse impacts described above from road realignments, these management actions would advance the documentation and protection of the park's archeological resources, resulting in long-term, beneficial impacts.

Cumulative Impacts. Other past, present, and reasonably foreseeable actions have adversely affected, or have the potential to adversely affect, archeological resources throughout the Moose-Wilson corridor. Although historic land use and development (e.g., road construction, the operations of homesteads and dude ranches) have contributed to the historic archeological record, these activities have also inadvertently impacted prehistoric archeological resources such as site 48TE498 near Sawmill Ponds and the site in the vicinity of the LSR Preserve. NPS activities involving ground disturbance such as those associated with the rehabilitation and adaptive use of historic sites (e.g., Murie Ranch, White Grass Ranch) and activities associated with transferring the Laurance S. Rockefeller Preserve to the National Park Service may also have inadvertently disturbed archeological resources. Although outside the study area, other proposed actions, such as the NPS water system and wastewater improvements at Moose, also have the potential to disturb presently unknown archeological resources because of ground disturbance. These actions have had (or could potentially result in) long-term or permanent adverse impacts on archeological resources that vary from minimal surface disturbance to significant loss of resource integrity depending on whether sites could be avoided, mitigated through data recovery, or are irretrievably lost.

The impacts associated with implementation of alternative D would have primarily permanent, significant and irreversible adverse impacts. Limited beneficial impacts on the park's archeological resources would also result from continued professional NPS archeological management actions and visitor outreach measures. Other past, present, and reasonably foreseeable actions have had or would result in long-term or permanent adverse impacts on archeological resources that would likely range from slight to significant in consideration of the degree to which site information is retained, disturbed or lost. Consequently, the adverse impacts of the other past, present, and reasonably foreseeable actions described above, in combination with the impacts of alternative D, would result in long-term or permanent adverse cumulative impacts on archeological resources. The impacts associated with alternative D would represent a substantial component of the adverse cumulative impact.

Conclusion. Alternative D would primarily result in permanent, significant, and irreversible adverse impacts on two of the park's most important prehistoric archeological sites (48TE498 and the site in the vicinity of the LSR Preserve) as a result of relocation of the Sawmill Ponds section of Moose-Wilson Road and construction of a multiuse pathway adjacent to the roadway. Site 48TE498 would be completely destroyed by ground disturbance associated with road and pathway construction and the LSR Preserve site would be substantially disturbed by pathway construction. The exceptional informational potential retained by these sites in their current conditions would be permanently lost. Construction of a spur road connecting the Death Canyon Trailhead and White Grass / Death Canyon Roads would also result in significant impacts on archeological site 48TE1197 as a result of ground-disturbing road construction activities. Potential adverse impacts on presently unidentified archeological resources could also result from other project actions (e.g., new construction for rerouted road segments, new horse trails), natural erosion, visitor use, ongoing NPS maintenance operations, and other factors.

Significant, permanent, adverse cumulative impacts on archeological resources would result from implementation of alternative D in conjunction with other past, present, or reasonably foreseeable actions. Compared with the other alternatives, alternative D would have the greatest adverse impacts because of the combined effect of road realignments and pathway construction on important archeological sites.

ETHNOGRAPHIC RESOURCES

Alternative A (No Action)

Under the no action alternative, the National Park Service would continue to carry out routine maintenance for the Moose-Wilson corridor, and would manage operations, traffic and visitor use activities / services along the corridor in accordance with existing conditions and policies. In consideration of NPS management and policy objectives to preserve the historic character of the corridor, there would be little potential for impacts on ethnographic resources as a result of ground-disturbing construction, development actions, or curtailment of access to traditional use areas. The existing alignment and width of the road would be retained, the currently unpaved portion of the road would remain unpaved, and parking areas and roadside turnouts would remain unmodified. There is a limited potential for presently unidentified ethnographic resources to be affected by the development of unofficial, user-created roadside turnouts by visitor vehicles or other inadvertent activities. Ethnographic resource assessments and investigations would continue to be carried out, as necessary, of areas where future ground-disturbing project and maintenance activities may occur. NPS cultural resource specialists and archeologists would also continue to routinely monitor the condition of known sites and resources and would undertake appropriate protection and stabilization measures as necessary to avoid or reduce adverse impacts possibly occurring from natural processes of erosion, park operations, visitor use (e.g., erosion inadvertently resulting from pedestrian and horse trails), the illegal removal of artifacts from archeological sites of ethnographic importance, and other factors. Any adverse effects would likely be long term or permanent, localized, and would not be expected to compromise the overall integrity, informational potential, and contemporary cultural associations of ethnographic resources.

As necessary, NPS cultural resource staff would continue to systematically survey areas along the road corridor in advance of future maintenance or construction to ensure that archeological and ethnographic resources are protected to the greatest extent possible. Identified sites would be recorded and assessed for their ethnographic importance in consultation with associated tribes. Additional testing may be conducted for selected sites to address specific research questions and/or to assist determinations of site eligibility for listing as traditional cultural properties in the National Register of Historic Places. Ethnographic/archeological resource management actions would be carried out in accordance with all pertinent laws and policies including consultation with the Wyoming State Historic Preservation Office, associated tribes, and other concerned parties under section 106 and section 110 of the National Historic Preservation Act. These management actions would further advance the documentation and protection of park ethnographic resources, resulting in long-term beneficial impacts.

Cumulative Impacts. Other past, present, and reasonably foreseeable actions have affected, or have the potential to affect, ethnographic resources along or in proximity to the Moose-Wilson corridor. Previous actions associated with historic land use and development, such as road construction and operations of dude ranches, have likely inadvertently impacted archeological/ ethnographic resources such as site 48TE498 near Sawmill Ponds and the site in the vicinity of the LSR Preserve that retain ongoing cultural importance to the park's associated tribes. Ethnographic resources of enduring value to the descendants of pioneer homesteaders, ranchers, and others having cultural associations with the area may also have been disturbed by subsequent development actions. NPS activities involving ground disturbance, such as those associated with the rehabilitation and adaptive use of historic sites (e.g., Murie Ranch, White Grass Ranch) and activities associated with transferring the Laurance S. Rockefeller Preserve to the National Park Service, may also have inadvertently disturbed ethnographic resources. Although outside the study area, other proposed actions, such as the NPS water system and wastewater improvements at Moose, also have the potential to disturb presently unknown ethnographic resources. These actions have had (or could potentially result in) long-term or permanent adverse impacts on ethnographic resources that vary from minimal surface disturbance to significant loss of resource integrity depending on whether sites and resources could be avoided, mitigated through data recovery, or are irretrievably lost.

The impacts associated with implementation of alternative A would have long-term or permanent, minimal adverse impacts on ethnographic resources. Beneficial impacts on the park's ethnographic resources would also result from continued professional NPS archeological and cultural resource management actions to document and protect resources. Other past, present, and reasonably foreseeable actions would result in long-term or permanent adverse impacts on ethnographic resources that would likely range from slight to significant in consideration of the degree to which site information and cultural connections are retained, disturbed, or lost. Consequently, the adverse impacts of the other past, present, and reasonably foreseeable actions described above, in combination with the impacts of alternative A, would result in long-term or permanent adverse cumulative impacts on ethnographic resources. The impacts associated with alternative A would represent a small component of the adverse cumulative impact.

Conclusion. Long-term or permanent, localized, minimal adverse impacts on ethnographic resources along the Moose-Wilson corridor would potentially occur from natural erosion, visitor use, ongoing NPS maintenance operations, and other factors. Long-term beneficial impacts would also result from continued NPS management, monitoring, and protection of ethnographic resources in accordance with NPS policies and guidelines. Long-term or permanent, adverse cumulative impacts on ethnographic resources would result from implementation of alternative A in conjunction with other past, present, or reasonably foreseeable actions.

Alternative B

Under alternative B, two segments of the northern portion of Moose-Wilson Road would be realigned and existing alignments would be removed and restored to natural conditions. Significant and irreversible adverse impacts on archeological site 48TE498 would result from relocation of the road segment near Sawmill Ponds. Because of the topographical constraints placed on relocation of this section, the rerouted road would cross directly through the archeological site resulting in substantial destruction of the site as a consequence of grading and construction activities. Preliminary estimates indicate that approximately 3,827 yd^2 (3,200 m^2) of surface disturbance would occur from road construction within the site boundaries. The extent of subsurface disturbance is presently unknown, but presumably road excavations would destroy culturally important portions of the site throughout its length and completely obliterate the site and its potential to further yield important scientific information. Another archeological/ ethnographic site recently identified along Moose-Wilson Road near the LSR Preserve could also be adversely affected by ground disturbance associated with parking and access improvements.

Site 48TE498 near Sawmill Ponds and the site in the vicinity of the LSR Preserve are recognized as among the park's most important archeological resources, with enduring cultural importance for associated tribes. Based on the results of 2014 tribal-NPS staff site visits, tribal representatives confirmed the ongoing cultural importance of site 48TE498 as an extensive (and likely repeatedly used) American Indian habitation area. Tribal representatives also confirmed the cultural importance of the site near the LSR Preserve as a tool processing location. Proposed project actions would have significant adverse effects on the sites by disturbing their integrity, cultural value, and the exceptional information potential they retain in buried stratigraphic contexts regarding prehistoric occupation and use along this area of the park.

There is the potential for other presently unidentified ethnographic/archeological sites to be impacted by new construction for rerouted road segments or restoration of existing segments to natural conditions because of ground-disturbing, earth-moving, and revegetation activities. Additionally, development of strategically sited parking turnouts along Moose-Wilson Road as well as new parking areas and improvements (e.g., horse trailer parking, Sawmill Ponds parking, new parking areas on White Grass and Death Canyon Roads) have the potential to affect presently unidentified ethnographic resources because of ground disturbance. However, all project areas would be surveyed by cultural resource specialists and assessed to help ensure the avoidance or appropriate mitigation of identified significant sites. Continued allowance of horse use on designated horse trails could disturb potential archeological/ ethnographic sites along the trails as a result of erosion, but existing trails and any new trail alignments would be surveyed and assessed as necessary to assist efforts to avoid or mitigate resource impacts. Slight or limited adverse impacts on ethnographic resources are anticipated from these actions.

As noted under alternative A, NPS archeologists and cultural resource specialists would continue to systematically survey lands within the Moose-Wilson corridor as needed and would record newly identified sites, assess their ethnographic importance in consultation with associated tribes, and monitor the condition of other known sites (those not substantially disturbed or lost by project actions). Additional testing may be conducted for selected sites to address specific research questions and/or to assist determinations of site eligibility for listing as traditional cultural properties in the National Register of Historic Places. Ethnographic/ archeological resource management actions would be implemented in accordance with all pertinent laws and policies including consultation with the Wyoming SHPO, associated tribes, and other concerned parties under section 106 of the National Historic Preservation Act. Under alternative B, visitors would be provided information through pre-visit media, interpretive programs, and publications regarding the need and requirements for protecting ethnographic and other cultural resources. Visitor education efforts would be carried out to discourage vandalism and would emphasize the significance and fragility of ethnographic resources along the Moose-Wilson corridor and how visitors can avoid or reduce inadvertent resource impacts. The management actions described above would assist efforts to document and protect park ethnographic resources, resulting in long-term, beneficial impacts.

Cumulative Impacts. Other past, present, and reasonably foreseeable actions have affected, or have the potential to affect, ethnographic resources along or in proximity to the Moose-Wilson corridor. Previous actions associated with historic land use and development, such as road construction and operations of dude ranches, have likely inadvertently impacted archeological/ ethnographic resources such as site 48TE498 near Sawmill Ponds and the site in the vicinity of the LSR Preserve that retain ongoing cultural importance to the park's associated tribes. Ethnographic resources of enduring value to the descendants of pioneer homesteaders, ranchers, and others having cultural associations with the area may also have been disturbed by subsequent development actions. NPS activities involving ground disturbance, such as those associated with the rehabilitation and adaptive use of historic sites (e.g., Murie Ranch, White Grass Ranch) and activities associated with transferring the Laurance S. Rockefeller Preserve to the National Park Service, may also have inadvertently disturbed ethnographic resources. Other proposed actions, such as the NPS water system and wastewater improvements at Moose, also have the potential to disturb presently unknown ethnographic resources. These actions have had (or could potentially result in) long-term or permanent adverse impacts on ethnographic resources that vary from minimal surface disturbance to significant loss of resource integrity, depending on whether sites and resources could be avoided, mitigated through data recovery, or are irretrievably lost.

The impacts associated with implementation of alternative B would be primarily permanent, significant and irreversible as a result of the obliteration and / or substantial disturbance of known archeological sites having ethnographic importance. Limited beneficial impacts on park ethnographic resources would also result from continued professional NPS archeological and cultural resource management actions and visitor outreach measures. Other past, present, and reasonably foreseeable actions would result in long-term or permanent adverse impacts on ethnographic resources that would likely range from slight to significant in consideration of the degree to which site information and cultural connections are retained, disturbed, or lost. Consequently, the adverse impacts of the other past, present, and reasonably foreseeable actions described above, in combination with the impacts of alternative B, would result in long-term or permanent adverse cumulative impacts on ethnographic resources. The impacts associated with alternative B would represent a substantial component of the adverse cumulative impact.

Conclusion. Relocation of the Sawmill Ponds section of Moose-Wilson Road and parking/access improvements near the LSR Preserve would result in significant and irreversible adverse impacts on two of the park's most important archeological/ ethnographic sites (48TE498 and the site in the vicinity of the LSR Preserve) as a result of relocation of the Sawmill Ponds section of Moose-Wilson Road and parking/access improvements near the LSR Preserve. The exceptional informational potential and cultural importance of these sites would be permanently lost by the proposed actions. Other permanent, localized adverse impacts on ethnographic resources along the Moose-Wilson corridor would potentially occur from natural erosion, visitor use, ongoing NPS maintenance operations, and other factors. Long-term or permanent, adverse cumulative impacts on ethnographic resources would result from implementation of alternative B, in conjunction with other past, present, or reasonably foreseeable actions. Compared to the other alternatives, alternative B would result in substantial disturbance and loss of important ethnographic resources, primarily as a result of ground-disturbing road realignment and development actions.

Alternative C (NPS Preferred)

Under alternative C, realignment of the northernmost segment of Moose-Wilson Road would involve new road construction and returning the existing 0.6-mile road section connecting to Murie Ranch Road to natural conditions. Archeological surveys and assessments of the proposed road realignment did not identify significant archeological/ethnographic resources. The segment of Moose-Wilson Road between the

Sawmill Ponds Overlook and the Death Canyon Road junction would be retained in its present alignment although the road would be reconstructed in this area to correct drainage and improve road conditions. Retention of this section of the road would achieve avoidance of archeological site 48TE498 although monitoring would likely be required because of the need to reconstruct and improve the road segment. Based on the results of the 2014 tribal-NPS staff site visits, tribal representatives confirmed the ongoing cultural importance of site 48TE498 as an extensive (and likely repeatedly used) American Indian habitation area. Development of new or improved parking areas would be designed to avoid the archeological site in the vicinity of the LSR Preserve and site 48TE1197 that also retain ethnographic importance. Minimal adverse impacts on these archeological/ethnographic sites are therefore anticipated by proposed project actions, visitor use, and ongoing park maintenance operations.

Development of strategically sited parking turnouts along Moose-Wilson Road, as well as new parking areas and improvements (e.g., horse trailer parking, Sawmill Ponds parking, new/improved parking areas on the White Grass / Death Canyon Roads), have the potential to affect presently unidentified archeological/ethnographic resources because of ground disturbance. However, all project areas would be surveyed by cultural resource specialists and assessed to help ensure the avoidance or appropriate mitigation of identified significant sites. Continued allowance of horse use on designated horse trails could disturb potential archeological/ethnographic sites along the trails as a result of erosion, but existing trails and any new trail alignments would be surveyed and assessed as necessary to assist efforts to avoid or mitigate resource impacts. Slight or limited adverse impacts on ethnographic resources are anticipated from these actions.

As noted under alternative A, NPS archeologists and cultural resource specialists would continue to systematically survey lands within the Moose-Wilson corridor as needed, record newly identified sites, assess their ethnographic importance in consultation with associated tribes, and monitor the condition of known sites. Additional testing may be conducted for selected sites to address specific research questions and/or to assist determinations of site eligibility for listing as traditional cultural properties in the National Register of Historic Places. Ethnographic/ archeological resource management actions would be implemented in accordance with all pertinent laws and policies including consultation with the Wyoming State Historic Preservation Office, associated tribes (tribal historic preservation offices) and other concerned parties under section 106 of the National Historic Preservation Act. Under alternative C, visitors would be provided information through pre-visit media, interpretive programs, and publications regarding the need and requirements for protecting ethnographic and other cultural resources. Visitor education efforts would be carried out to discourage vandalism and would emphasize the significance and fragility of ethnographic resources along the Moose-Wilson corridor and how visitors can avoid or reduce inadvertent resource impacts. The management actions described above would assist efforts to document and protect the park's ethnographic resources, resulting in long-term, beneficial impacts.

Cumulative Impacts. Other past, present, and reasonably foreseeable actions have affected, or have the potential to affect, ethnographic resources along or in proximity to the Moose-Wilson corridor. Previous actions associated with historic land use and development, such as road construction and operations of dude ranches, have likely inadvertently impacted ethnographic resources, such as site 48TE498 near Sawmill Ponds and the site in the vicinity of the LSR Preserve that retain ongoing cultural importance to the park's associated tribes. Ethnographic resources of enduring value to the descendants of pioneer homesteaders, ranchers, and others having cultural associations with the area may also have been disturbed by subsequent development actions. NPS activities involving ground disturbance such as those associated with the rehabilitation and adaptive use of historic sites (e.g., Murie Ranch, White Grass Ranch) and activities associated with transferring the Laurance S. Rockefeller Preserve to the National Park Service may also have inadvertently disturbed ethnographic resources. Other proposed actions, such as the NPS water system and wastewater improvements at Moose, also have the potential to disturb presently unknown ethnographic resources. These actions have had (or could potentially result in) long-term or permanent adverse impacts on ethnographic resources that vary from minimal surface disturbance to significant loss of resource integrity, depending on whether sites and resources could be avoided, mitigated through data recovery, or are irretrievably lost.

The impacts associated with implementation of alternative C would have long-term or permanent, minimal adverse impacts. Beneficial impacts on the park's ethnographic resources would also result from continued professional NPS archeological and cultural resource management actions and visitor outreach measures. Other past, present, and reasonably foreseeable actions have had, or would result, in long-term or permanent adverse impacts on ethnographic resources that would likely range from slight to significant in consideration of the degree to which site information and cultural connections are retained, disturbed, or lost. Consequently, the adverse impacts of the other past, present, and reasonably foreseeable actions described above, in combination with the impacts of alternative C, would result in long-term or permanent adverse cumulative impacts on ethnographic resources. The impacts associated with alternative C would represent a small component of the adverse cumulative impact.

Conclusion. Retention of the Sawmill Ponds section of Moose-Wilson Road would protect the archeological integrity of site 48TE498 and its cultural importance to associated tribes. Parking/ road design measures would be implemented to avoid or minimize disturbance in the vicinity of the LSR Preserve and site 48TE1197 along White Grass / Death Canyon Roads. Long-term or permanent, localized, minimal adverse impacts on ethnographic resources along the Moose-Wilson corridor would potentially occur from proposed construction and development, natural erosion, visitor use, ongoing NPS maintenance operations, and other factors. Long-term beneficial impacts would also result from visitor outreach and education measures to expand resource protection awareness. Long-term or permanent, adverse cumulative impacts on ethnographic resources would result from implementation of alternative C in conjunction with other past, present, or reasonably foreseeable actions. Outside of the no-action alternative, alternative C would result in the greatest degree of protection for ethnographic resources by retaining existing conditions to a large extent and retaining existing road alignments.

Alternative D

Under alternative D, two segments of the northern portion of Moose-Wilson Road would be realigned and existing alignments would be removed and restored to natural conditions. Significant and irreversible adverse impacts on archeological site 48TE498 would result from relocation of the road segment near Sawmill Ponds. Because of the topographical constraints placed on relocation of this section, the rerouted road would cross directly through the archeological site resulting in substantial destruction of the site as a consequence of grading and construction activities. Preliminary estimates indicate that approximately 3,827 yd^2 (3,200 m^2) of surface disturbance would occur from road construction within the site boundaries. The extent of subsurface disturbance is presently unknown, but presumably road excavations would destroy culturally important portions of the site throughout its length, obliterating the site and its potential to further yield important scientific information.

Development of a multiuse pathway would also adversely impact known and potentially unidentified archeological/ethnographic resources because the pathway would require additional ground disturbance. In addition to the significant adverse impact to site 48TE498 near Sawmill Ponds from road realignment, the multiuse pathway would also cross the site resulting in an estimated 2,272 yd^2 (1,900 m^2) of additional surface disturbance, and an unknown amount of subsurface disturbance to the site. The pathway would also cross the length of the site near the LSR Preserve, with an estimated 4,425 yd^2 (3,700 m^2) of surface disturbance to that extensive and culturally important site.

Site 48TE498 near Sawmill Ponds and site in the vicinity of the LSR Preserve are recognized as among the park's most important archeological resources, with enduring cultural importance for associated tribes. Based on the results of the 2014 tribal-NPS staff site visits, tribal representatives confirmed the ongoing cultural importance of site 48TE 498 as an extensive (and likely repeatedly used) American Indian habitation area. Tribal representatives also confirmed the cultural importance of the site near the LSR Preserve as a tool processing location. Proposed project actions would have significant and irreversible adverse effects on the sites by substantially disturbing or destroying their integrity, cultural value, and the exceptional information potential they retain in buried stratigraphic contexts regarding prehistoric occupation and use along this area of the park. Construction of a spur road connecting the Death Canyon Trailhead and White Grass and Death Canyon Roads would also result in significant impacts on archeological site 48TE1197 because of ground disturbance. The site also likely retains ethnographic importance.

There is a potential for other presently unidentified archeological/ethnographic sites to be impacted by new construction for rerouted road segments or restoration of existing segments to natural conditions because of ground-disturbing, earth moving, and revegetation activities. Additionally, development of strategically sited parking turnouts along Moose-Wilson Road, as well as new parking areas and improvements (e.g., horse trailer parking, Sawmill Ponds parking, new parking areas on the White Grass and Death Canyon Roads) have the potential to affect presently unidentified ethnographic resources because of ground disturbance. However, all project areas would be surveyed as necessary by cultural resource specialists and assessed to ensure the avoidance or appropriate mitigation of identified significant sites. Continued allowance of horse use on designated horse trails could disturb potential archeological/ethnographic sites along the trails as a result of erosion, and existing trails and any new trail alignments would be surveyed and assessed as necessary to assist efforts to avoid or mitigate resource impacts. Slight or limited adverse impacts on ethnographic resources are anticipated from these actions.

As noted under alternative A, NPS archeologists and cultural resource specialists would continue to systematically survey lands within the Moose-Wilson corridor as needed, record newly identified sites, assess their ethnographic importance in consultation with associated tribes, and monitor the condition of other known sites (those not substantially disturbed or lost by project actions). Additional testing may be conducted for selected sites to address specific research questions and/or to assist in determinations of site eligibility for listing as traditional cultural properties in the National Register of Historic Places. Ethnographic/archeological resource management actions would be carried out in accordance with all pertinent laws and policies including consultation with the Wyoming SHPO, associated tribes (tribal historic preservation officers), and other concerned parties under section 106 of the National Historic Preservation Act. Under alternative D, visitors would be provided information through pre-visit media, interpretive programs, and publications regarding the need and requirements for protecting ethnographic and other cultural resources. Visitor education efforts would be carried out to discourage vandalism and would emphasize the significance and fragility of ethnographic resources along the Moose-Wilson corridor and how visitors can avoid or reduce inadvertent resource impacts. The management actions described above would assist efforts to document and protect the park's ethnographic resources, resulting in long-term, beneficial impacts.

Cumulative Impacts. Other past, present, and reasonably foreseeable actions have affected, or have the potential to affect, ethnographic resources along or in proximity to the Moose-Wilson corridor. Previous actions associated with historic land use and development such as road construction and operations of dude ranches have likely inadvertently impacted ethnographic resources such as site 48TE498 near Sawmill Ponds and the site in the vicinity of the LSR Preserve that retain ongoing cultural importance to the park's associated tribes. Ethnographic resources of enduring value to the descendants of pioneer homesteaders, dude ranchers and others having cultural associations with the area may also have been disturbed by subsequent development actions. NPS activities involving ground disturbance such as those associated with the rehabilitation and adaptive use of historic sites (e.g., Murie Ranch, White Grass Ranch) and activities associated with transferring the Laurance S. Rockefeller Preserve to the National Park Service may also have inadvertently disturbed ethnographic resources. Although outside the project area, other proposed actions such as the NPS water system and wastewater improvements at Moose also have the potential to disturb presently unknown ethnographic resources. These actions have had (or could potentially result in) long-term or permanent adverse impacts on ethnographic resources that vary from minimal surface disturbance to significant loss of resource integrity depending on whether sites and resources could be avoided, mitigated through data recovery, or are irretrievably lost.

The impacts associated with implementation of alternative D would be primarily permanent, significant and irreversible as a result of the obliteration and / or substantial disturbance of known archeological sites having ethnographic importance. Limited beneficial impacts on the park's ethnographic resources would also result from continued professional NPS archeological and cultural resource management actions and visitor outreach measures. Other past, present, and reasonably foreseeable actions have had, or would result in, long-term or permanent adverse impacts on ethnographic resources that would likely range from slight to significant in consideration of the degree to which site information and cultural connections are retained, disturbed or lost. Consequently, the adverse impacts of the other past, present, and reasonably foreseeable actions described above, in combination with the impacts of alternative D, would result in long-term or permanent adverse cumulative impacts on ethnographic resources. The impacts associated with alternative D would represent a substantial component of the adverse cumulative impact.

Conclusion. Relocation of the Sawmill Ponds section of Moose-Wilson Road and construction of a multiuse pathway adjacent to the road corridor would result in significant and irreversible adverse impacts on two of the park's most important archeological/ethnographic sites (48TE498 and the site in the vicinity of the LSR Preserve). Construction of a spur road connecting the Death Canyon Trailhead and White Grass and Death Canyon Roads would result in significant impacts on site 48TE1197, which also retains ethnographic importance. Other long-term or permanent, localized, adverse impacts on ethnographic resources along the Moose-Wilson corridor would potentially occur from natural erosion, visitor use, ongoing NPS maintenance operations, and other factors. Long-term or permanent, adverse cumulative impacts on ethnographic resources would result from implementation of alternative D in conjunction with other past, present, or reasonably foreseeable actions. Compared to the other alternatives, alternative D would result in the greatest degree of disturbance and loss of ethnographic resources by the combined impacts of ground disturbing road realignment and multiuse pathway construction.

VISUAL RESOURCES

METHODS AND ASSUMPTIONS FOR ANALYZING IMPACTS

This analysis discusses the visual resources available in the Moose-Wilson corridor, both from Moose-Wilson Road itself and from areas beyond the roadway. Visual resources are those that have scenic quality and that can be seen as visitors are traveling in the corridor. These resources are related to the fundamental resource of Scenery identified in chapter introduction of this plan. Visual resources from the roadway include those found while on the road or points of interest directly off the road. Visual resources beyond the roadway include those found along trails and from points of interest that are in the corridor but farther from the roadway. Where impacts are anticipated with each alternative, both topics of visual resources will be discussed if applicable. The effects of the proposed alternatives are analyzed based on anticipated results from changes in levels of development, levels of use, and management actions associated with each alternative. The impact analysis of each alternative is determined by describing how each impact topic would change compared to existing conditions. To accomplish this, the following two impact analysis questions were considered to identify the potential impacts of each alternative.

Impact Analysis Questions.

1. How would changes to the corridor affect the visual aesthetics of the Moose-Wilson corridor as a result of the alternatives? How would the visual resources change from the vantage point of a visitor travelling along the road, or viewing scenery in its immediate vicinity?

2. How would levels of visitation within the corridor change the visual resources within the corridor? How would this change result for each alternative?

The following assumptions were considered in concert with each of the above impact analysis questions when assessing the effects of each alternative management strategy:

General Assumptions.

- The materials and conditions of Moose-Wilson Road add to the rustic nature and feel of the corridor. Changes to the roadway would change the visual resources of the corridor

- Relocating sections of the road would result in a visual change for visitors. The natural features visible while driving would change as well as the view of the road itself. Similar to adding a multiuse path, previously undisturbed areas would be developed therefore causing a change in visual resources. Natural features that previously were not visible would become visible. Natural resources that were visible before would no longer be visible if the roadway is moved.

The analysis is primarily qualitative rather than quantitative due to the conceptual nature of the alternatives. Impacts on visual resources were determined considering best available information. Information on visual resources and opinions were taken during public comment periods for this plan and viewshed analyses were conducted by NPS geographic information specialist (GIS) using recently collected high definition imagery (LiDAR) of the corridor.

Impacts were assessed assuming that mitigation measures would be implemented to minimize or avoid impacts.

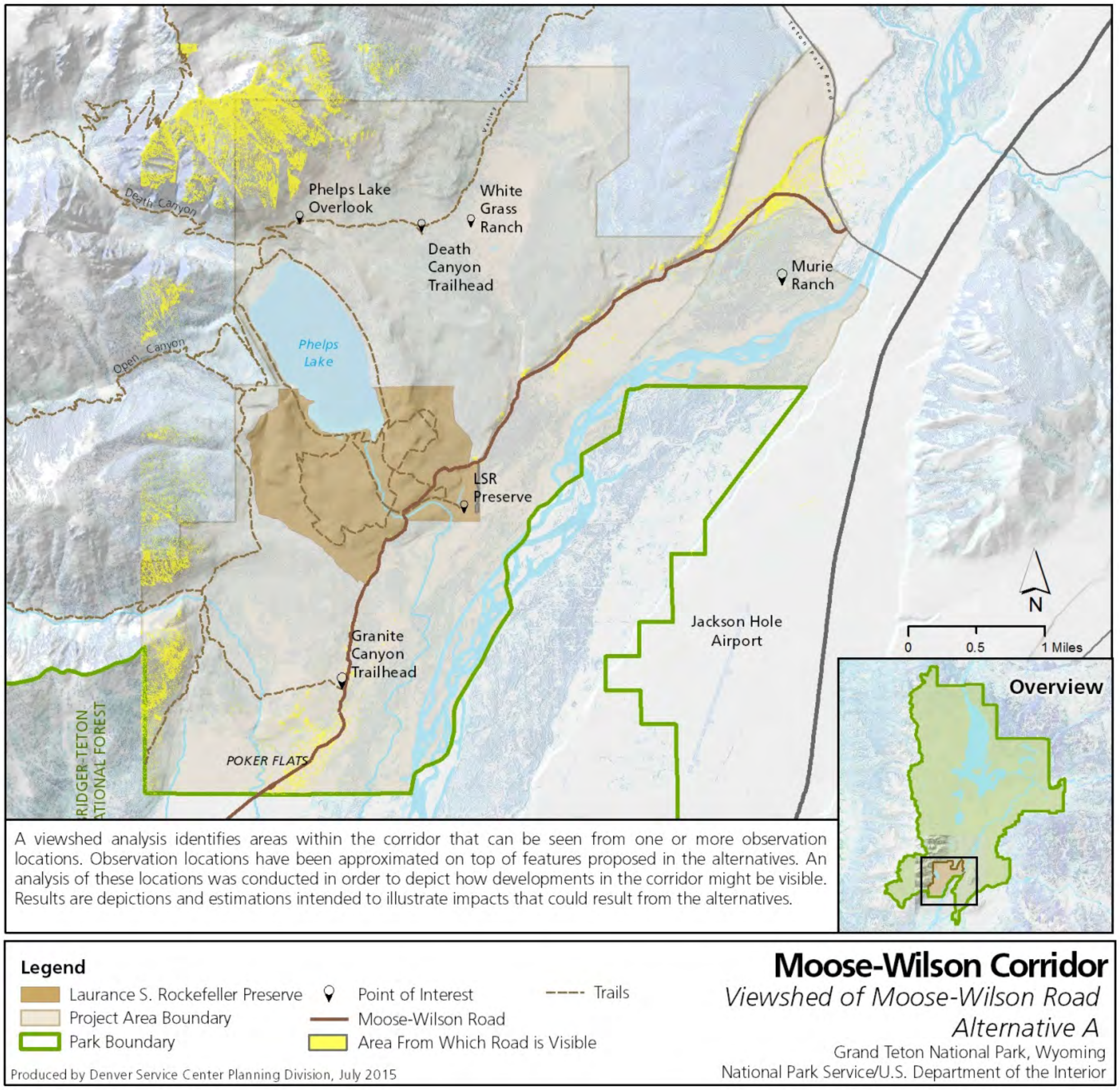
ALTERNATIVE A (NO ACTION)

Along Moose-Wilson Road

Under this alternative, there would be no substantial changes to management of the Moose–Wilson Road. Visitors would continue to experience the scenic views and diverse landscape of the area in much the same way as they do currently. The road would remain in its current alignment, preserving the visual experience that park visitors have enjoyed for decades. The natural environment consisting of wetlands, sagebrush meadows, dense forest, and mixed aspen stands would continue to exist immediately adjacent to the road, defining a foreground scenery that is unmatched elsewhere in the park. During peak traffic hours and at other times when congestion is present, adverse effects on the scenic quality along and near the road would result from the presence of large numbers of parked or stopped vehicles that interfere with the ability to experience the rustic character and scenery along the road. These adverse effects would be greater in this alternative than in the three action alternatives because the National Park Service would not undertake any actions to limit traffic volume and growth, and therefore, congestion would likely be worse. Adverse effects on the scenic quality of the corridor would also result from the presence of eroded and denuded areas alongside the road in numerous locations where user-created turnoffs have been created and persist.

Beyond Moose-Wilson Road

Within the portions of the corridor away from the Moose-Wilson Road, including the LSR Preserve, Death Canyon Road and Trailhead, and backcountry areas, little or no change would occur to the scenery and visual character. Along the Death Canyon Road, adverse effects on the scenic quality would continue to occur as a result of large numbers of vehicles parked at eroded user-created turnoffs along the unpaved last mile of the road. The degraded condition of the road and adjacent vegetation would continue to adversely affect the visual quality of the area, including the nearby forest and meadows. Elsewhere in the corridor, the scenery and visual quality would remain largely natural and unaffected by human influence, except for the presence of trails, road, trail signage, restrooms and other facilities, and the LSR Preserve Center and associated parking area. Map 20 demonstrates the areas within the corridor from which portions of the Moose-Wilson Road can be seen. This viewshed analysis was created using high resolution images of the corridor and observation points placed every 1,000 feet, or approximately every 30 seconds when traveling 25 miles per hour along the road. One exception to this is airplanes that can be seen flying above the corridor. The Jackson Hole Airport is roughly 2.0 miles east of the corridor's Granite Canyon Entrance and the runway is oriented north-south. This means that aircraft are likely to be seen from the Sawmill Ponds area of the corridor and from other more elevated portions of trails and overlooks. Aircraft intermittently visible in the distance result in temporary, although long-term adverse impacts, on the scenic and visual resources in the Moose-Wilson corridor.



21. VIEWSHED ANALYSIS OF MOOSE-WILSON ROAD IN ALTERNATIVE A

Cumulative Impacts. A variety of actions have altered, and would continue to alter, visual resources within and outside the project area. Past development of park facilities has altered visual resources in the area. Within the project area soil and vegetation damage would continue to occur and vehicles would continue to be visible as vehicles stop in unauthorized locations. Aircraft approaching or departing the Jackson Hole Airport would continue to be visible in the distance from some trails and overlooks within the corridor.

Outside the project area other NPS and non-NPS actions have, are, and would continue to alter visual resources, as outlined in the cumulative impact scenario (e.g., construction of planned residential and commercial developments on the west side of the Snake River near Teton Village, and operation of the Jackson Hole Airport). Of these actions, the continued operation of the Jackson Hole Airport would continue to have a long-term cumulative effect on visual resources.

Conclusion. Under alternative A, the corridor would continue to provide outstanding scenery and visual quality, both along Moose-Wilson Road and elsewhere. There would be some slight adverse impacts on the scenery and visual resources of the Moose-Wilson corridor under alternative A. Adverse effects on the visual quality of the area would continue to occur in certain places, especially along Moose-Wilson and Death Canyon Roads due to the degraded condition of the roadside, haphazard and unorganized parking on eroded user-created turnouts, and congestion. Additionally, aircraft from Jackson Hole Airport would continue to cause long-term adverse impacts on the visual resources in the corridor.

When the effects of alternative A on scenery and visual resources are added to other past, present, and reasonably foreseeable effects, a slight, long-term, cumulative adverse effect would continue to occur. Alternative A would have a slight contribution to the overall cumulative effect.

ALTERNATIVE B

Along Moose-Wilson Road

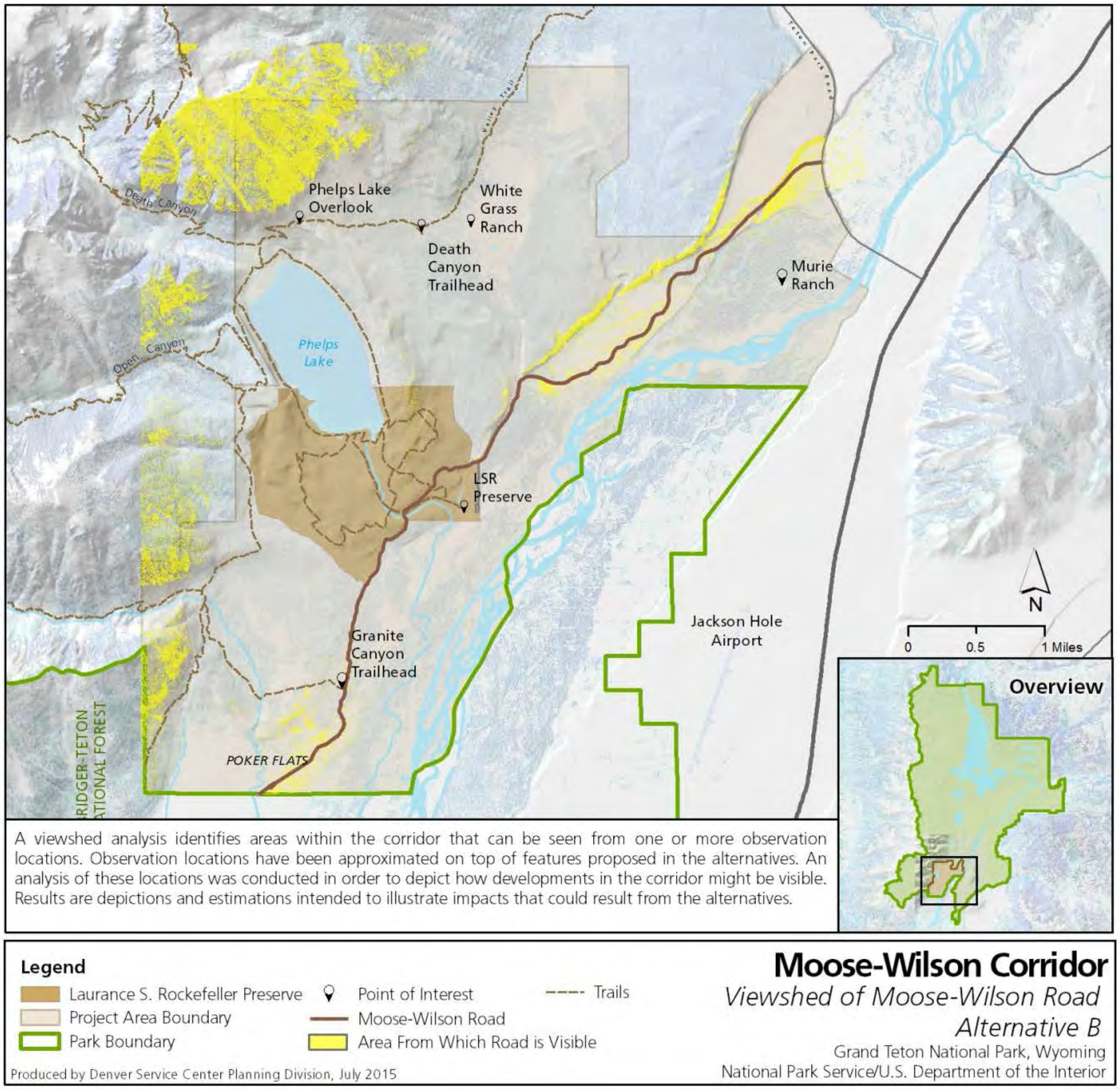
Alternative B emphasizes the corridor as a visitor destination by placing focus on the destinations within the corridor. Management actions under this alternative aim to reduce crowding and congestion in the corridor. Overall the quality of visual resources would be moderately improved under alternative B as traffic levels and therefore crowding along the roadway would be reduced and new opportunities to view scenic vistas are provided under this alternative. To accomplish this, a gate would be placed on Moose-Wilson Road near the LSR Preserve. During periods of peak visitation, the gate would be closed and vehicles would exit the corridor the same way they entered it. Lower traffic and therefore visitation levels would result when the gate is closed by removing traffic driving through the corridor. For this reason, visual resources along the roadway would be improved as congestion would be reduced. This reduction would result in fewer vehicles being visible on the roadway and visible soil and vegetation disturbance from vehicles attempting to pass one another or stopping in unauthorized areas. Slight adverse impacts would also result as a gate at the LSR Preserve would alter the visual resources of the road at that location. The two roundabouts at the gate would slightly open the canopy in an otherwise densely forested area and add pavement materials where vegetation would otherwise be. This development would also interrupt the continuity of Moose-Wilson Road, therefore changing the visual look of the road at this specific location. These impacts would be slight when considering the visual resources along the road as a whole.

Under alternative B, two road realignments would alter the visual resources in the corridor resulting in slightly adverse and somewhat substantial beneficial impacts. Realignment of the northernmost section of Moose-Wilson Road to the Chapel of the Transfiguration Road junction would also change the perspective from which the Tetons and other scenery are viewed by visitors traveling that segment of Moose-Wilson Road. Realignment of the road between Sawmill Ponds Overlook and the Death Canyon junction would significantly alter the perspective from which visitors observe the scenery within and beyond the corridor. The current road alignment provides close-up foreground views of the wetlands, beaver ponds, and adjacent hillsides, and often provides close-up views of wildlife. Sagebrush meadows, Blacktail Butte, and partial views of the Teton Range are in the background. During the fall, foliage colors are spectacular and the perspective is one of being surrounded by the foreground scenery. The new alignment of the road would provide a different perspective, with spectacular views of the Teton Range extending from Teewinnot to Rendezvous Peak and beyond. The foreground would be encompass sagebrush meadows, mixed aspen and conifer stands, with the beaver ponds, wetlands, and hillsides just beyond. Blacktail Butte would continue to be visible to the east. Since the existing road would be removed and the area restored to natural condition, the views from the new road would be of high scenic value. This change in perspective and vantage point could be considered adverse by some and beneficial by others. However, dense riparian vegetation, extensive wetlands, and fruit-bearing trees and shrubs that are visible from the current road alignment and often result in wildlife viewing opportunities would not be visible from the realigned road. See the “Visitor Use and Experience” section of this chapter for a discussion on wildlife viewing and visitor experience as part of this alternative. Designated turnouts along the roadway would improve opportunities for visitors to experience visual resources as vehicles would be able to fully leave the road. In the long-term, and especially for first-time visitors, the change in perspective would likely become of little or no importance.

Beyond Moose-Wilson Road

Under alternative B, the realignment of two road segments would alter the visual resources of the Moose-Wilson corridor as seen from trails and overlooks beyond the roadway. The realigned road segments would be visible from the immediate area but not from trails or overlooks in the area that are regularly used by visitors; therefore, it would have minimal adverse impacts on visual resources. Map 22. demonstrates the areas within the corridor from which portions of Moose-Wilson Road, as aligned in this alternative, can be seen. This viewshed analysis was created using high resolution images of the corridor and observation points placed every 1,000 feet, or approximately every 30 seconds when traveling 25 miles per hour along the road. The newly visible road segment would be an intrusion to the currently continuous scenic vistas of the Snake River riparian area.

Visual resources at two key destinations beyond the roadway would be affected under alternative B—Death Canyon Trailhead would be relocated and improved to a 60 vehicle parking area a short distance from its current location (0.4 mile to the southeast). Along Death Canyon Road, turnouts for passing and an improved gravel surface would enhance the visual resources of this area because vehicles would no longer be parked along the road. As visitors travel Death Canyon Road to the trailhead, visitors would be able to view White Grass Dude Ranch Historic District. A relocated parking area and restroom would alter the visual resources near the trailhead by increasing the area of development visible and decreasing the amount of visible forested area. The new parking area would be an improvement to the current visual aesthetics of vehicles being parked near the trailhead in a haphazard manner. Views from the White Grass Dude Ranch Historic District would be slightly adversely impacted as the new parking area and vehicles travel to and from it would be seen. This impact would be smaller if the parking lot is located farther to the west. Map 22 depicts areas within the White Grass Ranch area from which portions of the parking area would be located. This viewshed analysis was created using high resolution images of the corridor and observation points placed in the potential parking area.



22. Viewshed Analysis of Moose-Wilson Road in Alternative B

Under alternative B, parking at the LSR Preserve would be modified into two separate 25-vehicle parking areas rather than the current 50-vehicle parking area. One of the smaller parking areas would be in the footprint of the current parking area. The other would be built slightly to the east. A viewshed analysis demonstrates that the eastern parking lot is not likely to be visible from the LSR Preserve Center or overlooks. Map 23 demonstrates the areas within the LSR Preserve from which portions of the eastern parking area would be visible. This viewshed analysis was created using high resolution images of the corridor and observation points placed in the potential parking area.

The unpaved section of Moose-Wilson Road would be paved under alternative B, therefore slightly altering the visual aesthetics of that portion of road in terms of road color and condition. For some visitors, this change would be beneficial as the section would be consistent with the rest of the road and less erosion of soil and loss of vegetation would be visible along the road edges. For others, it would lessen the rustic character of this section of the road.

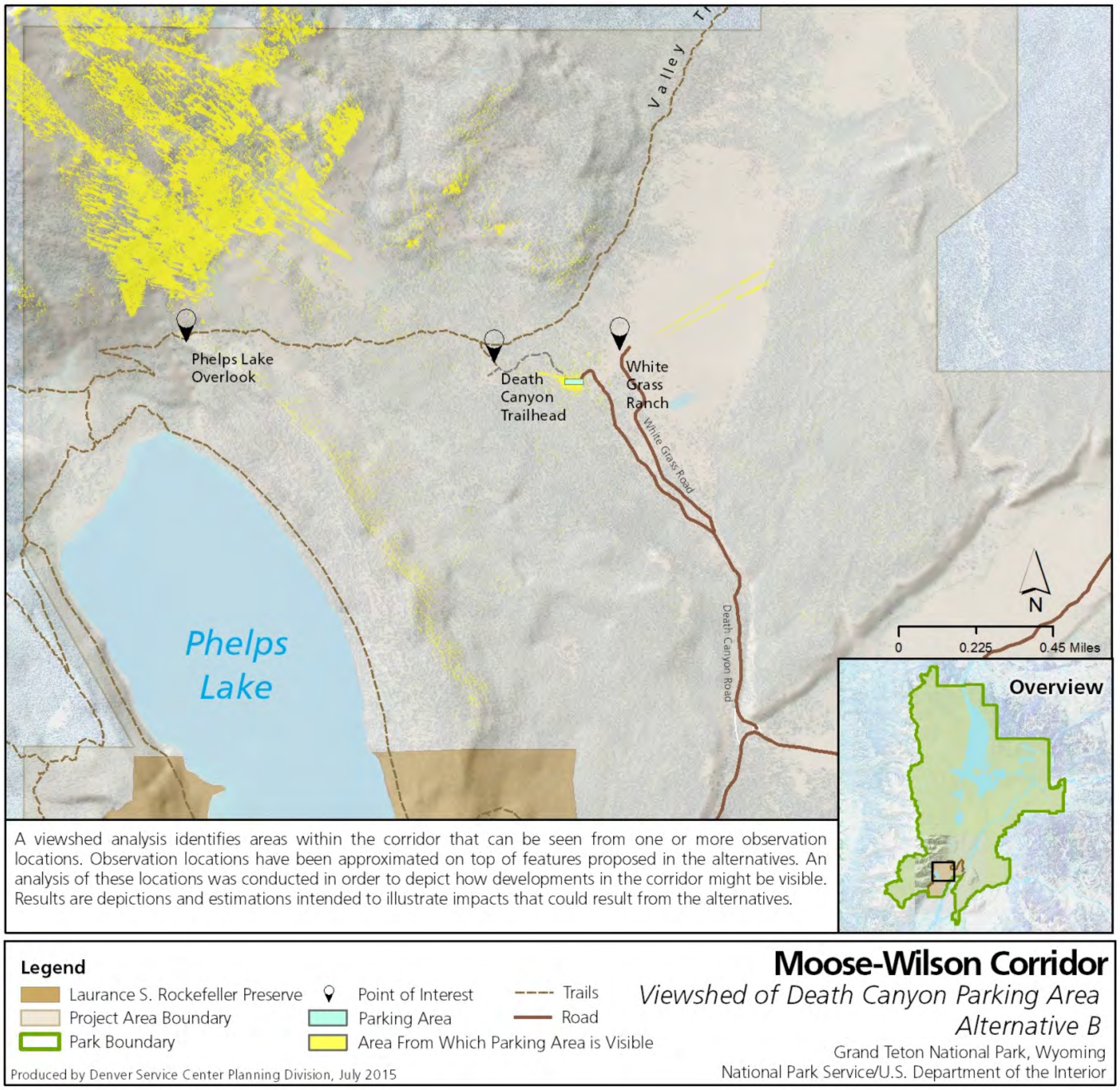
Cumulative Impacts. A variety of actions has altered, and would continue to alter, visual resources within and outside the project area. Past development of park facilities has altered visual resources in the area. Within the project area new opportunities to experience scenic vistas would be added for visitors traveling along Moose-Wilson Road and visible vegetation damage and unauthorized parked vehicles would be substantially reduced. Beyond Moose-Wilson Road, visual resources along Death-Canyon Road would be improved; however, road realignments would be visible from trails along the lower foothills that overlook sagebrush flats between Sawmill Ponds Overlook and the Death Canyon Road junction. These trails are used occasionally by horseback riders and would therefore have slight adverse impacts on the visual resources of this portion of the corridor. overlooks and trails within the corridor. Aircraft approaching or departing the Jackson Hole Airport would continue to be visible in the distance from some trails and overlooks within the corridor.

Outside the project area, other NPS and non-NPS actions have, are, and would continue, to alter visual resources, as outlined in the cumulative impact scenario (e.g., , construction of planned residential and commercial developments on the west side of the Snake River near Teton Village, and operation of the Jackson Hole Airport). Of these actions, the continued operation of the Jackson Hole Airport would continue to have a long-term cumulative effect on visual resources.).

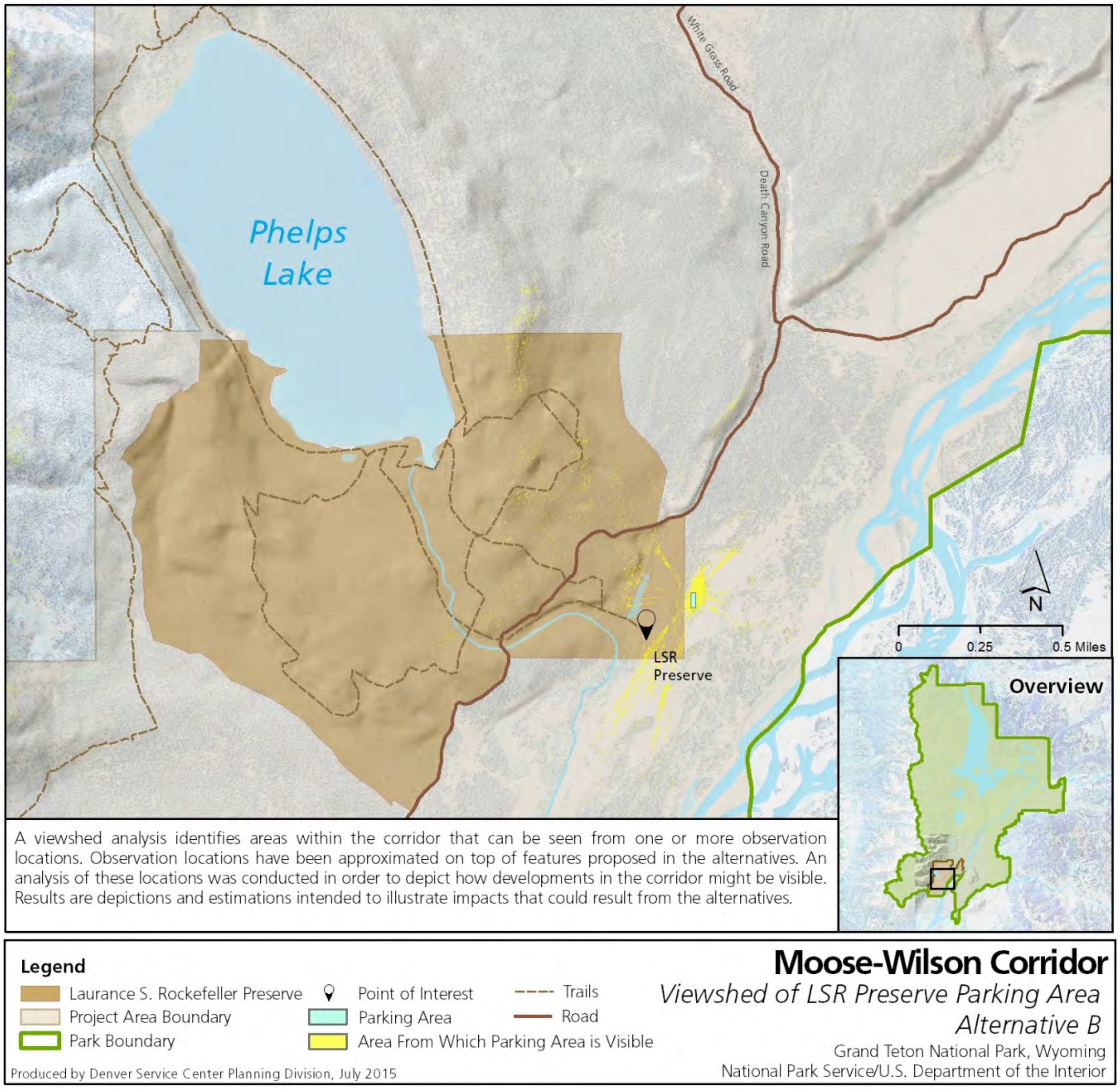
The impacts associated with implementation of alternative B would have long-term or permanent, minimal adverse impacts. Consequently, the adverse impacts of other actions described above, in combination with the impacts of alternative B, would cumulatively result in long-term or permanent moderately adverse impacts on visual resources. The impacts associated with alternative B represent a slight component of the adverse cumulative impact.

Conclusion. Alternative B would result in modest beneficial and slight adverse impacts on the visual resources of the Moose-Wilson corridor, but overall, the actions proposed in this alternative would not result in significant adverse impacts. Beneficial impacts would result from reduced congestion along the roadway due to the placement of a gate near the LSR Preserve during peak use times and the addition of turnouts along the roadway resulting in less damaged vegetation and visible congestion of vehicles. Realignment of two sections of the road would overall provide new opportunities for visitors to experience scenic vistas not currently accessed from the roadway; however, this would result in the loss of intimate views as experienced in the current alignments. Consolidating parking at the new Death Canyon Trailhead would improve visual resources along Death Canyon Road and at the trailhead itself. While views of the White Grass Dude Ranch Historic District from the improved Death Canyon Road would result in slight beneficial impacts, scenic views from the historic district would be slightly adversely impacted by the new parking area. Slight and localized adverse impacts would result from the construction of two separate parking areas at the LSR Preserve and developments surrounding the gate. Additionally, aircraft from Jackson Hole Airport would continue to cause long-term adverse impacts on the visual resources in the corridor.

When the effects of alternative B on scenery and visual resources are added to other past, present and reasonably foreseeable effects, a slight long-term, cumulative adverse effect would occur. Alternative B would have a slight contribution to the overall cumulative effect.



23. Viewshed Analysis of Death Canyon Trailhead in Alternative B



24. VIEWSHED ANALYSIS OF LSR PRESERVE PARKING AREA IN ALTERNATIVE B

ALTERNATIVE C (NPS PREFERRED)

Along Moose-Wilson Road

A timed entry, or sequencing system, would be implemented during peak use times under this alternative to directly manage the volume and timing of visitors entering the corridor. Lower traffic and therefore visitation levels would result when the timed entry system is in place. For this reason, visual resources along the roadway would be improved as congestion would be reduced. This reduction would result in fewer vehicles being visible on the roadway and visible soil and vegetation disturbance from vehicles attempting to pass one another or stopping in unauthorized areas would be reduced.

As part of alternative C, realignment of the northernmost section of Moose-Wilson Road to the Chapel of the Transfiguration Road would change the vantage point of how the Tetons are viewed from the road as visitors enter or exit from the Moose entrance station. This altered view would offer less direct views of the Tetons when heading southbound on Moose-Wilson Road and more direct views when traveling northward. To accomplish timed sequencing, a new queuing station, turnaround area, and queueing lanes would be developed on the realigned road segment. Striking views of the Tetons behind open sagebrush flats would be somewhat intruded upon by these developments as additional structures may be placed on the road when timed entry is occurring and additional pavement would be visible. As visitors travel westward, views of the Snake River bench would be somewhat interrupted by these developments. Similar developments would occur on the southern end of Moose-Wilson Road at the Granite Canyon Entrance.

The road section between Sawmill Ponds and Death Canyon Junction would not be realigned under alternative C. For this reason, additional impacts on visual resources in this area would not occur. Additional turnouts along the roadway under alternative C would improve visual resources as vehicles would be able to fully leave the roadway. Turnouts would also decrease visible damage to soil and vegetation along the roadside currently caused by vehicles leaving the road in unauthorized areas.

Under alternative C, other small developments would alter visual resources. A vault toilet would be installed at Granite Canyon Trailhead, therefore adding intrusion nonnatural and nonhistoric structure in surrounding scenery. The intrusion would be highly localized but could interrupt scenic views of the Tetons depending on where a visitor is standing at the trailhead. The unpaved section of Moose-Wilson Road would be paved under alternative C, therefore slightly altering the visual aesthetics of that portion of road in terms of road color and condition. For some visitors, this change would be beneficial as the section would be consistent with the rest of the road and less erosion of vegetation would be visible along road edges. For others, it would lessen the rustic character of this section of the road.

Beyond Moose-Wilson Road

Under alternative C, the northernmost section of Moose-Wilson Road to the Chapel of Transfiguration Road would be realigned. This realigned segment of road would be visible from the immediate area but not from trails or overlooks in the area; therefore, it would have minimal adverse impacts on visual resources. The timed entry queueing lanes that would be developed as part of this alternative would also be visible. Map 24 demonstrates areas within the corridor from which portions of the Moose-Wilson Road, as aligned in this alternative, can be seen. This viewshed analysis was created using high resolution images of the corridor and observation points placed every 1,000 feet, or approximately every 30 seconds when traveling 25 miles per hour, along the road. The inclusion of these nonnatural and nonhistoric developments would result in a significant change and therefore adverse impact to the visual resources of the corridor.

Visual resources at Death Canyon Trailhead would be affected under alternative C. Under alternative C, the Death Canyon Trailhead would be relocated and improved to an 80 to 90 vehicle parking area where White Grass Road and Death Canyon Road currently split (approximately 1 mile to the south). The existing 1 mile unpaved portion of Death Canyon Road would be converted to a trail. By relocating the trailhead and creating a trail, visual obstructions of vehicles would be removed from this portion of Death Canyon Road. The additional 1 mile of trail would provide views of forested areas to the west and views of the White Grass Dude Ranch Historic District to the east. This action would result in improved scenic vistas, both from this section of trail and from the White Grass Dude Ranch Historic District as vehicles parked along Death Canyon Road would no longer be visible. Slight adverse impacts on visual resources would occur at the site of the new parking area as designated parking areas are defined so that it is clear to visitors where to park. However, using specific Moose-Wilson corridor design standards for parking areas would likely have a slight improvement over the current haphazard nature of parking along Death Canyon Road and near the trailhead.

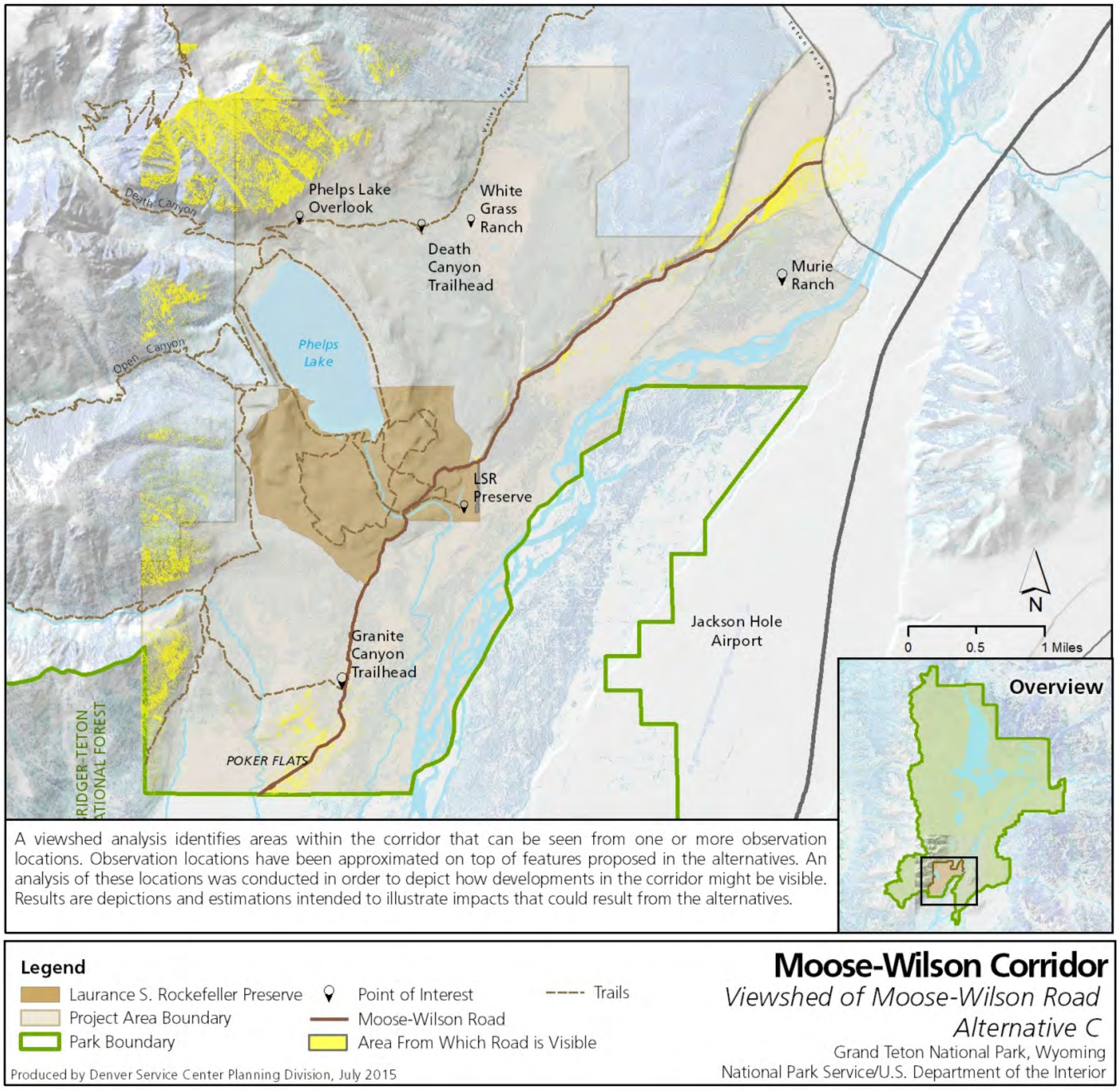
Cumulative Impacts. A variety of actions has altered, and would continue to alter, visual resources within and outside the project area. Past development of park facilities has altered visual resources in the area. Within the project area, visible vegetation damage and unauthorized parked vehicles would be substantially reduced, therefore improving visual resources. Beyond Moose-Wilson Road, visual resources along Death-Canyon Road would be improved. Aircraft approaching or departing the Jackson Hole Airport would continue to be visible in the distance from some trails and overlooks within the corridor.

Outside the project area, other NPS and non-NPS actions have, are, and would continue, to alter visual resources as outlined in the cumulative impact scenario (e.g., development of multiuse pathways outside the project area, construction of planned residential and commercial developments, such as the Teton Village expansion on the west side of the Snake River near Teton Village and operation of the Jackson Hole Airport).

The impacts associated with implementation of alternative C would have long-term or permanent, slight adverse impacts. Consequently, the adverse impacts of other actions described above, in combination with the impacts of alternative C, would cumulatively result in long-term or permanent minimal adverse impacts on visual resources. The impacts associated with alternative B represent a slight component of the adverse cumulative impact.

Conclusion. Alternative C would result in substantial beneficial and slight adverse impacts on the visual resources of the Moose-Wilson corridor, but overall, the actions proposed in this alternative would not result in significant adverse impacts. Beneficial impacts would result from reduced congestion along the roadway due to timed entry of vehicles. Compared to alternatives A and B, the congestion would be reduced within this alternative as use levels are directly managed. The queuing lanes would result in slight adverse impacts from Moose-Wilson Road as visitors travel along this road segment; however, those impacts would be localized to that portion of the road. Consolidation and relocation of parking at the new Death Canyon Trailhead would improve visual resources from White Grass Dude Ranch Historic District and would bring additional visual resources along the new 1.0-mile stretch of trail. These changes result in moderate beneficial impacts on visual resources along Death Canyon Road as an active roadway is removed from the White Grass Dude Ranch Historic District and new scenic views are added with a new trail segment. Slight and localized adverse impacts would result from the development of the new Death Canyon Trailhead. Additionally, aircraft from Jackson Hole Airport would continue to cause long-term adverse impacts on the visual resources in the corridor.

When the effects of alternative C on scenery and visual resources are added to other past, present, and reasonably foreseeable effects, a slight long-term, cumulative adverse effect would occur. Alternative C would have a slight contribution to the overall cumulative effect.



25. VIEWSHED ANALYSIS OF MOOSE-WILSON ROAD IN ALTERNATIVE C

ALTERNATIVE D

Along Moose-Wilson Road

Under this alternative, the scenery observed by park visitors along Moose-Wilson Road would experience significant adverse effects, as well as some beneficial effects. Realignment of the road between Sawmill Ponds Overlook and the Death Canyon junction would significantly alter the perspective from which visitors observe the scenery within and beyond the corridor. The current road alignment provides close-up foreground views of the wetlands, beaver ponds, and adjacent hillsides, and often provides close-up views of wildlife. Sagebrush meadows, Blacktail Butte, and partial views of the Teton Range are in the background. During the fall, colors are spectacular and the perspective is one of being surrounded by the foreground scenery. The new alignment of the road would provide a different perspective, with spectacular views of the Teton Range extending from Teewinnot to Rendezvous Peak and beyond. The foreground would be comprised of sagebrush meadows, mixed aspen and conifer stands, with the beaver ponds, wetlands, and hillsides just beyond. Blacktail Butte would continue to be visible to the east. Since the existing road would be removed and the area restored to natural condition, the views from the new road would be of high scenic value. This change in perspective and vantage point could be considered adverse by some, and beneficial by others. In the long-term, and especially for first-time visitors, the change in perspective would likely become of little or no importance.

Realignment of the northernmost section of Moose-Wilson Road to the Chapel of the Transfiguration Road junction would also change the perspective from which the Tetons and other scenery are viewed by visitors travelling that segment of Moose-Wilson Road. In addition, a new entrance/contact station, turnaround area, and queuing lanes would be constructed, adding a nonnatural element into the landscape, which could be considered an adverse effect but would not likely have an effect on the overall scenic quality of the corridor.

The reservation system in this alternative would limit the growth in traffic volume and thereby reduce congestion and the adverse effects on scenic quality associated with it. In light of projected growth in traffic volumes if no action is taken, and the likelihood of even greater congestion, this is particularly important. In addition, by relocating the road away from the areas most prone to congestion, those adverse effects would be further reduced. Development and maintenance of an appropriate number of established parking areas and vehicle turnouts would result in beneficial effects by reducing the roadside soil and vegetation degradation associated with user-created turnouts.

Development of a multiuse pathway, particularly along those portions of the road that would remain in their current alignment, would have the potential for significant adverse effects on the character and visual quality of the area. If the pathway were constructed immediately adjacent or very close to the road, the change in visual character would be significant and irreversible, especially in areas of dense forest. In those areas, the removal of large numbers of trees to accommodate a pathway would result in essentially a doubling of the overall corridor road width and widening of the forest canopy. This change would be obvious to most visitors and would fundamentally alter the visual character of the road corridor. Along the southern portion of the road, where dense forest gives way to mixed stands of aspen and sagebrush meadow, placement of a pathway in the foreground area would adversely affect the visual quality of the area by introducing a new nonnatural element into what has heretofore been an almost entirely natural scene. While the adverse effect would be less pronounced than in the heavily forested areas, and could be somewhat mitigated through careful design and placement, it would nonetheless result in a significant adverse effect on the natural visual character of the area.

Development of a pathway would provide a new and different visual perspective on the corridor for those visitors using it. In addition to providing a different perspective, bicyclists and pedestrians would be able to focus more of their attention on the scenery as a result of being separated from motor vehicle traffic. These factors would result in a substantial beneficial effect on visitors' enjoyment of the scenery.

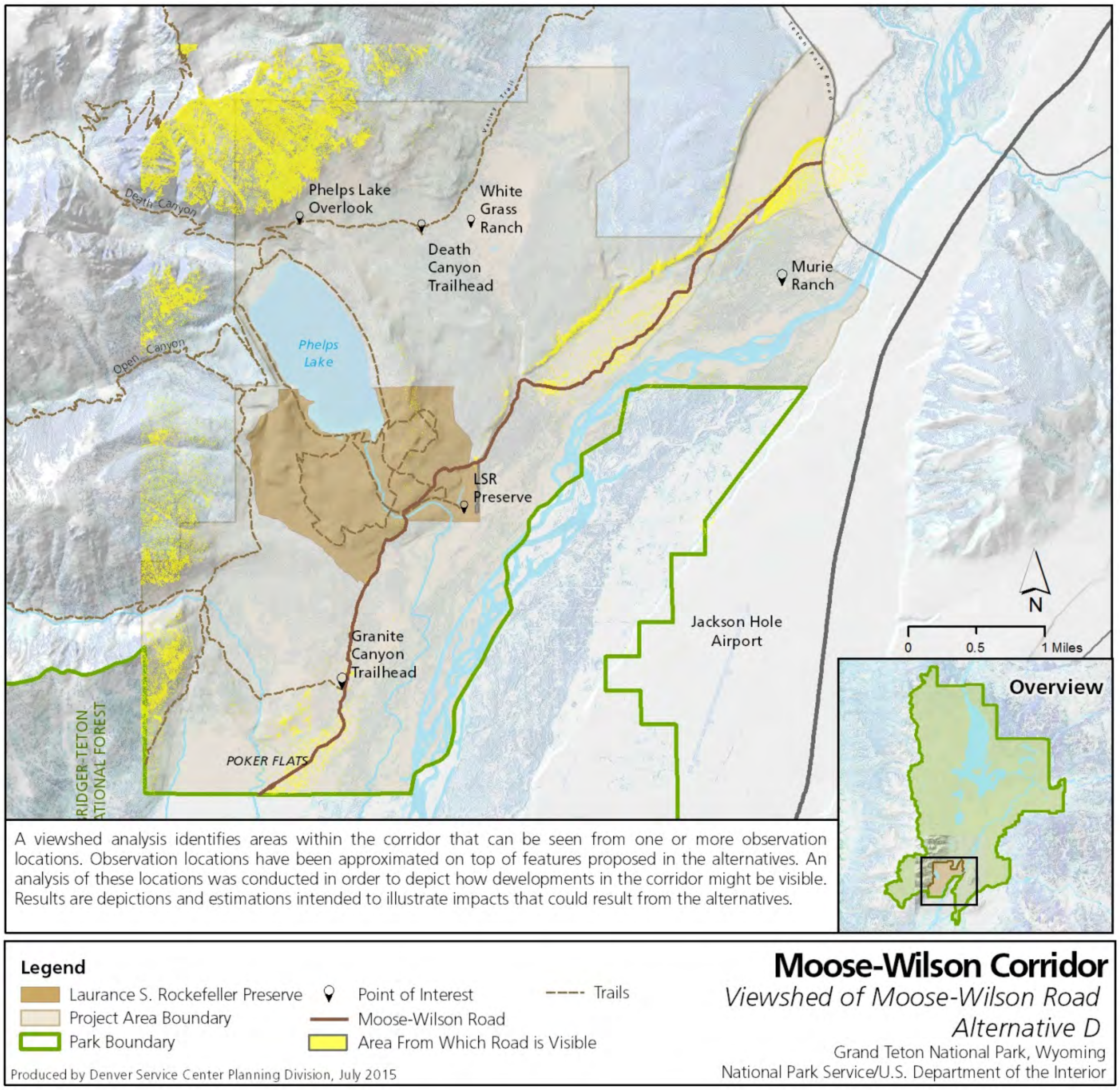
Beyond Moose-Wilson Road

Under alternative D, the realignment of two road segments and the addition of a multiuse pathway would significantly alter the visual resources of the Moose-Wilson corridor as seen from trails and overlooks beyond the roadway. The realigned road segments would be visible from the immediate area but not from trails or overlooks in the area that are regularly used by visitors; therefore, it would have minimal adverse impacts on the visual resources. Map 25 demonstrates the areas within the corridor from which portions of Moose-Wilson Road, as aligned in this alternative, can be seen. Map 26 demonstrates the areas within the corridor from which portion so the multiuse pathway can be seen. This viewshed analysis was created using high resolution images of the corridor and observation points placed every 1,000 feet, or approximately every 30 seconds when traveling 25 miles per hour along the road. The newly visible road segment would be an intrusion to the currently continuous scenic vistas of the Snake River riparian area.

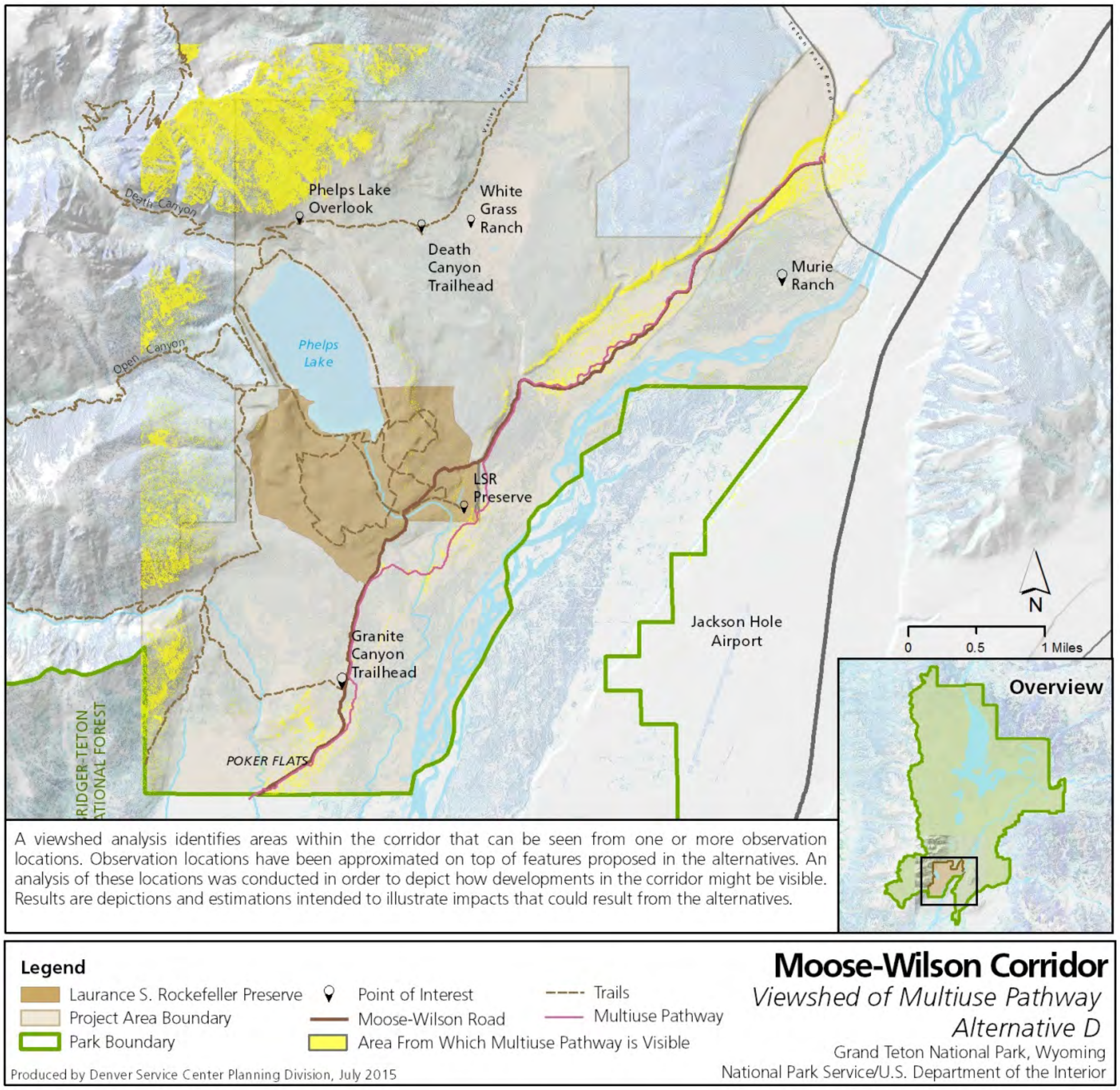
Under this alternative, the Death Canyon Trailhead parking area would be expanded and reconfigured in its current location to accommodate approximately 100 vehicles. Access to the trailhead would be realigned as described in chapter 2, using the existing White Grass Road and the last 0.4-mile of Death Canyon Road. The 0.6-mile segment of Death Canyon Road below White Grass Road would be reclaimed and restored with native vegetation. Expansion of the trailhead parking area would adversely affect the scenic quality in that area, although consolidation of the parking would eliminate the existing adverse effects of dispersed and disorganized parking along Death Canyon Road. Map 27 depicts areas within the White Grass Ranch area from which portions of the reconfigured parking area may be visible. This viewshed analysis was created using high resolution images of the corridor and observation points placed in the potential parking area. Use of White Grass Road for access to the trailhead by visitors would substantially increase the amount and frequency of vehicle use visible from within the historic district, thereby adding visual elements not in keeping with the historic nature of the district. For visitors along the roadway the opportunity to view White Grass Ranch would result in moderate beneficial impacts as a new vantage point would now be possible.

Cumulative Impacts. A variety of actions have altered, and would continue to alter, visual resources within and outside the project area. Past development of park facilities has altered visual resources in the area. Within the project area, visible vegetation damage and unauthorized parked vehicles would be substantially reduced, thus improving visual resources. Beyond Moose-Wilson Road, visual resources along Death Canyon Road would be improved; however, road realignments and the construction of a multiuse pathway would be visible from overlooks and trails within the corridor. Planes approaching or departing the Jackson Hole Airport would continue to be visible in the distance from some trails and overlooks within the corridor.

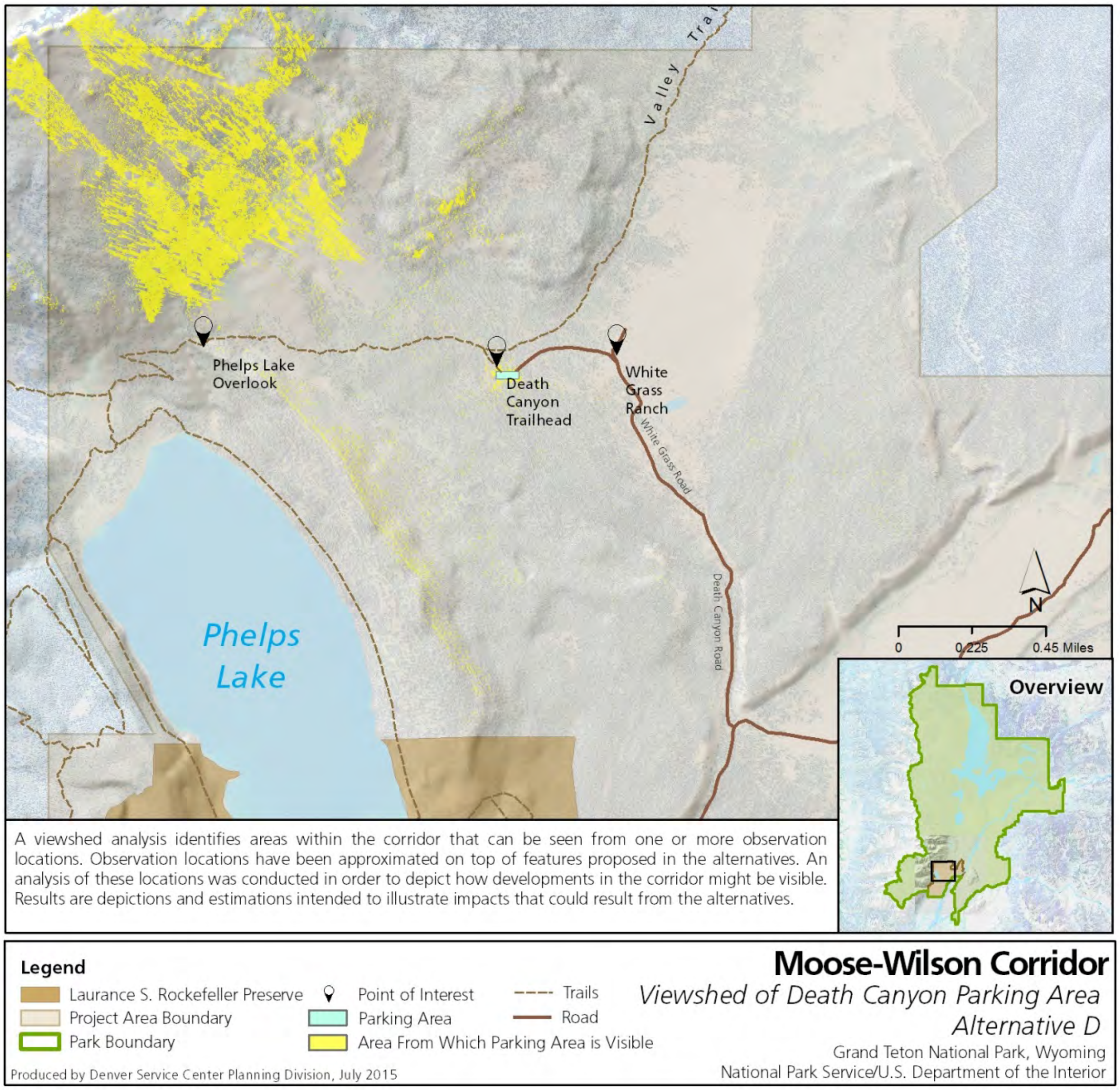
Outside the project area other NPS and non-NPS actions have, are, and would continue, to alter visual resources, as outlined in the cumulative impact scenario (e.g., development of multiuse pathways outside the project area, construction of planned residential and commercial developments, such as the Teton Village expansion on the west side of the Snake River near Teton Village, and operation of Jackson Hole Airport). Of these actions, the continued operation of Jackson Hole Airport would continue to have a long-term cumulative effect on visual resources.



26. VIEWSHED ANALYSIS OF MOOSE-WILSON ROAD IN ALTERNATIVE D



27. VIEWSHED ANALYSIS OF MULTIUSE PATHWAY IN ALTERNATIVE D



28. VIEWSHED ANALYSIS OF DEATH CANYON TRAILHEAD IN ALTERNATIVE D

The impacts associated with implementation of alternative D would have long-term or permanent, substantial adverse impacts. Consequently, the adverse impacts of other actions described above, in combination with the impacts of alternative D, would cumulatively result in long-term or permanent minimal adverse impacts on visual resources. The impacts associated with alternative D represent a substantial contribution to the adverse cumulative impact.

Conclusion. Overall, alternative D would result in significant adverse impacts on the visual character and quality of the Moose-Wilson corridor. Development of a multiuse pathway, especially along portions of Moose-Wilson Road that remains in the current alignment, would significantly alter the historic and rustic character of the area.

Realignment of the road between Sawmill Ponds Overlook and the Death Canyon Road junction would change the perspective from which visitors view the scenery of the corridor, which could be considered both beneficial and adverse. Actions regarding Death Canyon Road and trailhead parking would have both beneficial and adverse impacts. Additionally, aircraft from Jackson Hole Airport would continue to cause long-term adverse impacts on the visual resources in the corridor.

When the effects of alternative D on scenery and visual resources are added to other past, present, and reasonably foreseeable effects, a significant long-term, cumulative adverse effect would occur. Alternative C would have a significant contribution to the overall cumulative effect.

ACOUSTIC RESOURCES AND SOUNDSCAPES

METHODS AND ASSUMPTIONS FOR ANALYZING IMPACTS

Acoustic resources are physical sound sources, including both natural sounds (wind, water, wildlife, vegetation) and cultural and historic sounds (dude ranch activities, tribal ceremonies). The acoustic environment is the combination of all the acoustic resources within a given area—natural sounds as well as human-caused sounds. The acoustic environment includes sound vibrations made by geological processes, biological activity, and even sounds that may be inaudible to humans such as bat echolocation calls. Soundscape is the component of the acoustical environment that is audible by humans. The natural soundscape exists without human-caused sounds. The nonnatural soundscape includes human-caused sounds. The character and quality of the soundscape influences human perceptions of an area, providing a sense of place that differentiates it from other regions. Noise refers to sound that is unwanted or extraneous because of its effects on humans and wildlife. Cultural soundscapes include cultural and historic sounds that are fundamental components of the purposes and values for which the parks were established.

The planning alternatives that may cause changes to the soundscapes or the acoustical environment have been compared to current acoustical conditions along the Moose-Wilson corridor (see the “Affected Environment” chapter for data on current conditions). Where data exists, current sound levels were collected using park acoustical equipment, which is capable of measuring type 1 ANSI sound pressure levels (dBA). The percent time audibility was also calculated using recordings from acoustical monitoring equipment.

This section addresses potential impacts on the acoustic resources and soundscapes. The impact analyses considered a variety of factors that could affect the acoustic resources or soundscapes and assumes that changes in development and use of the Moose-Wilson corridor could lead to changes in the soundscapes. There is also an assumption that changes in the types and levels of noise due to alternatives could impact wildlife presence or behavior in the corridor. In general, the effects of the alternatives on the acoustic resources and soundscapes in the project area were analyzed based on impacts resulting from visitor use levels, traffic patterns, and developments associated with each alternative. To accomplish this, the following two impact analysis questions were considered to identify the potential impacts of each alternative:

1. What are the environmental consequences and impacts on the natural and cultural acoustic resources and human-caused sounds associated with the plan alternatives?

2. What are the environmental consequences and impacts on the acoustic resources and soundscapes associated with the plan alternatives?

ALTERNATIVE A (NO ACTION)

Because no new management strategies are being proposed under alternative A, there would be few if any impacts on the current condition of soundscapes or the acoustic resources. However, possible increases in traffic volume and lack of management tools to regulate increases in traffic could lead to increased vehicle noise and therefore would allow adverse changes in the percentage of time that vehicles are audible, thereby affecting the condition of the soundscapes or acoustic resources over time. The lack of management to regulate possible increases in use at the Death Canyon area could lead to adverse changes in the condition of the soundscapes or acoustic resources near the potential wilderness area. Under alternative A, there would also continue to be noise impacts several times per year when the unpaved section of Moose-Wilson Road is being graded and treated for dust abatement. There would continue to be noise from snow plowing in the winter and louder traffic sounds compared to the action alternatives because of the higher speed limit in the no-action alternative.

Cumulative Impacts. The Jackson Hole Airport operates under an agreement administered by the National Park Service and is authorized to continue operating until April 27, 2053. Noise from aircraft are the most widespread nonnatural sound source in Grand Teton National Park, and aircraft arriving and departing the Jackson Hole Airport are louder and more audible for greater periods of time in the southern portions of the park and the Moose-Wilson corridor. Aircraft sounds are most audible during the winter months. For example, data collected at White Grass Ranch in the winter of 2003, 2004, and 2005 indicated that aircraft sounds were audible nearly 30% of the time (7:00 a.m. to 7:00 p.m.) at White Grass Ranch (Burson 2008). Therefore, operation of the Jackson Hole Airport would continue to generate long-term adverse noise impacts on the acoustic resources along the Moose-Wilson corridor. During the summer months, road vehicles are audible around 75% of the time along Moose-Wilson Road, a greater percentage of time than aircraft. During the winter, aircraft are more audible, especially in areas of Moose-Wilson Road that are closed to vehicles for the season. This is because the ambient sound level is lower in the winter and more distant aircraft can be heard. It should also be noted that avalanche control at Jackson Hole Resort is clearly audible during and after snowstorms, and rotary plow operations affect the soundscape on many days in the winter and spring. Additionally, future increases in winter recreational visitors would add to human-caused noise in the Moose-Wilson corridor. Overall, when the effects of alternative A are added to the effects of long-term airport noise and road vehicle noise, there would be long-term adverse noise impacts on the soundscapes and the acoustic resources. However, alternative A would contribute a slight increment to the negative effects of airport noise and vehicle noise that is audible within the corridor.

Conclusion. Overall, there may be a small number of slight noise impacts on the soundscape and acoustical environment as a result of traffic noise and dust abatement that would continue to occur under alternative A, the no-action alternative. There would not be significant adverse impacts caused by actions under alternative A.

Additionally, aircraft noise from Jackson Hole Airport and audible vehicle noise would continue to cause long-term adverse impacts on soundscapes and the acoustical environment along the Moose-Wilson corridor. Overall, alternative A would contribute a slight increment to the existing noise impacts in the corridor.

ALTERNATIVE B

Under alternative B, there would be small beneficial impacts on the soundscapes and acoustical environment due to the reduction in speed limits. This change would reduce sound levels of road vehicles, thereby improving the condition of the soundscapes for visitors and improving the condition of the acoustic resources. Restricting through-traffic in either direction beyond the LSR Preserve Center during certain peak periods may also reduce the percentage of time that vehicle noise is audible. There would also be a small beneficial impact due to the conversion approximately 0.4 mile of unpaved road near the Death Canyon Trailhead into a pedestrian only trail. This would lessen the audibility of vehicle and human-caused noise from the newly placed Death Canyon Trailhead, thereby slightly improving the condition of soundscapes and the acoustic resources near this section of trail. Improving the condition of the gravel road near Death Canyon would also decrease the audibility of vehicle noises in that area and would likely reduce average sound levels. Another small beneficial impact under alternative B includes ending winter maintenance of Moose-Wilson Road at the Murie Ranch Road junction. This action would reduce vehicle access to this area in the winter and therefore decrease the percentage of time that vehicle noise is audible. This would create a small beneficial impact and improve the condition of soundscapes for visitors and improve the condition of the acoustic resources.

Under alternative B, the unpaved section of Moose-Wilson Road would be paved, and this action would cause noticeable yet short-term adverse noise impacts that would only last for the duration of paving the road section. It should be noted that tire noise on the newly paved road surface would be quieter than on a gravel road surface, thereby reducing sound levels of vehicle noise in that area over the long term. In general, road surface noise increases in sequential order for the following substrates: packed dirt, blacktop, concrete, chip seal, then gravel. However, other factors such as speed also influence the sound levels created by tire/road noise. There would also be short-term noise impacts that would only last during the duration of road construction of the two realignments on the road segment between the Sawmill Ponds Overlook and Death Canyon Junction and the segment north of Sawmill Ponds to Teton Park Road. The new road segments would be constructed to maintain slow speeds, which would maintain sound levels of road vehicles, thereby preventing further impacts on the soundscapes or acoustical environment from higher speed traffic. Creating additional parking spaces along Moose-Wilson Road may increase the percentage of time that human-caused noise is audible in the places where increased use occurs. This may have a small adverse impact on soundscapes and the acoustic resources.

Cumulative Impacts. The Jackson Hole Airport operates under an agreement administered by the National Park Service and is authorized to continue operating until April 27, 2033. Noise from aircraft is the most widespread nonnatural sound source in Grand Teton National Park. Aircraft arriving and departing Jackson Hole Airport are louder and more audible for greater periods of time in the southern portions of the park and the Moose-Wilson corridor. Aircraft sounds are most audible during the winter months. For example, data collected at White Grass Ranch in the winter of 2004 and 2005 indicated that aircraft sounds were audible nearly 30% of the time (7:00 a.m. to 7:00 p.m.) at White Grass Ranch (Burson 2008). Therefore, operation of Jackson Hole Airport would continue to generate long-term adverse noise impacts on soundscapes and the acoustical environment along the Moose-Wilson corridor. During the summer months, vehicle noise is audible around 75% of the time along Moose-Wilson Road, a greater percentage of time than aircraft. During the winter, aircraft is more audible, especially in areas of Moose-Wilson Road that are closed to vehicles for the season. This is because the ambient sound level is lower in the winter and more distant aircraft can be heard. It should also be noted that avalanche control at Jackson Hole Resort is clearly audible during and after snowstorms, and rotary plow operations affect the soundscape on many days in the winter and spring. Additionally, future increases in winter recreational visitors would add to human-caused noise in the Moose-Wilson corridor. Overall, when the effects of alternative B are added to the effects of long-term airport noise and road vehicle noise, there would be long-term adverse noise impacts on the soundscapes and the acoustic resources. However, the impacts of alternative B would contribute a small increment to the overall negative effects of airport noise and vehicle noise that is audible within the corridor.

Conclusion. Overall, there would be small beneficial impacts on soundscapes and the acoustical environment due to lower speed limits, restriction of through-traffic at LSR Preserve during peak periods, the conversion of the approximately 0.4 mile of unpaved road near Death Canyon, and ending winter maintenance of Moose-Wilson Road near the Murie Ranch Road Junction. These actions are beneficial because they would reduce noise in the area. There would be short-term adverse noise impacts when the unpaved section of Moose-Wilson Road is being paved and during the realignment of the two road sections. The addition of parking on Moose-Wilson Road may also create slight localized adverse noise impacts along the corridor. There would not be significant adverse impacts caused by actions under alternative B. Overall, alternative B would contribute a small increment to the existing noise impacts in the corridor.

ALTERNATIVE C (NPS PREFERRED)

Under alternative C, there would be small beneficial impacts due to the reduction in speed limits. This change would reduce sound levels of road vehicles, thereby improving the condition of soundscapes for visitors and improving the condition of the acoustic resources for wildlife. There would also be small to appreciable beneficial impacts due to the conversion of 1.0 mile of unpaved road into a pedestrian-only trail near Death Canyon Trailhead. This action would likely reduce the average sound levels and lessen the audibility of vehicle noise from White Grass Junction toward Death Canyon and into the potential wilderness area, thereby improving the condition of soundscapes and the acoustic resources in this area.

Alternative C would also create short-term and noticeable adverse noise impacts that would only last for the duration of paving the unpaved section of the road. It should be noted that tire noise on the newly paved road surface would be quieter than tire noise created on a gravel road surface. In general, road surface noise increases in sequential order for the following substrates: packed dirt, blacktop, concrete, chip seal, then gravel. However, other factors such as speed also influence the sound levels created by tire/road noise. There would also be short-term noise impacts that would only last during realignment of the road segment north of Sawmill Ponds to Teton Park Road. This new road segment would be constructed to maintain the slow speeds that may reduce sound levels of road vehicles over the long term. Creating additional parking spaces along Moose-Wilson Road may increase the percentage of time that human-caused noise is audible where increased use occurs. This may have a small adverse impact on soundscapes and the acoustic resources. Bicycles would continue to share the road with vehicles under alternative C, and there would be few if any impacts on the current condition of soundscapes or the acoustic resources caused by this shared use. Finally, traffic management techniques such as providing travel alerts or time sequencing for congested situations are unlikely to change the character of soundscapes or the acoustic resources in a noticeable way because traffic levels would remain the same. This alternative would prevent future increases in traffic volumes, thereby avoiding future degradation of soundscapes or the acoustical environment that would be caused by increasing the percentage of time that vehicle noise is audible.

Cumulative Impacts. The Jackson Hole Airport operates under an agreement administered by the National Park Service and is authorized to continue operating until April 27, 2053. Noise from aircraft is the most widespread nonnatural sound source in Grand Teton National Park. Aircraft arriving and departing Jackson Hole Airport are louder and more audible for greater periods of time in the southern portions of the park and the Moose-Wilson corridor. Aircraft sounds are most audible during the winter months. For example, data collected at White Grass Ranch in the winter of 2004 and 2005 indicated that aircraft sounds were audible nearly 30% of the time (7:00 a.m. to 7:00 p.m.) at White Grass Ranch (Burson 2008). Therefore, operation of Jackson Hole Airport would continue to generate long-term adverse noise impacts on soundscapes and the acoustical environment along the Moose-Wilson corridor. During the summer months, road vehicles are audible around 75% of the time along Moose-Wilson Road, a greater percentage of time than aircraft. During the winter, aircraft are more audible, especially in areas of Moose-Wilson Road that are closed to vehicles for the season. This is because the ambient sound level is lower in the winter and more distant aircraft can be heard. It should also be noted that avalanche control at Jackson Hole Resort is clearly audible during and after snowstorms, and rotary plow operations affect the soundscape on many days in the winter and spring. Additionally, future increases in winter recreational visitors would add to human-caused noise in the Moose-Wilson corridor. Overall, when the effects of alternative C are added to the effects of long-term airport noise and road vehicle noise, there would be long-term adverse noise impacts on soundscapes and the acoustic resources. However, the impacts of alternative C would contribute a small beneficial increment to the overall negative effects of airport noise and road vehicle noise that is audible in the corridor.

Conclusion. Overall, alternative C would create small to appreciable beneficial impacts on soundscapes and the acoustical resources in the Moose-Wilson corridor. These beneficial impacts would be due to lower speed limits (lower dBA levels) and the conversion of approximately 1.0 mile of unpaved road into a pedestrian-only trail (noise would be less likely to travel into the wilderness) near the Death Canyon Trailhead and the potential wilderness area. These actions are beneficial because they would reduce noise in the area. There would also be short-term adverse noise impacts that would occur during road paving and during the realignment of one road section. The additional parking spaces along the Moose-Wilson corridor may allow slight increases in visitor-created noise over the long term, which could impact soundscapes. There would not be significant adverse impacts caused by actions under alternative C. Overall, alternative C would contribute a small increment to the existing noise impacts in the corridor.

ALTERNATIVE D

Under alternative D, there would be a few small beneficial impacts on the soundscape or the acoustical environment. For example, the new road segments would be constructed to maintain slow speeds and sound levels from road vehicles, thereby maintaining the condition of the soundscapes for visitors and the condition of the acoustic resources for wildlife. Ending winter maintenance of Moose-Wilson Road at Sawmill Ponds Overlook would also cause small beneficial impacts. Reduction in vehicle access to this area in the winter (smaller portion of the road than in alternative B) would decrease the percentage of time that vehicle noise is audible. This would also improve the condition of soundscapes for visitors and improve the condition of the acoustic resources for wildlife.

There would be several small adverse impacts on soundscapes and the acoustical environment under alternative D. For example, there would continue to be noise impacts several times per year when the unpaved section of the road is being graded and treated for dust abatement, but equal number of days with especially quiet days as road surface dries and traffic is prohibited. There would also be short-term and noticeable noise impacts that would only last for the duration of road construction of the two road realignments between the Sawmill Ponds Overlook and Death Canyon Junction, and the segment north of Sawmill Ponds to Teton Park Road. Creating additional parking spaces along Moose-Wilson Road may increase the percentage of time that human-caused noise is audible where increased use occurs. This may have a small adverse impact on soundscapes and the acoustic resources. The expansion of the Death Canyon Trailhead to accommodate 100 vehicles would also allow increased use in the area, which could lead to increased audibility of human-caused sounds coming from the parking area near the potential wilderness area. Under alternative D, public vehicle traffic would be diverted through White Grass Ranch to access the Death Canyon Trailhead, and this would substantially impact the cultural soundscape of the historic district. Finally, there would likely be few if any impacts on the soundscape and acoustic resources due to the improved parking situation and the groomed trails for winter recreation.

As proposed under alternative D, bicycle use of a multiuse pathway adjacent to Moose-Wilson Road would not have substantial impacts on soundscapes after the extended construction period (which would have a large, but short-term increase in construction noise). The variety of audible sounds may change because visitors would be provided with new opportunities to recreate in the corridor. For example, there may be increased levels of human-caused sounds such as voices and bicycle use. However, bicycle use on a multiuse pathway could have an adverse impact on the acoustic resources. For example, it is important for bears to hear approaching humans to prevent undesirable encounters. As noted in the 2014 report by Grant MacHutchon, biking at quiet high speeds in an area such as the Moose-Wilson corridor "limits the reaction time of people and/or bears and limits the warning noise that would reduce the chance of sudden encounters with a bear." Finally, traffic management techniques such as providing travel alerts for congested situations or providing a reservation system for vehicle use are unlikely to change the character of soundscapes or the acoustic resources in a noticeable way if traffic levels remain the same. This alternative would prevent future increases in traffic volumes, thereby avoiding future degradation of soundscapes or the acoustical environment over time.

Cumulative Impacts. The Jackson Hole Airport operates under an agreement administered by the National Park Service and is authorized to continue operating until April 27, 2053. Noise from aircraft is the most widespread nonnatural sound source in Grand Teton National Park. Aircraft arriving and departing Jackson Hole Airport are louder and more audible for greater periods of time in the southern portions of the park and the Moose-Wilson corridor. Aircraft sounds are most audible during the winter months. For example, data collected at White Grass Ranch in the winter of 2004 and 2005 indicated that aircraft sounds were audible nearly 30% of the time (7:00 a.m. to 7:00 p.m.) at White Grass Ranch (Burson 2008). Therefore, operation of Jackson Hole Airport would continue to generate long-term adverse noise impacts on soundscapes and the acoustical environment along the Moose-Wilson corridor. During the summer months, road vehicles are audible around 75% of the time along Moose-Wilson Road, a greater percentage of time than aircraft. During the winter, aircraft are more audible, especially in areas of Moose-Wilson Road that are closed to vehicles for the season. This is because the ambient sound level is lower in the winter and more distant aircraft can be heard. It should also be noted that avalanche control at Jackson Hole Resort is clearly audible during and after snowstorms, and rotary plow operations affect the soundscape on many days in the winter and spring. Additionally, future increases in winter recreational visitors would add to human-caused noise in the Moose-Wilson corridor. Overall, when the effects of alternative D are added to the effects of long-term airport noise and road vehicle noise, there would be long-term adverse noise impacts on soundscapes and the acoustic resources. However, the impacts of alternative D would contribute a small increment to the overall negative effects of airport noise and road vehicle noise that is audible within the corridor

Conclusion. Overall, alternative D would create a few small beneficial impacts and several small adverse impacts on soundscapes and the acoustical environment along the Moose-Wilson corridor. The beneficial impacts would be due to slow speed limits and ending winter maintenance at the Sawmill Ponds Overlook, which would reduce vehicular noise in the corridor. The adverse impacts would be due to noise from grading and treatment for dust abatement and from noise during the realignment of two sections of the road. There may be possible noise impacts from the creation of additional parking along Moose-Wilson Road and at the Death Canyon Trailhead. Under alternative D, public vehicle traffic would be diverted through White Grass Ranch to access the Death Canyon Trailhead, and this would substantially impact the cultural soundscape of the historic district. Bicycle use on a multiuse pathway would have slight impacts on the soundscapes after the extended construction period. However, bicycle use on a multiuse pathway could have an adverse impact on the acoustic resources, such as the ability of bears to hear bicyclists in time to prevent undesirable encounters. There would not be significant adverse impacts caused by actions under alternative D. Overall, alternative D would contribute a small increment to the existing noise impacts in the corridor.

WILDERNESS

METHODS AND ASSUMPTIONS FOR ANALYZING IMPACTS

This analysis identifies how impacts on wilderness would change with implementation of alternatives proposed in this Draft CMP/EIS. Baseline information and methods used for analysis include park staff knowledge of resources and sites, review of existing literature and park plans and studies, information provided by specialists in the National Park Service and other agencies, and professional judgment. Additional wilderness information and sources used are described in "Chapter 3: Affected Environment," under the "Wilderness" section.

Addressing impacts on wilderness requires a clear understanding of the five qualities of wilderness character for these qualities to be protected in accordance with the mandate of the Wilderness Act. These qualities include: (1) untrammeled, (2) natural, (3) undeveloped, (4) solitude or primitive and unconfined recreation, and (5) other features and values—which together are referred to as wilderness character. For example, adverse impacts on the untrammeled quality would occur as a result of intentional actions of modern human control or manipulation. Similarly, adverse impacts on the natural quality would occur due to alteration of the wilderness ecological system, which should remain substantially free from the effects of modern civilization. Adverse impacts on the undeveloped quality would occur if the primeval character were to be impeded due to permanent improvements or signs of modern human occupation. Impacts on solitude or primitive and unconfined recreation could occur if opportunities for these types of experiences were decreased or made difficult to obtain. Finally, adverse impacts on other features of value would occur if ecological, geological, or other features of scientific, educational, scenic, or historical value were to be degraded.

This section of the document addresses potential impacts on wilderness character. The impact analyses considered a variety of factors that could affect wilderness and assumes that changes in development and use of the Moose-Wilson corridor could lead to impacts on wilderness character near Death Canyon, where potential wilderness exists. In general, the effects of the alternatives on wilderness character in the project area were analyzed based on impacts resulting from visitor use levels and patterns and developments associated with each alternative. To accomplish this, the following impact analysis question was considered to help identify the potential impacts of each alternative:

1. What are the environmental consequences and impacts on wilderness character associated with the plan alternatives?

It should be noted that most of the possible impacts on wilderness character were related to the solitude or primitive and unconfined types of recreation quality, and not the other qualities of wilderness. This is because the size of the Death Canyon parking area (a primary access point for wilderness) varies by alternative.

ALTERNATIVE A (NO ACTION)

Because no new management strategies are being proposed under alternative A and only a portion of the affected environment (1,650 acres) is classified as potential wilderness, there would be few if any impacts on the current condition of wilderness. However, possible increases in use and lack of management tools to regulate use could lead to decreased opportunities for solitude. Currently, up to 87 vehicles per day may be parked in the Death Canyon area. Twenty-five of these vehicles park in designated areas, while the remaining 62 have been documented parking in visitor-created parking areas along the roadside leading to the Death Canyon Trailhead (Monz, D'Antonio, and Heaslip 2014a). As parking areas fill and overflow, increased use could potentially lead to other issues and impacts from visitors (social trailing and vegetation impacts) as they enter and disperse inside the wilderness boundary. These impacts are relevant to the Death Canyon area because it serves as a gateway to the potential wilderness area. Because no changes are being proposed under alternative A, opportunities for solitude may decline and adverse impacts on the natural and untrammeled qualities may continue if use increases.

Cumulative Impacts. The Jackson Hole Airport operates under an agreement administered by the National Park Service and is authorized to continue operating until April 27, 2033. Noise from aircraft is the most widespread nonnatural sound source in Grand Teton National Park, and may contribute to the loss of solitude in the Death Canyon area (Burson 2008). This topic is more fully analyzed in "Chapter 4: Environmental Consequences," under "Acoustic Resources and Soundscapes."

Other actions that may impact wilderness character include impacts from short-term projects related to trail rehabilitation and maintenance. Because these actions would be administered under a project-specific or trail management-related minimum requirement analysis and likely short term in nature, these impacts would be minimal. Overall, when the effects of alternative A are added to the effects of long-term airport noise, there would be long-term adverse impacts on opportunities for solitude in wilderness. However, the impacts of alternative A would contribute a small increment to the overall adverse effects of airport noise that is audible in the corridor.

Conclusion. Overall, there may be a small number of slight impacts on wilderness such as possible social trailing or related vegetation impacts inside of the wilderness area, which impacts the natural quality of wilderness. Impacts on solitude may also occur as a result of increasing visitor use trends that would likely continue under alternative A, the no-action alternative. Additionally, aircraft noise from Jackson Hole Airport would continue to cause long-term adverse impacts on opportunities for solitude in the potential wilderness area near Death Canyon. Overall, alternative A would contribute a slight adverse increment to impacts on wilderness character in the Moose-Wilson corridor. There would not be significant adverse impacts caused by actions under alternative A.

ALTERNATIVE B

Under alternative B, there would be beneficial impacts on wilderness due to the upper 0.4-mile section of the Death Canyon Road being converted to trail. This would contribute to increased opportunities for solitude in the Death Canyon area. Furthermore, the extent to which day users currently travel into the wilderness area may be shortened by the extra 0.4 mile of trail, possibly decreasing the amount of time they could spend in the potential wilderness area. However, visitors with more time to explore may move deeper into the wilderness and away from civilization, and their opportunities for solitude may increase due to reduced encounters with others.

Alternative B would provide a variety of design and management strategies that would address expected increases in visitation to the corridor. This improvement may create beneficial impacts on opportunities for solitude in the wilderness area. The implementation of the gate closure during peak use periods would deter through-traffic and reduce traffic volumes, which would be beneficial for traffic flow.

Under alternative B, a parking lot would be provided for 60 vehicles, and a defined parking area would decrease degradation from visitor-created parking areas and create beneficial impacts on the natural quality of wilderness. Furthermore, the accommodation of up to 60 vehicles would equate to an overall decrease in use of the area, which may lead to increased opportunities for solitude on the trails within the potential and recommended wilderness areas. Decreased use may lead to reduced encounters with others and thus increased opportunities for solitude and beneficial effects to wilderness.

Cumulative Impacts. The Jackson Hole Airport operates under an agreement administered by the National Park Service and is authorized to continue operating until April 27, 2033. Noise from aircraft is the most widespread nonnatural sound source in Grand Teton National Park and may contribute to the loss of solitude in the Death Canyon area. This topic is more fully analyzed in "Chapter 4: Environmental Consequences" under the "Acoustic Resources and Soundscapes" section. Other actions that may impact wilderness character include impacts from short-term projects related to trail rehabilitation and maintenance. Because these actions would be administered under a project-specific or trail management-related minimum requirement analysis and likely short term in nature, the impact would be minimal. Overall, when the effects of alternative B are added to the effects of long-term airport noise, there would be long-term adverse impacts on opportunities for solitude in wilderness. However, the impacts of alternative B would contribute a small beneficial increment to the overall negative effects of airport noise that is audible in the corridor.

Conclusion. Overall, there may be a small number of benefits to wilderness as a result of visitor use and traffic management strategies under alternative B. In particular, alternative B provides a defined parking area near White Grass Ranch, which would reduce the number of people parking and entering the wilderness from this location and would increase opportunities for solitude in the wilderness. Overall, alternative B would contribute a small beneficial increment to the impacts on wilderness character in the corridor. There would not be significant adverse impacts caused by actions under alternative B.

ALTERNATIVE C (NPS PREFERRED)

Under alternative C, there would be beneficial impacts on opportunities to experience solitude in wilderness due to the existing 1.0 mile unpaved portion of the Death Canyon Trailhead access road being converted to trail. This would contribute to increased opportunities for solitude in the Death Canyon area. Furthermore, the distance day users currently travel into wilderness may be decreased because of the addition of an extra 1.0 mile of trail in this alternative; therefore, decreasing the amount of time they may be able to spend inside wilderness. However, as visitors with more time to explore move deeper into the wilderness and away from civilization, their opportunities for solitude may increase due to reduced encounters with others.

Alternative C would provide a variety of design and management strategies that would address expected increases in visitation to the corridor. The implementation of the timed sequencing strategy during peak use periods would deter through-traffic and reduce traffic volumes, which would be beneficial for traffic flow. This improvement may create beneficial impacts on opportunities for solitude in the wilderness area. Alternative C places a limit on the number of people/ vehicles at one time in the corridor, which over time will prevent unrestricted growth, providing better protection of solitude and wilderness values into the future than alternative A. Navigation would be greatly improved at Death Canyon because the road changes and parking improvement would be better able to accommodate parking demand.

Under alternative C, the accommodation of 80 to 90 vehicles would maintain current use levels in the area. However, as noted above, encounters with others in wilderness may decrease given the extra mile of walking it would take to access them. Reduced encounters with other hikers in wilderness would lead to increased opportunities for solitude, and thus beneficial effects to wilderness.

Cumulative Impacts. The Jackson Hole Airport operates under an agreement administered by the National Park Service and is authorized to continue operating until April 27, 2033. Noise from aircraft is the most widespread nonnatural sound source in Grand Teton National Park and may contribute to the loss of solitude in the Death Canyon area (Burson 2008). This topic is more fully analyzed in "Chapter 4: Environmental Consequences," under the "Acoustic Resources and Soundscapes" section. Other actions that may impact wilderness character include impacts from short-term projects related to trail rehabilitation and maintenance. Because these actions would be administered under a project-specific or trail management-related minimum requirement analysis and likely short term in nature, the impact would be minimal. Overall, when the effects of alternative Care added to the effects of long-term airport noise, there would be long-term adverse impacts on opportunities for solitude in wilderness. However, the impacts of alternative C would contribute a small beneficial increment to the overall negative effects of airport noise that is audible in the corridor.

Conclusion. Overall, there may be a small number of benefits to wilderness as a result of potential decreased use in the recommended and potential wilderness areas under alternative C. There would be beneficial impacts on opportunities to experience solitude in wilderness due to the existing 1.0 mile unpaved portion of the trailhead access road being converted to a hiking trail. This additional 1.0 mile of trail may possibly increase opportunities for solitude once visitors are inside wilderness. Overall, alternative C would contribute a small beneficial increment to the impacts on wilderness character in the corridor. There would not be significant adverse impacts caused by actions under alternative C.

ALTERNATIVE D

Under alternative D, the Death Canyon Trailhead parking lot would be expanded to accommodate 100 vehicles. The improved road and larger parking at the trailhead itself would increase visitation to wilderness. While the visitor capacity would be addressed for the Moose-Wilson corridor in general through the use of a reservation system during peak periods, visitation to wilderness would still increase under alternative D because of road and parking lot improvements. Increased use could lead to increased encounters with other hikers and thus decreased opportunities for solitude and adverse effects to wilderness character.

Alternative D would provide a variety of design and management strategies that would address expected increases in visitation to the corridor. The implementation of the reservation system during peak use periods would limit vehicular access and prevent increased traffic volumes, which would be beneficial for traffic flow. Traffic flow would also be improved through formalized parking/turnouts along the road and at Death Canyon.

Cumulative Impacts. The Jackson Hole Airport operates under an agreement administered by the National Park Service and is authorized to continue operating until April 27, 2033. Noise from aircraft is the most widespread nonnatural sound source in Grand Teton National Park and may contribute to the loss of solitude in the Death Canyon area. This topic is more fully analyzed in "Chapter 4: Environmental Consequences," under the "Acoustic Resources and Soundscapes" section.

Other actions that may impact wilderness character include impacts from short-term projects related to trail rehabilitation and maintenance. Because these actions would be administered under a project-specific or trail management-related minimum requirement analysis and likely short term in nature, the impact would be minimal. Overall, when the effects of alternative D are added to the effects of long term airport noise, there would be long term adverse impacts on opportunities for solitude in wilderness. Additionally, the impacts of alternative D would contribute a slight adverse increment to the overall negative effects of airport noise that is audible within the corridor. This small adverse increment would be due to the expanded parking area near the wilderness trailhead because increased use may decrease opportunities for solitude.

Conclusion. Overall, there would be a small number of adverse impacts on wilderness character under alternative D. In particular, managing for up to 100 vehicles through developing a defined parking lot and implementing traffic management would equate to an overall increase in use of the Death Canyon parking area, which may lead to decreased opportunities for solitude on trails within potential wilderness areas. Overall, alternative D would contribute a slight adverse increment to the impacts on wilderness character. There would not be significant adverse impacts caused by actions under alternative D.

VISITOR USE AND EXPERIENCE

METHODS AND ASSUMPTIONS FOR ANALYZING IMPACTS

This analysis discusses the diversity and quality of visitor experiences available within the Moose-Wilson corridor, opportunities to understand the important stories of the corridor, and visitor safety. Diversity and quality of visitor experience focuses on recreation activities, whereas opportunities for orientation, education, and interpretation focuses on interpretive and education activities within the corridor, as well as information provided to visitors to familiarize them with the surroundings. Not all of these topics are discussed for each alternative, only for those which impacts are anticipated. The effects of the proposed alternatives are analyzed based on anticipated results from changes to visitor use patterns, types of use, timing of use, changes in levels of development, and management actions associated with each alternative. The impacts analysis of each alternative is determined by describing how each impact topic would change compared to existing conditions.

Impact Analysis Questions.

1. How would the diversity and quality of visitor experiences and opportunities change as a result of the alternatives?
2. How would the levels of crowding and promotion of close connection to resources be affected as a result of the alternatives?
3. How would opportunities for education, interpretation, and orientation within the corridor, and orientation to the corridor change as a result of the alternatives?
4. How would visitor safety, both real and perceived, be affected by the alternatives?
5. How would multimodal (e.g., bicycle, vehicular, pedestrian, and equestrian) interaction with wildlife change as a result of the alternatives?

Impacts on visitor use and experience were determined considering best available information. Information on visitor use and opinions were taken during public comment periods for this plan and surveys of visitors conducted by researchers. Other information that was considered in the analysis includes information on visitor use levels, visitor use patterns, types of use, and timing of use collected during this planning effort by various researchers and through interviews with park staff. Information on local and regional travel and tourism trends and development activities was also considered in the analysis.

Impacts were assessed assuming that mitigation measures would be implemented to minimize or avoid impacts. If the mitigation measures described in chapter 2 were not applied, the potential for adverse impacts and the magnitude of those impacts would increase. Therefore, the mitigation measures would be incorporated into the record of decision for the selected alternative.

Because impacts on visitor use patterns, types of use, and timing of use are linked to impacts on traffic and transportation, this impact topic is closely tied to the Traffic and Transportation impact topic. The "Visitor Use and Experience" section discusses impacts that traffic flow and safety on the roadway have on the visitor, while the "Traffic and Transportation" section focuses specifically on impacts on traffic flow and safety on the roadway. Complementary information is generally included in the "Traffic and Transportation" section. Cross-references have been made in this chapter where appropriate.

ALTERNATIVE A (NO ACTION)

Diversity and Quality of Visitor Experiences and Opportunities

Current management of the Moose-Wilson corridor provides visitors the opportunity to experience a variety of activities. Whether snowshoeing in the winter, visiting the LSR Preserve, or hiking in Death Canyon, visitors gain a sense of discovery as they explore the corridor. Because no new management strategies are being proposed under alternative A, visitors would continue to be able to access the corridor, its destinations, and opportunities from both north and south, continuing to provide beneficial impacts on the diversity of opportunities within the corridor. However, maintaining the current condition of the Moose-Wilson corridor would result in degradation of the visitor experience. Roadside damage to soil and vegetation would continue to increase under this alternative as management actions are not taken to improve the flow of traffic by clearly indicating authorized turnouts along Moose-Wilson Road. Driving and parking conditions along Death Canyon Road would continue to degrade as vehicles haphazardly park along the roadside causing resource damage as well as confusion for visitors navigating the area. According to 2014 visitor surveys, 37.6% of participants in vehicles reported the condition of the roadway a “Problem,” and 24.3% reported the amount of room to adequately pull your vehicle off the road to view areas of interest a “Problem.” Additionally, 50.0 % of cyclists reported the conditions of the roadway were a “Problem,” as well as 37.5% considered the amount of room to adequately pull your vehicle off the road to view areas of interest a “Problem” (Newman 2015). For some visitors, the recommendation for a four-wheel-drive vehicle to access the Death Canyon Trailhead would lessen their ability to reach it. Crowding along the roadway and particularly in parking areas would become more prevalent under this alternative because no management actions to influence use levels would be in place. Crowding in parking areas would limit the ability of visitors to reach specific destinations in the corridor during busy times. Visitor conflicts would continue along the road due to congestion, wildlife jams, and varying desires for traffic speed. All of these are issues of concern for many members of the public and visitors, as expressed during public scoping and visitor surveys for this plan. While these effects would take place during peak use times in the near future, as visitation increases over time the same effects would take place during the entire summer season as use levels increase during shoulder seasons. Therefore, alternative A would continue to provide both beneficial and adverse impacts on the quality of visitor experiences and opportunities within the Moose-Wilson corridor.

Opportunities for Orientation, Education, and Interpretation

The Moose-Wilson corridor conveys an intimate feel with an emphasis on self-discovery. The opportunities for orientation, education, and interpretation within the corridor reflect these ideals. Visitors entering Moose-Wilson Road from the south have the opportunity to obtain basic orientation, education, and interpretation information through the Granite Canyon Entrance Station during open hours, resulting in some beneficial impact. There is no entrance station for the northern end of the Moose-Wilson corridor, so visitors do not have the opportunity to gain information about the corridor unless they go to the Craig Thomas Discovery and Visitor Center and specifically request information about Moose-Wilson Road or are told by park staff. Visitors can currently obtain some trip planning information related to the corridor through the Grand Teton National Park website or the park newspaper, providing slight benefits to visitors.

The LSR Preserve is the focal point for visitor information within the corridor. Visitors are personally greeted as they enter the parking lot and are provided with a welcome and orientation to the LSR Preserve. Visitors may also participate in multiple offerings of ranger programs including a daily guided hike to Phelps Lake, an audience centered facilitated dialog program, a daily talk about wildlife, or check out a family focused Nature Explorer's Backpack from the Center. These opportunities result in benefits for visitors to the LSR Preserve.

Under alternative A, cyclists joining Moose-Wilson Road from existing multiuse pathways are not oriented to the shared use experience with vehicles along the narrow road, nor are motorists explicitly oriented to sharing the road with cyclists. This combined effect results in adverse impacts on both cyclists and drivers due to the lack of information provided, which would continue to lead to increased real and perceived safety concerns among visitors. Current management does not allow direct contact with all visitors entering the corridor to educate and orient them to the corridor, which would continue to lead to adverse impacts, including drivers unsure of their location, lack of knowledge of natural and cultural resources within the corridor, and unsafe behavior around and awareness of wildlife.

Providing Safe Visitor Opportunities

Possible increases in traffic volumes and lack of management tools to regulate increases in traffic could lead to continued conflicts between motorists, such as road rage and aggressive driving behavior. Visitors would continue to experience congestion and conflict along the road, especially during peak visitation times (July–August), when wildlife presence is high (September–October), and at parking lots during peak times due to lack of adequate levels of parking and turnouts. Park staff and volunteers would continue to help mitigate traffic congestion related to wildlife jams and conflict between visitors associated with congestion and wildlife. The continuation of increasing traffic and visitation and the limited management tools available to regulate these changes could lead to unsafe incidents between visitors, adversely affecting visitor safety and the visitor experience over time. Negative public perception of safety along Moose-Wilson Road was expressed during public comment periods. Particularly concerns about bicycle safety and unsafe driving behavior were stated. Because no new management strategies are being proposed under alternative A, there would be few if any additional impacts on the current condition of providing safe visitor opportunities.

The road would continue to be closed temporarily when grizzly bears are present, providing beneficial impacts on visitor and bear safety. However, visitors would not be able to experience the road during these closures, causing continued temporary adverse impacts on visitor use and experience.

Cumulative Impacts. Several past actions related to the Southwest Entrance Facilities (Environmental Assessment 1998) have, and continue to, beneficially affect visitor use and experience within the project area from the addition of the Granite Canyon Entrance Station. This entrance station provides visitors entering from the south some level of orientation, education, and interpretation to the corridor during operating hours.

The actions contained in several present and reasonably foreseeable future plans call for the expansion of the existing pathway system, including the *Jackson/Teton County Comprehensive Plan*, the *Jackson Hole Community Pathways Master Plan*, and the Grand Teton National Park Transportation Plan. These networks provide more opportunities for cyclists and pedestrians and enhance the experience for many cyclists, which could attract more cyclists to the region. However, the expansion of the existing pathway system could also direct more of these visitors onto an increasingly congested Moose-Wilson Road, which they must share with motor vehicles. Additionally, the 2013 Teton Village Expansion Master Plan called for 380 new dwelling units south of Teton Village. These units would consist of condominiums, townhouses, affordable housing, and employee housing. Increasing the number and volume of new residents in the area would likely increase traffic volumes, which would have an adverse impact on traffic congestion in the region, which could also direct more traffic to Moose-Wilson Road. The lack of traffic management strategies under the no-action alternative would contribute substantially to the overall effect traffic growth in the region has on traffic volumes and congestion within the corridor, which would adversely impact visitor use and experience.

When the effects of alternative A on visitor use and experience are added to these other past, present, and reasonably foreseeable effects, a notable, long-term, cumulative adverse effect would continue to occur. However, the incremental effect of alternative A, added to the adverse effects of these other actions in the area, would be modest.

Conclusion. Alternative A would contribute a few beneficial impacts along with relatively larger adverse impacts on visitor use and experience in the Moose-Wilson corridor. Overall, alternative A would result in significant adverse impacts on visitor use and experience as the demand for opportunities in the corridor increase over time and visitation to the area rises.

These adverse impacts would be significant because increasing traffic and visitation would continue to cause crowding at destinations along the road and at parking areas. The ability for visitors to experience the corridor in an unhurried, relaxed, and rustic manner characteristic of this part of the park would be less likely over time. Congested parking lots would result in visitors feeling frustrated by not being able to reach an intended destination and recreation opportunity.

Limited management tools to regulate these changes could lead to unsafe incidents between visitors, adversely affecting visitor safety and visitor experience over time as visitation continues to grow. Visitors would continue to be able to access the diversity of opportunities in the corridor from both north and south, including the LSR Preserve, providing some ongoing beneficial impacts on visitor use and experience.

When the effects of alternative A on visitor use and experience are added to other past, present, and reasonably foreseeable effects, an appreciable, long-term, cumulative adverse effect would continue to occur. Alternative A would have a modest contribution to the overall cumulative effect.

ALTERNATIVE B

Diversity and Quality of Visitor Experience and Opportunities

Alternative B emphasizes the corridor as a visitor destination given the many premier sites within the corridor that offer unique visitor opportunities and experiences. Management actions under this alternative generally endeavor to reduce crowding and congestion throughout the corridor. The Laurance S. Rockefeller Preserve becomes the heart of the corridor under alternative B and the important conservation stories that are held throughout the corridor are highlighted.

Overall, the quality of visitor experiences at destinations would be slightly improved under alternative B as traffic levels and therefore crowding along the roadway and at destinations would be reduced. To accomplish this, a gate would be placed along Moose-Wilson Road near the LSR Preserve. During periods of peak visitation, the gate would be closed and vehicles would exit the corridor the same way they entered it. Gate closures would be informed by the visitor capacity as determined for the corridor (see “Visitor Use Framework” section of chapter

2 and appendix A on the visitor capacity determination). The analysis for capacity of the corridor considered the other management strategies being proposed in the plan that better facilitate visitation through the corridor (e.g., road turnouts, improved parking, road conditions) and address many of the current issues in the corridor (e.g., crowding, use conflicts, and resource impacts). Given desired conditions and these related management strategies, it was determined that current use levels could be accommodated and would serve as the maximum amounts of use (visitor capacity) for the corridor. By closing the gate during peak use periods when visitation exceeds visitor capacity, the gate encourages lower traffic volumes as vehicles will not be able to drive straight through the corridor at these times. For this reason, visitor experiences at destinations would be slightly less crowded and would be more aligned with the slow paced and rustic qualities of the road corridor. In addition, the opportunity for visitors to experience greater solitude while hiking would be improved as trail densities would be kept low. However, the gate closure would passively encourage visitors to use alternate transportation routes rather than using the corridor as a way to reach other destinations within the area. As visitation increases over time and visitors become accustomed to entering the corridor from either side and returning the same way they entered, the gate would remain closed for longer periods of time. It would be possible for the capacity to be reached and visitation volumes on either side of the gate to increase beyond the determined capacity as the gate does not directly manage levels of use. As this occurs in the future, visitor experiences of a slow and uncrowded roadway and destinations would become less likely, therefore adversely impacting the visitor experience.

During off-peak visitation periods, the gate would be open and visitors would be able to travel the corridor from one end to the other, starting from either the north or the south. If traffic volumes increase significantly over time, the gate would need to be closed for longer periods of time, which would have greater adverse impacts on the diversity and quality of visitor experiences and opportunities. For visitors seeking the opportunity to take a scenic drive through the entire corridor, their experience would be greatly diminished when the gate is closed. Access to the entire corridor as well as the ability to drive directly to other portions of the park through the Moose-Wilson corridor would be limited during peak use times due to the gate being closed. All destinations within the corridor would remain accessible. However, visitors seeking to visit a specific destination may be inconvenienced by having to first travel to either the north or the south end of the corridor to reach their intended destination

Under alternative B, realigning the road segment between Sawmill Ponds Overlook and Death Canyon Road junction would affect two of the most popular activities in the corridor: viewing wildlife and scenic vistas. Wildlife viewing would continue from turnouts along the realigned road, but from a farther distance. Additional turnouts and improvements to existing parking areas would improve visitor experience by reducing congestion along the road and supporting a leisurely driving or bicycling experience. Turnouts would improve visitor opportunities to view wildlife and scenery since it allows visitors to stop, get out of their vehicles, take photographs, and appreciate their surroundings. The ability to leave the road and possibly get out of a vehicle was expressed as a desire by many individuals during public comment periods. Additional turnouts would also provide beneficial impacts on the quality of visitor experience by reducing visitor conflict along Moose-Wilson Road (please see “Providing Safe Visitor Opportunities” below for more detail). For those visitors who enjoy viewing scenic vistas, road realignment would provide beneficial impacts as scenic views of riparian areas and the Teton Range would be visible. However, visitor opportunities to view wildlife and fall colors would be greatly diminished by realignment since the road would be moved farther from prime wildlife habitat and dense vegetation, resulting in adverse impacts on those that prize viewing these types of settings.

Under alternative B, parking at the LSR Preserve would occur in two smaller separated parking lots rather than one larger parking area, as a result of the gate that would be used for closures during peak traffic times. Overall, the ability to access the LSR Preserve would be continued as visitors could reach the LSR Preserve from either the north or the south whether or not the gate is closed. These smaller lots could create visitor frustration if visitors find themselves waiting a long time for a parking spot in one lot, while there are empty spaces or shorter wait times in the other lot. While the LSR Preserve would continue to be accessed from the north and the south, the visitor experience would be diminished by less efficient parking and possibly longer wait times at the parking lots during peak use times.

Bicycles and motor vehicles would continue to share the road in this alternative when the gate is open. When the gate is closed, bicycles could continue to travel the entire length of the corridor. The addition of small sections of pavement would serve to join existing multiuse pathways and Moose-Wilson Road. In addition, signs indicating where nonmotorized users would be transitioning to the road would be added. These actions would serve to improve how bicyclists transition from the existing multiuse pathways to Moose-Wilson Road and would enhance both the bicyclists' and motor vehicle drivers' experiences since their ability to share the road would be improved. During seasonal periods when the road is closed to motor vehicles, but free of ice and snow, bicyclists would be able to ride the corridor. A more clearly defined bicycle experience in the corridor would beneficially impact bicycle use (see "Providing Safe Visitor Opportunities" for a discussion on perceived and real safety).

Commercial use in the corridor would continue under alternative B with a set number of resource-focused, corridor-specific road-based tours. By asking commercial tour operators to include resource-based interpretation, visitors who wish to travel in the corridor on an organized tour would have an enhanced experience of the resource diversity and cultural history of the corridor whether on horseback, driving, skiing, or snowshoeing tour. By basing the number and size of tours on current use levels, visitors utilizing a tour would experience the corridor in an uncrowded manner while also obtaining the guided experience they desire. For visitors not on commercial tours, a set number and size of tours would ensure that they are not competing with large tour vehicles and groups for parking or recreational opportunities. Taxis and all other nonpark-dependent commercial traffic would be prohibited in the corridor, therefore decreasing visitor conflict on the road and adding to the slow paced setting. However, this may limit a small number of visitors that rely on a taxi ride as their transportation to visit the corridor. By managing the type and amount of commercial use in the corridor, the diversity and quality of visitor experiences and opportunities is improved under this alternative.

Under alternative B, the Death Canyon Trailhead would be relocated and improved to a 60-vehicle parking area a short distance from its current location (0.4 mile to the southeast). As visitors travel the single-lane Death Canyon Road, turnouts for passing and improved gravel surface would greatly improve visitor experiences as rough and narrow road conditions are greatly reduced. By improving conditions in Death Canyon, visitor experiences and opportunities would be beneficially impacted as the area would be accessible to more visitors without four-wheel drive vehicles. In addition, the new parking area would clearly indicate where parking is permissible, therefore decreasing confusion and anxiety concerning parking and trailhead access. Currently, the Death

Canyon Trailhead parking area has 25 designated parking spaces, but an average of 62 additional vehicles park at the trailhead during peak times, for a total of approximately 90 vehicles. With the new parking area, fewer would be permitted but the access would be easier and more clearly defined. However, the road improvements could also allow more visitors to reach the trailhead, thereby increasing parking demand for fewer spaces, possibly resulting in adverse impacts on visitor use and experience. For those unable to find parking during peak times given the smaller number of vehicles permitted, their experience would be diminished under alternative B. The new parking area would generally maintain current use levels for average peak use at the Death Canyon Trailhead and would ensure the continued high-quality experiences on the adjacent trail system. Another potential impact of adding a new parking area near the Death Canyon Trailhead is changes in how visitor access and use nearby trails around Sky Ranch and White Grass Ranch. The parking lot's new location would make accessing the White Grass Ranch easier and could therefore increase use levels on these trails. This would result in beneficial impacts on visitors who previously were unaware of these opportunities.

The removal of redundant horse trails in the northern section of the corridor would beneficially impact some users as navigability would be easier with fewer trails. For others, a reduction of trails would negatively impact the equestrian experience as options for different types of trails become more limited. Horse trailers would no longer be able to park at Sawmill Ponds or Granite Canyon under this alternative, therefore making it less convenient for some equestrians to use the corridor. This would be a small adverse impact due to the low frequency in which these locations are currently used for horse trailer parking.

As actions under this alternative that require construction are implemented, visitor experience would be temporarily impacted. Construction would occur over three to four seasons for all action alternatives. During these seasons, visitors would have various levels of access to the corridor. For details on construction phases please see the "Park Operations" section of this chapter. During the first phase, visitors would not be able to access the corridor from the Moose Entrance. Visitors would not be able to access Sawmill Ponds Overlook or the portion of Moose-Wilson Road between Teton Park Road and the junction of Death Canyon Road. The inability to view wildlife and vegetation along this portion of the road at this time would negatively impact visitor experiences. During the second phase, the Death Canyon Trailhead would not be accessible to visitors. During all phases efforts would be made to keep the LSR Preserve open to the extent possible, however temporary closures may occur. While visitors could continue to access the associated trails from other trailheads, particularly the Laurance S. Rockefeller Preserve, visitors would have to hike additional lengths of trails to do so. This would negatively impact visitors, particularly those for whom long-distance hiking is difficult and who specifically seek out this trailhead to reach wilderness from a short distance. During the third phase, visitors would not be able to access the corridor from the Granite Canyon Entrance. Access to the Granite Canyon Trailhead would not be possible during this phase. While associated trails could be accessed from the Laurance S. Rockefeller Preserve, the need to add additional miles of hiking to reach the trails near Granite Canyon Trailhead would cause negative impacts on some visitors. All of the impacts on visitor access and opportunities to experience the corridor would be isolated to each phase's extent and to one season. A fourth phase would occur during or after these phases but construction would not hamper visitor's abilities to access the corridor.

Opportunities for Orientation, Education, and Interpretation

Alternative B emphasizes the corridor as a destination. Traveler alerts, provided before entrances, would allow visitors to effectively plan their trip. These alerts would inform visitors of potential traffic congestion, full parking lots, and provide visitors the opportunity and knowledge to choose an alternate route before entering the corridor at peak visitation times. Through the use of pre-visit information, such as the park newspaper, electronic media, park website, or a Grand Teton National Park or Moose-Wilson corridor specific app with interpretive and educational information about the natural and cultural resources of the corridor, visitors would gain a sense of arrival to a unique protected area. According to 2014 visitor surveys conducted by Pennsylvania State University, the majority of visitors in all user types stated the amount of information provided by the park to properly prepare them for a visit to the area was “Not a Problem” (Newman et al. 2015). Therefore, these types of interpretive information management tools would result in beneficial impacts on visitors understanding of the Moose-Wilson corridor.

Under alternative B, the number of physical interpretive signs and kiosks installed on the landscape would be kept to a minimum. Small low lying panels could be placed at turnouts and overlooks and would follow design guidelines for the corridor to create a unified visitor experience throughout the corridor. In the 2014 visitor surveys, the majority of visitors in all user types reported the number of signs describing areas of interest along the road was “Not a Problem.” In addition, the majority of visitors in all user types also stated the number of signs with information about the natural and cultural history of the area was “Not a Problem” (Newman et al. 2015). Updating old interpretive panels and the addition of a few new ones in highly used visitor locations would be beneficial to understand the important resources and stories of the Moose-Wilson corridor while still allowing a sense of self-discovery.

Under this alternative, cyclists and motor vehicles would continue to share Moose-Wilson Road. Informative tools and signs would be created to facilitate the transition for cyclists from the existing multiuse pathways on the south and north ends of the corridor to Moose-Wilson Road. This could include something like a gateway kiosk or gathering areas for cyclists departing the existing multiuse pathways. These kiosks or gathering areas would contain information to prepare cyclists for the bicycling experience on Moose-Wilson Road and how it may be different than the cycling experience on existing multiuse pathways. Kiosks could contain panels about sharing the narrow road with traffic, the corridors natural and cultural resources, being bear and moose aware, and could contain route suggestions for cyclists that may not feel comfortable riding through the corridor.

FIGURE 43. EXAMPLE OF A SHARROW

In addition to informative tools and signs to facilitate the transition for cyclists from the existing multiuse pathways on the south and north ends of the corridor to Moose-Wilson Road, road markings, such as “sharrows,” would be used to alert motorists to the presence of cyclists (figure 43). Share the road signs would also be made for motorists to facilitate the safety and transition of cyclists from the existing multiuse pathways on the south and north ends of the corridor to Moose-Wilson Road. During the 2014 visitor surveys, the majority of cyclists (62.5%) reported the level of safety for vehicles, pedestrians, and bicyclists traveling the roadway at the same time was a problem, while 23.9% of participants in vehicles, and 20.8% of hikers reported it to be a "Problem" (Newman et al. 2015). These types of informative tools and markings would provide useful information to cyclists and motor vehicle drivers about what types of other transportation to expect on the road. Therefore, these tools would result in beneficial impacts on visitors understanding of how to share the important resources of the Moose-Wilson corridor safely with other visitors. During public comment periods visitors stated they would support signage that explains how to safely share the road with bicycles.

Providing Safe Visitor Opportunities

This alternative proposes to reduce the speed limit on Moose-Wilson Road, which would improve real and perceived safety for roadway users, especially cyclists and pedestrians. For example, although there are few accidents between motorists along the road (3.8 crashes per year on average) and between motorists and bicycles (less than one per year, and more than one every five years), during public comment periods many people said they do not feel safe while using the road (FHWA 2014). Lowering the speed limit would provide beneficial impacts on visitor safety, both real and perceived, though 100% compliance with the speed limit is not likely.

Under alternative B, the existing unpaved portion of Moose-Wilson Road would be reconstructed and paved. "Safety edges" would be incorporated into the entire paved portion of the road to increase safety for bicyclists and motorists. "Safety edges" would result in benefit by improving the edge of the pavement and enabling drivers and bicyclists to safely return to the road once they have left the pavement. These features would result in greater safety for cyclists when riding closer to the edge of the pavement. Paving the road would improve perceived and real safety for many motorists and cyclists by eliminating the need to navigate potholes and washboards. Road surface improvements would result in beneficial impacts on visitor safety by allowing motorists and cyclists more time to focus on each other rather than on road surface distractions. However, some visitors reported during public comment periods that they feel paving diminishes the rustic character and experience of the road and would decrease safety by encouraging higher speeds. For these visitors, paving may cause adverse impacts on their perceived level of safety.

FIGURE 44. SAFETY EDGE

Currently, there is no entrance station for the northern end of the Moose-Wilson corridor, since Moose-Wilson Road joins Teton Park Road east of the existing entrance station for Grand Teton National Park. Under alternative B, the northernmost segment of Moose-Wilson Road would be realigned and the existing park entrance station would be relocated and replaced. Moose-Wilson Road would be realigned to the west of the entrance station. This entrance station would continue to serve as an entrance to Grand Teton National Park, but would also provide entry to the Moose-Wilson corridor for those visitors traveling west on Teton Park Road from Hwy 26/89/191 and turning south to enter the corridor. Realignment of the northern segment of Moose-Wilson Road and relocation of the entrance station under alternative B, would address visitor confusion and slightly minimize the number of drivers in the corridor with oversized vehicles by increasing direct staff contact with motorists during entrance station open hours. Staff would be able to inform visitors of oversize vehicle restrictions for the corridor, of the unique driving experience within the corridor, orient people to their location within the park, and of the presence of bicyclists on the road. For reference, see the alternative B map, which shows the road realignment and relocation of the entrance station.

Cyclists traveling west along the existing multiuse pathway adjacent to Teton Park Road from Hwy 26/89/191 would also pass through the relocated entrance station and could receive useful information there about the Moose-Wilson corridor and the park. Informative tools and signs would be created to facilitate the transition for cyclists from the existing multiuse pathway to Moose-Wilson Road. Please see the previous section "Opportunities for Orientation, Education, and Interpretation" under alternative B, for more detailed information on the potential impacts of these proposed actions.

Besides reducing visitor confusion, realigning Moose-Wilson Road under alternative B would also reduce vehicular congestion, visitor conflicts, and undesirable human-wildlife encounters due to repositioning the segment between Sawmill Ponds Overlook and Death Canyon Road junction east of prime wildlife habitat. During public comment periods, people suggested wildlife viewing is a major cause for congestion along the corridor. Park staff and volunteers reported 84 wildlife jams in the corridor in the summer of 2013, which lasted anywhere from 15 minutes to more than two hours (Monz, D'Antonio, and Heaslip 2014a). Road realignment would lessen the likelihood of temporary road closures due to the presence of grizzly bears as the road would no longer bisect prime grizzly bear habitat areas. Visitors would therefore be able to experience the corridor with minimal interruption. This realigned road segment would allow visitors opportunities to safely view wildlife (generally road realignment of this segment would provide wildlife viewing at distances greater than the park standard of 100 yards for bears and wolves) and appreciate vistas from distances slightly farther than currently provided. According to 2014 visitor surveys, the majority of visitors thought other visitors getting too close to wildlife was "not a problem" and thought the majority of visitors view wildlife from a safe distance (Newman et al. 2015). Some visitors prize the opportunity to view wildlife close-up and may be disappointed to have to view wildlife farther away due to the road realignment. Overall, road realignment east of prime wildlife habitat along with the addition of a few designated turnouts would result in beneficial impacts on visitor safety.

Under alternative B, installation of officially designated turnouts that would accommodate up to 120 vehicles (similar to the current parking demand) would alleviate road congestion and reduce visitor conflict. Additional turnouts would improve traffic flow by providing a place for slower drivers, or those wishing to view wildlife or vistas to move out of the way of other traffic. Reducing vehicle congestion on the road would also improve safety for cyclists choosing to use the road. During public comment periods many commenters suggested a lack of turnouts and parking areas for wildlife viewing were a major source of congestion because wildlife viewers stop in the middle of the road to watch and photograph the animals. Others believed efforts should be made to further protect wildlife in the corridor by adding turnouts and parking, educating visitors on safe distances from wildlife, and continued traffic control. In combination with road realignment, proposed turnouts would allow visitors to view wildlife from a safe distance, but without making it difficult for other motorists, law enforcement, emergency response teams, and cyclists to safely use the roadway. By reducing congestion and increasing safety, visitor conflicts associated with wildlife traffic jams would also decrease thereby resulting in beneficial impacts on visitor safety and overall visitor experience within the corridor.

Under alternative B, visitors would continue to have the opportunity to travel the road by bicycle, but would share the road with motor vehicles. Bicyclists' level of perceived safety would continue to vary consistent with their own skills, abilities, and experiences. During public comment periods, people expressed concerns over safety risks along the corridor. Unsafe driver behavior noted by some commenters included aggressive driving, distracted driving, and speeding. When coupled with limited sight lines along the narrow, winding corridor both motorized and nonmotorized users feel unsafe. Many commenters cited conflicts with incompatible users such as slowed or stopped tourists versus speeding commuters and commercial users, motorized vs. nonmotorized users, and wildlife-visitor interactions as another cause of safety concerns. According to 2014 visitor surveys, the majority of cyclists (62.5%) reported the level of safety for vehicles, pedestrians, and bicyclists to travel the roadway at the same time was a "Problem" (Newman et al. 2015). Bicyclists' level of real safety would continue to vary based on many variables, including but not limited to, traffic levels and speeds, road and weather conditions, personal comfort of sharing the road with vehicles, and wildlife movements and sightings across the road. The road speed reduction, road realignment, paving changes, additional turnouts, and "safety edges" proposed under this alternative would result in beneficial impacts on a cyclist's level of perceived or real safety; however, this would continue to vary on an individual basis.

Cumulative Impacts. Several past actions related to the southwest entrance facilities (Environmental Assessment 1998) have, and continue to, beneficially affect visitor use and experience within the project area from the addition of the Granite Canyon Entrance Station. This entrance station offers visitors entering from the south some level of orientation, education, and interpretation to the corridor during operating hours.

The actions contained in several present and reasonably foreseeable future plans call for the expansion of the existing pathway system, including the *Jackson/Teton County Comprehensive Plan*, the *Jackson Hole Community Pathways Master Plan*, and the *Grand Teton National Park Transportation Plan*. These networks provide more opportunities for cyclists and pedestrians and enhance the experience for many cyclists, which could attract more cyclists to the region. However, the expansion of the existing pathway system could also direct more of these visitors to an increasingly congested Moose-Wilson Road, which they must share with motor vehicles. Additionally, the 2013 *Teton Village Expansion Master Plan* calls for 380 new dwelling units south of Teton Village. These units would consist of condominiums, townhouses, affordable housing, and employee housing. Increasing the number and volume of new residents in the area would likely increase traffic volumes, which would have an adverse impact on traffic congestion in the region, which could also direct more traffic to Moose-Wilson Road. The lack of traffic management strategies under the no-action alternative would contribute substantially to the overall effect traffic growth in the region has on traffic volumes and congestion within the corridor, which would adversely impact visitor use and experience.

When the effects of alternative B on visitor use and experience are added to these other past, present, and reasonably foreseeable effects, a notable, long-term, cumulative adverse effect would continue to occur. However, the incremental effect of alternative B, added to the adverse effects of these other actions in the area, would be modest.

Conclusion. Alternative B would result in both beneficial and adverse impacts on visitor use and experience, but overall, the actions proposed in this alternative would result in significant adverse impacts on visitor use and experience. The proposed action that would have the greatest adverse impact on visitor use and experience is the potential gate closure at the LSR Preserve. Realignment of sections of Moose-Wilson Road would have the most potential benefit to visitor use and experience.

The gate closure at the LSR Preserve during peak visitation times would reduce crowding and congestion throughout the corridor, providing some short-term benefits to visitor use and experience as a substantial portion of users wishing to use the corridor as a commuting route between Teton Village and Moose would instead use county roads. However, as visitation to the area and the corridor increases over time the gate would not directly manage the volume or timing of visitation within the corridor. The inability to drive from one end of the corridor in either direction at all times would cause substantial adverse impacts on visitor use and experience. Gate closures would greatly reduce the number of destinations visitors could realistically reach due to the need to travel to the opposite end of the corridor in to visit the other section they could not access first. Some visitors may need to add additional driving time to their itinerary, depending on what destinations within the corridor they are seeking. While the gate is open, visitors would be able to access all destinations within the corridor. Overall, the gate closure at the LSR Preserve would result in significant adverse impacts on visitor use and experience due to greatly reduced access.

Realigning segments of Moose-Wilson Road, including additional turnouts and paving the unpaved road segment, would reduce wildlife jams and chances of road closures due to grizzly bear presence on the road, improve visitor safety, and improve scenic viewing opportunities for many visitors, providing substantial beneficial long-term impacts for most visitors. Visitors would be able to experience the corridor in a relaxed and unhurried manner while being able to participate in activities that exemplify the uniqueness of the corridor such as scenic driving and wildlife viewing. However, the road realignments would also diminish wildlife viewing opportunities for those visitors who prize viewing wildlife close-up, adversely affecting these visitors. Overall, road realignments and associated road improvements would result in substantial beneficial impacts on visitor use and experience.

When the effects of alternative B on visitor use and experience are added to other past, present, and reasonably foreseeable effects, a notable long-term, cumulative adverse effect would occur. Alternative B would have an appreciable contribution to the overall cumulative effect.

ALTERNATIVE C (NPS PREFERRED)

Diversity and Quality of Visitor Experiences and Opportunities

Alternative C emphasizes the important conservation stories within the corridor and public use of the corridor is balanced with preservation. Management actions within the alternative aim to provide high-quality visitor opportunities while maintaining a high integrity of natural and cultural resources. As part of this effort, managing how and when visitors enter the corridor is part of this alternative. A timed entry, or sequencing system, would be implemented during peak use times to directly manage the volume and timing of visitors entering the corridor. Vehicles would queue after either the Granite Canyon Entrance Station or the Moose Entrance Station, which are part of this alternative. Beyond the entrance stations, a queuing station would indicate potential wait times if any are needed. Wait times would depend on how many visitors are in the corridor when a new visitor arrives.

A visitor capacity (see "Visitor Use Framework" section of chapter 2 and appendix A on the visitor capacity determination) has been identified for the corridor. This capacity quantifies the amount of visitation that can be accommodated in the corridor given desired conditions for visitor experiences and resources. The analysis for capacity of the corridor took into account the other management strategies being proposed in the plan that better facilitate visitation through the corridor (e.g., road turnouts, improved parking, road conditions) and address many of the current issues in the corridor (e.g., crowding, use conflicts, and resource impacts). Given desired conditions and these related management strategies, it was determined that current use levels could be accommodated and would serve as the maximum amounts of use (visitor capacity) for the corridor. For the purpose of implementing the timed entry strategy, the visitor capacity has been translated into vehicle use levels of 200 vehicles at one time. The sequencing system operates on a one in, one out basis. If a visitor arrives at a queuing station during high-use times of the day and the corridor is "full," that visitor would wait until another vehicle exits the corridor. Traffic counters would collect real-time data as visitors enter and exit the corridor. This information would be totaled and relayed to NPS staff at the queuing stations.

Wait times in this alternative would vary based on vehicle volumes. Projections indicate, based on visitation data and established visitor capacities (200 vehicles at one time, as described in appendix A), that wait intervals would not occur frequently with current visitation levels. If the system had been implemented during the 2013 season, a wait of any length would only occur for 20 to 25 days of the season—ranging from just a few minutes to about 20 minutes on the busiest days of the year. Average wait times on July 6, 2013, would have been 9 minutes and 26 seconds. As noted in the description of the alternatives, this strategy is part of an adaptive approach, and other strategies, such as a reservation system, may be implemented if wait times become excessive.

With traffic levels expected to increase throughout the county, frequency and length of queuing may increase over time. Projections indicate waits for 35 to 40 days of the season in 2020, and 50 to 60 days of the season by 2025. These waits are based on the assumption that traffic levels would increase with no change in visitation patterns due to the implementation of the timed sequencing system. It is likely that visitors who strictly use Moose-Wilson Road as a through-route to other destinations would choose alternate routes (44% of visitors surveyed in 2013 were through-commuters with no plan to stop in the corridor; see "Affected Environment: Traffic and Transportation" for more information).

As has been seen at the LSR Preserve, visitors tend to individually have preferences for how long they are willing to wait in a line before leaving the line and opting to come back at another time. Through future traffic monitoring, assumptions about future wait times will be tested and tracked. If visitation increases to the point that vehicles are queued for long distances and having to wait for extensive times, a reservation system would be implemented in place of the timed entry system. The details of implementing a reservation system would be determined in the future so that it reflects best available information, including monitoring data and lessons learned from the sequencing system. See alternative D in this section for a discussion of potential impacts of a reservation system within the corridor.

Adopting a sequencing system would limit the number of vehicles on the roadway during busy periods of the day, therefore enhancing the slow, rustic, relaxed driving experience of the corridor. Conflicts between commuters and visitors would be reduced due to a decreased number of vehicles on the road and less congestion. Access to all destinations in the corridor, as well as the ability to drive from one end to the other would be retained under this alternative. Prior knowledge of the sequencing system would not be required for visitors to enter the corridor. However, as patterns of wait times are seen and relayed to the public, some visitors may plan on visiting the corridor during a time when visitation levels are likely low and therefore no queuing would be occurring. The need to plan accordingly may slightly inconvenience some visitors while others may appreciate the ability to plan ahead.

The sequencing system would accommodate visitors no matter when they arrive at the corridor. During those times when visitation is high, some visitors may need to wait before entering the corridor. The queuing lanes that would be developed as part of this plan would allow visitors to turn around if they decide to go to another portion of the park or to surrounding areas rather than waiting. This may inconvenience some visitors who do not want to wait before entering the corridor. Information on potential wait times would be prominently displayed to visitors when queueing is occurring so that they can determine if they want to wait or come back at a different time. Because the number of vehicles entering the corridor would be managed through the sequencing system and based on the visitor capacity for the corridor visitation levels would remain at current levels. The sequencing system and other management strategies (e.g., road turnouts and improved parking) would result in visitor experiences at destinations and while scenic driving to be moderately less crowded and more aligned with the rustic character of the road. In addition, the opportunity for visitors to experience greater solitude while hiking would be improved as trail densities would be kept at appropriate levels. Parking availability in lots and turnouts would be much more likely when the sequencing system is in place (parking at the LSR Preserve would continue to be full during peak use periods). This would benefit visitors as the likelihood of being able to reach intended destinations would be improved. However, the need to wait during high-use periods at the LSR Preserve could frustrate some visitors as they may have to wait before entering the corridor and then again wait at the LSR Preserve. Visitors who do not want to wait would need to come back to the corridor at a different time of day.

Under alternative C, the road segment between Sawmill Ponds Overlook and Death Canyon Road junction would be retained in its existing alignment with improvements to portions of the road adjacent to wetlands. Wildlife viewing in proximity to the road would continue under this alternative with the addition of wildlife safety mitigation such as vegetation setbacks so that drivers and wildlife are aware of one another sooner. Additional turnouts and improvements to existing parking areas would improve visitor experience by reducing congestion along the road and supporting a leisurely driving or bicycling experience. Turnouts would improve visitor opportunities to view wildlife and scenery. The ability to leave the road and possibly get out of a vehicle was expressed as a desire by many individuals during public comment periods. Additional turnouts would also provide beneficial impacts on the quality of visitor experience by reducing visitor conflict along Moose-Wilson Road (please see “Providing Safe Visitor Opportunities” below for more detail). Visitor opportunities to view wildlife and fall colors close-up would be retained within this alternative as the road traverses prime wildlife habitat and dense vegetation. For visitors who prize the opportunity to view wildlife and fall colors, improvements to the road in its current alignment would improve their experience.

Bicycles and motor vehicles would continue to share the road in alternative C. The addition of small sections of pavement would serve to join existing multiuse pathways and Moose-Wilson Road. In addition, signs indicating where nonmotorized users would be transitioning to the road would be added. These actions serve to improve how bicyclists transition from the existing multiuse pathways to Moose-Wilson Road and would enhance both the cyclists' and motor vehicle drivers' experiences as knowledge of how to share the road would be improved. During seasonal periods when the road is closed to motor vehicles, but free of ice and snow, bicyclists would be able to ride the corridor. A more facilitated bicycling experience in the corridor would beneficially impact bicycle use in the corridor (see "Providing Safe Visitor Opportunities" for a discussion on perceived and real safety).

Commercial use in the corridor would continue under alternative C with a set number of road-based tours. Tours would include a variety of interpretive topics and could include learning-focused commercial activities such as photography workshops. Visitors who wish to travel in the corridor on an organized tour would have an enhanced experience of resource diversity and cultural history of the corridor whether on horseback, driving, skiing, or snowshoeing tour. By basing the number and size of tours on current use levels, visitors utilizing a tour would experience the corridor in an uncrowded manner while also obtaining the guided experience they desire. For visitors not on commercial tours, a set number and size of tours would ensure that they are not competing with large tour vehicles and groups for parking or recreational opportunities. Taxis and all other nonpark-dependent commercial traffic would be prohibited in the corridor, therefore decreasing visitor conflict on the road and adding to the slow paced setting. However, this may limit a small number of visitors that rely on a taxi ride as their transportation to visit the corridor. By managing the type and amount of commercial use in the corridor, the diversity and quality of visitor experiences and opportunities would be improved under this alternative.

Under alternative C, the Death Canyon Trailhead would be relocated and improved to an 80 to 90 vehicle parking area where White Grass Road and Death Canyon Road currently split (approximately 1.0 mile to the south). Visitors would travel a short distance up Death Canyon Road to the new parking area. The 1.0 mile section of road that goes to the current trailhead would be reclaimed and converted to a trail. By relocating and improving the parking area, visitors without four-wheel-drive vehicles would easily be able to reach the new trailhead. In addition, the new parking area would clearly indicate where parking is permissible, therefore decreasing confusion and anxiety concerning parking and trailhead access. Currently, the Death Canyon Trailhead parking area can accommodate approximately 25 vehicles, but excess demand for parking results in an average of 67 additional vehicles parked alongside the road during peak times for a total of 82 vehicles. The improved parking space would therefore generally accommodate the current levels of use seen at the trailhead. Another potential impact of relocating the Death Canyon Trailhead is changes in how visitors access and use nearby trails around Sky Ranch and White Grass Ranch. The parking lot's new location would slightly increase the distance a visitor would have to hike to access these trail systems. This would result in a slight adverse impact to some visitors and a moderate beneficial impact to others since the sound and sights of vehicles in the area would be substantially reduced with the new parking lot location away from the White Grass Dude Ranch Historic District.

For some visitors, the additional 1.0 mile of trail created in this alternative would provide a desirable trail experience that offers views of the historic White Grass Dude Ranch District. For others, the need to hike an additional mile each way could diminish their experience by increasing the length of their intended hike, including popular hikes to Phelps Lake, which begin at the current trailhead. In addition, some visitors may choose to park at the LSR Preserve rather than the Death Canyon Trailhead to then hike to the Phelps Lake area, thereby somewhat increasing demand for parking at the LSR Preserve. The Preserve and Phelps Lake were most frequently listed as anticipated destinations in the corridor (Newman 2015).

The removal of redundant horse trails in the northern section of the corridor would beneficially impact some users as navigability would be easier with fewer trails. For others, a reduction of trails would negatively impact the equestrian experience as trail opportunities become more limited. Horse trailers would no longer be able to park at Granite Canyon under this alternative, therefore making it less convenient for some equestrians to use a portion of the corridor. This would be a small adverse impact due to the low frequency in which these locations are currently used for horse trailer parking.

As actions under this alternative that require construction are implemented, visitor experience would be temporarily impacted. Construction would occur over three to four seasons for all action alternatives. During these seasons, visitors would have various levels of access to the corridor. For details on construction phases please see the "Park Operations" section of this chapter. During the first phase, visitors would not be able to access the corridor from the Moose Entrance. Visitors would not be able to access Sawmill Ponds Overlook or the portion of Moose-Wilson Road between Teton Park Road and the junction of Death Canyon Road. The inability to view wildlife and vegetation along this portion of the road at this time would negatively impact visitor experiences. During the second phase, the Death Canyon Trailhead would not be accessible to visitors. During all phases efforts would be made to keep the LSR Preserve open to the extent possible, however temporary closures may occur. While visitors could continue to access the associated trails from other trailheads, particularly the Laurance S. Rockefeller Preserve, visitors would have to hike additional lengths of trails to do so. This would negatively impact visitors, particularly those for whom long-distance hiking is difficult and who specifically seek out this trailhead to reach wilderness from a short distance. During the third phase, visitors would not be able to access the corridor from the Granite Canyon Entrance. Access to the Granite Canyon Trailhead would not be possible during this phase. While associated trails could be accessed from the Laurance S. Rockefeller Preserve, the need to add additional miles of hiking to reach the trails near Granite Canyon Trailhead would cause negative impacts on some visitors. All of the impacts on visitor access and opportunities to experience the corridor would be isolated to each phase's extent and to one season. A fourth phase would occur during or after these phases but construction would not hamper visitor abilities to access the corridor.

Opportunities for Orientation, Education, and Interpretation

Under alternative C, traveler alerts provided before entrances would allow visitors to effectively plan their trip. These alerts would inform visitors of potential traffic congestion, full parking lots, and allow visitors the opportunity and knowledge to choose an alternate route before entering the corridor at peak visitation times. Through the use of pre-visit information, such as the park newspaper and electronic media such as the park website or a Grand Teton National Park or Moose-Wilson corridor-specific app with interpretive and educational information about the natural and cultural resources of the corridor, visitors would gain a sense of arrival to a unique and protected area. According to 2014 visitor surveys conducted by Pennsylvania State University, the majority of visitors for all user groups stated the amount of information provided by the park to properly prepare them for a visit to the area was "Not a Problem" (Newman et al. 2015). These types of interpretive information management tools would result in beneficial impacts on visitors' understanding of the Moose-Wilson corridor.

In this alternative, a sense of discovery would predominate, and very few physical interpretive signs and kiosks would be installed on the landscape. Small low lying panels would be placed at strategic turnouts and overlooks and would follow design guidelines for the corridor to create a unified visitor experience throughout the corridor. In the 2014 visitor surveys, the majority of visitors for all user groups reported the number of signs describing areas of interest along the road was "Not a Problem." The majority of visitors, those in vehicles, hikers, and cyclists, also stated the number of signs with information about the natural and cultural history of the area was "Not a Problem" (Newman et al.2015). Updating old interpretive panels and the addition of a few new ones in highly used visitor locations would result in beneficial impacts on opportunities for visitors to understand the important resources and stories of the Moose-Wilson corridor while still allowing a sense of self-discovery.

Under this alternative, informative tools and signs would be created to facilitate the transition for cyclists from the existing multiuse pathways on the south and north ends of the corridor to Moose-Wilson Road. This could include something like a gateway kiosk or gathering areas for cyclists departing the existing multiuse pathways. These kiosks or gathering areas would contain information to prepare cyclists for the bicycling experience on Moose-Wilson Road and how it may be different than the cycling experience on existing multiuse pathways. Kiosks could contain panels about sharing the narrow road with traffic, the corridors natural and cultural resources, being bear and moose aware, and could contain route suggestions for cyclists that may not feel comfortable riding through the corridor.

In addition to informative tools and signs to facilitate the transition for cyclists from the existing multiuse pathways on the south and north ends of the corridor to Moose-Wilson Road, road markings, such as "sharrows," would be used to alert motorists to the presence of cyclists (see figure 43). Share the road signs would also be made for motorists to facilitate the safety and transition of cyclists from the existing multiuse pathways on the south and north ends of the corridor to Moose-Wilson Road. During the 2014 visitor surveys, the majority of cyclists (62.5%) stated the level of safety for vehicles, pedestrians, and bicyclists traveling the roadway at the same time was a problem, while 23.9% of participants in vehicles, and 20.8% of hikers reported it to be a "Problem" (Newman et al. 2015). These types of informative tools and markings would result in beneficial impacts on visitors' understanding of how to share the important resources of the Moose-Wilson corridor safely with other visitors.

Providing Safe Visitor Opportunities

This alternative proposes to reduce the speed limit on Moose-Wilson Road, which would improve real and perceived safety for roadway users, especially cyclists and pedestrians. For example, although there are few accidents between motorists along the road (3.8 crashes per year on average) and between motorists and bicyclists (less than one per year, and more than one every five years), during public scoping many people said they do not feel safe while using the road (FHWA 2014). Lowering the speed limit would result in beneficial impacts on visitor safety, both real and perceived, though 100% compliance with the speed limit is not likely.

Under alternative C, the existing unpaved portion of Moose-Wilson Road would be reconstructed and paved. "Safety edges" would be incorporated into the entire paved portion of the road to increase safety for bicyclists and motorists (see figure 44). Safety edges would be beneficial by improving the edge of the pavement and enabling motorists and bicyclists to safely return to the road once they have left the pavement. These features would result in greater safety for cyclists when riding near the edge of the pavement. Paving the road would improve perceived and real safety threats for many motorists and cyclists by eliminating the need to navigate potholes and washboards road sections. Road surface improvements result in beneficial impacts on visitor safety by allowing motorists and cyclists more time to focus on each other rather than on road surface distractions. However, some visitors feel paving diminishes the rustic character and experience of the road and would decrease safety by encouraging higher speeds. For these visitors, paving may cause adverse impacts on their perceived level of safety.

In addition to the general park entrance station, a queuing station would be constructed on the north end of Moose-Wilson Road under this alternative. This station would include interpretive information about the corridor, a turnaround area, and traffic sequencing system lanes. Contact with park staff at an entrance station, along with interpretive information at the dedicated corridor station, would prepare motorists for the unique driving conditions in the corridor, orient motorists to their location, offer opportunities for dissemination of informative materials, and thereby decrease visitor confusion and improve visitor safety. Relocation of the park entrance station would also slightly minimize the number of motorists with oversized vehicles in the corridor by increasing direct contact with park staff during entrance station open hours. For reference, see the alternative C map, which shows the road realignment and relocation of the entrance station.

Cyclists traveling west along the existing multiuse pathway adjacent to Teton Park Road from Hwy 26/89/191 would also pass through the relocated entrance station and could receive useful information about the Moose-Wilson corridor and the park. Informative tools and signs would be created to facilitate the transition for cyclists from the existing multiuse pathway to Moose-Wilson Road. Please see the previous section “Opportunities for Orientation, Education, and Interpretation” (alternative C) for more detailed information on the potential impacts of these proposed actions.

Drainage correction issues would slightly improve traffic flow and congestion issues. Mitigation measures, such as vegetation setbacks, would be implemented to improve visibility. Other management techniques would be used to improve wildlife and visitor safety such as increased use of park staff and volunteers during increased wildlife use periods (September–October) and a continued use of temporary road closures due to the presence of grizzly bears. These road modifications, mitigation measures, and management techniques would result in slight beneficial impacts on visitor safety by improving traffic flow, reducing congestion, improving visibility, and educating visitors on appropriate behavior around wildlife.

However, under alternative C, congestion and conflicts would continue between visitors, particularly during increased wildlife use periods along the Sawmill Ponds area, because this is the most common place to encounter wildlife in the corridor. Park staff and volunteers reported 84 wildlife jams within the corridor in the summer of 2013, which lasted anywhere from 15 minutes to more than two hours (Monz, D’Antonio, and Heaslip 2014a). Since many visitors often stop in the middle of the road to view wildlife up close, maintaining the current road realignment in this alternative would lead to continued vehicle congestion and visitor conflict. Temporary closures due to the presence of grizzly bears would continue to have both a beneficial impact on visitor safety and an adverse impact on visitor use and experience because visitors would be unable to experience the road during these closures.

Installation of officially designated turnouts that would accommodate up to 120 vehicles (similar to the current parking demand) would alleviate road congestion and reduce visitor conflict. Additional turnouts would improve traffic flow by providing a place for slower drivers, or those wishing to view wildlife or vistas, to move out of the way of other traffic. During public comment periods, many commenters suggested a lack of turnouts and parking areas for wildlife viewing were a major source of congestion because wildlife viewers stop in the middle of the road to watch and photograph the animals. Others believed efforts should be made to further protect wildlife in the corridor by adding turnouts and parking, educating visitors on safe distances from wildlife, and continued traffic control. Reducing vehicle congestion on the road would also improve safety for cyclists. In combination with road realignment, proposed turnouts would allow visitors to view wildlife from a safe distance, but without making it difficult for other motorists, law enforcement, emergency response teams, and cyclists to safely use the roadway. By reducing congestion and increasing safety, visitor conflicts associated with wildlife traffic jams would also decrease, thereby providing beneficial impacts on visitor safety and overall visitor experience within the corridor.

Under alternative C, visitors would continue to have the opportunity to travel the road by bicycle but would share the road with motor vehicles. Bicyclists' level of perceived safety would continue to vary, consistent with their own skills, abilities, and experience. During public comment periods, people expressed concerns over safety risks along the corridor. Unsafe driver behavior noted by some commenters included aggressive driving, distracted driving, and speeding. When coupled with limited sight lines along the narrow, winding corridor, both motorized and nonmotorized users feel unsafe. Many commenters cited conflicts with incompatible users such as slowed or stopped tourists versus speeding commuters and commercial users, motorized vs. nonmotorized users, and visitor-wildlife interactions as another cause of safety concerns. According to 2014 visitor surveys, the majority of cyclists (62.5%) stated the level of safety for vehicles, pedestrians, and bicyclists to travel the roadway at the same time was a "problem" (Newman et al. 2015). Bicyclists' level of real safety would continue to vary based on many variables, including but not limited to, traffic levels and speeds, road and weather conditions, personal comfort with sharing the road with vehicles, and wildlife movements and sightings along the road. The road speed reduction, road realignment, paving changes, additional turnouts, and "safety edges" proposed under this alternative would result in beneficial impacts on a cyclist's level of perceived or real safety; however, this would continue to vary on an individual basis.

Cumulative Impacts. Several past actions related to the southwest entrance facilities (Environmental Assessment 1998) have, and continue to, beneficially affect visitor use and experience in the project area with the addition of the Granite Canyon Entrance Station. This entrance station offers visitors entering from the south some level of orientation, education, and interpretation to the corridor during operating hours.

The actions contained in several present and reasonably foreseeable future plans call for the expansion of the existing pathway system, including the *Jackson/Teton County Comprehensive Plan*, the *Jackson Hole Community Pathways Master Plan*, and the *Grand Teton National Park Transportation Plan*. These networks provide more opportunities for cyclists and pedestrians and enhance the experience for many cyclists, which could attract more cyclists to the region. Additionally, the *Amended Teton Village Expansion Resort Master Plan, PUD* (Snake River Associates 2013) calls for 380 new dwelling units south of Teton Village. These units would consist of condominiums, townhouses, affordable housing, and employee housing. Increasing the number and volume of new residents in the area would likely increase traffic volumes, which would have an adverse impact on traffic congestion in the region, which could also direct more traffic to Moose-Wilson Road. The lack of traffic management strategies under the no-action alternative would contribute substantially to the overall effect traffic growth in the region has on traffic volumes and congestion within the corridor, which would adversely impact visitor use and experience.

When the effects of alternative C on visitor use and experience are added to these other past, present, and reasonably foreseeable effects, a notable, long-term, cumulative adverse effect would continue to occur. However, the incremental effect of alternative C, added to the adverse effects of these other actions in the area, would be moderate.

Conclusion. Alternative C would result in both beneficial and adverse impacts on visitor use and experience, but overall, the actions proposed in this alternative would result in substantial beneficial impacts on visitor use and experience. This alternative would increase the types of opportunities available for visitors within the corridor while maintaining current average peak visitation levels. The proposed actions that would have the largest beneficial impacts on visitor use and experience are the proposed sequenced entry system and road improvements.

By managing use levels over time through a sequenced entry system, visitors who enter the corridor would have the opportunity to experience the corridor in an uncongested and relaxed manner compared to average current peak levels. By managing the amount and timing of visitor use in the corridor and implementing other strategies in the alternative that intend to keep crowding and congestion relatively stable over the long term, visitors would be able to reach their intended destinations in the corridor as they would not need to compete for parking spaces and room on the road. Visitors would not need to plan ahead to use the sequenced entry system, but some visitors may plan on visiting the corridor during a time when visitation levels are likely low to avoid waiting in line. Visitors would experience some adverse impacts from the sequencing system because the need to wait during high-use periods could frustrate some visitors and may deter some from visiting the corridor. Over the long term, a sequenced entry system would result in substantial benefit to visitor use and experience by keeping crowding and congestion relatively stable within the corridor.

Proposed road improvements, including paving the unpaved road segment, correcting drainage issues, vegetation setbacks, and adding turnouts, would reduce congestion and visitor conflict by improving traffic flow and increasing visibility for drivers. Increased use of park staff and volunteers would also help improve traffic flow around wildlife jams by controlling and directing traffic and increasing visitor education on appropriate behavior around wildlife. Overall, these actions may result in slight beneficial impacts on visitor use and experience by improving traffic flow compared to current conditions.

When the effects of alternative C on visitor use and experience are added to other past, present, and reasonably foreseeable effects, an appreciable long-term, cumulative adverse effect would occur. Alternative C would have a noticeable contribution to the overall cumulative effect.

ALTERNATIVE D

Diversity and Quality of Visitor Experiences and Opportunities

Alternative D emphasizes the Moose-Wilson corridor as part of the larger Grand Teton National Park experience and intends to connect this area to broader regional recreational networks. Management actions within the alternative would connect people with the important resources and stories of the corridor by providing quality visitor opportunities. As part of this effort, managing how and when visitors enter the corridor is part of this alternative. A reservation system would be implemented as part of alternative D to directly manage the volume and timing of visitors entering the corridor. The number and timing of reservations would be based on the visitor capacity determination (see "Visitor Use Framework" in chapter 2 and "Visitor Capacity Determination" in appendix A) and would be implemented during peak use periods. The analysis for capacity of the corridor took into account the other management strategies being proposed in the plan that better facilitate visitation through the corridor (e.g., road turnouts, improved parking, road conditions) and address many of the current issues in the corridor (e.g., crowding, use conflicts, and resource impacts). Given desired conditions and these related management strategies, it was determined that current use levels could be accommodated and would serve as the maximum amounts of use (visitor capacity) for the corridor. Adopting a reservation system would limit the number of vehicles on the roadway during busy times therefore enhancing the slow, rustic, relaxed driving experience. Conflicts between commuters and visitors would be reduced due to a decreased number of vehicles on the road and less congestion. Access to all destinations in the corridor, as well as the ability to drive from one end to the other, would be retained under this alternative.

The reservation system would include a limited number of reservations to be used on a first-come, first-served basis. The possibility therefore would exist to visit the corridor without a preheld reservation for those who did not know they needed one, were not able to make one, or who did not plan on visiting the corridor initially. Some visitors may need to visit the corridor earlier or later in the day than they otherwise would have planned on due to availability of reservations. This may inconvenience some visitors who are not able to get a reservation at the exact time they would like. Because the number of vehicles entering the corridor would be managed through the reservation system and based on visitor capacity for the corridor, visitation levels would remain at current levels. The reservation system and other management strategies (e.g., roadside turnouts and improved parking) would result in visitor experiences at destinations and scenic driving would be moderately less crowded and more aligned with the rustic character of the road. In addition, the opportunity for visitors to experience greater solitude while hiking would be improved as trail densities would be kept at appropriate levels. Parking availability would be more likely when the reservation system would be in place (parking at the LSR Preserve would continue to be at capacity during peak use periods). This would benefit visitors as the likelihood of being able to reach intended destinations would be improved. However, the need to conduct more detailed trip planning before arriving in the corridor could frustrate some visitors. Visitors who do not have a reservation may feel limited in their ability to experience the corridor. This would result in the loss of spontaneity while visiting the corridor as the freedom to visit at one's discretion would not be possible for all visitors during periods of time when the reservation system is required. If some visitors are not able to obtain a reservation during their visit to the park and cannot be accommodated on a first-come, first-served basis, adverse impacts would result as those visitors may not be able to experience the corridor or its key destinations at the time they would like. However, this would occur only if visitation levels drastically increase in the future. Unless visitors could not come back to the corridor at a different time during their visit, it is unlikely that they would not be able to enter the corridor during nonpeak periods of the day such as mornings or evenings.

Under alternative D, realigning the road segment between Sawmill Ponds Overlook and the Death Canyon Road junction would affect two of the most popular activities in the corridor—viewing wildlife and scenic vistas. Wildlife viewing would continue from parking areas and turnouts along the realigned road, but from a farther distance. For visitors who enjoy viewing scenic vistas, road realignment would provide beneficial impacts as scenic views of riparian areas and the Teton Range would be visible. Under this alternative, two new roadside parking areas for 10 to 12 vehicles and additional turnouts would be added along the realigned road. Wildlife and scenic viewing areas would be available at the two new parking areas and would provide visitors with a comparable and safer experience (please see “Providing Safe Visitor Opportunities” below for more detail). For visitors who prize the opportunity to view wildlife and fall colors close-up, road realignment under alternative D would cause slightly adverse impacts on the quality of the visitor experience as the road is realigned away from prime wildlife habitat and dense vegetation.

Additional turnouts and improvements to existing parking areas would improve visitor experience by reducing congestion along the road and supporting a leisurely driving or bicycling experience along the road. Turnouts would improve visitor opportunities to view wildlife and scenery. The ability to leave the road and possibly get out of a vehicle would greatly improve the diversity and quality of visitor experience and opportunities in the corridor by increasing the ways visitors can experience the corridor. Additional turnouts would also provide beneficial impacts on the quality of visitor experience by reducing visitor conflict along Moose-Wilson Road (please see “Providing Safe Visitor Opportunities” below for more detail).

The addition of a multiuse pathway under alternative D would provide an additional visitor experience in the corridor. Visitors using the multiuse pathway would have the opportunity for viewing wildlife, vegetation, and scenic views within the corridor in a slow-paced and self-paced manner, therefore benefiting their overall experience. Bicyclists and other nonmotorized road users who may not be comfortable riding with vehicular traffic (i.e., families with small children and roller bladers) would particularly enjoy and benefit from the separated multiuse pathway. Safety for motorized and nonmotorized users alike would be improved in some ways but decreased in others. (See “Providing Safe Visitor Opportunities” for a discussion on perceived and real safety and proximity to wildlife.) The LSR Preserve is managed to accommodate a specific amount of visitation. The addition of a multiuse pathway could increase the volume of visitors who want to access the LSR Preserve. Nonmotorized users, such as bicyclists, would be managed in a similar manner as motorists and would need to leave their bicycles at designated areas within the parking lot and would not be permitted to enter the LSR from trails intersecting with Moose-Wilson Road. This would result in increased lines and wait times for entry to the LSR Preserve as both bicyclists and vehicles wait to “park.” For some visitors, this would cause frustration and adversely impact their experience.

Development of a multiuse pathway in the Moose-Wilson corridor could also adversely impact the experience for some motorized users or visitors using equestrian trails near the roadway by altering the character of the corridor. In areas where it is necessary to construct the pathway in proximity to the existing road to accommodate topography, natural or cultural resource concerns, or to provide sight distances consistent with minimizing the potential for surprise encounters with grizzly bears and other wildlife, the width of the corridor would be substantially increased. This would diminish the intimate experience that currently characterizes travel along Moose-Wilson Road, providing a different experience from what currently exists. Such a change in the corridor could diminish the quality of the experience relative to the existing conditions. This would be especially true in areas of dense forest.

Commercial use in the corridor would continue under alternative D, with a limited number of road-based tours. Tours could focus on a broad array of interpretive topics and would be accommodated within the reservation system. By basing the number and size of tours on current use levels, visitors utilizing a tour would experience the corridor in an uncrowded manner while also obtaining the guided experience they desire. For visitors not on commercial tours, a set number and size of tours would ensure that they are not competing with large tour vehicles and groups for parking or recreational opportunities. The ability to experience a tour that covers a variety of interpretive topics would increase a visitor's understanding and therefore experience of the corridor whether on a horseback, driving, skiing, or snowshoeing tour. Taxis would be allowed to provide transportation service in the corridor with appropriate permits, therefore allowing visitors without vehicles the opportunity to experience a scenic drive through the corridor. By prohibiting all other nonpark-dependent commercial traffic, visitor conflict on the road would be decreased and the slow and relaxed driving experience would be enhanced. The need to acquire appropriate permits via the reservation system would frustrate and negatively impact taxi drivers. By managing the type and amount of commercial use in the corridor, the diversity and quality of visitor experience and opportunities is improved under this alternative.

Under alternative D, the Death Canyon Trailhead parking area would be reconfigured and expanded in its current location. The expanded parking area would be built to accommodate 100 vehicles, thus increasing the number of visitors who can enjoy the Death Canyon area and the White Grass Dude Ranch Historic District. Currently, the Death Canyon Trailhead parking area has 25 designated parking spaces, but an average, 62 additional vehicles park at the trailhead during peak times resulting in approximately 90 vehicles being parked in this area at one time. As visitors would travel the single-lane White Grass Road, turnouts for passing and improved gravel surface would facilitate access for a wide range of visitors because the rough and narrow road conditions would be greatly reduced. In addition, the new parking area would clearly indicate where parking is permissible, thus decreasing confusion and anxiety concerning parking and trailhead accessibility. The decommission and revegetation of Death Canyon Road would increase the amount of natural vegetation visible along White Grass Road, therefore improving the visitor experience along the road. By improving conditions and parking availability in Death Canyon, visitor experience and opportunities would be beneficially impacted as the area would be accessible to visitors without four-wheel-drive vehicles. A marginally higher number of parking spaces than is currently used near the trailhead would allow slightly higher levels of use to occur on the associated trails system. This slight increase in visitor use could add to visitor-caused resource damage such as visitor-created social trails and vegetation trampling as well as instances of crowding at the trailhead and along trails.

The removal of redundant horse trails in the northern section of the corridor would beneficially impact some users as navigability would be easier with fewer trails. For others, a reduction of trails would negatively impact the equestrian experience as opportunities for different trail experiences lessen. Horse trailer parking would continue at currently allowed locations.

As actions under this alternative that require construction are implemented, visitor experience would be temporarily impacted. Construction would occur over three to four seasons for all action alternatives. During these seasons, visitors would have various levels of access to the corridor. For details on construction phase please see the "Park Operations" section of this chapter. During the first phase, visitors would not be able to access the corridor from the Moose Entrance. Visitors would not be able to access Sawmill Ponds Overlook or the portion of Moose-Wilson Road between Teton Park Road and the junction of Death Canyon Road. The inability to view wildlife and vegetation along this portion of the road at this time would negatively impact visitor experiences. During the second phase, the Death Canyon Trailhead would not be accessible to visitors. While visitors could continue to access the associated trails from other trailheads, particularly the Laurance S.

Rockefeller Preserve, visitors would have to hike additional trails to do so. This would negatively impact visitors, particularly those for whom long-distance hiking is difficult and who specifically seek out this trailhead to reach wilderness from a short distance. During the third phase, visitors would not be able to access the corridor from the Moose Entrance. Access to the Granite Canyon Trailhead would not be possible during this phase. While associated trails could be accessed from the Laurance S. Rockefeller Preserve, the need to add additional miles of hiking to reach the trails near Granite Canyon Trailhead would cause negative impacts on some visitors. All of the impacts on visitor access and opportunities to experience the corridor would be isolated to each phase's extent and to one season. A fourth phase would occur during or after these phases but construction would not hamper visitor's abilities to access the corridor.

Opportunities for Orientation, Education, and Interpretation

Alternative D would emphasize strategies to enhance the recreational scenic driving experience and reduce traffic congestion. Traveler alerts, provided before entrances, would allow visitors to effectively trip plan. These alerts would inform visitors of potential traffic congestion, full parking lots, and offer visitors the opportunity and knowledge to choose an alternate route before entering the corridor at peak visitation times. Through the use of pre-visit information, such as the park newspaper and electronic media, such as the park website, or a Grand Teton National Park or Moose-Wilson corridor specific app with interpretive and educational information about the natural and cultural resources of the corridor, visitors would gain a sense of arrival to a unique and protected area. According to 2014 visitor surveys conducted by Pennsylvania State University, the majority of visitors from all user groups stated the amount of information provided by the park to properly prepare them for a visit to the area was "Not a Problem" (Newman et al.2015). These types of interpretive information management tools would result in beneficial impacts on visitors' understanding of the Moose-Wilson corridor.

Under alternative D, the Death Canyon Trailhead parking area and access road via White Grass Ranch would be improved and expanded. More visitors would be able to find parking at the Death Canyon Trailhead and walk to White Grass Ranch or drive to the ranch directly. Improved access would allow more visitors the opportunity to view the White Grass Dude Ranch Historic District and read interpretive panels there. This would result in beneficial impacts on visitors' understanding of White Grass Dude Ranch Historic District contributions to the history of the corridor and the Jackson Valley. For visitors who would rather experience the White Grass Dude Ranch Historic District with fewer fellow visitors, the additional access offered by the larger parking area would slightly diminish their experience.

Under this alternative, informative tools and signs would be created to orient cyclists to the Moose-Wilson corridor as they transition from the existing multiuse pathways on the south and north ends of the corridor to the Moose-Wilson multiuse pathway. These signs could include something like a gateway kiosk or gathering areas for cyclists. These kiosks or gathering areas would contain information about the corridors' natural and cultural resources and to being aware of the presence of bear and moose.

In addition to informative tools and signs to orient cyclists to the corridor, a few signs would advise motorists to facilitate the safety of cyclists who still choose to use the road, and those that may cross the road in certain places. These types of informative tools and markings would result in beneficial impacts on visitors' understanding of how to share the important resources of the Moose-Wilson corridor safely with other visitors.

Providing Safe Visitor Opportunities

Under alternative D, the unpaved section of the road would remain unpaved and would be graded and treated for dust abatement several times per year. Grading and dust abatement would maintain current roadway conditions for motorists and cyclists, continuing to result in slight beneficial impacts on visitor safety.

In addition to this general park entrance station, a new queuing station would be constructed on the north end of Moose-Wilson Road, under alternative D. This station would include an information kiosk, a turnaround area, and a reservation system for use during peak periods. Contact with park staff at an entrance station, along with information at the dedicated corridor station, would prepare motorists for the unique driving conditions in the corridor, orient motorists to their location, offer opportunities for dissemination of informative materials, and thereby decrease visitor confusion and improve visitor safety. Relocation of the park entrance station would also slightly minimize the number of drivers in the corridor with oversized vehicles by providing direct park staff contact with motorists during entrance station open hours.

Cyclists traveling west along the existing multiuse pathway adjacent to Teton Park Road from Hwy 26/89/191 would pass the relocated entrance station and could receive useful information about the Moose-Wilson corridor and the park. Informative tools and signs would be created to orient cyclists to the Moose-Wilson corridor as they transition from the existing multiuse pathway to the Moose-Wilson multiuse pathway. Please see the previous section "Opportunities for Orientation, Education, and Interpretation" (alternative D) for more detailed information on potential impacts of these proposed actions.

Under alternative D, realigning the road segment between Sawmill Ponds Overlook and the Death Canyon Road junction would reduce vehicular congestion, visitor conflicts, and undesirable human-wildlife encounters due to repositioning the road east of prime wildlife habitat. Road realignment would lessen the likelihood of temporary road closures due to the presence of grizzly bears because the road would no longer bisect prime grizzly bear habitat. Visitors would therefore be able to experience the corridor with minimal interruption. During public comment periods, people suggested that wildlife viewing is a major cause for congestion along the corridor. Others believed efforts should be made to further protect wildlife in the corridor by adding turnouts and parking, educating visitors on safe distances from wildlife, and continued traffic control. The addition of two viewing areas with spaces for 10 to 12 cars along this realigned road segment and some designated turnouts would allow visitors opportunities to safely view wildlife (generally road realignment of this segment would offer wildlife viewing at distances greater than the park standard of 100 yards for bears and wolves) and appreciate vistas from distances slightly farther than currently provided. According to 2014 visitor surveys, the majority of visitors thought other visitors getting too close to wildlife was "not a problem" and thought the majority of visitors view wildlife from a safe distance (Newman et al. 2015). Interpretive materials, such as low lying interpretive signs, would be added to these viewing areas to enhance visitors' experiences and understanding of the important resources and stories of the Moose-Wilson corridor and/or educate them on visitor safety such as appropriate behavior around wildlife. Some visitors prize the opportunity to view wildlife close-up and may be disappointed to have to view wildlife farther away due to the road realignment. Overall, the road realignment east of prime wildlife habitat, along with the addition of viewing areas and interpretive materials would result in beneficial impacts on visitor safety.

Installation of officially designated turnouts that would accommodate up to 120 vehicles (similar to the current parking demand) would alleviate road congestion and reduce visitor conflict. During public comment periods many commenters suggested a lack of turnouts and parking areas for wildlife viewing were a major source of congestion because wildlife viewers stop in the middle of the road to watch and photograph the animals. According to 2014 visitor surveys, 24.3% of drivers and 37.5% of cyclists that participated reported the "amount of room to adequately pull your vehicle off the road to view areas of interest," was a "Problem" (Newman et al. 2015). Additional turnouts would improve traffic flow by providing a place for slower drivers or those wishing to view wildlife or vistas to get out of the way of other traffic. Reducing vehicle congestion on the road would also improve safety for cyclists choosing to use the road. In combination with road realignment, proposed turnouts would allow visitors to view wildlife from a safe distance, but without making it difficult for other motorists, law enforcement, emergency response teams, and cyclists to safely use the roadway. By reducing congestion and increasing safety, visitor conflicts associated with wildlife traffic jams would also decrease, thereby providing beneficial impacts on visitor safety and overall visitor experience within the corridor.

Under alternative D, a multiuse pathway would be constructed parallel to Moose-Wilson Road between Moose and the Granite Canyon Entrance Station. Unsafe driver behavior noted by some commenters included aggressive driving, distracted driving, and speeding. When coupled with limited sight lines along the narrow, winding corridor, both motorized and nonmotorized users feel unsafe. Many commenters cited conflicts with incompatible users such as slowed or stopped tourists versus speeding commuters and commercial users and motorized versus nonmotorized users as another cause for safety concerns. Overall, a multiuse pathway would increase real and perceived safety for cyclists, pedestrians, and motorists due to the separation of nonmotorized travel from motor vehicles. According to 2014 visitor surveys, 60.0% of cyclists stated the availability of safe locations for bicycling within the corridor was a "Problem," while 23.7% of participants in vehicles and 14.3% of hikers reported it to be "Problem" (Newman et al. 2015). Visitor experiences would improve for both motorized and nonmotorized visitors as visitor conflicts decrease and opportunities to recreate increase as a result of this separation of use, thereby creating beneficial impacts on visitor safety.

Cyclists, pedestrians, and other recreationists could encounter wildlife along the multiuse pathway. These encounters would be extremely close to wildlife due to the topography, dense vegetation, and diverse prime wildlife habitat in the corridor. These encounters could offer some visitors with memorable and unique wildlife viewing experiences, but these encounters could also be dangerous, physically and emotionally, to the visitor. Cyclists and pedestrians are more likely to have close encounters (a distance less than 100 yards) with wildlife than motorists because they move more quietly than vehicles and generally in less developed areas. Cyclists generally move faster and quieter than pedestrians, especially on paved surfaces, and therefore are more likely to surprise an animal at a close distance. During public comment periods, some people stated visitor-wildlife interactions as a cause of safety concern. The multiuse pathway would be closed from sunset to sunrise daily when wildlife are most active and during wildlife-related temporary closures to protect visitor and wildlife safety. Overall, the addition of a multiuse pathway proposed under this alternative would result in beneficial impacts on perceived and real visitor safety for cyclist in regards to vehicle safety (this would continue to vary on an individual basis and experience); however undesirable encounters between cyclists and wildlife would likely increase resulting in adverse impacts for both cyclists and wildlife.

Cumulative Impacts. Several past actions related to the southwest entrance facilities (Environmental Assessment 1998) have, and continue to, beneficially affect visitor use and experience within the project area from the addition of the Granite Canyon Entrance Station. This entrance station provides visitors entering from the south some level of orientation, education, and interpretation to the corridor during operating hours.

The actions contained in several present and reasonably foreseeable future plans call for the expansion of the existing pathway system, including the *Jackson/Teton County Comprehensive Plan*, the *Jackson Hole Community Pathways Master Plan*, and the *Grand Teton National Park Transportation Plan.* These networks provide more opportunities for cyclists and pedestrians and enhance the experience for many cyclists, which could attract more cyclists to the region. Additionally, the *Amended Teton Village Expansion Resort Master Plan, PUD* (Snake River Associates 2013) calls for 380 new dwelling units south of Teton Village. These units would consist of condominiums, townhouses, affordable housing, and employee housing. Increasing the number and volume of new residents in the area would likely increase traffic volumes, which would have an adverse impact on traffic congestion in the region, which could also direct more traffic to Moose-Wilson Road. The lack of traffic management strategies under the no-action alternative would contribute substantially to the overall effect traffic growth in the region has on traffic volumes and congestion within the corridor, which would adversely impact visitor use and experience.

When the effects of alternative D on visitor use and experience are added to these other past, present, and reasonably foreseeable effects, a notable, long-term, cumulative adverse effect would continue to occur. However, the incremental effect of alternative D, added to the adverse effects of these other actions in the area, would be moderate.

Conclusion. Alternative D would result in both beneficial and adverse impacts on visitor use and experience, but overall, the actions proposed in this alternative would result in great benefit to visitor use and experience. This alternative would increase the types of opportunities available for visitors within the corridor while maintaining current average peak visitation levels.

The two proposed actions that would have the greatest potential long-term beneficial impacts on visitor use and experience are the addition of the multiuse pathway and a reservation system. The multiuse pathway would accommodate a wider variety of user types and skill levels therefore increasing the types of activities visitors could choose while in the corridor. The multiuse pathway would also improve real and perceived safety for cyclists, pedestrians, and drivers by separating bicyclists and pedestrians from vehicles on the narrow roadway and helping visitors feel more at ease and lowering the chance of vehicle-bicycle and vehicle-pedestrian collisions. However, the multiuse pathway would likely increase the potential for undesirable human-wildlife encounters. Encounters with grizzly bears are of particular concern, since cyclists and pedestrians would be nearer prime wildlife habitat than on the road and could easily surprise bears, given the quiet nature of the recreation activity. Although the magnitude of the increase in potential undesirable human-wildlife encounters is unknown, the loss of even one human life would be a substantial adverse impact. As with any activity, the potential for risk along the multiuse pathway exists and each visitor would have to assess their own comfort level and willingness to accept those risks. Overall, the multiuse pathway would result in substantial beneficial impacts on visitor use and experience.

By managing use levels over time through a reservation system, visitors who enter the corridor would have the opportunity to experience the corridor in an uncongested and relaxed manner compared to average current peak levels. By managing the amount and timing of visitor use in the corridor and implementing other strategies in the alternative that intend to keep crowding and congestion relatively stable over the long term, visitors would be able to reach their intended destinations within the corridor as they would not have to compete for parking spaces and room on the road. The need to make a reservation before entering the corridor would require substantial trip planning on behalf of visitors, which could frustrate some visitors and have an adverse impact on their experience. This adverse impact would not be significant because the impact would diminish over time as visitors become familiar with the reservation system and the need for trip planning. Over the long term, the reservation system would result in substantial beneficial impacts on visitor use and experience.

When the effects of alternative D on visitor use and experience are added to other past, present, and reasonably foreseeable effects, an appreciable, long-term, cumulative adverse effect would occur. Alternative D would have an appreciable contribution to the overall cumulative effect.

TRAFFIC AND TRANSPORTATION

METHODS AND ASSUMPTIONS FOR ANALYZING IMPACTS

This analysis discusses impacts on traffic and transportation in the Moose-Wilson corridor through the lens of five topics: vehicular access, traffic mix, traffic volumes, traffic safety conditions, and parking conditions. While each of these sections is included under each alternative, the level of detail varies because the level of impacts would vary. If there are no impacts or only slight impacts associated with certain actions, then they are not discussed here. The effects of the alternatives are analyzed based on anticipated results from changes to traffic management strategies, visitor use patterns, types of use, timing of use, changes in levels of development, and management actions associated with each alternative. The impacts of each alternative are determined by describing how each impact topic would change compared to existing conditions.

Because impacts on traffic and transportation are linked to visitor use patterns, types of use, and timing of use, this impact topic is closely tied to the "Visitor Use and Experience" impact topic. The "Traffic and Transportation" section focuses specifically on impacts on traffic flow and safety on the roadway, while the "Visitor Use and Experience" section discusses impacts that traffic flow and roadway safety have on the visitor. Complementary information is generally included in the "Visitor Use and Experience" section. Cross-references have been made in this chapter where appropriate.

In certain instances, this analysis is qualitative rather than quantitative. Impacts on traffic and transportation were determined considering best available information, and sometimes that information is more appropriate for qualitative analysis. The primary information that was considered in the analysis includes information on visitor use levels, visitor use patterns, types of use, and timing of use collected during this planning effort by various researchers and through interviews with park staff. Information on local and regional travel and tourism data, and development activities was also considered in the analysis.

Impacts were assessed assuming that mitigation measures would be implemented as part of the alternative management actions to minimize or avoid impacts. If the mitigation measures described in chapter 2 were not applied, the potential for adverse resource impacts and the magnitude of those impacts would increase. Additionally, all impacts are described considering the goals of the plan. For example, while disallowing through-traffic would impede the ability of vehicles to traverse the corridor, it would not necessarily impact traffic flow as considered under this impact topic because facilitating access from one end of the corridor to the other is not a goal of the plan. There would, however, be an impact if increasing traffic volumes and associated congestion prohibited visitors from reaching key corridor destinations.

ALTERNATIVE A (NO ACTION)

Vehicular Access

With the continuation of current management practices, there would only be minimal, if any, changes in vehicular access to destinations along or adjacent to the Moose-Wilson corridor. The same roadways in the region would continue to provide access to the corridor, and Granite Canyon Entrance Station would continue to monitor entry at the south end. The Moose Entrance Station on Teton Park Road would be replaced and relocated through separate compliance, but would still monitor entry into the northern portion of the park—not onto Moose-Wilson Road. While the corridor would see increases in visitation and vehicular traffic, months and hours of peak visitation would likely remain the same (see "Traffic Volumes" for more information on expected increases in vehicular traffic).

Although there are no major changes anticipated in terms of access, Teton County does predict significant growth in vehicle miles traveled for the county overall, as well as traffic increases along roadways that provide access to Moose-Wilson Road. Assuming no interventions to the transportation system or travel behaviors, countywide vehicle miles traveled is forecast to grow about 1.3% each year (14% and 29% increase by 2024 and 2035, respectively). The county anticipates an annual 1.4% increase along Highway 26/89/191 near the intersection with Gros Ventre Road and an annual 1.8% increase along WY 390 near Teton Village (Charlier n.d.). These projections indicate that while access routes would not change, they would likely become more congested over time, which can have implications for visitors that seek to drive to destinations along or adjacent to the Moose-Wilson corridor.

Traffic Mix

With no changes in management strategies, there would likely be no changes in traffic mix. Existing restrictions to vehicle size would remain in place, which would discourage/prohibit the use of larger trucks and vans. Although there would likely be increases in traffic due to growth in the Jackson Hole area, cars would continue to comprise the vast majority of all traffic within the corridor. Because of the proximity of Teton Village, it could also be expected that the park would continue to see more northbound traffic than southbound traffic from Moose. Because of increasing traffic and minimal improvements along the roadway, bicycle use would continue to be relatively low, as cyclists must share the road in this alternative. Horse trailer parking would continue to occur at existing parking areas, so this user group would likely comprise a similar proportion of all users as current conditions.

Traffic Volumes

As described in the "Affected Environment" chapter, studies completed in 2006, 2007, 2008, and 2013 indicate that there have been steady increases in average daily traffic over time (table 16; figure 36). This alternative would not provide any design enhancements that could accommodate anticipated traffic increases. The road would remain in its current alignment, which is an area of frequent wildlife jams. The current configuration of the road does not allow sufficient space for vehicles to pull off; future traffic increases would likely amplify congestion issues.

Traffic Safety Conditions

Traffic safety conditions in this alternative mainly concern interactions between different user groups. With an expanding pathway network throughout the county, there will likely be an increase in bicycle use within the corridor. With no change in bicycle management techniques proposed in this alternative, both bicycles and motor vehicles would continue to share the road, which could increase the potential for conflicts with anticipated future traffic increases. Additionally, though documented traffic and bicycle incidents are currently low, a negative public perception of safety exists due to the narrowness of the road and proximity of vehicles and bicycles. This perception would likely persist under this alternative (see "Affected Environment: Visitor Use and Experience" for more information on perceived visitor safety).

Parking Conditions

The current configuration of parking lots and turnouts regularly impedes traffic flow and creates congestion within the corridor. Changes to parking on a case-by-case basis, as is the current management approach, may address small issues as they arise, but anticipated future traffic increases would affect parking on a more comprehensive scale than could be addressed through an as-needed approach to parking management. User-created parking areas would continue to be used when designated lots are full or improperly parked, which has impacts on both roadside vegetation and traffic flow. This is particularly notable along Death Canyon Road and at the Death Canyon Trailhead as users often park inappropriately in nondesignated parking areas along the roadway (see "Parking Conditions" section in "Affected Environment" for more information on current parking conditions). Parking conditions at Death Canyon would likely become worse under this alternative because no strategies are being proposed to manage inappropriate parking in this or other areas. Additionally, the lack of sufficient turnouts along Moose-Wilson Road would continue to impede effective traffic movement, particularly during periods of peak visitation and/or wildlife jams.

Cumulative Impacts. As described above, several impacts may occur related to traffic flow and safety as a result of this alternative. There are also proposed future actions outside the corridor that may have adverse impacts on traffic flow and potentially safety. Several plans call for the expansion of the existing pathway system, including the *Jackson/Teton County Comprehensive Plan*, the *Jackson Hole Community Pathways Master Plan*, and the *Grand Teton National Park Transportation Plan*. The expansion of these networks could attract more bicyclists regionally, but could also direct more of these users onto an increasingly congested Moose-Wilson Road, which they must share with motor vehicles.

Additionally, the *Amended Teton Village Expansion Resort Master Plan, PUD* (Snake River Associates 2013) calls for 380 new dwelling units south of Teton Village. These units would consist of condominiums, townhouses, affordable housing, and employee housing. Increasing the number and volume of new residents in the area would likely increase traffic volumes, which would have an adverse impact on traffic congestion in the region and could also direct more traffic onto Moose-Wilson Road. In fact, Teton County has forecasted that vehicle miles traveled will increase approximately 1.3% each year. Considering these countywide projections, major growth in traffic volumes may also occur in the corridor. Overall, with no changes in management strategies under alternative A, these increases could substantially exacerbate current transportation issues in the corridor, including increased traffic congestion and the potential for user conflicts (i.e., vehicle versus bicycle).

Conclusion. Alternative A would not provide management solutions to address expected increases in visitation to the corridor. Overall, this alternative would have substantial and sustained adverse impacts on traffic and transportation over time, with no anticipated long-term beneficial impacts. This is significant because existing challenges, such as congestion and inadequate parking, would amplify as vehicular and bicycle traffic continues to increase in the county (see "Cumulative Impacts" above for more details on county growth), and no mitigation measures would be implemented to manage this growth. More congestion would increase risks to visitor safety, as the potential for accidents for both vehicles and bicyclists increases when more users and inappropriately parked vehicles are present on the road.

When the effects of alternative A on traffic and transportation are added to past, ongoing, and likely future actions, such as increased development in Teton Village and an expanded regional pathway system, a substantial, long-term cumulative adverse effect would also occur.

ALTERNATIVE B

Vehicular Access

In this alternative, through-traffic would be restricted during peak hours of the peak season (above the established visitor capacity described in chapter 2) through the use of a gate placed on Moose-Wilson Road near the Laurance S. Rockefeller Preserve. While not serving to limit traffic entirely, such a restriction would likely minimize future increases in traffic volumes within the corridor and would likely have the minor beneficial impact of decreasing congestion and improving traffic flow on the road during gate closures. Visitors who are not seeking through-travel would still be able to experience the corridor; however, users who seek to traverse the corridor would need to use alternate routes, which would likely have ripple effects on traffic volumes and congestion along adjacent roadways. The visitor capacity for the corridor is set near current visitation levels so the impacts on adjacent roadways would be minimal until visitation is high enough to warrant more frequent closure of the gate in the future.

The realignment of the roadway between Murie Ranch Road and the base of the hill near Sawmill Ponds in this alternative would also have implications for vehicular access. This portion of the road would be relocated behind the Moose Entrance Station (moved and replaced under separate compliance) and intersect with Teton Park Road at Chapel of the Configuration Road. This new station would guide traffic onto both Teton Park Road and Moose-Wilson Road. Because it is responsible for entry to both of these areas of the park, this could adversely impact ease of access onto Moose-Wilson Road. Vehicles may back-up at this point of entry making immediate access more difficult. There may also be a slight reduction in congestion along the road, as the entrance station could inadvertently serve to regulate timing of vehicular access to the corridor.

Vehicular access would be temporarily impacted during construction periods for implementation of the physical modifications presented in this alternative. Construction would be completed over the course of three construction seasons (roughly May through November). The LSR Preserve Center would be accessible during all phases of construction—from the north during phases two and three, and from the south during phase one. Death Canyon Trailhead would be accessible from the north during phase three and from the south during phase one, but would be closed during phase two. Sawmill Ponds would be closed to the public during phase one. The primary impact to traffic and transportation would be due to temporary traffic delays at the entrance during the course of construction, which would last for approximately 15 minutes. This may cause congestion at the entrances to Moose-Wilson Road. The entrances that are open during construction may also see more congestion, which could exacerbate this impact to access, as visitors would be using one entrance for access to the entire corridor.

Traffic Mix

In this alternative, certain management actions regarding commercial traffic would have a beneficial impact for traffic mix and would likely improve traffic flow. This alternative includes a prohibition of both taxis and all other nonpark-dependent commercial traffic. These users are currently allowed in the corridor and are often, by nature of the service they provide, traversing the road to destinations at the other end of the corridor. The prohibition of this user group would reduce the number of vehicles on the road and the number of through-trips, even during nonpeak visitation periods (when the gate is open). This would improve traffic flow and would eliminate the potential for conflict between these users and visitors who often seek exploration, sightseeing, and recreation in the corridor. Horse trailer parking would continue to occur at certain areas, but would be restricted at Sawmill Ponds Overlook and Granite Canyon Trailhead, so this user group may comprise a smaller proportion of all users in this alternative based on availability of parking. Otherwise, no additional strategies would affect traffic mix; this alternative would likely see a similar composition of vehicle types and bicycles to that described in the “Affected Environment” chapter.

Traffic Volumes

As described in the “Affected Environment” chapter, there have been notable increases in traffic throughout the 2000s. Several strategies presented in this alternative would manage such growth, including design enhancements, formalized parking/turnouts, and the potential use of alternative transportation systems. Cyclists would continue to share the road with vehicles in this alternative, but certain enhancements would also improve conditions for those users.

The northern portion of the road would be realigned in this alternative, moving a segment of the road out of a sensitive wetland area and into the open sage flats. The current proximity of the road to the wetland limits space at the road edge for vehicles to leave the road if needed. This is a location of frequent wildlife jams and adequate turnoff space would minimize wildlife-related traffic congestion. Moving the road into the open sage would provide more room at the edges of the roadway, which would greatly improve traffic flow. It would also improve road conditions and navigability for both motor vehicles and bicycles because road conditions are currently variable in this area due to poor drainage.

The unpaved section of the road would be paved in this alternative, which would provide an improved road surface for motor vehicles and bicycles and increase navigability. Paving would generally allow faster speeds, but the physical design characteristics (e.g., curvilinear road alignment and obstructed sight lines) would still discourage speeding under this alternative. In addition to design limitations, this alternative includes an overall reduction in the speed limit to 20 mph.

This alternative also includes parking strategies that would greatly improve traffic flow along Moose-Wilson Road. With up to 120 strategically sited and clearly defined turnouts, there would be sufficient space to meet current parking demand—effectively eliminating the prevalence of improperly parked vehicles and traffic flow issues that contribute to congestion (i.e., parking for wildlife viewing). Those who are trying to traverse the corridor or reach specific corridor destinations would be able to more effectively pass stopped vehicles.

Traffic Safety Conditions

Although documented traffic and bicycle incidents are currently low, a negative public perception of safety exists due to the narrowness of the road and proximity of vehicles and bicycles. This perception may continue in this alternative because bicycles and motor vehicles would continue to share the road, but certain strategies presented would minimize the potential for user conflicts and other safety issues.

Restricting taxis and nonpark-dependent commercial traffic, as well as other through-traffic during peak periods in this alternative would decrease the number of vehicles on the road and reduce the potential for vehicle/bicycle conflicts. This would also be supported through formalized turnouts and improved parking, which would accommodate stopped vehicles and allow more room for cyclists and other vehicles to more safely navigate the roadway near the shoulder where cars are frequently inappropriately parked during wildlife jams. This alternative would also incorporate a "safety edge" along the road shoulder, which would slightly reduce the potential for injury or property damage due to run-off-road bicycle incidents.

Additionally, the northern segment of the road would be realigned, routing the road away from the Beaver Ponds, where poor road conditions and obstructive vegetation can pose a challenge for motorists and cyclists. This would move the road into the open sage flats, which would improve sight lines and visibility among users and enhance traffic flow and cyclist safety overall. These measures, combined with a reduction in speed in this alternative, could reduce safety-related issues and improve public perception of safety. In particular, reduced speeds would serve to make speeds between motorists and cyclists more consistent, reducing the need for motorists to continually pass cyclists. Such a reduction in speed would also greatly reduce the potential for life-threatening accidents for pedestrians and cyclists (Transportation for America 2011).

This alternative includes paving the unpaved segment of Moose-Wilson Road, which would provide an improved road surface for motor vehicles and bicycles and would increase navigability for both of these user groups. This strategy could allow higher speeds in this area if the reduced speed limit is not adequately enforced, which could create the potential for more serious traffic incidents. Even in the absence of adequate enforcement however, speeds could only increase to the extent that physical design characteristics allow. This segment would still maintain its curvilinear road alignment, and sight lines would still be obstructed by vegetation—characteristics that both serve to physically limit speeds.

Despite this suite of strategies that would likely improve safety, inappropriate and/or illegal visitor behaviors, including speeding and improper parking, could reduce these beneficial effects on both real and perceived safety.

Parking Conditions

This alternative proposes officially designating parking turnouts along Moose-Wilson Road that are strategically located and clearly defined to accommodate up to 120 vehicles, which is similar to current parking demand. Such strategically sited turnouts would improve visitor parking options and likely alleviate some traffic flow issues that currently contribute to congestion (i.e., parking for wildlife viewing). Those who are trying to traverse the corridor would be able to more effectively pass stopped vehicles.

This alternative also includes improvements to Death Canyon Road and a relocated parking lot for the Death Canyon Trailhead. As stated in the "Affected Environment" chapter, parking in this area is a constant challenge. Demand often exceeds the number of parking spaces in the existing unmarked parking lot, and visitors regularly park along the road leading up to the trailhead due to poor navigability of the existing dirt road. By improving the road surface, more users would be able to navigate the road and reach the trailhead parking area. Delineated spaces for 60 vehicles would be a minor improvement over current conditions in terms of traffic flow and navigability, but would not be adequate to accommodate the numbers of vehicles in this area during peak use conditions (see the "Affected Environment" chapter). User-created/overflow parking might still be an issue, which can impede traffic flow and reduce navigability during high-use periods.

This alternative also includes the creation of an additional parking lot at the LSR Preserve to accommodate vehicles entering the corridor from either end during periods of gate closure. The existing parking lot and this new lot would still be sized to accommodate the same number of vehicles, so there is no anticipated impacted related to traffic flow and transportation.

Cumulative Impacts. As described above, several impacts may occur related to traffic flow and safety as a result of this alternative. There are also proposed future actions outside the corridor that may have adverse impacts on traffic flow and potentially, safety. Several plans that were developed for the area call for the expansion of the existing pathway system, including the *Jackson/Teton County Comprehensive Plan*, the *Jackson Hole Community Pathways Master Plan*, and the *Grand Teton National Park Transportation Plan*. The expansion of these networks could attract more bicyclists regionally, which could direct more of these users onto an increasingly congested Moose-Wilson Road, which they must share with motor vehicles. This alternative, however, proposes restricting through-traffic during peak periods, which may serve to reduce the volume of vehicles on the road and limit traffic congestion. Design enhancements would also accommodate vehicles and bicycles, including the realigned roadway into the open sage, a fully paved road surface, and the use of a “safety edge” as described above under “Traffic Volumes.”

Additionally, the *Amended Teton Village Expansion Resort Master Plan* (Snake River Associates 2013) calls for 380 new dwelling units south of Teton Village. These units would consist of condominiums, townhouses, affordable housing, and employee housing. Increasing the number and volume of new residents in the area would likely have adverse impacts on traffic congestion in the region. In fact, Teton County has forecasted that vehicle miles traveled will increase approximately 1.3% each year. These projections suggest that steady growth in traffic volumes could occur within the corridor if unrestricted, although traffic management strategy presented in this alternative may prevent the adverse impacts from this regional traffic growth on traffic within the corridor.

Conclusion. Alternative B would provide a variety of design and management strategies that would address expected increases in visitation to the corridor. Overall, this alternative would have minor beneficial impacts regarding traffic flow and safety. This is primarily because implementation of the gate closure during peak use periods would deter through-traffic and reduce traffic volumes, which would be beneficial for traffic flow and minimize the potential for safety-related incidents. Traffic flow would also be improved through formalized parking/ turnouts along the road and realignment of the road away from the wetland area and into the open sage, reducing the potential for inappropriately parked vehicles, which can act as obstacles to other vehicles and bicycles. Navigation may still be a challenge at Death Canyon because the parking configurations may not be adequate during peak visitation.

Bicycles would share the road with motorists in this alternative, so there may be adverse effects to cyclists with regard to real or perceived safety, especially with the expected expansion of the regional bicycle network, which may bring more cyclists to the area. This would not be significant because some of these impacts would be mitigated by design solutions that would improve sight lines, provide an improved road surface and create a “safety edge.” However, with more cyclists sharing the road with vehicles, there would still be an increase in the potential for safety incidents.

There may also be some minor adverse impacts on adjacent roadways associated with expected growth near Teton Village and diverted through-traffic from Moose-Wilson Road. The magnitude of this impact is unknown because it is difficult to determine the amount of traffic that will be diverted given changes in visitation patterns.

When the effects of alternative B on traffic and transportation are added to past, ongoing, and likely future actions, minor beneficial impacts would occur, since the bulk of potential adverse impacts on traffic flow would likely be reduced by the traffic management strategy in this alternative.

ALTERNATIVE C (NPS PREFERRED)

Vehicular Access

In this alternative, a timed sequencing system would be implemented to control and time vehicular access to the corridor during peak use periods (above the established visitor capacity described in chapter 2). Such a system would prevent future increases in traffic volumes within the corridor and would likely have the moderately beneficial impact of decreasing congestion and improving traffic flow within the corridor when the system is activated. This system would require visitors to queue and wait for access to the corridor. Users that seek to traverse the corridor high-use periods would need to wait in the queue or use alternate routes. This would likely have ripple effects on traffic volume and congestion on adjacent roadways. However, visitor capacity for the corridor is set near current visitation levels, so the system would not need to be regularly activated until increasing visitation more frequently exceeds corridor capacity. Impacts from diverted traffic on adjacent roadways would be minimal until visitation is high enough to necessitate more frequent use of the timed sequencing system.

Wait times in this alternative would vary based on vehicle volumes. Projections indicate, based on visitation data and established visitor capacities (200 vehicles at one time, as described in appendix A), that wait intervals would not occur frequently with current visitation levels. If the system had been implemented during the 2013 season, a wait of any length would only occur for 20 to 25 days of the season—ranging from just a few minutes to about 20 minutes on the busiest days of the year. Average wait times on July 6, 2013, would have been 9 minutes and 26 seconds. As noted in the description of the alternatives, this strategy is part of an adaptive approach, and other strategies, such as a reservation system, may be implemented if wait times become excessive.

With traffic levels expected to increase throughout the county, frequency and length of queuing may increase over time. Projections indicate waits for 35 to 40 days of the season in 2020, and 50 to 60 days of the season by 2025. These waits are based on the assumption that traffic levels would increase with no change in visitation patterns due to the implementation of the timed sequencing system. It is likely that visitors who strictly use Moose-Wilson Road as a through-route to other destinations would choose alternate routes (44% of visitors surveyed in 2013 were through-commuters with no plan to stop in the corridor; see “Affected Environment: Traffic and Transportation” for more information).

Queueing lanes would be constructed as part of this alternative, which would be designed to accommodate approximately 30 vehicles at either end of the corridor; this should meet queuing demand through 2020 based on the assumption, as stated above, that traffic levels would increase with no change in visitation patterns. Since it is likely that many visitors would choose alternate routes, the lanes would likely accommodate visitors further into the future. These queuing lanes would mitigate any potential impacts on adjacent roadways that could result due to extended wait times and associated vehicle backups. To ensure visitor safety in the corridor, emergency vehicles would use a bypass lane to access the road.

The realignment of the roadway between Murie Ranch Road and the base of the hill near Sawmill Ponds in this alternative would also have implications for vehicular access. This portion of the road would be relocated behind the Moose Entrance Station (moved and replaced under separate compliance) and intersect with Teton Park Road at Chapel of the Configuration Road. Visitors would pass through this entrance station and stop at a new entrance station on Moose-Wilson Road, which would be constructed to manage vehicle queuing when the timed sequencing system is activated during peak use periods. When the timed sequencing system is not in use, the two entrance stations may cause a slight reduction in congestion along the road because they could inadvertently serve to regulate timing of vehicular access.

Vehicular access would be temporarily impacted during construction periods for implementation of the physical modifications presented in this alternative. Construction would be completed over the course of three construction seasons (roughly May through November). The LSR Preserve Center would be accessible during all phases of construction—from the north during phases two and three, and from the south during phase one. Death Canyon Trailhead would be accessible from the north during phase three and from the south during phase one, but would be closed during phase two. Sawmill Ponds would be closed to the public during phase one. The primary impact to traffic and transportation would be due to temporary traffic delays of approximately 15 minutes at the entrance station during the course of construction. This may cause congestion at the entrances to Moose-Wilson Road. The entrances that are open during construction may also see more congestion, which could exacerbate this impact to access, as visitors would be using one entrance for access to the entire corridor.

Traffic Mix

In this alternative, certain management actions regarding commercial traffic would have a beneficial impact for traffic mix and would likely improve traffic flow. This alternative includes a prohibition of both taxis and all other nonpark-dependent commercial traffic. These users are currently allowed in the corridor and are often, by nature of the service they provide, traversing the road to destinations at the other end of the corridor. The prohibition of this user group would reduce the number of vehicles on the road and the number of through-trips, even during nonpeak visitation periods. This would improve traffic flow and would eliminate the potential for conflict between these users and visitors who often seek exploration, sightseeing, and recreation in the corridor. Horse trailer parking would continue to occur at certain areas, but would be restricted at Granite Canyon Trailhead, so this user group may comprise a smaller proportion of all users in this alternative based on availability of parking. Otherwise, no additional strategies would affect traffic mix. This alternative would likely see a similar composition of vehicle types and bicycles to that described in the “Affected Environment” chapter.

Traffic Volumes

As described in the “Affected Environment” chapter, there have been notable increases in traffic throughout the 2000s. Several strategies presented in this alternative would help manage traffic and expected growth, including design enhancements, formalized parking/turnouts, and the potential use of alternative transportation systems. Cyclists would continue to share the road with vehicles in this alternative, but certain enhancements would also improve conditions for those users.

The unpaved section of the road would be paved in this alternative, which would provide an improved road surface for motor vehicles and bicycles and increase navigability. Paving would generally allow for faster speeds, but the physical design characteristics (e.g., curvilinear road alignment and obstructed sight lines) would still discourage speeding in this alternative. In addition to design limitations, this alternative also includes an overall reduction in the speed limit to 20 mph.

This alternative also includes parking strategies that would greatly improve traffic flow along Moose-Wilson Road. With up to 120 strategically sited and clearly defined turnouts, there would be sufficient space to meet current parking demand—effectively eliminating the prevalence of improperly parked vehicles and traffic flow issues that contribute to congestion (i.e., parking for wildlife viewing). Those who are trying to traverse the corridor or reach specific corridor destinations would be able to more effectively pass stopped vehicles.

The portion of the road between Sawmill Ponds Overlook and the Death Canyon Road junction would not be realigned in this alternative. The current proximity of the road to the wetland in this area limits space at the road edge for vehicles to leave the road if needed. This is a location of frequent wildlife jams and lack of adequate turnoff space currently contributes to wildlife-related traffic congestion. This issue would persist in this alternative and would have a moderate adverse impact on traffic flow and congestion, particularly when wildlife is present. Certain management techniques in this alternative, including use of temporary road closures and increased use of the Wildlife Brigade may mitigate some of the impacts on traffic movement in this area. Physical design enhancement and drainage improvements in this alternative would also increase navigability for both motor vehicles and bicycles because road conditions are currently variable in this area due to poor drainage.

Traffic Safety Conditions

Although documented traffic and bicycle incidents are currently low, a negative public perception of safety exists due to the narrowness of the road and proximity of vehicles and bicycles. This perception may continue in this alternative, as bicycles and motor vehicles would continue to share the road, but certain strategies presented would minimize the potential for user conflicts and other safety issues.

Restricting taxis and nonpark-dependent commercial traffic, as well as other through-traffic during peak periods in this alternative would decrease the number of vehicles on the road and reduce the potential for vehicle/bicycle conflicts. This would also be supported through formalized turnouts and improved parking, which would accommodate stopped vehicles and allow more room for cyclists and other vehicles to safely navigate the roadway near the shoulder where cars are frequently inappropriately parked during wildlife jams. This alternative would also incorporate a “safety edge” along the road shoulder, which would slightly reduce the potential for injury or property damage due to run-off-road bicycle incidents.

This alternative includes paving the unpaved segment of Moose-Wilson Road. This would provide an improved road surface for motor vehicles and bicycles and would increase navigability for both of these user groups. This strategy could allow higher speeds in this area if the reduced speed limit is not adequately enforced, which could create the potential for more serious traffic incidents. Even in the absence of adequate enforcement, however, speeds could only increase to the extent that physical design characteristics allow. This segment would still maintain its curvilinear road alignment, and sight lines would still be obstructed by vegetation—characteristics that both serve to physically limit speeds.

The alignment of the northern road segment between Sawmill Ponds Overlook and Death Canyon Road is a challenge for cyclists due to congestion and variably poor road conditions. Drainage improvements in this alternative would improve road conditions, and modifications to vegetation setbacks along the roadway would improve sight lines for motorists and cyclists, although congestion would likely persist. Potential for vehicle and bicycle conflict may also continue, but the use of timed sequencing to control traffic near current levels would ensure that this potential for conflict does not become a larger issue. The reduction in speed in this alternative could also serve to reduce safety-related issues and improve public perception of safety. In particular, reduced speeds would serve to make speeds between motorists and cyclists more consistent, reducing the need for motorists to continually pass cyclists. Such a reduction in speed would also greatly reduce the potential for life-threating accidents for pedestrians and cyclists (Transportation for America 2011).

Despite this suite of strategies that would likely improve safety, inappropriate and/or illegal visitor behaviors, including speeding and improper parking could reduce these beneficial effects on both real and perceived safety.

Parking Conditions

This alternative proposes officially designating parking turnouts along Moose-Wilson Road that are strategically sited and clearly defined to accommodate up to 120 vehicles, which is similar to current parking demands. Such strategically placed turnouts would improve visitor parking options and likely alleviate some traffic flow issues that currently contribute to congestion (i.e., parking for wildlife viewing). Those who are trying to traverse the corridor would be able to more effectively pass stopped vehicles.

This alternative also includes reconfiguring Death Canyon Road and relocating and improving the parking lot for the Death Canyon Trailhead. As stated in the "Affected Environment" chapter, parking in this area is a constant challenge. Demand often exceeds the number of parking spaces in the existing unmarked parking lot, and visitors regularly park along the road leading up to the trailhead due to poor navigability of the existing dirt road. Navigability would be greatly improved in this alternative because the trailhead would be moved back to the end of the existing pavement. More users would be able to reach the trailhead parking area, eliminating the conditions that cause many users to inappropriately park along the roadway. Delineated spaces for 80 to 90 vehicles would be a significant improvement over current conditions in terms of traffic flow and navigability, as this amount of parking would accommodate current parking demand in this area. Demand is not expected to increase in this alternative because the timed sequencing traffic management strategy would limit any future increases in traffic within the corridor.

Cumulative Impacts. As described above, several impacts may occur related to traffic flow and safety as a result of this alternative. There are also proposed future actions outside the corridor that may have adverse impacts on traffic flow and potentially safety. Several plans that were developed for the area call for the expansion of the existing pathway system, including the *Jackson/Teton County Comprehensive Plan*, the *Jackson Hole Community Pathways Master Plan*, and the *Grand Teton National Park Transportation Plan*. The expansion of these networks could attract more bicyclists regionally, which could direct more of these users onto an increasingly congested Moose-Wilson Road, which they must share with motor vehicles. This alternative, however, proposes restricting through-traffic during peak periods, which would serve to reduce the volume of vehicles on the road. Design enhancements would also accommodate vehicles and bicycles, including the realigned roadway into the open sage, a fully paved road surface, and the use of a "safety edge," as described above under "Traffic Volumes."

Additionally, the *Amended Teton Village Expansion Resort Master Plan, PUD* (Snake River Associates 2013) calls for 380 new dwelling units south of Teton Village. These units would consist of condominiums, townhouses, affordable housing, and employee housing. Increasing the number and volume of new residents in the area would likely have adverse impacts on traffic congestion in the region. In fact, Teton County has forecasted that vehicle miles traveled will increase approximately 1.3% each year. These projections suggest that steady growth in traffic volumes could occur within the corridor if unrestricted, although the traffic management strategy presented in this alternative would prevent the adverse impacts from this regional traffic growth on traffic within the corridor.

Conclusion. Alternative C would provide a variety of design and management strategies that would address expected increases in visitation to the corridor. Overall, this alternative would have moderate beneficial impacts regarding traffic flow and safety. This is primarily because implementation of the timed sequencing strategy during peak use periods would deter through-traffic and reduce traffic volumes, which would be beneficial for traffic flow and minimize the potential for safety-related incidents. Traffic flow would also be improved through formalized parking/turnouts along the road, reducing the potential for inappropriately parked vehicles, which can act as obstacles to other vehicles and bicycles. The road, however, would not be realigned out of the wetland area in this alternative, which could continue to pose challenges to navigability, congestion, and safety, but some of these issues may be mitigated through active management techniques targeted at improving conditions in this area. Navigation would be greatly improved at Death Canyon because the road changes and parking improvements would accommodate parking demand.

Bicycles would share the road in this alternative, so there may be adverse effects to cyclists in regard to real or perceived safety, especially with the expected expansion of the regional bicycle network, which may bring more cyclists to the area. This would not be significant because some of these impacts would be mitigated by design solutions that would provide an improved road surface and create a "safety edge." However, with more cyclists sharing the road with vehicles, there would still be an increase in the potential for safety incidents.

There may also be some minor adverse impacts on adjacent roadways associated with expected growth near Teton Village and diverted through-traffic from Moose-Wilson Road. The magnitude of this impact is unknown because it is difficult to determine the amount of traffic that would be diverted given changes in visitation patterns.

When the effects of alternative C on traffic and transportation are added to past, ongoing, and likely future actions, moderate beneficial impacts would occur because the bulk of potential adverse impacts on traffic flow would be effectively eliminated by the traffic management strategy in this alternative.

ALTERNATIVE D

Vehicular Access

In this alternative, a reservation system would be implemented to control vehicular access to the corridor during peak use periods (above the established visitor capacity described in chapter 2). Such a system would prevent future increases in traffic volumes within the corridor and would likely have the moderately beneficial impact of decreasing congestion and improving traffic flow in the corridor when the system is activated. This reservation system would include an allotment for a set number of visitors that arrive without a reservation, on a space available, first-come, first-served basis, but any additional users would not be allowed access. Users that seek to traverse the corridor without a reservation (outside the allotment) would need to use alternate routes. This would likely have ripple effects on traffic volume and congestion along adjacent roadways. However, visitor capacity for the corridor is set near current visitation levels; thus, the system would not need to be regularly activated until increasing visitation frequently exceeds corridor capacity. Impacts from diverted traffic on adjacent roadways would be minimal until visitation is at a level that would necessitate more frequent use of the reservation system.

Realignment of the roadway between Murie Ranch Road and the base of the hill near

Sawmill Ponds in this alternative would also have implications for vehicular access. This portion of the road would be relocated behind the Moose Entrance Station (moved and replaced under separate compliance) and intersect with Teton Park Road at Chapel of the Configuration Road. Visitors would pass through this entrance station and stop at a new entrance station on Moose-Wilson Road, which would be constructed to manage implementation of the reservation system. When the reservation system is not in use, the two entrance stations may cause a slight reduction in congestion along the road, as they could inadvertently serve to regulate timing of vehicular access.

Vehicular access would be temporarily impacted during construction periods for implementation of the physical modifications presented in this alternative. Construction would be completed over the course of three construction seasons (roughly May through November). The LSR Preserve Center would be accessible during all phases of construction—from the north during phases two and three and from the south during phase one. Death Canyon Trailhead would be accessible from the north during phase three and from the south during phase one, but would be closed during phase two. Sawmill Ponds would be closed to the public during phase one. Temporary traffic delays at the entrance during the course of construction would last for approximately 15 minutes and would have the primary impact to traffic and transportation. This may cause congestion at the entrances to Moose-Wilson Road. The entrances that are open during construction may also see more congestion, which could exacerbate this impact to access because visitors would be using one entrance for access to the entire corridor.

Traffic Mix

In this alternative, certain management actions regarding commercial traffic would have a beneficial impact for traffic mix and would likely improve traffic flow. This alternative includes a prohibition of nonpark-dependent commercial traffic and a permitting system for taxis. Because they function as a transportation service, taxis often provide through-trips to destinations outside the Moose-Wilson corridor rather than providing opportunities for park visitors. Consequently, there are sometimes conflicts between taxis and visitors who often seek to explore, sightsee, and recreate in the corridor rather than travel from one end to the other. A permitting system could be used to ensure appropriate behaviors by taxi drivers who use the corridor and reduce incidences of conflict between these users and visitors that may desire a more leisurely experience. Such a system could also reduce the number of vehicles on the road overall. Horse trailer parking would continue to occur at existing parking areas, so this user group would likely comprise a similar proportion of all users as current conditions.

The creation of a multiuse pathway would also have effects on traffic mix along the road. Bicycles would no longer share the road in this alternative and would instead be directed to use the multiuse pathway that would run adjacent to the roadway. This would have substantial beneficial impacts regarding both traffic congestion and safety (see “Traffic Volumes” and “Traffic Safety Conditions” below).

Traffic Volumes

As described in the “Affected Environment” chapter, there have been notable increases in traffic throughout the 2000s. Several strategies presented in this alternative would help manage traffic and expected growth including design enhancements, formalized parking/turnouts, and the potential use of alternative transportation systems. This alternative also includes the creation of a multiuse pathway, which would eliminate bicycle traffic on the road and could serve to reduce congestion as motor vehicles would no longer need to navigate around bicyclists that currently occupy the shoulders of the roadway (see also "Traffic Safety Conditions"). The pathway and associated parking outside the corridor could also reduce vehicular traffic volumes because drivers could choose to experience the corridor through the use of this new facility.

The northern portion of the road would be realigned in this alternative, moving a segment of the road out of a sensitive wetland area and into the open sage flats. The current proximity of the road to the wetland, limits space at the road edge for vehicles to turnoff if needed. Frequent wildlife jams occur in this area and adequate turnoff space would minimize wildlife-related traffic congestion. Moving the road into the open sage would provide more room at the edges of the roadway, which would greatly improve traffic flow and road conditions and navigability for motor vehicles. Road conditions here are currently variable due to poor drainage.

This alternative also includes parking strategies that would greatly improve traffic flow along Moose-Wilson Road. With up to 120 strategically placed and clearly defined turnouts, there would be sufficient space to meet current parking demands, effectively eliminating the prevalence of improperly parked vehicles and the traffic flow issues contributing to congestion (i.e., parking for wildlife viewing). Those who are trying to traverse the corridor or reach specific corridor destinations would be able to more effectively pass stopped vehicles.

Certain new commercial activities might also serve to reduce traffic volumes. This alternative proposes road-based tours, which would be given priority access to the corridor within the reservation system. These tours would provide access to the greatest number of visitors and may utilize higher occupancy vehicles. The use of a reservation system creates a level of uncertainty regarding access for visitors that arrive without a reservation. Such road-based tours may eliminate some of this uncertainty because motorists may choose to use this new service, ultimately reducing the number of vehicles that seek access to the corridor.

Traffic Safety Conditions

Although documented traffic and bicycle incidents are currently low, a negative public perception of safety exists due to the narrowness of the road and proximity of vehicles and bicycles. This perception would likely be improved in this alternative, as bicycles and motor vehicles would no longer share the road. Cyclists would use a new multiuse pathway that would be constructed as part of this alternative, effectively eliminating the potential for conflicts between motor vehicles and bicycles, except at certain points (i.e., road crossings). The alignment of the pathway away from the road, however, would increase the potential for interactions between cyclists and wildlife, which could pose a threat to cyclist safety (see the "Visitor Use and Experience" section).

Restricting nonpark-dependent commercial traffic, permitting taxis, and limiting traffic during peak periods, as presented in this alternative, would decrease the number of vehicles on the road and reduce congestion and the potential for traffic incidents. Formalized turnouts and improved parking could accommodate stopped vehicles and further serve to reduce the potential for incidents because there would be more room for other vehicles to safely navigate the roadway near the shoulder where cars are frequently inappropriately parked during wildlife jams.

Additionally, the northern road segment would be realigned, routing the road away from the Beaver Ponds, where poor road conditions and obstructive vegetation can pose a challenge for motorists. This would move the road into the open sage flats, which would improve sight lines and visibility among users and enhance traffic flow and safety overall.

Despite this suite of strategies that would likely improve safety, inappropriate and/or illegal visitor behaviors, including speeding and improper parking, could reduce these beneficial effects on both real and perceived safety.

Parking Conditions

This alternative proposes officially designating parking turnouts along Moose-Wilson Road that are strategically located and clearly defined to accommodate up to 120 vehicles, which is similar to current parking demand. Such strategically placed turnouts would improve visitor parking options and likely alleviate some traffic flow issues that currently contribute to congestion (i.e., parking for wildlife viewing). Those who are trying to traverse the corridor would be able to effectively pass stopped vehicles.

This alternative also includes a change in configuration along Death Canyon Road that would improve access and accommodate more vehicles at the existing Death Canyon Trailhead. As stated in the "Affected Environment" chapter, parking in this area is a constant challenge. Demand often exceeds the number of parking spaces in the currently unmarked parking lot and visitors regularly park along the road leading up to the trailhead due to poor navigability of the existing unpaved road. By removing a portion of Death Canyon Road and improving the surface of White Grass Road, as proposed in this alternative, more users would be able to navigate the road and reach the trailhead parking area. Delineated spaces for 100 vehicles would provide adequate parking to accommodate the numbers of vehicles in the area during even the highest visitation periods (see the "Affected Environment" chapter). This would be a substantial improvement over current conditions because it would effectively eliminate the need for user-created/overflow parking, which currently impedes traffic flow and reduces navigability during high-use periods. The reservation system would ensure that use levels are maintained, essentially eliminating the need for future increases in parking capacity.

Cumulative Impacts. As described above, several impacts may occur related to traffic flow and safety as a result of this alternative. There are also proposed future actions outside the corridor that may have adverse impacts on traffic flow and potentially on safety. Several plans that were developed for the area call for the expansion of the existing pathway system, including the *Jackson/Teton County Comprehensive Plan*, the *Jackson Hole Community Pathways Master Plan*, and the *Grand Teton National Park Transportation Plan*. The expansion of the existing pathway system and the completion of a new multiuse pathway proposed in this alternative would complete a network of pathways that would provide new recreational opportunities to visitors throughout the region. While this would not have implications for traffic and transportation, it would affect other impact topics (see "Visitor Use and Experience" and "Socioeconomics").

Additionally, the *Amended Teton Village Expansion Resort Master Plan, PUD* (Snake River 2013) calls for 380 new dwelling units south of Teton Village. These units would consist of condominiums, townhouses, affordable housing, and employee housing. Increasing the number and volume of new residents in the area will likely have adverse impacts on traffic congestion in the region. In fact, Teton County has forecast that vehicle miles traveled would increase approximately 1.3% each year. These projections suggest that steady growth in traffic volumes could occur within the corridor if unrestricted, although the traffic management strategy presented in this alternative would prevent the adverse impacts from this regional traffic growth in traffic within the corridor.

Conclusion. Alternative D would provide a variety of design and management strategies that would address expected increases in visitation to both the corridor and the county. Overall, this alternative would have substantial beneficial effects regarding traffic flow and safety for both motor vehicles and cyclists. This is primarily because the implementation of the reservation system during peak use periods would limit vehicular access and prevent increased traffic volumes, which would be beneficial for traffic flow and minimize the potential for safety-related incidents. Traffic flow would be improved through formalized parking/turnouts along the road and at Death Canyon, as well as realignment of the road away from the wetland area and into the open sage. These strategies would reduce the potential for inappropriately parked vehicles along the road and at Death Canyon, which can act as obstacles to other vehicles and bicycles.

Bicycles would have a dedicated multiuse pathway in this alternative, which would greatly improve both real and perceived safety along the roadway and would also improve traffic flow for motor vehicles.

There may also be some minor adverse impacts on adjacent roadways associated with expected growth near Teton Village and diverted traffic from Moose-Wilson Road. The magnitude of this impact is unknown because it is difficult to determine the amount of traffic that will be diverted given changes in visitation patterns.

When the effects of alternative D on traffic and transportation are added to past, ongoing, and likely future actions, moderate beneficial impacts would occur because the bulk of potential adverse impacts would be effectively eliminated by the traffic management strategy in this alternative.

SOCIOECONOMIC ENVIRONMENT

METHODS AND ASSUMPTIONS FOR ANALYZING IMPACTS

This section evaluates the potential socioeconomic impacts of the alternative that are associated with the local and regional economy, quality of life issues, and public services within Teton County, Wyoming, associated with the alternative management strategies including:

- Contributions to local and regional economy from visitor expenditures.
- Contributions to local and regional economy from commercial and concession activity and business owners using the park.
- Contributions to local economy from NPS management and spending such as employee salaries, construction, operational costs, and purchases.
- Community—traffic congestion on alternate roads—in Jackson and south of Jackson on WY 390.
- Community–convenience for taxi travel through the corridor.
- Public services.

Socioeconomic impacts were evaluated by considering the effect of the existing conditions and the proposed changes in travel and visitation on the communities and populations that could be affected by the alternatives. Possible changes in the travel patterns of the visitors could affect the distribution of tourism spending within Teton County, potentially impacting local and regional economic conditions. Not all of these topics are discussed for each alternative, for those which impacts are anticipated. The effects of the proposed alternatives are analyzed based on anticipated results from changes to travel and visitor use patterns and management actions associated with each alternative. The impacts analysis of each alternative is determined by describing how different aspects of socioeconomics would change compared to existing conditions.

Impacts on visitor spending, business owners, and commercial activity relevant to the Moose-Wilson corridor were evaluated qualitatively, while using data on sales and use tax receipts and distributions, including lodging taxes and the Teton Village resort district tax, to inform the location and type of tourism spending within Teton County, specifically in the Town of Jackson, Teton Village, and the remaining unincorporated portions of the county. Impacts related to changes in visitor use as a result of the proposed alternatives are considered in context of the local economy of Teton Village and the regional economy of Teton County. Impacts on businesses that provide services to visitors, such as retail establishments, lodging, and food facilities, and others, are evaluated qualitatively. Impacts on the quality of life of Teton County residents, specifically traffic congestion and taxi services, are described qualitatively.

Impacts were assessed assuming that mitigation measures would be implemented to minimize or avoid impacts. If the mitigation measures described in chapter 2 were not applied, the potential for adverse resource impacts and the magnitude of those impacts would increase.

ALTERNATIVE A (NO ACTION)

Local and Regional Economy

Visitors to the park come to experience the beauty, culture, scenery, and wildlife of the region. Traveling Moose-Wilson Road is an important amenity that contributes to this experience. However, the existing traffic management along the corridor does not affect the magnitude of visitor spending within the region's economy to any noticeable degree. Under alternative A, visitors would continue to visit Jackson and the park regardless of how the Moose-Wilson corridor is managed. However, management of the road would continue to affect how visitors travel in the county and spending patterns within the county. Similarly, while bike access on the corridor does not directly affect the region's economy, it may influence how visitors travel within the county and spending patterns within the region.

Visitation to the park and the corridor is expected to continue along current trends, increasing under alternative A, causing congestion and undesirable encounters between visitors and wildlife. As the corridor becomes more congested in the future, diminished visitor experience is likely to cause some visitors to avoid visiting the corridor. In addition, increased future visitation, along with lodging capacities and congestion, would broaden the length of the peak season to the entire summer season as use levels increase during shoulder seasons.

As described in the "Socioeconomic Environment," average summer visitation to the park between 2000 and 2013 was 2,144,711. These visitors were estimated to spend $865.5 million, supporting 13,010 jobs and $279.5 million in income in the region, including direct, indirect, and induced effects (Loomis and Caughlan 2004).

Visitor spending and economic impact is anticipated to increase as visitation increases in the future, benefiting local economies relative to existing conditions. Under alternative A, the patterns of visitor spending would continue and would increase because there is no traffic management strategy under this alternative that would change these patterns of visitation, with increased visitor spending in Moose and Teton Village and economic benefits for these communities.

Visitors staying in Teton Village, possibly because of its proximity to the corridor and the park, are likely to continue visiting the corridor and traveling northward into the park without travel restrictions during the peak seasons. However, many of the visitors to the corridor would continue to drive through the corridor and on to the place where they are staying, possibly in or near the town of Jackson or in park hotels, spending limited money in Moose and Teton Village.

The distribution of visitor spending in the county is expected to continue based on current trends subject to many factors, such as economic conditions, gas prices, cost of accommodations, and many other considerations. Visitors to the Moose-Wilson corridor would continue to visit Teton Village, the communities along WY 390 south of the corridor, and Moose, contributing to retail, restaurant, and recreation services and business sales in these proximate communities. Although some visitors may be discouraged from traveling the corridor in the future under alternative A due to congestion and high travel times, increased traffic in the corridor is anticipated to continue based on existing trends in travel patterns and associated visitor spending because alternative A does not have a traffic management strategy to mitigate traffic growth over time.

In addition, lodging is expected to continue to operate at full capacity during the summer months in the region and would be largely unaffected by the traffic management of the Moose-Wilson corridor.

While bicyclists have pathway access to both ends of the corridor, bicyclists currently share Moose-Wilson Road with vehicles and would continue to share the road under alternative A. Because Moose-Wilson Road is narrow, winding, and congested with motor vehicles, it is not anticipated that bicycle use would change under alternative A.

Continued commercial activities in the corridor, such as guided horse, wildlife, snowshoeing, ski tours, and other current commercial visitor services would continue under current use limits. These activities economically benefit local business owners and communities through visitor spending in proximity of the corridor and the activity, especially in Teton Village and Moose. However, these economic activities are minimal in the context of all visitor spending in the area and the county's economy. Compared to existing conditions, visitation, visitor spending, and sales and use tax receipts are all anticipated to increase over the planning horizon under alternative A. The contribution to visitor spending associated with continued and increasing travel of the Moose-Wilson corridor is anticipated to increase compared to existing conditions and be relatively more noticeable in the communities of Moose and Teton Village in the summer. However, visitor spending is likely to be negligible in terms of Teton County's overall economy.

Under alternative A, construction activities would continue to be needed to maintain Moose-Wilson Road, including resurfacing the paved section of the road. These construction activities are estimated to cost $3.6 million over the planning horizon. Construction and road maintenance activities would support $5.0 million in sales, $1.9 million in gross regional product, and 26 annual jobs during the construction and maintenance projects in Teton County[8]. In addition, the current annual NPS staffing requirements (FTE) to maintain the corridor under alternative A is 22 employees as well as $121,204 in ongoing annual operating and maintenance costs. These construction and ongoing operation and maintenance costs and level of NPS staffing are consistent with current requirements and would continue to benefit the county's economy, although these benefits are negligible in the context of the region's current jobs, income, and sales.

[8] These estimates were assessed with IMPLAN for Teton County with 2013 data; figures are presented in 2014 dollars and include total impacts, including direct, indirect, and induced economic impacts.

Quality of Life

Under alternative A, road congestion and safety concerns during peak times may be currently discouraging some travel along the road. However, motor vehicle traffic is likely to continue to increase, which could cause further traffic congestion and transportation conflicts in the corridor but also alleviate pressure on through-traffic in the Jackson area. Under this alternative, park staff would attempt to address traffic issues and transportation conflicts specifically associated with long queuing lines, such as lines blocking local access roads, by waving cars through entrance stations when queuing lines get too long. Because travel within the county (i.e., vehicle miles traveled) is expected to increase at approximately 1.5% annually, traffic congestion in the town of Jackson is likely to worsen; however, traffic management under alternative A would not adversely affect traffic congestion because unrestricted travel along Moose-Wilson Road would provide an alternative route of travel in the area. (Visitor and residential use and experience of the corridor are addressed under VUE.)

Currently, taxis travel the Moose-Wilson corridor between Teton Village and the airport, bypassing traffic in the town of Jackson, providing convenience and travel benefits for those traveling to the airport. This service would continue to occur throughout the corridor, with alternative A benefitting airport travelers staying in Teton Village and locations south of the corridor on WY 390, the same as existing conditions.

Public Services

The current management of Moose-Wilson Road to accommodate emergency and fire access would continue under alternative A. There are limited construction activities under the no-action alternative and access for emergencies and fire and medical personnel would be provided for the duration of these projects. These policies are consistent with the current management of Moose-Wilson Road. Under alternative A, because there would be limited construction activities, there would be no impacts on school enrollment or to the level of service or capacity for medical, emergency, or police services.

Cumulative Impacts. There are several proposed future actions outside the corridor that may have beneficial impacts on socioeconomic resources. Several plans call for the expansion of the existing pathway system, which could direct more users onto the corridor, increasing visitor spending in Moose and Teton Village and communities along WY 390. Additionally, the *Amended Teton Village Expansion Resort Master Plan, PUD* (Snake River Associates 2013) calls for 380 new dwelling units south of Teton Village. These units would consist of condominiums, townhouses, affordable housing, and employee housing. Increasing the number and volume of new residents to the area would likely increase spending in the area, benefitting these communities and the businesses located there. In addition, Teton County has forecasted that vehicle miles travelled would increase approximately 1.3% each year. Considering these figures, considerable changes in traffic volumes would likely occur in the future in the corridor. There are also many other factors that cumulatively affect the level of visitation and spending in Teton Village and across Teton County, including the economic business cycles, marketing efforts, gas prices, prevalence of forest fires, and others. The contribution to visitor spending associated with continued and increasing travel of the Moose-Wilson corridor is anticipated to be beneficial, and relatively more concentrated in the communities of Moose and Teton Village in the summer but negligible in terms of Teton County's overall economy. In combination with cumulative actions, impacts associated with alternative A would be negligible to proximate communities and Teton County's economy. Alternative A would not have cumulative impacts on traffic levels in the town of Jackson because traffic would continue to travel the corridor without restrictions.

Present and future construction, rehabilitation, restoration, and trail development activities within or near the Moose-Wilson corridor would benefit local communities through the jobs and income they support. One-time facility costs of $3.6 million and continued NPS staffing requirements for the corridor also provide jobs and income to Teton County. Alternative A, along with the cumulative actions, would not have noticeable cumulative socioeconomic impacts on the economy of Teton County.

Conclusion. Increased future visitation, along with lodging capacities and congestion, would broaden the length of the peak season to the entire summer season as use levels increase during shoulder seasons. The economic benefits to local economies are anticipated to increase under alternative A as visitation increases in the future, relative to existing conditions. Under alternative A, the corridor is anticipated to become more congested in the future. This congestion would likely contribute to diminished visitor experience, causing some visitors to avoid visiting the corridor. Compared to existing conditions, visitation, visitor spending, and sales and use tax receipts are all anticipated to increase over the planning horizon under alternative A, with more noticeable increases, and therefore benefits, in the communities of Moose and Teton Village in the summer. However, change in visitor spending is likely to be negligible in terms of Teton County's overall economy.

Construction and operations and maintenance activities and continued NPS staffing would continue to benefit the County's economy, although these benefits are negligible in the context of the region's current jobs, income, and sales. Traffic management under alternative A would not adversely affect traffic congestion because unrestricted travel along Moose-Wilson Road would provide an alternative route of travel in the area. Taxis would continue to travel the Moose-Wilson corridor between Teton Village and the airport, bypassing traffic in the Town of Jackson, providing convenience for those traveling to the airport. Public services would not be affected under alternative A.

The contribution to visitor spending associated with continued and increasing travel of the Moose-Wilson corridor and construction and facility costs under alternative A are anticipated to be beneficial, and relatively more noticeable in the communities of Moose and Teton Village in the summer but negligible in terms of Teton County's overall economy. In combination with cumulative actions, impacts associated with alternative A would be negligible to proximate communities and Teton County's economy.

ALTERNATIVE B

Local and Regional Economy

Visitors to the park come to experience the beauty, culture, scenery, and wildlife of the region. Traveling the Moose-Wilson corridor is an important amenity that contributes to this experience. However, the traffic management along the corridor does not have a measurable effect on the magnitude of visitation to the region and visitor spending within the county's economy to any noticeable degree; visitors would continue to visit Jackson and the park regardless of how the Moose-Wilson corridor is managed. The traffic management strategies under alternative B, including providing traveler alerts and restricting through-traffic during peak use periods, can affect how visitors travel within the county, perhaps also affecting spending patterns within the county.

Traveler alerts on either side of the park and restrictions on through-traffic during peak periods would discourage through-travel in the corridor at peak times. The current level of travel, visitation, visitor spending, and fiscal benefits to communities in the corridor is expected to continue in the short term because visitation to the corridor would be consistent with the current levels of use. As visitation to the corridor and travel in the region is expected to increase approximately 1.3% per year, visitation to the corridor would be restricted to through-traffic in either direction beyond the LSR Preserve Center during peak use periods to limit congestion, improve visitor experience, reduce undesirable human-wildlife encounters, and visitor conflicts. In the longer-term, this may encourage travel southbound and northbound through the town of Jackson instead of via the corridor, possibly reducing restaurant and retail spending in Teton Village and increasing spending in the town of Jackson. Increased visitation in the long term in the corridor is anticipated under alternative B in the off-peak times (e.g., morning) and shoulder months compared to existing conditions because visitors would likely avoid congested peak times to travel the corridor. In addition, alternative B does not actively limit travel in the corridor, but provides both signage and through-travel restrictions that may discourage travel in the corridor during peak periods. This may lead to additional visitation to the corridor when compared to the other action alternatives.

The majority (78%) of visitors travel through the corridor, with slightly more northbound travelers than southbound ones. Currently, 22% of travelers enter and exit through the same gate. During peak times, alternative B would encourage travelers to enter and exit through the same gate. This may encourage visitors staying in Teton Village and in the communities south of Teton Village on WY 390 to visit the corridor and then return to Teton Village, staying in Teton Village and/or traveling to the town of Jackson.

Increasing visitation, traffic, and associated visitor spending would continue under alternative B, especially in the spring and fall months (shoulder months), with increased benefits to proximate communities, compared to existing conditions. Because lodging is constrained and over capacity during peak summer periods, traffic management of the corridor would not affect lodging choices and receipts, limiting the adverse impacts on Teton Village, which relies heavily on lodging sales for sales and use tax receipts. As traffic and visitation to the region increases, traffic management strategies under alternative B may encourage increased visitation to the corridor during off-peak periods, increasing visitor spending and economic benefits to proximate communities during these times and seasons compared to existing conditions.

As described under the “Socioeconomic Environment” in chapter 3, Teton Village receives a considerable proportion of tax receipts from lodging as well as the majority of sales tax receipts during the winter months. In comparison to alternative A, there could be decreased visitor spending and economic benefits in Teton Village and increased benefit to the town of Jackson during the peak summer months in the long term. The decrease in visitor spending in Teton Village in the future is likely to be limited because lodging would continue to be at capacity and decreases could be offset by increases in visitor spending during the off-peak seasons. In the long term, any small increases in visitor spending that could occur in the town of Jackson would not be noticeable. Traffic management under alternative B, similar to alternatives A, C, and D, would provide negligible impacts on the regional economy.

As described in alternative A, bicycle traffic has also increased in the corridor due in part to the growing network of shared use pathways that extends throughout the region. The only major segment of network without built or planned bicycle pathways is the Moose-Wilson corridor. Consequently, bicycles have pathway access to both ends of the corridor, although under alternative B, bicyclists would continue to share Moose-Wilson Road with vehicles. During seasonal periods when the road is closed to motor vehicles, bicycles would be permitted to use the road when it is free of snow and ice. The restriction on through-traffic that would apply to motor vehicles at peak times would not apply to bicycles. The unpaved sections of the road would be paved and the speed limit would be reduced, which would improve bicyclists’ experience and may draw additional bikes to the corridor. However, similar to alternative A and existing conditions, it is not expected that bicycle use would be a considerable use under alternative B because Moose-Wilson Road is narrow, winding, and congested with motor vehicles. Although bicycle use would continue to benefit proximate communities through visitor spending on rentals, restaurants, retail, and other services, it would be negligible in terms of Teton County’s overall economy.

In addition, winter maintenance of Moose-Wilson Road would end at the Murie Ranch Road junction, compared to the Death Canyon Road junction, which would increase the unplowed portion of Moose-Wilson Road during the winter months. These changes relative to existing conditions are not expected to have noticeable impacts on the socioeconomic environment; although some beneficial visitor spending is associated with these activities, there would be negligible impacts on the regional economy.

Continued commercial activities within the corridor, such as guided horse, snowshoeing, and ski tours, would continue under this alternative. A number of road-based tours would be permitted under alternative B, consistent with current levels. The tours would remain small in size. These activities would continue to benefit local communities, providing revenue to businesses in proximate communities relative to existing conditions, the same as experienced under alternative A.

Under alternative B, construction activities would be required to pave the unpaved portion of Moose-Wilson Road, relocate powerlines, complete LSR Preserve parking enhancements, realign the northern portions of the road, improve Death Canyon Road, relocate the Death Canyon Trailhead, and install trailhead parking, signage, and interpretive stations. Total capital costs are estimated to be $32.6 million over the planning horizon for these projects. These construction activities would support $44.2 million in sales, $17.8 million in gross regional product, and 240 annual jobs (152 construction jobs) over the duration of the construction projects.[9] The construction activity is anticipated to occur over three years during the summer months. If construction occurs between May and October for three years, approximately 101 construction jobs would be required for construction activities during these summer months.[10] The annual NPS staffing requirements (FTE) to maintain the corridor under alternative B is 24 employees, 2 more staff than required under alternative A. In addition, $209,123 in ongoing annual operating and maintenance costs would be required for alternative B. These construction and ongoing operation and maintenance costs and level of NPS staffing would benefit the county's economy, although these benefits are minimal in the context of the region's current jobs, income, and sales.

Quality of Life

Future increases in traffic would be prevented to travel through the corridor during peak hours through the use of a gate, which would completely prevent through-trips during the busiest visitation periods and would likely have adverse effects on traffic volume and congestion along alternate roadways in the long-term as visitation and travel within the county increases. Under this alternative, there would be no queuing lanes, and park staff would wave traffic through entrances as in alternative A. There would be more diverted vehicle travel in the future that, in most cases, would travel via the Town of Jackson, causing congestion, traffic, and decreased quality of life in the Jackson area during peak visitation periods in the long term. (Visitor and residential use and experience of the corridor are addressed under VUE.)

Currently, taxis travel the Moose-Wilson corridor between Teton Village and the airport, bypassing traffic in the Town of Jackson, providing convenience and travel time benefits for those traveling to the airport. Alternative B would prohibit taxi use on the road, possibly causing extended travel times and less convenience for those using this route to access the airport. Travel distance would increase for travel to the airport from Teton Village by approximately 8.3 miles. However, because of slower travel speeds along the Moose-Wilson corridor, traveling to the airport via the town of Jackson (without congestion and delays under either route) is one minute shorter in travel time than travel via the Moose-Wilson corridor. Therefore, the adverse impact is likely to be very small for these corridor users compared with existing conditions.

Public Services

Traffic management strategies under alternative B would restrict traffic during peak use periods through the use of a gate at the LSR Preserve Center. Administrative use of the road would still be allowed through the gate when it is closed, allowing emergency and fire vehicles to access (and pass through) the corridor during emergency situations. In addition, under this alternative, access for emergencies and fire and medical personnel would be provided for the duration of construction activities. These policies are consistent with the current management of Moose-Wilson Road. Construction activities under alternative B would not affect the level of service or capacity of medical, emergency, and police services because the workforce

[9] These estimates were assessed with IMPLAN for Teton County with 2013 data; figures are presented in 2014 dollars and include total impacts, including direct, indirect, and induced economic impacts.

[10] Since IMPLAN provides its estimates as annual values, it is necessary to adjust for when the construction occurs (i.e., 152 construction jobs ÷ 3 years ÷ 0.5 [6/12 months/year]).

would already be residing within the county. Similarly, enrollment in Teton County schools would not be affected under alternative B.

Cumulative Impacts. There are several proposed future actions outside the corridor that may have beneficial impacts on socioeconomic resources, as described under alternative A. Under alternative B, in the near term, visitor spending patterns are likely to continue to benefit proximate communities similar to existing conditions because the gate would only be used once visitation in the corridor is above the current maximum visitation. In the future, visitor spending in Teton Village in the longer-term is anticipated to be higher in the shoulder months than under existing conditions with greater visitation and visitor spending as visitors find lodging availability and avoid congestion in the corridor. However, future visitor spending could be less and greater in the town of Jackson, relative to alternative A, during the peak summer months. These adverse impacts would be limited because Teton Village sales and tax receipts rely heavily on both winter and lodging visitor spending, which would be unaffected by alternative B. The possible future change in visitor spending in Teton Village, compared to existing conditions associated with alternative B is likely to be minimal when considering current and future cumulative actions. Similar to other alternatives, there would be no change in regional economic conditions. In combination with cumulative actions, impacts associated with alternative B would be negligible to Teton County's economy.

Present and future construction, rehabilitation, restoration, and trail development activities within or near the Moose-Wilson corridor would benefit local communities through the jobs and income they support. One-time facility costs of approximately $32.6 million and slightly increased NPS staffing requirements for the corridor under alternative B provide more jobs and income to Teton County compared to existing conditions. Alternative B, along with the cumulative actions, would have very small beneficial impacts on Teton County's overall economy.

Conclusion. The current level of travel, visitation, visitor spending, and fiscal benefits to proximate communities in the corridor is expected to continue in the short term because the corridor visitation would be consistent with the current levels of use. In the longer term, alternative B may reduce restaurant and retail spending in Teton Village and increase spending in the town of Jackson. Potential increased visitation in the long term in the corridor is anticipated under alternative B in the off-peak times (e.g., morning) and shoulder months compared to existing conditions because visitors would avoid congested peak times to travel the corridor. Because lodging is constrained and overcapacity issues occur during peak summer periods, traffic management of the corridor would not affect lodging choices and receipts, which would limit the adverse impacts on Teton Village. In the long term, any increases in visitor spending that could occur in the town of Jackson would be comparably small. Because alternative B does not actively limit travel in the corridor, it may lead to additional visitation to the corridor when compared to the other action alternatives.

Construction activities, anticipated to cost approximately $32.6 million, and increased NPS staffing would benefit local economies, but be minimal in the context of the region's current jobs, income, and sales. Under alternative B, there would be more diverted vehicle travel in the future that, in most cases, would travel via the town of Jackson, causing congestion, traffic, and decreased quality of life in the Jackson area during peak visitation periods in the long term. The contribution to traffic in the Jackson area would be minimal in the short term, but could be more noticeable in the future as travel and traffic increase across the area and more vehicles are diverted from Moose-Wilson Road. Alternative B would prohibit taxi use on the road, increasing the distance for travel to the airport from Teton Village. Administrative use of the road would still be allowed through the gate when it is closed, allowing emergency and fire vehicles to access (and pass through) the corridor during emergency situations. Construction activities under alternative B would not affect public services or schools because the workforce would already be residing within the county.

The possible future change in visitor spending in Teton Village and Moose, compared to existing conditions associated with alternative B is likely to be minimal when considering current and future cumulative actions. One-time facility costs of approximately $32.6 million and slightly increased NPS staffing requirements for the corridor under alternative B provide more jobs and income to Teton County compared to existing conditions. Together with the cumulative actions, the construction benefits and NPS staffing would have minimal beneficial impacts on Teton County's overall economy, while minimal adverse traffic impacts would occur in the Jackson area specifically, under alternative B in combination with cumulative actions, impacts associated with alternative B would be negligible to Teton County's economy.

ALTERNATIVE C (NPS PREFERRED)

Local and Regional Economy

Under alternative C, traffic would be managed through the corridor with the following techniques. Traveler alerts would be provided before entrances to inform visitors of conditions within the corridor, such as potential traffic congestion, full parking lots, and wait and travel times, and give them the opportunity to choose an alternate route before entering the corridor. An adaptive strategy to reduce future traffic and volume-related congestion would limit the number of vehicles entering the corridor at any one time during peak use periods through timed sequencing techniques. Queuing lanes on the north and south ends of the corridor would be provided, as needed. If additional traffic management measures are needed in the future, a corridor reservation system or transit system may be considered.

As described under alternative A, traffic management along the corridor does not have a measureable effect on the magnitude of visitation to the region and visitor spending within the county's economy to any noticeable degree; visitors would continue to visit Jackson and the park regardless of how the Moose-Wilson corridor is managed. However, the management of Moose-Wilson Road can affect how visitors travel within the county, perhaps affecting spending patterns as well.

Traveler alerts on either side of the park and timed sequencing restrictions during peak periods would discourage through-travel in the corridor at peak times. Similar to all of the action alternatives, the current level of travel, visitation, visitor spending, and fiscal benefits to proximate communities in the corridor is expected to continue in the short term because the corridor capacity would be set at current levels of use; however, as visitation to the corridor and the region is expected to increase, approximately 1.3% per year, visitation to the corridor would be capped during peak times to limit congestion and enhance visitor experience and prevent undesirable encounters between visitors and wildlife. Potential increased visitation in the long term in the corridor is anticipated under alternative C in the off-peak times (e.g., morning) and shoulder months compared to existing conditions because visitors would avoid congested peak times when they would have to wait to travel the corridor. Alternative C may also encourage travel southbound and northbound through the town of Jackson instead of via the corridor because of the timed sequencing restrictions, possibly reducing restaurant and retail spending in Teton Village and increasing spending in Jackson compared to alternative A.

Similar to existing conditions and all alternatives, because lodging is constrained and at over-capacity during peak summer periods, traffic management of the corridor would not affect lodging choices and receipts, limiting the adverse impacts on Teton Village, which relies heavily on lodging sales for sales and use tax receipts. In addition, as traffic and visitation to the region increases, the traffic management strategies under alternative C may encourage increased visitation to the corridor during off-peak seasons, increasing visitor spending and economic benefits to proximate communities during these times and seasons compared to existing conditions. Teton Village receives a considerable proportion of tax receipts from lodging and the majority of sales tax receipts during the winter months. As a result, similar to alternative B, reductions in future visitor spending in Teton Village during the peak summer months in the longer term would likely be limited. Any small increases in visitor spending that could occur in the town of Jackson would not be measurable. Since current visitor and vehicle capacity during the peak periods would be maintained, future restaurant and recreational spending in Teton Village from corridor visitation would remain at current levels, with similar economic benefits as experienced under existing conditions in the short term. However, during peak periods, visitation to the corridor in the future may be lower than anticipated under alternative A, with long-term adverse impacts on visitor spending within Teton Village and beneficial impacts on visitor spending in the town of Jackson. However, potential increases in visitation to the corridor during off-peak times and seasons may off-set this decrease. Across the region's economy, increased visitation to the park and the corridor would increase regional economic benefits in the long term compared to existing conditions. Traffic management under alternative C, similar to alternatives A, B, and D, would provide negligible impacts on the regional economy.

As described in alternative A, bicycle traffic has also increased in the corridor due in part to the growing network of shared use pathways that extend throughout the region. The only major segment of network without built or planned bicycle pathways is the Moose-Wilson corridor. Consequently, bicycles have pathway access to both ends of the corridor, although under alternative C, bicyclists would continue to share Moose-Wilson Road with vehicles. During seasonal periods when the road is closed to motor vehicles, bicycles would be permitted to use the road when it is free of snow and ice. The unpaved sections of the road would be paved, a "safety edge" would be incorporated, and the speed limit would be reduced, which would all improve bicyclists' experience and may draw additional bikes to the corridor. In addition, congestion on the road during peak times would be reduced under alternative C, which would also benefit bicycle use of the road. However, similar to existing conditions and alternatives A and B, it is not expected that bicycle use would considerably increase under alternative C because Moose-Wilson Road is narrow, winding, and needs to be shared with motor vehicles. Although bicycle use would continue to benefit proximate communities through visitor spending on rentals, restaurants, retail, and other services, it would be negligible in terms of Teton County's overall economy.

Alternative C would be the same as existing conditions and alternative A for winter use of the corridor; the unplowed section of Moose-Wilson Road would continue to extend from the Death Canyon Road junction to Granite Canyon Trailhead. The unplowed portion of the road would be available for cross-country skiing and snowshoeing but would not be groomed. There would not be impacts on socioeconomic conditions.

Continued commercial activities in the corridor, such as guided horse, snowshoeing, and ski tours, would continue under current use limits under alternative C. A limited number of road-based tours conducted by a set number of operators would be permitted within the corridor based on the current assessment of corridor capacity. These activities would continue to benefit local communities although fewer trips would provide slightly less revenue to businesses in proximate communities relative to existing conditions, although this change would not noticeably affect the regional economy.

Under alternative C, construction activities would be required to realign the northern portions of the road and Moose Entrance Station: paving the unpaved portion of the road, improving Death Canyon Road, relocating the Death Canyon Trailhead, installing parking and turnout facilities, and installing trailhead parking, signage, and interpretive stations. Total capital costs are estimated to be $24.4 million over the planning horizon. These construction activities would support $33.7 million in sales, $13.9 million in gross regional product, and 186 annual jobs over the duration of the projects; 121 of these jobs are construction jobs.[11] The construction activity is anticipated to occur over three years during the summer months. Construction would occur between May and October for three years, approximately 81 construction jobs would be required for construction activities during these summer months.[12]

The annual NPS staffing requirements (FTE) to maintain the corridor under alternative C is 25 employees, 3 more staff than required under alternative A. In addition, $190,028 in ongoing annual operating and maintenance costs would also be required for alternative C. These construction and ongoing operation and maintenance costs and level of NPS staffing would benefit the county's economy, although these benefits are minimal in the context of the region's current jobs, income, and sales.

[11] These estimates were assessed with IMPLAN for Teton County with 2013 data; figures are presented in 2014 dollars and include total impacts, including direct, indirect, and induced economic impacts.

[12] Since IMPLAN provides its estimates as annual values, it is necessary to adjust for when the construction occurs (i.e., 121 construction jobs ÷ 3 years ÷ 0.5 [6/12 months/year]).

Quality of Life

Future increases in traffic volume in the corridor would be prevented during peak hours through the use of a sequencing timing system, which would limit the number of vehicles in the corridor during the busiest visitation periods and would likely have adverse effects on traffic volumes and congestion along alternate roadways in the long term as visitation and travel within the county increases. This is likely to cause additional congestion, traffic, and decreased quality of life in the Jackson area during peak visitation periods in the long term. How travelers would alter their behavior under alternative C is not certain—how many travelers would queue and for how long would they wait before they travel an alternate route. Queuing lanes would be constructed inside the park under this alternative; and along with active traffic management, would help ensure queuing lines would not form beyond the park boundary. The contribution to traffic in the Jackson area from the traffic management strategies under alternative C (peak sequencing and queuing) would be minimal in the short term because the existing peak use levels would be maintained under alternative C relative to existing conditions. As congestion in the corridor grows under alternative A, it is likely that the growth in traffic in the future without traffic management strategies would lessen as visitors are discouraged from traveling the corridor. Therefore, the diverted travel from Moose-Wilson Road under alternative C relative to alternative A would be small but could be a noticeable impact on traffic volumes in the Jackson area during the summer months. These adverse traffic impacts under alternative C are likely to be less than those experienced under alternative B because alternatives C provides traffic management strategies that allow through-travel of the corridor. That is, travelers may choose to queue, waiting to travel the corridor instead of not being able to travel through the corridor during peak times (alternative B).

Currently, taxis travel the Moose-Wilson corridor between Teton Village and the airport, bypassing traffic in the town of Jackson, providing convenience and travel time benefits for those traveling to the airport. Alternative C would prohibit nonpark-dependent commercial and taxi use on the road, possibly causing higher travel times and less convenience for those using this route to access the airport. As described under alternative B, travel distance would increase for travel to the airport from Teton Village by approximately 8.3 miles. However, because of slower travel speeds along the Moose-Wilson corridor, traveling to the airport via the town of Jackson (without congestion and delays under either route) is one minute shorter in travel time than travel via the Moose-Wilson corridor. Therefore, the adverse impact is likely to be minimal for these corridor users compared with existing conditions.

Public Services

Similar to all of the alternatives, the current management of the road would accommodate emergency and fire access during construction activities as well as during normal operation of the road. In addition, construction activities under alternative C would not affect the level of service or capacity of medical, emergency, and police services because the construction workforce would already be residing within the county. In addition, enrollment in Teton County schools would not be affected under alternative C.

Cumulative Impacts. There are several proposed future actions outside the corridor that may have beneficial impacts on socioeconomic resources, as described under alternative A. Under alternative C, similar to all of the alternatives, in the near-term visitor spending patterns are likely to continue to benefit proximate communities similar to existing conditions because the current existing maximum capacity would be maintained in the corridor. In the future, visitor spending in Teton Village in the longer term is anticipated to be higher in the shoulder months than under existing conditions with greater visitation and visitor spending as visitors find lodging availability and avoid congestion in the corridor. Future visitor spending on restaurants and retail establishments during the peak summer periods in the longer term could be less in Teton Village, and greater in the town of Jackson, relative to alternative A. However, these adverse impacts would be limited because Teton Village sales tax receipts rely heavily on both winter and lodging visitor spending, which would be unaffected by the management of the corridor. The possible future change in visitor spending in Teton Village associated with alternative C compared with existing spending is likely to be minimal when considering current and future cumulative actions. In combination with cumulative actions, impacts associated with alternative C would be negligible to the economy of Teton County.

Present and future construction, rehabilitation, restoration, and trail development activities within or near the Moose-Wilson corridor would benefit local communities through jobs and the incomes they support. One-time facility costs of $24.4 million and slightly increased NPS staffing requirements (three additional people compared to alternative A) for the corridor also provide jobs and income to Teton County. Alternative C, along with the cumulative actions, would contribute minimal beneficial impacts on the economy of Teton County.

Conclusion. The current level of travel, visitation, visitor spending, and fiscal benefits to proximate communities in the corridor is expected to continue in the short term because the corridor capacity would be set at current levels of use. Increased visitation in the long term in the corridor is anticipated under alternative C in the off-peak times (e.g., morning) and shoulder months compared to existing conditions because visitors would avoid congested peak times where they would have to wait to travel the corridor. Alternative C may reduce restaurant and retail spending in Teton Village and increase spending in Jackson compared to alternative A, due to timed sequencing restrictions; however, increases in visitation to the corridor during off-peak times and seasons may offset this. Because lodging is constrained during peak summer periods, traffic management of the corridor would not affect lodging choices and receipts, which would also limit the adverse impacts on Teton Village. Traffic management under alternative C would provide negligible impacts on the economy of Teton County.

Construction activities, anticipated to cost approximately $24.4 million, and increased NPS staffing would benefit local economies, but be minimal in the context of the region's current jobs, income, and sales. There would be more diverted vehicle travel in the future that would cause congestion, traffic, and decreased quality of life in the Jackson area during peak visitation periods in the long term, although these impacts would be small relative to alternative A and less adverse than alternative B. Alternative C would prohibit taxi use on Moose-Wilson Road, increasing the distance for travel to the airport from Teton Village. The current management of the road to accommodate emergency and fire access would continue, and construction activities under alternative C would not affect public services or schools because the workforce would already reside in the county.

The possible future change in visitor spending in Teton Village and Moose, compared to existing conditions associated with alternative C, is likely to be minimal when considering current and future cumulative actions. One-time construction and facility costs of approximately $24.4 million and slightly increased NPS staffing requirements for the corridor under alternative C provide more jobs and income to Teton County compared to existing conditions. Together with the cumulative actions, the construction benefits and NPS staffing would have minimal beneficial impacts on the overall economy of Teton County, while increased vehicle traffic in the Jackson area would cause minor adverse impacts. In combination with cumulative actions, impacts associated with alternative C would be negligible to Teton County's economy.

ALTERNATIVE D

Local and Regional Economy

Under alternative D, traffic would be managed through the corridor with the following techniques. Traveler alerts would be provided before entrances to inform visitors of potential traffic congestion, full parking lots, and wait and travel times to give visitors the opportunity to choose an alternate route before entering the corridor. An adaptive strategy to reduce future traffic and volume-related congestion would establish a reservation system. Visitors without reservations would be accommodated on a space available, first-come, first-served basis. The maximum capacity during these peak times and seasons would be set at today's average peak use levels.

As described under alternative A, traffic management along the corridor does not have a measureable effect on the magnitude of visitation to the region and visitor spending within the county to any noticeable degree; visitors would continue to visit Jackson and the park regardless of how the Moose-Wilson corridor is managed. However, management of the road can affect how visitors travel within the county, perhaps affecting spending patterns within the county.

Traveler alerts on either side of the park and a reservation system during peak periods would discourage through-travel in the corridor at peak times. The current level of travel, visitation, visitor spending, and fiscal benefits to proximate communities in the corridor is expected to continue in the short term because the corridor capacity would be set at current levels of use. As visitation to the corridor and the region is expected to increase, approximately 1.3% per year, visitation to the corridor would be capped during peak times to limit congestion and reduce visitor experience and undesirable encounters between visitors and wildlife. Increased visitation in the corridor in the long term is anticipated under alternative D in the off-peak times (e.g., morning) and shoulder months compared to existing conditions and alternative A because visitors would make a reservation and avoid congested peak times. Similar to alternative C, alternative D may also encourage travel southbound and northbound through the town of Jackson instead of via the corridor, possibly reducing restaurant and retail spending in Teton Village and increasing spending in the town of Jackson compared to alternative A.

Because lodging is constrained and over capacity during peak summer periods, traffic management of the corridor would not affect lodging choices and receipts, limiting adverse impacts on Teton Village, which relies heavily on lodging sales for sales and use tax receipts. Teton Village receives a considerable proportion of tax receipts from lodging and the majority of sales tax receipts during the winter months. As a result, similar to alternatives B and C, reduced future visitor spending in Teton Village during the peak summer months in the longer term would likely be limited. Any small increases in visitor spending that could occur in the town of Jackson would not be measurable. Since the current visitor and vehicle capacity during the peak periods would be maintained, future restaurant and recreational spending in Teton Village from corridor visitation would remain at current levels. However, it may be lower than anticipated under alternative A in the future, with long-term adverse impacts on visitor spending within Teton Village. Increases in visitation to the corridor during off-peak times and shoulder seasons may offset this decrease. Across the region's economy, increased visitation to the park and the corridor would increase regional economic benefits in the long term compared to existing conditions. Traffic management under alternative D, similar to alternatives A, B, and C, would provide negligible impacts on the regional economy.

Under alternative D, a multiuse pathway would be constructed between Moose and the Granite Canyon Entrance, which would complete the network or loop throughout the area with dedicated pathways throughout the network. This pathway amenity is likely to draw bicycle visitors to the corridor, with increased economic benefits to proximate communities. For example, for rental businesses, retail establishments, and restaurants (if cyclists stop in these locations to eat) compared to existing conditions. If the pathway were to draw new or additional visitors to the county, there would be beneficial effects on the region's economy; however, these benefits are likely to be small relative to the current level of visitation and tourism spending in the region.

In addition, similar to existing conditions, winter plowing of Moose-Wilson Road would not occur between Death Canyon Road to Granite Canyon Trailhead. However, the park would seek a partner to groom the unplowed section of Moose-Wilson Road, which would enhance cross-county skiing experiences. These changes would have negligible impacts on local and regional economies compared to existing conditions.

Continued commercial activities in the corridor, such as guided horse, snowshoeing, and ski tours, would continue under current use limits under alternative D. Road-based tours would be permitted through a limited number of operators; these trips would have an allocation should a reservation system be implemented. Road-based tours would be given priority access (an allocation within the reservation system) and would be required to provide trips in a manner that promotes access of the road to the greatest number of visitors. This may occur through higher occupancy vehicles, trips that avoid crowded destinations in the corridor, or other configurations. Additional visitors and tours to the corridor may increase revenue to businesses in proximate communities (i.e., Moose and Wilson) relative to existing conditions, although this change would have a negligible effect on the county's economy.

Under alternative D, construction activities would be required to realign the northern portions of the road; improve Death Canyon Road; relocate the Death Canyon Trailhead; improve parking and turnout facilities; and install vault toilets, trailhead parking, signage, and interpretive stations. Total capital costs are estimated to be $43.2 million over the planning horizon. These construction activities would support $55.5 million in sales, $22.4 million in gross regional product, and 302 annual jobs (192 construction jobs) over the duration of the projects.[13] The construction activity is anticipated to occur over three years during the summer months. If we assume that construction would occur between May and October for three years, approximately 128 construction jobs would be required for construction activities during these summer months.[14] In addition, the annual NPS staffing requirements (FTE) to maintain the corridor under alternative D is 27 employees, 5 more staff than required under alternative A. In addition, $274,818 in ongoing annual operating and maintenance costs would also be required for alternative D. These construction and ongoing operation and maintenance costs and level of NPS staffing would benefit the county's economy, although these benefits are small in the context of the region's current jobs, income, and sales.

[13] These estimates were assessed with IMPLAN for Teton County with 2013 data; figures are presented in 2014 dollars and include total impacts, including direct, indirect, and induced economic impacts.

[14] Since IMPLAN provides its estimates as annual values, it is necessary to adjust for when the construction occurs (i.e., 192 construction jobs ÷ 3 years ÷ 0.5 [6/12 months/year]).

Quality of Life

Future increases in traffic volume in the corridor would be prevented during peak hours through the use of a reservation system and would likely have adverse effects on traffic volume and congestion along alternate roadways in the long term as visitation and travel within the county increases. Visitors without a reservation would be accommodated on a space available, first-come, first-served basis. How travelers would alter their behavior under alternative D is not certain—how many travelers would queue and wait (for how long) for capacity in the corridor, and how many travelers would the reservation system accommodate, perhaps spreading out the timing of the travel through the corridor. The contribution to traffic in the Jackson area from traffic management strategies under alternative D (reservation system and queuing) would be minimal in the short term because the existing peak use levels would be maintained under alternative D relative to existing conditions. As congestion in the corridor grows under alternative A, it is likely that the growth in traffic in the future without traffic management strategies would lessen as travelers are discouraged from traveling the corridor. Therefore, the diverted travel from Moose-Wilson Road under alternative D relative to alternative A would be small but could have a noticeable impact on traffic volumes in the Jackson area during the summer months. These adverse traffic impacts under alternative D are likely to be less than those experienced under alternative B because alternative D provides traffic management strategies that allow through-travel of the corridor, as well as queuing lanes that would be constructed inside the park boundaries, as under alternative C. That is, travelers may choose to queue, waiting to travel the corridor, or get a reservation instead of not being able to travel through the corridor during peak times (alternative B).

Currently, taxis travel the Moose-Wilson corridor between Teton Village and the airport, bypassing traffic in the town of

Jackson, providing convenience and travel time benefits for those traveling to the airport. Alternative D would prohibit taxi use on the road, possibly causing extended travel times and less convenience for those using this route to access the airport. As described under alternative B, travel distance would increase for travel to the airport from Teton Village by approximately 8.3 miles. However, because of slower travel speeds along Moose-Wilson Road, traveling to the airport via the town of Jackson (without congestion and delays under either route) is one minute shorter in travel time than travel via the Moose-Wilson corridor. Therefore, the adverse impact is likely to be minimal for these corridor users compared with existing conditions.

Public Services

Similar to all of the alternatives, the current management of Moose-Wilson Road would accommodate emergency and fire access during both construction activities and normal operations of the road. In addition, construction activities under alternative D would not affect the level of service or capacity of medical, emergency, and police services because the construction workforce would already reside within the county. In addition, enrollment in Teton County schools would not be affected by alternative D.

Cumulative Impacts. There are several proposed future actions outside the corridor that may have beneficial impacts on socioeconomic resources, as described under alternative A. Under alternative D, in the near term, visitor spending patterns are likely to continue to benefit proximate communities similar to existing conditions because a reservation system would only be used once visitation in the corridor is above the current maximum visitation. In the future, visitor spending in Teton Village in the longer term is anticipated to be higher in the shoulder months than under existing conditions with greater visitation and visitor spending as visitors find lodging availability and avoid congestion in the corridor. Under alternative D, similar to alternatives B and C, future visitor spending during the summer months in the longer term could be smaller in Teton Village, and greater in the town of Jackson, relative to alternative A. These adverse impacts would be limited because Teton Village sales and tax receipts rely heavily on both winter and lodging visitor spending, which would be unaffected by alternative D. In addition, increased bicycle use of the corridor may offset some of this decrease in spending. The possible future change in visitor spending in Teton Village associated with alternative D is likely to be minimal when considering current and future cumulative actions. Similar to other alternatives, there would be no change in regional economic conditions. In combination with cumulative actions, impacts associated with alternative D would be negligible to the economy of Teton County.

Present and future construction, rehabilitation, restoration, and trail development activities within or near the Moose-Wilson corridor would benefit local communities through the jobs and income they support. One-time facility costs of approximately $43.2 million and slightly increased NPS staffing requirements (five additional people compared to the alternative A) for the corridor also provide jobs and income to Teton County. Alternative D, along with the cumulative actions, would contribute small beneficial impacts on the economy of Teton County.

Conclusion. In the long term, increased visitation in the corridor is anticipated under alternative D in the off-peak times and shoulder months, compared to existing conditions and alternative A, because visitors would make a reservation and avoid congested peak times. Because current visitor and vehicle capacity during the peak periods would be maintained, restaurant and recreational spending in the short term in Teton Village and Moose would remain at current levels. Alternative D may reduce long-term restaurant and retail spending in Teton Village, and increase spending in the town of Jackson compared to alternative A, because it limits through-traffic during peak periods. This may lead to long-term adverse impacts on visitor spending in Teton Village although increases in visitation to the corridor during off-peak times and shoulder seasons may offset this. Because lodging is constrained during peak summer periods, traffic management of the corridor would not affect lodging choices and receipts, which would also limit adverse impacts on Teton Village. The pathway amenity is likely to draw bicycle visitors to the corridor, with increased economic benefits to proximate communities, although these benefits are likely to be small relative to the current level of visitation and tourism spending in the region. Alternative D would have negligible impacts on the economy of Teton County.

Construction activities, anticipated to cost approximately $43.2 million, and increased NPS staffing, would benefit local economies, but be minimal in the context of the region's current jobs, income, and sales. There would be more diverted vehicle travel in the future that would cause congestion, traffic, and decreased quality of life in the Jackson area during peak visitation periods in the long term, although these impacts would be small relative to alternative A and less adverse than alternative B. Alternative D would prohibit taxi use on the road, increasing the distance for travel to the airport from Teton Village. The current management of the road to accommodate emergency and fire access would continue, and construction activities under alternative D would not affect public services or schools because the workforce would already reside in the county.

The possible future change in visitor spending in Teton Village and Moose, compared to existing conditions associated with alternative D, is likely to be minimal when considering current and future cumulative actions. In combination with cumulative actions, impacts associated with alternative D would be negligible to Teton County's economy. One-time construction and facility costs of approximately $43.2 million and slightly increased NPS staffing requirements for the corridor under alternative D provide more jobs and income to Teton County compared to existing conditions. Together with the cumulative actions, the construction benefits and NPS staffing would have minimal beneficial impacts on the overall economy of Teton County.

PARK OPERATIONS

METHODS AND ASSUMPTIONS FOR ANALYZING IMPACTS

This section evaluates the impacts on park operations from the alternatives, including the potential for changes to workload, staffing levels, funding, and facilities within the project area.

Impact analyses are based on the current description of park operations and facilities presented in chapter 3 of this Draft CMP/EIS, and the ability of the park to maintain the infrastructure used in the operation of the project area to adequately protect and preserve critical resources and provide an effective and safe employee environment and visitor experience. The resource-specific context for assessing impacts of the alternatives on park operations and park facilities includes the following assumptions:

- The park must operate within the constraints of the unit-specific budget and number of staff positions that have been allocated by congress and the NPS director's office. This plan assumes that the additional FTE proposed in each action alternative would be fully funded.
- Park staff members are not only responsible for activities within the Moose-Wilson corridor, but must also protect resources and provide an effective and safe visitor experience in the entire park.

ALTERNATIVE A (NO ACTION)

Alternative A would continue the existing management strategies for the Moose-Wilson corridor. There would be no increase in park staffing under this alternative.

The Visitor and Resource Protection Division would continue to patrol throughout the corridor, manage traffic congestion, provide emergency response, and operate the Moose and Granite Canyon Entrance Stations. This division would also continue backcountry patrols to ensure compliance with regulations, manage special events, operate counters to monitor visitor use at trailheads, and supervise mechanical thinning and prescribed burn projects.

The Division of Interpretation and Partnerships would continue to operate the LSR Preserve from June through the third week of September and provide informal interpretation of park resources throughout the corridor, especially in areas of high visitor use. Current efforts to recruit and train volunteers and interns to supplement available staff would also continue. The partnership with The Murie Center would be maintained.

The Division of Science and Resource Management would continue to monitor plant and animal species, conduct revegetation and invasive species control activities, manage the Wildlife Brigade to ease traffic congestion associated with wildlife activity, and monitor the hydrology and soundscapes of the corridor. All prehistoric and historic sites within the corridor would continue to be monitored.

Traffic Management

Moose-Wilson Road would remain open to vehicle traffic from as early as May 1 if conditions allow through October 31. Current traffic levels, consisting of visitor traffic, commuter traffic, and participants in road-based recreational activities such as bicycling and wildlife watching will likely continue to grow over time. This increased volume of traffic would exacerbate existing congestion on the road and potentially result in a greater level of conflict among these different user groups during peak use periods. Visitor use conflicts already require substantial staff time to resolve, and there would be an escalating adverse effect as the frequency of these visitor use conflicts increases over time. Park staff would be required to manage these increasingly frequent conflicts without an increase in staff capacity in the corridor.

Physical Characteristics of Moose-Wilson Road

Under the no-action alternative, the physical characteristics of Moose-Wilson Road would remain unchanged. The road would remain within its current alignment and current combination of paved and unpaved surface treatments. The Moose-Wilson Road, LSR Preserve entrance road, and Lake Creek Bridge currently have $3.0 million in deferred maintenance. Under the no-action alternative, the park would address these needs by resurfacing the paved segments of these roads and performing related repair work. This would result in a short-term adverse effect during pavement application from supervision and monitoring of construction and a long-term beneficial effect with the reduced maintenance requirements of properly installed pavement.

Moose-Wilson Road Realignment

The hydrology issues that contribute to pavement degradation in the wetlands area between Sawmill Ponds and the Death Canyon Road junction, as well as the ongoing need for beaver dam management by park roads staff, would not be addressed under alternative A. There would be a long-term adverse effect from more intensive pavement maintenance and repair requirements along this portion of the road because damage caused by frost heaving of the pavement in this area would likely reappear over time after the road is resurfaced.

The projected increase in traffic volume along Moose-Wilson Road over time would result in accelerated pavement wear, more intensive maintenance and repair requirements in response to declining pavement condition, and ultimately a shorter pavement lifespan. There would be a long-term adverse effect from increased repair and major rehabilitation requirements. Maintenance funds and staffing would have to be redirected from other uses, and more project funding would be needed to complete more frequent pavement rehabilitation work.

Turnouts and Parking

The availability of designated parking throughout the corridor would be insufficient relative to visitor demand. As designated parking fills to capacity at the LSR Preserve during peak visitation times, staff would manage more visitors waiting in their vehicles for parking spaces to open. Insufficient turnout and parking space throughout the corridor would continue to result in parking along the shoulders of Moose-Wilson Road. Shoulder parking causes damage to the pavement edge and ultimately shortens its lifespan. Staff would continue to acquire and periodically reposition barrier logs in an effort to prevent this parking. Increased pavement damage and management of barrier logs would result in long-term adverse effects as more staff time and resources would be required to manage parking-related congestion, react to shoulder parking by visitors, and apply fill material at user-created turnouts to protect the pavement edge.

Under the no-action alternative, the park would address $56,000 in deferred maintenance at parking areas within the corridor.

Bicycle Use

There is the potential for additional visitor use conflict as more cyclists ride Moose-Wilson Road. There would be an adverse effect from the combined increase in vehicle and bicycle traffic, as more staff time would be required to manage potential visitor use conflict and protect visitor safety.

Commercial Activity

Interest in commercially provided recreational activities in the corridor may increase over time, including wildlife watching tours, cycling tours, and horseback riding. Demand for more commercial use authorizations and potential concessions contracts for these activities would require more time of commercial services staff. There would be a long-term adverse effect in managing this increased commercial activity with existing staff.

Death Canyon

Demand for parking at the Death Canyon Trailhead already exceeds available space, and growing visitor use of Death Canyon and other backcountry trails in the future would increase the amount of shoulder parking along Death Canyon Road. There would be a long-term adverse effect as park staff spend more time repositioning barrier logs along Death Canyon Road to prevent this undesignated parking and perform increased site maintenance at the trailhead associated with growing visitor use, notably keeping the unpaved portion of the road passable by high-clearance vehicles and servicing the vault toilet at the trailhead.

Under the no-action alternative, the park would address $503,000 in deferred maintenance on the paved and unpaved segments of Death Canyon Road through resurfacing or regrading of these road segments.

Horse Use

Horse use in the corridor would continue to be managed per existing compliance, including trails and parking areas. Horse trailers currently share parking with other visitors, especially at the parking areas at Sawmill Ponds and Granite Canyon. This shared parking could lead to visitor conflict as visitation increases, especially as current lots are not properly sized for horse trailers. There would be a long-term adverse impact as the need for park staff to manage this type of conflict could increase.

Cumulative Impacts. There are several past, present, and future foreseeable actions that have affected or may affect park operations. Several past and future actions within the corridor have adverse and beneficial effects. The *Teton Corridor Moose to North Jenny Lake Development Concept Plan / Environmental Assessment* (1991) and the *Southwest Entrance Facilities/Environmental Assessment, Grand Teton National Park* (1998) led to construction of additional employee housing at Moose and Poker Flats, respectively, which improves employee retention and reduces commute times, while requiring additional maintenance. The *Southwest Entrance Facilities/Environmental Assessment, Grand Teton National Park* (1998) also led to the addition of an entrance station at the southern end of the Moose-Wilson corridor, which requires maintenance and staffing to operate. The *Moose Headquarters Rehabilitation: Site Work Environmental Assessment* (2010) reduced maintenance needs by removing several structures and improving stormwater management. The *Moose Wastewater / Water System Environmental Assessment* (2012) would improve water system performance and further reduce ongoing maintenance needs through upgrading or replacement of the existing water system. A new boat launch site at Moose proposed in the *Snake River Headwaters Comprehensive River Management Plan and Environmental Assessment* (2013) will require maintenance and staff time to ensure visitor safety.

Grand Teton National Park currently has a deferred maintenance backlog in excess of $200 million (Annual NPS Asset Inventory Summary by Park, 2014). There could be an adverse effect to the extent that projects in other areas of the park divert funds away from needed projects in the corridor.

There are also several past, present, and future foreseeable actions occurring outside the park that could affect park operations. The *Jackson/Teton County Comprehensive Plan* (2012) and *Integrated Transportation Plan* (in process), along with the *Grand Teton National Park Transportation Plan / Environmental Impact Statement* (2006), propose the future development of a transit system in which the park would be a partner; such a system could bring more visitors into the corridor. The *Pathways Master Plan, The Town of Jackson & Teton County, Wyoming* (2007) proposed an extensive network of shared-use pathways in and outside the park and has led to the construction of pathways along Teton Park Road to Jenny Lake and to the park's shared southern boundary with the National Elk Refuge. These pathways have increased bicycle traffic entering the corridor. Planned growth in Teton Village outlined in the *Amended Teton Village Expansion Resort Master Plan, Planned Unit Development* (Snake River Associates 2013) would increase the year-round and seasonal population to the south of the corridor, which would further increase visitation. Significant expansion of recreational activities resulting from the *Jackson Hole Ski Area Master Development Plan Revision / Environmental Impact Statement* (USDA Forest Service 1996), and continuation of the open gate backcountry policy, both increase the number of winter visitors to the area immediately to the west of the corridor and the number of skiers using the park backcountry, potentially increasing the number of search and rescue operations conducted by park staff.

The overall combined impacts of these past, present, and future actions on park operations within the Moose-Wilson corridor would be long term and primarily adverse due to external actions that would lead to increased visitation. These impacts, combined with the long-term adverse impacts under alternative A, would result in observable long-term adverse cumulative impacts on park operations. The impacts of alternative A would comprise a considerable portion, but less than a majority, of the overall cumulative impact.

Conclusion. The no-action alternative would have continued adverse impacts on park operations resulting from growing visitation, congestion, and conflict that require staff intervention and accelerate deterioration of roads and trails in the corridor. The current configuration of Moose-Wilson Road would continue to require frequent repairs to hydrology-induced damage around the wetlands area between Sawmill Ponds and the Death Canyon Road junction, regular dust abatement treatments for the unpaved road segment, and management of beaver dam activity. Insufficient parking capacity and road shoulder parking in the corridor would continue to require staff management and cause damage to road pavement. The combined adverse impact of the no-action alternative and cumulative impact resulting from increased development outside the park would result in long-term significant adverse impacts on park operations.

ALTERNATIVE B

Alternative B proposes the following increase in staffing for the park to cover added responsibilities within the corridor.

Proposed Staffing Increase for Alternative B		
Division	**Proposed New FTE**	**Total Corridor FTE**
Facility Management (roads)	0.75	5.36
Facility Management (trails)	0.25	
Interpretation and Partnerships (LSR Parking)	0.75	3.85
Science and Resource Management	0.75	3.30
Visitor and Resource Protection (traffic control and counters)	0.25	11.81
Business and Administration (commercial services)	0.45	0.75
Total	**3.20**	**25.07**

Traffic Management

The reconfiguration of access and parking for the LSR Preserve includes the construction of a second parking area and the installation of a gate on Moose-Wilson Road that would be closed to prevent through-traffic during peak-use periods. Park staff would operate the gate, manage the split parking area, and report congestion, parking lot status, and wait times for the new traveler alert board system. Interpretive staff would provide increased messaging to explain the purpose of the peak period road closure, especially to new visitors. The proposed addition of 0.75 interpretive FTE and 0.25 visitor and resource protection (VRP) FTE would offset these new requirements. There would be a long-term beneficial effect from the reduction of traffic congestion during peak use periods requiring the need for staff management, although this effect would be less than in alternatives C and D, which limit overall corridor capacity as opposed to through traffic on Moose-Wilson Road. There would be a beneficial effect from elimination of $0.2 million in deferred maintenance on the LSR Preserve access road and parking area due to improvements.

There would be a short-term adverse effect from the relocation of the Moose Entrance Station because park staff would supervise and monitor construction. This new entrance station would also pose a new maintenance requirement, a long-term adverse effect. Construction would occur as project funding becomes available, so there would be no adverse effect on the park's base operating budget from the construction costs.

As part of the visitor use data collection and monitoring effort, the park would install strategically placed traffic counters under alternative B at key road and parking sites. The addition of VRP FTE would provide capacity to operate and maintain these counters in addition to message boards and other components of the traffic management system in the corridor. There would be a long-term adverse effect associated with collection and analysis of traffic data, to the extent that existing staff would be diverted from other responsibilities.

Physical Characteristics of Moose-Wilson Road

The unpaved segment of Moose-Wilson Road would be paved and any road segments not realigned would be rehabilitated. There would be a short-term adverse effect during the paving process to manage the necessary road closures and provide project supervision. Funding would likely come from the Federal Highway Administration, so there would be no effect on the park's base operating budget. There would be a long-term beneficial effect from eliminating the need to perform magnesium chloride treatments for dust suppression, as park staff would no longer need to close the road three times per year for the treatments; the park would save approximately $30,000 annually in treatment costs.

The rehabilitation and realignment of Moose-Wilson Road in alternative B would eliminate $2.9 million of deferred maintenance.

Moose-Wilson Road Realignment

Funding for the realignment of Moose-Wilson Road at the northern end of the corridor at Moose and from Sawmill Ponds to the Death Canyon Road junction would likely come from the Federal Highway Administration. This construction would include two bridges to connect the new road segment across the wetland areas to the existing road. There would be no adverse effect on the park's base operating budget, but the realignment would require staff time for project supervision, management of any required road closures, ensuring access to in-holders and emergency services, and monitoring potential resource impacts, representing a short-term adverse effect. Construction along Moose-Wilson Road, which also includes resurfacing of other segments, would likely be phased over several years.

There would be long-term beneficial effects from moving the road away from both the Sawmill Ponds wetland area. The new route would avoid heavily used wildlife habitat, which would reduce the number of wildlife-induced traffic jams requiring staff attention, and there would no longer be a need to control water levels at the beaver ponds. There is a long-term adverse effect from the addition of the two bridges because they would require additional operations and maintenance funding. There would also be a short-term adverse effect from staff coordination of a powerline relocation project associated with the realignment, although the work would be performed by the local utility cooperative. The addition of 0.75 facility management FTE will provide capacity to maintain the rehabilitated road and improved turnouts and parking throughout the corridor.

Turnouts and Parking

Addition of designated turnouts with capacity for up to 120 vehicles, along with strategically placed physical barriers, would eliminate the road shoulder parking that currently occurs along Moose-Wilson Road. The construction process would pose a short-term adverse effect, but the parking improvements would offer several long-term beneficial impacts. Park staff would not have to routinely reposition barrier logs to prevent shoulder parking and damage to the pavement edge would be reduced. In addition, traffic jams would decrease as vehicles that want to stop would have designated spaces available to leave the road. Work would be performed as project funding became available, resulting in no adverse effect on the park's base operating budget.

Stabilization of the parking areas in the corridor would eliminate $44,000 in deferred maintenance.

Commercial Activity

The need to manage limitations on road-based tours and interpretive quality would be offset by the addition of 0.45 commercial services FTE.

There would be a beneficial impact for VRP staff as the elimination of most special events in the corridor would free these staff to perform other tasks.

Death Canyon

The relocation of the Death Canyon Trailhead and the reconfiguration of road access would result in a reduction in required maintenance and parking management activities, a long-term beneficial effect. The 60-car parking lot would reduce shoulder parking along Death Canyon Road and the need to manage barrier logs, although the new lot would require a minor amount of maintenance. The shorter gravel segment of Death Canyon Road would reduce road maintenance requirements, and the improvements to the remaining road would eliminate $253,000 of deferred maintenance for the unpaved portion of Death Canyon Road. Resurfacing of the paved portion of Death Canyon Road would eliminate another $251,000 of deferred maintenance. There would be an adverse effect during construction of these road and parking improvements, not only for project supervision but the likely need to close access to Death Canyon for safety reasons because trucks and heavy equipment would need to use the narrow, winding road to access work sites.

There could be a long-term adverse effect as road and trail improvements make the Death Canyon Trail more popular, which would require more intensive patrolling by VRP staff. Construction would take place as project funding became available, resulting in no adverse effect on the park's base operating budget. The conversion of the White Grass Ranger Station to a backcountry cabin for a VRP ranger would pose an adverse effect because VRP staff would face longer response to emergency situations in the Death Canyon area. The addition of 0.25 facility management FTE for trail maintenance will provide capacity to maintain the additional 0.4 mile trail segment resulting from conversion of the abandoned access road, as well as improve capacity for other trail maintenance needs within the corridor.

During the phase of construction that would rehabilitate Death Canyon Road and relocate the Death Canyon Trailhead, there would be a short-term adverse effect on the operations of the Western Center for Historic Preservation as access to and from the center would be limited. Center staff access would be limited to scheduled carpools.

Winter Access and Use

Plowing the northern portion of Moose-Wilson Road would only extend to the Murie Ranch Road junction, as opposed to the Death Canyon Road junction. There would be a beneficial effect from this reduced road clearing requirement. There is an adverse effect as VRP rescue efforts requiring access to the LSR Preserve, White Grass Ranch, Granite Canyon, or other backcountry areas would have to transit a greater distance over snow, which would lengthen response times.

Horse Use

Alternative B would reduce maintenance requirements by removing unsustainable or redundant horse trails. Improved parking for horse trailers at Poker Flats and the Death Canyon Road junction would also reduce parking conflicts by expanding accommodation for oversized horse trailers. Trail removal and parking area reconfiguration would occur as funding becomes available, resulting in no effect on the park's base operating budget.

Cumulative Impacts. There are several past, present, and future foreseeable actions that have affected or may affect park operations. Several past and future actions within the corridor have adverse and beneficial effects. The *Teton Corridor Moose to North Jenny Lake Development Concept Plan / Environmental Assessment* (1991) and the *Southwest Entrance Facilities/Environmental Assessment, Grand Teton National Park* (1998) led to construction of additional employee housing at Moose and Poker Flats, respectively, which improves employee retention and reduces commute times, while requiring additional maintenance. The *Environmental Assessment: Southwest Entrance Facilities, Grand Teton National Park* (1998) also led to the addition of an entrance station at the southern end of the Moose-Wilson corridor, which requires maintenance and staffing to operate. The *Moose Headquarters Rehabilitation: Site Work Environmental Assessment* (2010) reduced maintenance needs by removing several structures and improving stormwater management. The *Moose Wastewater / Water System Environmental Assessment* (2012) would improve water system performance and further reduce ongoing maintenance needs through upgrading or replacement of the existing water system. A new boat launch site at Moose proposed in the *Snake River Headwaters Comprehensive Management Plan and Environmental Assessment* (2013) will require maintenance and staff time to ensure visitor safety.

Grand Teton National Park currently has a deferred maintenance backlog in excess of $200 million (Annual NPS Asset Inventory Summary by Park, 2014). There could be an adverse effect to the extent that projects in other areas of the park divert funds away from needed projects in the corridor.

There are also several past, present, and future foreseeable actions occurring outside the park that could affect park operations. The *Jackson/Teton County Comprehensive Plan* (2012) and *Integrated Transportation Plan* (in process), along with the *Grand Teton National Park Transportation Plan / Environmental Impact Statement* (2006), propose the future development of a transit system in which the park would be a partner; such a system could bring more visitors into the corridor. The *Pathways Master Plan, The Town of Jackson & Teton County, Wyoming* (2007) proposed an extensive network of shared-use pathways in and outside the park, and led to the construction of such pathways along Teton Park Road to Jenny Lake and to the park's shared southern boundary with the National Elk Refuge. These pathways have increased bicycle traffic entering the corridor. Planned growth in Teton Village outlined in the *Amended Teton Village Expansion Resort Master Plan, Planned Unit Development* (Snake River Associates 2013) would increase the year-round and seasonal population to the south of the corridor, which would further increase visitation. Significant expansion of recreational activities resulting from the *Jackson Hole Ski Area Master Development Plan Revision / Environmental Impact Statement* (1996), and continuation of the open gate backcountry policy, both increase the number of winter visitors to the area immediately to the west of the corridor and the number of skiers using the park backcountry, potentially increasing the number of search and rescue operations conducted by park staff.

The impacts of alternative B are both adverse and beneficial to park operations. Short-term adverse impacts are associated with additional staff burden related to construction activities, while long-term adverse impacts are associated with staff operation of the traffic management and related information systems. Beneficial impacts are long term and associated with reduced crowding, congestion, and degradation of park assets that would reduce the staff management burden as well as operations and maintenance costs for Moose-Wilson Road and other assets in the corridor.

The overall combined impacts of these past, present, and future actions on park operations within the Moose-Wilson corridor would be long-term and primarily adverse, due to external actions that would lead to increased visitation throughout the year. These impacts, combined with the adverse and beneficial impacts under alternative B, would result in observable long-term adverse cumulative impacts on park operations, though these impacts would be of lesser magnitude than those of alternative A. The impacts of alternative B would comprise a small portion of the overall cumulative impact.

Conclusion. Alternative B would have both beneficial and adverse impacts on park operations. Alternative B includes several changes that would ease the operational burden to park staff, primarily though a reduced need to manage traffic and parking congestion. The barrier gate at the LSR Preserve would reduce overall congestion by limiting through-traffic during peak use periods. Realigning segments of Moose-Wilson Road would reduce wildlife jams and hydrology-induced pavement damage, while paving the unpaved segment would eliminate the need for dust abatement treatments. Delineated turnouts along Moose-Wilson Road and improved parking at Death Canyon Trailhead would reduce staff management of parking overflow and reduce pavement damage caused by shoulder parking.

However, the barrier gate at the LSR Preserve and traffic information system would require additional staff time to operate, and new bridges at Sawmill Ponds would require substantial additional maintenance. Commercial services staff would have to manage increased contracting and commercial use authorization requirements. Reduced winter plowing would increase emergency response times. The combination of the beneficial and adverse impacts of alternative B with the primarily adverse impact of the cumulative scenario, which is mainly due to growth and development outside of the park, would result in long-term adverse impacts on park operations, though much smaller in magnitude compared to those of the no-action alternative.

ALTERNATIVE C (NPS PREFERRED)

Alternative C proposes the following increase in staffing for the park to cover added responsibilities within the corridor.

Traffic Management

A sequenced entry system would be implemented that would limit the number of visitors in the corridor during peak-use periods. Park staff would operate this entry system and report congestion, parking lot status, and wait times for the new traveler alert board system. Interpretive staff would provide increased messaging to explain the purpose of the peak period road closure, especially to new visitors. An additional 2.00 VRP FTE would be added to operate the new queueing system and related queueing station on the north end of Moose-Wilson Road and perform the queueing function at the existing Granite Canyon Entrance Station at the south end of the corridor. There would be a long-term beneficial effect from the reduction of traffic congestion during peak use periods that would reduce the need for staff management of congestion-induced visitor use conflict in the corridor, and this effect would be greater than for alternative B, which limits only through-traffic on Moose-Wilson Road during peak periods.

There would be a short-term adverse effect from the relocation of the Moose Entrance Station and construction of a new queueing station at the north end of Moose-Wilson Road, as park staff would supervise and monitor construction. The new queueing station also poses a new maintenance requirement, a long-term adverse effect. Part of the additional 0.4 FTE allocated to the Facility Management Division for building maintenance would support the new queueing station (the remainder would support maintenance of new vault toilets in the corridor). The project would be implemented as funding becomes available, so there would be no adverse effect on the park's base operating budget.

As part of the visitor use data collection and monitoring effort, the park would install strategically placed traffic counters under alternative C at key road and parking sites. The addition of VRP FTE would provide capacity to operate and maintain these counters in addition to message boards and other components of the traffic management system in the corridor. There would be a long-term adverse effect associated with collection and analysis of traffic data, to the extent that existing staff would be diverted from other responsibilities.

Proposed Staffing Increase for Alternative C		
Division	**Proposed New FTE**	**Total Corridor FTE**
Facility Management (roads)	0.75	5.61
Facility Management (trails)	0.10	
Facility Management (buildings)	0.40	
Interpretation and Partnerships	0.00	3.10
Science and Resource Management	0.83	3.38
Visitor and Resource Protection (Sawmill Entrance Station, queueing system, traffic counters)	2.00	13.56
Business and Administration (commercial services)	0.25	0.55
Total	**4.33**	**26.20**

Physical Characteristics of Moose-Wilson Road

The unpaved segment of Moose-Wilson Road would be paved, and any road segments not realigned would be rehabilitated. There would be a short-term adverse effect during the paving process to manage the necessary road closures, and provide project supervision. Funding would likely come from the Federal Highway Administration, so there would be no effect on the park's base operating budget. There would be a long-term beneficial effect from eliminating the need to perform magnesium chloride treatments for dust suppression, as park staff would no longer need to close the road three times per year for the treatments, and the park would save approximately $30,000 annually in treatment costs.

Moose-Wilson Road Realignment

Funding for the realignment of Moose-Wilson Road at the northern end of the corridor at Moose would come from the Federal Highway Administration. There would be no adverse effect on the park's base operating budget from the realignment, but the realignment would require staff time for project supervision, management of any required road closures, ensuring access to in-holders and emergency services, and monitoring of potential resource impacts, representing a short-term adverse effect. Similarly, the new queuing station at the north end of Moose-Wilson Road would be constructed as project funding became available. There would be a long-term adverse effect from the required operation and maintenance of the new structures and queueing areas.

The segment of Moose-Wilson Road that is between the Sawmill Ponds area and the Death Canyon Road junction would be substantially reconstructed within its existing alignment. The existing grade would be raised and additional culverts installed to correct drainage issues that currently damage the pavement surface. There would be a substantial beneficial effect from reduced maintenance requirements to correct frost heaving and other damage caused by the hydrology of the area, and the lifespan of the new pavement surface would be considerably extended. In addition, protection of wetlands would be improved, and there would no longer be a need to control water levels at the beaver ponds. Ongoing maintenance costs for this alternative would be less than for alternatives B and D, as there are no bridges proposed. The proposed 0.75 additional facility management FTE for road maintenance would provide capacity to keep these additional culverts clear, maintain the rehabilitated road surface and improved parking areas throughout the corridor. Construction along Moose-Wilson Road, which also includes resurfacing other segments, would likely be phased over several years.

Turnouts and Parking

Delineation of designated turnouts with capacity for up to 120 vehicles, along with strategically placed physical barriers, would eliminate the road shoulder parking that currently occurs along Moose-Wilson Road. The construction process would pose a short-term adverse effect, but the parking improvements would offer several long-term beneficial impacts. Park staff would not have to routinely reposition barrier logs to prevent shoulder parking, and damage to the pavement edge would be reduced. In addition, traffic jams would decrease as vehicles that want to stop would have designated spaces available to leave the road. Work would be performed as project funding became available, resulting in no adverse effect on the park's base operating budget. A share of the proposed 1.15 additional facility management staff for road and building maintenance would provide capacity to maintain the improved parking areas and turnouts, new vault toilets, and the queueing areas at both corridor entrances.

Stabilization of the parking area at Sawmill Ponds would eliminate approximately $20,000 in deferred maintenance.

Commercial Activity

Road-based tour activity could increase without specific quantitative restrictions but subject to the same peak-period access limits that apply to all other visitors to the corridor. The resulting increase in permit management would be offset by the addition of 0.25 commercial services FTE.

There would be a beneficial impact for VRP staff as the elimination of most special events in the corridor would free these staff to perform other tasks.

Death Canyon

The relocation of the Death Canyon Trailhead and the reconfiguration of road access would result in a reduction in required maintenance and parking management activities, a long-term beneficial effect. The 80- to 90-car parking lot would reduce shoulder parking along Death Canyon Road and the need to manage barrier logs, although the new lot would require a minor amount of maintenance itself. The conversion of the entire unpaved segment of Death Canyon Road to a hiking trail would reduce road maintenance requirements and eliminate $253,000 of deferred maintenance for the unpaved portion of Death Canyon Road. Resurfacing of the paved portion of Death Canyon Road would eliminate another $251,000 of deferred maintenance. An additional 0.1 FTE would be allocated to the Facility Management Division to provide for upkeep of this additional trailhead and trail segment. There would be an adverse effect during construction of the road and parking improvements, not only for project supervision but the likely need to close access to Death Canyon for safety reasons, as trucks and heavy equipment would need to use the narrow, winding road to get to work sites.

There could be a long-term adverse effect as road and trail improvements make the Death Canyon trail more popular, which would require more intensive patrolling by VRP staff, though the larger parking area should require less parking management by staff than alternative B. Construction would take place as project funding became available, resulting in no adverse effect on the park's base operating budget. The conversion of the White Grass Ranger Station to a backcountry cabin for a VRP ranger would pose an adverse effect, as VRP staff would face longer response to emergency situations in the Death Canyon area.

During the phase of construction that would rehabilitate Death Canyon Road and relocate the Death Canyon Trailhead, there would be a short-term adverse effect on the operations of the Western Center for Historic Preservation as access to and from the center would be limited. Center staff access would be limited to scheduled carpools.

Horse Use

Alternative C would reduce maintenance requirements by removing unsustainable or redundant horse trails. Improved parking for horse trailers at Poker Flats, Death Canyon Road junction, and Sawmill Ponds Overlook would also reduce parking conflicts by expanding accommodation for oversized horse trailers. Trail removal and parking area reconfiguration would occur as funding becomes available, resulting in no effect on the park's base operating budget. While there would be increased workload for park staff in the short-term, there is a long-term beneficial effect from the reduced trail mileage requiring maintenance as well as a reduction in visitor conflict over parking space.

Cumulative Impacts. There are several past, present, and future foreseeable actions that have affected or may affect park operations. Several past and future actions within the corridor have adverse and beneficial effects. The *Teton Corridor Moose to North Jenny Lake Development Concept Plan / Environmental Assessment* (1991) and the *Southwest Entrance Facilities/Environmental Assessment, Grand Teton National Park* (1998) led to construction of additional employee housing at Moose and Poker Flats, respectively, which improves employee retention and reduces commute times, while requiring additional maintenance. The *Southwest Entrance Facilities/Environmental Assessment, Grand Teton National Park* (1998) also led to the addition of an entrance station at the southern end of the Moose-Wilson corridor, , which requires maintenance and staffing to operate. The *Moose Headquarters Rehabilitation: Site Work Environmental Assessment* (2010) reduced maintenance needs by removing several structures and improving stormwater management. The *Moose Wastewater / Water System Environmental Assessment* (2012) would improve water system performance and further reduce ongoing maintenance needs through upgrading or replacement of the existing water system. A new boat launch site at Moose proposed in the *Snake River Headwaters Comprehensive Management Plan and Environmental Assessment* (2013) will require maintenance and staff time to ensure visitor safety.

Grand Teton National Park currently has a deferred maintenance backlog in excess of $200 million (Annual NPS Asset Inventory Summary by Park, 2014). There could be an adverse effect to the extent that projects in other areas of the park divert funds away from needed projects in the corridor.

There are also several past, present, and future foreseeable actions occurring outside the park that could affect park operations. The *Jackson/Teton County Comprehensive Plan* (2012) and *Integrated Transportation Plan* (in process), along with the *Grand Teton National Park Transportation Plan / Environmental Impact Statement* (2006), propose the future development of a transit system in which the park would be a partner; such a system could bring more visitors into the corridor. The *Pathways Master Plan, the Town of Jackson & Teton County, Wyoming* (2007) proposed an extensive network of shared-use pathways in and outside the park, and has led to the construction of pathways along Teton Park Road to Jenny Lake and to the park's shared southern boundary with the National Elk Refuge. These pathways have increased bicycle traffic entering the corridor. Planned growth in Teton Village outlined in the *Amended Teton Village Expansion Resort Master Plan, Planned Unit Development* (Snake River Associates 2013) would increase the year-round and seasonal population south of the corridor, which would further increase visitation. Significant expansion of recreational activities resulting from the *Jackson Hole Ski Area Master Development*

Plan Revision / Environmental Impact Statement (USDA Forest Service 1996), and continuation of the open gate backcountry policy, both increase the number of winter visitors to the area immediately to the west of the corridor and the number of skiers using the park backcountry, potentially increasing the number of search and rescue operations conducted by park staff.

The impacts of alternative C are both adverse and beneficial to park operations. Adverse impacts are primarily short-term impacts associated with additional staff burden related to construction activities and long-term impacts associated with staff operation of the sequenced entry and related traffic information systems. Beneficial impacts are long term and associated with reduced crowding, congestion, and degradation of park assets that would reduce the staff management burden as well as operations and maintenance costs for Moose-Wilson Road and other assets in the corridor. In comparison to alternative B, alternative C would more effectively manage peak period crowding, proposes much less new construction, and adds more staff to maintain assets and operate the proposed peak capacity guidelines, resulting in a relatively smaller adverse impact.

The overall combined impacts of these past, present, and future actions on park operations within the Moose-Wilson corridor would be long term and primarily adverse due to external actions that would lead to increased visitation. These impacts, combined with the adverse and beneficial impacts under alternative C, would result in observable long-term adverse cumulative impacts on park operations, although these impacts would be of lesser magnitude than those of alternatives A or B. The impacts of alternative C would comprise a small portion of the overall cumulative impact.

Conclusion. Alternative C would have both beneficial and adverse impacts on park operations. Alternative C includes several changes that would ease the operational burden to park staff, primarily though a reduced need to manage traffic and parking congestion. The sequenced entry system would reduce congestion to a greater extent than in alternative B. Realigning the northern segment of Moose-Wilson Road, paving the unpaved segment, and drainage enhancements on the segment between Sawmill Ponds and the Death Canyon Road junction would reduce wildlife jams, reduce hydrology-induced pavement damage, and eliminate dust abatement needs, with lower cost and maintenance needs than the solutions in alternative B. Added turnouts along Moose-Wilson Road and expanded parking at Death Canyon Trailhead would reduce staff management of parking issues and pavement damage.

However, the sequenced entry system and traffic information system would require additional staff time to operate, as well as manage visitors waiting in the queueing areas. The combination of the beneficial and adverse impacts of alternative C with the primarily adverse impact of the cumulative scenario, which is mainly due to growth and development outside of the park, would result in long-term adverse impacts on park operations, although the impacts would be smaller in magnitude than either the no-action alternative or alternative B.

ALTERNATIVE D

Alternative D proposes the following increase in staffing for the park to cover added responsibilities within the corridor.

Proposed Staffing Increase for Alternative D		
Division	**Proposed New FTE**	**Total Corridor FTE**
Facility Management (Roads)	0.65	5.61
Facility Management (Trails)	0.10	
Facility Management (Buildings)	0.50	
Interpretation and Partnerships	0.00	3.10
Science and Resource Management (Vegetation Management)	1.50	4.05
Visitor and Resource Protection (Traffic Management)	2.25	14.81
Visitor and Resource Protection (Multiuse Pathway)	1.00	
Business and Administration	0.70	1.00
Total	**6.70**	**28.57**

Traffic Management

Visitation to the corridor during peak-use periods would be managed with a reservation system, and visitors without reservations would be accommodated on a space-available basis. Park staff would operate the reservation system, both from taking reservations and enforcement, as well as the required reporting of congestion, parking lot status, and wait times for the new traveler alert board system. Interpretive staff would provide increased messaging to explain the purpose of the peak period road closure, especially to new visitors. A total of 2.25 VRP FTE would be added to manage the reservation system, operate the new queuing station on the north end of Moose-Wilson Road, and perform the queueing function at the existing Granite Canyon Entrance Station at the south end of the corridor. There would be a long-term beneficial effect from the reduction of traffic congestion during peak use periods that would reduce the need for staff management of congestion-induced visitor use conflict in the corridor. This effect would be greater than the approach of alternative B which limits only through traffic on Moose-Wilson Road, and would be comparable to that of alternative C.

There would be a short-term adverse effect from the relocation of the Moose Entrance Station and construction of a new reservation and queueing station at the north end of Moose-Wilson Road, as park staff would supervise and monitor construction. This new entrance station also poses a new maintenance requirement, a long-term adverse effect. Part of the additional 0.5 FTE allocated to the Facility Management Division for building maintenance would support the new queueing station (the remainder would support maintenance of new vault toilets in the corridor). The project would be implemented as funding becomes available, so there would be no adverse effect on the park's base operating budget.

As part of the visitor use data collection and monitoring effort, the park would install strategically placed traffic counters under alternative D at key road and parking sites. The addition of VRP FTE would provide capacity to operate and maintain these counters in addition to message boards and other components of the traffic management system in the corridor. There would be a long-term adverse effect associated with collection and analysis of traffic data, to the extent that existing staff would be diverted from other responsibilities.

Physical Characteristics of Moose-Wilson Road

The unpaved segment of Moose-Wilson Road would remain unpaved. There would be a long-term adverse effect from the ongoing need to perform magnesium chloride treatments for dust abatement, as park staff would need to close the road three times per year for the treatments, which cost approximately $30,000 annually.

Moose-Wilson Road Realignment

Funding for the realignment of Moose-Wilson Road at the northern end of the corridor at Moose and from Sawmill Ponds to the Death Canyon Road junction would likely come from the Federal Highway Administration. This construction would include two bridges to connect the new road segment over wetlands to the existing road. There would be no adverse effect on the park's base operating budget from construction, but the realignment would require staff time for project supervision, management of any required road closures, ensuring access to in-holders and emergency services, and monitoring of potential resource impacts, representing a short-term adverse effect. Construction along Moose-Wilson Road, which also includes resurfacing other segments, would likely be phased over several years.

There would be a long-term beneficial effect from moving the road away from the Sawmill Ponds wetland area. The lifespan of the new pavement would be extended due to the improved hydrology along the proposed route. The new route would also avoid heavily used wildlife habitat, which would reduce the number of wildlife-induced traffic jams requiring staff attention. There is a long-term adverse effect from the addition of the two bridges because they would require additional operations and maintenance funding. This effect would be slightly greater than for alternative B, as the bridges in this alternative include additional deck area to accommodate segments of the proposed multiuse pathway.

There would also be a short-term adverse effect from staff coordination of a powerline relocation project associated with the realignment, although the work would be carried out by the local utility cooperative. The addition of 0.65 facility management FTE will provide capacity to maintain the rehabilitated road and improved turnouts and parking throughout the corridor.

Turnouts and Parking

Addition of designated turnouts with capacity for up to 120 vehicles, along with strategically placed physical barriers, would eliminate the road shoulder parking that currently occurs along Moose-Wilson Road. The construction process would pose a short-term adverse effect, but the parking improvements would offer several long-term beneficial impacts. Park staff would not have to routinely reposition barrier logs to prevent shoulder parking, and damage to the pavement edge would be reduced. In addition, traffic jams would decrease as vehicles that want to stop would have designated spaces available to leave the road. Work would be performed as project funding became available, resulting in no adverse effect on the park's base operating budget. Additional facility management staff would provide capacity to maintain the new vault toilet at the Granite Canyon Trailhead and Death Canyon Road junction.

Stabilization of the parking area at Sawmill Ponds would eliminate approximately $20,000 in deferred maintenance.

The two viewing areas proposed in alternative D would result in an adverse effect, as any interpretive staff presence at these sites would have to be diverted from other sites in the park, or volunteers would have to be recruited. There is also a minor maintenance requirement for the barriers that would surround each viewing area, and the gravel surface of the viewing area and associated road turnouts. Construction would occur as funding becomes available, resulting in no effect on the park's base operating budget.

Bicycle Use

The proposed multiuse pathway would require additional VRP staff for patrols to ensure visitor safety, enforcement of the sunset to sunrise closure and enforcement of periodic closures due to wildlife activity. An additional 1 VRP FTE would be added to perform these functions. While the construction cost of the pathway would be covered by non-NPS federal and/or external funds, it would require a significant ongoing allocation of park staff and operating funds to regularly clear tree and other debris and maintain the pavement surface in good condition. Staff burden related to pathway construction represents a short-term adverse effect from management of pathway construction activities. There is also a long-term adverse effect related to the increased operations and maintenance requirements of the pathway, which in addition to clearing and pavement maintenance, would involve maintenance of two combined road/pathway bridges on Moose-Wilson Road, and several pathway-only bridges over stream and irrigation ditch crossings where the pathway diverges from the road.

Commercial Activity

The level of management required under alternative D, particularly for management of the road-based tour providers within the corridor reservation system, taxi permits, and possible guided bike tours would be offset by the addition of 0.70 commercial services FTE.

There would be a beneficial impact for VRP staff as the elimination of most special events in the corridor would free these staff to perform other tasks.

Death Canyon

The relocation of the Death Canyon Trailhead and the reconfiguration of road access proposed in alternative D would result in a reduction in required maintenance and parking management activities, a long-term beneficial effect. The 100-car parking lot would reduce shoulder parking along Death Canyon Road and the need to manage barrier logs, although the new lot would require a minor amount of maintenance itself. The removal of the entire unpaved segment of Death Canyon Road, and improvement of White Grass Road, would reduce road maintenance requirements and eliminate $253,000 of deferred maintenance to the unpaved segment of Death Canyon Road. Resurfacing the paved portion of Death Canyon Road would eliminate another $251,000 of deferred maintenance. There would be an adverse effect during construction of these road and parking improvements, not only for project supervision but the likely need to close access to Death Canyon for safety reasons, as trucks and heavy equipment would need to use the narrow, winding road to get to work sites.

There could be a long-term adverse effect as road and trail improvements make the Death Canyon trail more popular, which would require more intensive patrolling by VRP staff, although the larger parking area should require less parking management by staff than in alternatives B and C. An additional 0.1 FTE would be allocated to the Facility Management Division to improve the capacity for trail maintenance. Construction would take place as project funding became available, resulting in no adverse effect on the park's base operating budget.

During the phase of construction that would rehabilitate Death Canyon Road and reconfigure the Death Canyon Trailhead, there would be a short-term adverse effect on the operations of the Western Center for Historic Preservation as access to and from the center would be limited. Center staff access would be limited to scheduled carpools.

Winter Access and Use

Plowing the northern portion of Moose-Wilson Road would only extend to the Sawmill Ponds Overlook, as opposed to the Death Canyon Road junction. There would be a beneficial effect from this reduced road clearing requirement, although less than in alternative B. There is an adverse effect as VRP rescue efforts requiring access to the LSR Preserve, White Grass Ranch, Granite Canyon, or other backcountry areas would have to transit a greater distance over snow, which would lengthen response times.

Horse Use

Alternative D would reduce maintenance requirements by removing unsustainable or redundant horse trails. Improved parking for horse trailers at Poker Flats, Death Canyon Road junction, Sawmill Ponds Overlook, and Granite Canyon Trailhead would also reduce parking conflicts by expanding accommodation for oversized horse trailers. Trail removal and parking area reconfiguration would occur as funding becomes available, resulting in no effect on the park's base operating budget, although there would be additional workload for park staff in the short term, while the work is underway. There is a long-term beneficial effect from the reduced trail mileage requiring maintenance as well as a reduction in visitor conflict over parking space, though potential for conflict is greater than in alternative C due to the shared use of the Granite Canyon Trailhead.

Cumulative Impacts. There are several past, present, and future foreseeable actions that have affected or may affect park operations. Several past and future actions within the corridor have adverse and beneficial effects. The *Teton Corridor Moose to North Jenny Lake Development Concept Plan /Environmental Assessment* (1991) and the *Southwest Entrance Facilities/Environmental Assessment, Grand Teton National Park* (1998) led to construction of additional employee housing at Moose and Poker Flats, respectively, which improves employee retention and reduces commute times, while requiring additional maintenance. The *Southwest Entrance Facilities/Environmental Assessment, Grand Teton National Park* (1998) also led to the addition of an entrance station at the southern end of the Moose-Wilson corridor, which requires maintenance and staffing to operate. The *Moose Headquarters Rehabilitation: Site Work Environmental Assessment* (2010) reduced maintenance needs by removing several structures and improving stormwater management. The *Moose Wastewater / Water System Environmental Assessment* (2012) would improve water system performance and further reduce ongoing maintenance needs through upgrading or replacement of the existing water system. A new boat launch site at Moose proposed in the *Snake River Headwaters Comprehensive Management Plan and Environmental Assessment* (2013) would require maintenance and staff to ensure visitor safety.

Grand Teton National Park currently has a deferred maintenance backlog in excess of $200 million (Annual NPS Asset Inventory Summary by Park, 2014). There could be an adverse effect to the extent that projects in other areas of the park divert funds away from needed projects in the corridor.

There are also several past, present, and future foreseeable actions occurring outside of the park that could affect park operations. The *Jackson/Teton County Comprehensive Plan* (2012) and *Integrated Transportation Plan* (in process), along with the *Grand Teton National Park Transportation Plan/Environmental Impact Statement* (2006), propose the future development of a transit system in which the park would be a partner; such a system could bring more visitors into the corridor. The *Pathways Master Plan, The Town of Jackson & Teton County, Wyoming* (2007) proposed an extensive network of shared-use pathways in and outside the park, and has led to the construction of pathways along Teton Park Road to Jenny Lake and up to the park's shared southern boundary with the National Elk Refuge. These pathways have increased bicycle traffic entering the corridor. Planned growth in Teton Village outlined in the *Amended Teton Village Expansion Resort Master Plan*, *Planned Unit Development* (Snake River Associates 2013) would increase the year-round and seasonal population to the south of the corridor, which would further increase visitation. Significant expansion of recreational activities resulting from *the Jackson Hole Ski Area Master Development Plan Revision / Environmental Impact Statement* (USDA Forest Service 1996), and continuation of the open gate backcountry policy, both increase the number of winter visitors to the area immediately to the west of the corridor and the number of skiers using the park backcountry, potentially increasing the number of search and rescue operations conducted by park staff.

The impacts of alternative D are both adverse and beneficial to park operations. Adverse impacts are primarily short-term impacts associated with additional staff burden related to construction activities and long-term impacts associated with staff operation of reservation system and related traffic information systems. Compared to alternatives B and C, the adverse impacts are of greater magnitude due to the multiuse pathway, which represents a significant increase in patrolling and maintenance requirements in the corridor, as well as the construction of larger bridges to accommodate both the road and pathway over wetlands and separated pathway bridges over streams and irrigation ditch crossings, and the need to continue maintenance of the unpaved segment of Moose-Wilson Road. Beneficial impacts are long-term and associated with reduced crowding, congestion, and degradation of park assets that would reduce the staff management burden as well as operations and maintenance costs for Moose-Wilson Road and other assets in the corridor.

The overall combined impacts of these past, present, and future actions on park operations within the Moose-Wilson corridor would be long-term and primarily adverse, due to external actions that would lead to increased visitation. These impacts, combined with the adverse and beneficial impacts under alternative D, would likely result in observable long-term adverse cumulative impacts on park operations, of a magnitude greater than in alternatives B or C. The impacts of alternative D would comprise a considerable portion, but less than a majority, of the overall cumulative impact.

Conclusion. Alternative D would have both beneficial and adverse impacts on park operations. Alternative D includes several changes that would ease the operational burden to park staff, primarily through a reduced need to manage traffic and parking congestion. The reservation system would reduce congestion to a greater extent than in alternative B but to a similar extent as alternative C. Realigning segments of Moose-Wilson Road would reduce wildlife jams and reduce hydrology-induced pavement damage. Added turnouts along Moose-Wilson Road and expanded parking at Death Canyon Trailhead would reduce staff management of parking issues and pavement damage.

However, the reservation system and traffic information system would require additional staff time to operate, as well as manage visitors waiting to enter the corridor. The multiuse pathway would present a sizeable increase in operational requirements, including patrolling, clearing debris, closures for wildlife activities, and pavement maintenance. New roadway/pathway bridges over wetlands and separated pathway bridges over stream and irrigation ditch crossings would require more maintenance than those in alternative B because they must accommodate the added width of the pathway. Commercial services staff would have to manage increased permitting requirements relative to alternatives B and C with the addition of taxi permitting and reduced winter plowing of Moose-Wilson road would lengthen emergency response times. The combination of the beneficial and adverse impacts of alternative D with the primarily adverse impact of the cumulative scenario, which is mainly due to growth and development outside the park, would result in long-term adverse impacts on park operations. These impacts would be larger in magnitude than for alternatives B and C, primarily due to the construction and maintenance of new infrastructure proposed in alternative D.

5 Consultation and Coordination

Photograph courtesy of Jackson Hole Historical Society

PUBLIC AND AGENCY INVOLVEMENT

The National Park Service consulted with various agencies, tribes, organizations, and interested persons in preparing this document. The process of consultation and coordination is an important part of this project. The public had two primary avenues for participation during the development of the plan—participation in public meetings and responding to newsletters by submitting comments via regular mail, by hand, and electronically through the NPS Planning, Environment, and Public Comment (PEPC) system website. This chapter summarizes the opportunities the public had to participate in the planning process, the roles four cooperating agencies played in developing the plan, and consultations that occurred with federal and state agencies and tribes.

PUBLIC SCOPING

On December 6, 2013, the National Park Service published in the *Federal Register* (vol. 78, no. 235, pages 73559–73560) a notice of intent to develop a comprehensive management plan / environmental impact statement for the Moose-Wilson corridor. The notice requested the public to share their thoughts, concerns, and ideas for the corridor during a 60-day comment period, which ran between December 6, 2013, and February 6, 2014. The planning team sought this public input to understand the public's perspectives on key issues and management options for the future of the Moose-Wilson corridor. These comments were instrumental in the subsequent creation of the range of preliminary plan alternatives.

To inform the public of the scoping process, a newsletter describing the context for the plan and how to comment was distributed in December 2013. This newsletter provided a general overview of the planning schedule and data collection efforts, provided background on issues and opportunities within the project area, and described the foundational elements that would guide planning and management.

To reach a broad audience, the newsletter and information about public scoping were shared with the public in a variety of ways. Paper copies of the newsletter were mailed to individuals on the park's general mailing list (528 contacts). Paper copies were also provided to the Teton County Library and the Jackson Hole and Greater Yellowstone Visitor Center in Jackson, Wyoming. A press release was issued announcing public scoping, which received coverage from a variety of news media and advocacy organizations, including *Jackson Hole News and Guide*, *Yellowstone Gate*, and National Parks Traveler. An easy to access web page (go.nps.gov/moose-wilson) was created and a Constant Contact® Email Marketing™ campaign dedicated to this planning effort was initiated. The web page included information on the plan, a link to the PEPC site, and a way for individuals to sign up for the park's Constant Contact mailing list. Constant Contact was used to send e-mail updates about the public scoping period. Social media, including Facebook and Twitter, were also used during the scoping period to inform people about the planning effort.

A large majority of the public comments (75%) submitted during the public scoping period were from Wyoming, but comments were also received from across the country. A total of 1,007 individual correspondences were submitted, of which 487 were submitted directly to the NPS PEPC website. In addition, 520 form letters were received from Friends of Pathways, some of which contained personalized responses from the public. Hard copy letters that were mailed or delivered to the park, including those submitted on behalf of Friends of Pathways, were entered into the PEPC system.

Approximately 187 people also attended a January 14, 2014, public open house held at St. John's Medical Center in Jackson, Wyoming. During the public open house, approximately 300 comments on flip charts and maps and 14 comment cards were received. All hand-written comments received during the public open house were transcribed and entered into the PEPC system.

In addition to general public comments, the National Park Service received 28 letters from agencies and organizations, including the State of Wyoming (Wyoming Game and Fish Department, Office of the Governor), Teton County and the Town of Jackson, conservation groups (e.g., Greater Yellowstone Coalition, National Parks Conservation Association), user groups (e.g., International Mountain Bicycling Association, League of American Bicyclists, Teton Backcountry Horsemen), and other special interest groups (e.g., Friends of Pathways, Jackson Hole Chamber of Commerce).

For more details on the nature of the scoping comments, see the "Public Scoping Report: Moose-Wilson Corridor Comprehensive Management Plan" (NPS 2014).

Public Engagement on the Preliminary Alternatives

During the spring of 2014, the NPS planning team began developing a range of preliminary alternatives for the *Moose-Wilson Corridor Comprehensive Management Plan / Environmental Impact Statement*. While not required by the National Environmental Policy Act, the planning team felt that public feedback on the preliminary alternatives would be vital to inform development of the draft environmental impact statement.

To inform the public of the range of preliminary alternatives and provide an update on the planning effort, a newsletter was released on August 14, 2014. The newsletter described the draft goals and desired conditions for each fundamental resource and value, management strategies and contextual maps for each preliminary alternative, provided an update on data collection efforts, and identified next steps in the planning processes. The public was asked to provide feedback on the preliminary alternatives during a 30-day comment period that ran from August 15 to September 15, 2014.

To reach a broad audience, the newsletter and information about the preliminary alternatives were shared with the public in a variety of ways. Paper copies of the newsletter were mailed to individuals on the park's general mailing list (528 contacts). Paper copies were also provided to the Teton County Library and the Jackson Hole and Greater Yellowstone Visitor Center in Jackson, Wyoming. A press release was distributed announcing the release of the range of preliminary alternatives, which received coverage from a variety of news media and advocacy groups, including *Jackson Hole News and Guide*, *Wyoming Business Report*, and National Parks Traveler. The park's website dedicated to this planning effort was also updated. The park's website included information on the plan and a link to the NPS PEPC website where the public could access an electronic version of the newsletter and submit their comments. Constant Contact Email Marketing (with more than 500 subscribers) and social media (with more than 250,000 followers) were used to inform the public of the preliminary alternatives and direct them to the park's website and the NPS PEPC website.

A large portion of public comments (26%) submitted during the public review of the range of preliminary alternatives were from Wyoming, but comments were received from individuals in all 50 states and Washington, D.C. Eighteen correspondences were received from 11 foreign countries. A total of 2,605 individual correspondences were received, the majority of which were submitted directly to the PEPC website. Hard copy letters that were mailed or delivered to the park also were entered into the PEPC system.

Approximately 180 people attended an August 28, 2014, public open house held at the Teton County Library in Jackson, Wyoming. During the public open house, approximately 365 comments on flip charts and comment cards were received. All hand-written comments received during the public open house were transcribed and entered into the PEPC system.

In addition to individual public comments, comments were received from 31 agencies and organizations, including the State of Wyoming (Wyoming Office of Tourism), US Environmental Protection Agency, Teton County and Town of Jackson, conservation groups (e.g., Jackson Hole Conservation Alliance, Sierra Club, Wilderness Society), user groups (e.g., Treasure Valley Cycling Alliance, Teton Equestrian Club), and other special interest groups (e.g., Society for American Archaeology Repatriation, Wyoming Pathways).

For more details on the nature of the scoping comments, see the "Public Comment Report. Moose-Wilson Corridor Comprehensive Management Plan. Preliminary Alternatives" (NPS 2014).

Cooperating Agency Participation

As established in CEQ regulations (40 CFR Part 1501), Executive Order 13352 on cooperative conservation, and the Department of the Interior Departmental Manual on NEPA (516 DM 2.5), Interior bureaus will cooperate with all agencies that have jurisdiction by law or special expertise to the "fullest extent practicable." The National Park Service invited four agencies with special expertise to be cooperating agencies in preparing the *Moose-Wilson Corridor Comprehensive Management Plan*. The role of a cooperating agency in an environmental impact statement is to collaborate, under the coordination of the lead agency, throughout the NEPA process on issues relating to the cooperating agency's jurisdiction or special expertise. Cooperating agency participation is intended to enable effective communication among government entities and provide relevant information to be used in the forthcoming NPS decision on the Moose-Wilson corridor.

Federal Highway Administration, Western Federal Lands Highway Division. An agreement was signed with this federal agency on January 21, 2014, to cooperate in preparing the environmental impact statement. The Western Federal Lands Highway Division was requested to be a cooperating agency because it has jurisdiction by law as the funding agency for transportation elements of the proposed action, and it has special transportation planning expertise. The division provided technical expertise and assistance, as appropriate, during the planning process and provided review comments on draft documents. It also ensured the plan is in compliance with any necessary Federal Highway Administration standards and requirements.

State of Wyoming, Teton County, and the Town of Jackson, Wyoming. A memorandum of understanding was established between the National Park Service and these agencies in October 2013 in order for them to serve as cooperating agencies on the *Moose-Wilson Corridor Comprehensive Management Plan*. These agencies all have special expertise on the corridor and its environs. They provided technical assistance and advice, and technical reviews as appropriate, in such areas as historical, current, and projected traffic volumes that could influence traffic volumes on Moose-Wilson Road, and information regarding proposed transportation or other development projects that could affect use of the road.

CONSULTATION WITH OTHER AGENCIES / OFFICIALS AND ORGANIZATIONS

US Fish and Wildlife Service, Section 7 Consultation

The National Park Service initiated informal consultation with the US Fish and Wildlife Service, Wyoming Field Office, in a letter dated January 21, 2014. The letter notified the US Fish and Wildlife Service that the National Park Service was developing a comprehensive management plan for the Moose-Wilson corridor and was initiating informal consultation on the project. The Endangered Species Act requires (section 7(a)(2)) that each federal agency, in consultation with the Secretary of the Interior, ensure that any action the agency authorizes, funds, or carries out is not likely to jeopardize the continued existence of a listed species or result in the destruction or adverse modification of designated critical habitat. The US Fish and Wildlife Service was requested to provide a current list of federally listed plant and animal species and any designated critical habitat for such species that might occur in and around the corridor.

The planning team subsequently checked the US Fish and Wildlife Service website for federally listed species in Teton County. Based on the park staff's knowledge of species occurring in the project area, the list of possible listed species was narrowed down to grizzly bear, Canada lynx, gray wolf, and greater sage-grouse. The yellow-billed cuckoo western distinct population segment also was considered as an impact topic, but dropped from further analysis (see chapter 1).

A separate biological assessment is being prepared that analyzes the effects of the preferred alternative on the grizzly bear, Canada lynx, gray wolf, and greater sage-grouse in accordance with the Endangered Species Act. The biological assessment will be submitted to the US Fish and Wildlife Service for their concurrence and will be included in an appendix in the final environmental impact statement.

Section 106 Consultation with Wyoming State Historic Preservation Office

In a letter dated December 30, 2013, the National Park Service (Grand Teton National Park) notified the Wyoming State Historic Preservation Office of the intent to consult under section 106 of the National Historic Preservation Act regarding the preparation of a comprehensive management plan / environmental impact statement for the Moose-Wilson corridor. The Wyoming SHPO has been informed of the status of the project throughout the planning process and was provided a copy of the preliminary alternatives newsletter. The Wyoming SHPO responded (informal correspondence dated September 18, 2014) that it was unclear at that preliminary point in the alternatives development process which alternative would have the greatest impact on cultural resources. NPS staff has also consulted with the SHPO regarding studies and reports supporting the identification and assessment of cultural resources within the area of potential effect, including the eligibility of the Moose-Wilson corridor's cultural landscape for listing in the National Register of Historic Places. In previous correspondence (August 31, 2006, prior to the present planning effort) the SHPO concurred with a finding of national register eligibility for Moose-Wilson Road.

Park staff have substantially completed cultural resource surveys of the area of potential effect. There may be a need to conduct additional surveys for specific project areas that are yet to be finalized (e.g., rerouted horse trails, vehicle turnouts, horse trailer parking areas) and to carry out monitoring during construction. However, the historic properties currently identified in the document reflect the best available information regarding the known resources that could be affected by project actions.

The SHPO will be provided a review copy of the draft plan / environmental impact statement to assess the potential effects of the proposed alternatives on cultural resources (archeological resources; ethnographic resources; historic structures, sites, and cultural landscapes). In accordance with section 106 provisions, the National Park Service will continue to consult with the SHPO, associated American Indian tribes, and other stakeholders as actions identified in the plan advance to more detailed design development and implementation stages.

Consultation with American Indian Tribes

In letters dated January 16, 2014, the National Park Service (Grand Teton National Park) notified representatives of the park's associated tribal governments of the intent to prepare a comprehensive management plan / environmental impact statement for the Moose-Wilson corridor and to seek to consult with the tribes under section 106 of the National Historic Preservation Act. The tribes were informed of the status of the project throughout the planning process, and in correspondence dated August 28, 2014, were provided copies of the preliminary alternatives newsletter for their review and comment.

On July 15 and 16, 2014, NPS staff met with and held onsite visits with tribal representatives at selected locations along the Moose-Wilson corridor to assess tribal issues and concerns and to gain insight into potential resources of cultural importance. Representatives of the Arapaho Tribe of the Wind River Reservation, Crow Tribe of Montana, Fort Belknap Indian Community, Northern Cheyenne Tribe, Shoshone-Bannock Tribes, and Yankton Sioux Tribe of South Dakota, accompanied NPS staff on the site visits. Among the items discussed were recommendations for tribal members to assist archeological surveys. The importance of incorporating tribal perspectives in interpretive programs and media, measures to improve consultation, and the purpose and need of the *Moose-Wilson Corridor Comprehensive Management Plan* were also discussed.

Subsequent tribal consultation meetings and a rapid ethnographic assessment of the Moose-Wilson corridor were held November 5–7, 2014, with the participation of representatives of the Assiniboine and Sioux Tribes, Crow Tribe of Montana, Shoshone-Bannock Tribes, and Shoshone Tribe of the Wind River Reservation. The rapid ethnographic assessment was intended to examine and document traditional and contemporary tribal perspectives on the resources and landscape of the corridor, and to address potential impacts on ethnographic resources from actions proposed in the comprehensive management plan / environmental impact statement, along with recommended mitigation measures. Site visits were made to identified archeological sites and tribal representatives discussed the cultural importance of the sites and resources along the road corridor.

Associated tribes will be provided copies of the draft plan / environmental impact statement for their review and comment and will be invited to participate, as appropriate, in follow-up project meetings (yet to be scheduled). In accordance with section 106 provisions, the National Park Service will continue to consult with the tribes as actions identified in the plan advance to more detailed design development and implementation stages.

AGENCIES AND ORGANIZATIONS RECEIVING A COPY OF THIS DOCUMENT

Federal Agencies

Advisory Council on Historic Preservation
Bureau of Land Management
- Cheyenne
- Pinedale

- Rock Springs Field Office
- Wyoming State Office

Bureau of Reclamation
- Boise
- NW Regional Office

Federal Aviation Administration
Federal Highway Administration, Western Federal Lands Highway Division
National Resources Conservation Service, USDA
Teton Village Association
US Army Corps of Engineers
- Cheyenne
- Omaha District
- Walla Walla

US Department of Agriculture, Agriculture Extension Agent
US Environmental Protection Agency
US Fish and Wildlife Service
- Cheyenne Office
- Jackson Hole Fish Hatchery
- National Conservation Training Center
- National Elk Refuge

US Forest Service
- Bridger-Teton National Forest
- Caribou-Targhee National Forest
- Regional Forester, Northern Region

US Geological Survey
- Colorado Water Science Center
- Reston

US Post Office
- Moose
- Moran
- Teton Village

Yellowstone National Park

US Senators and Representatives

Senator John Barrasso
Senator Michael B. Enzi
Representative Cynthia Lummis

State Agencies

Idaho Dept. of Commerce
Idaho Dept. of Parks & Recreation
Montana Heritage Commission
University of Wyoming
Wyoming Department of Agriculture
Wyoming Department of Environmental Quality
Wyoming Department of Transportation
Wyoming Extension Office
Wyoming Game & Fish Department
Wyoming Governor's Policy Office
Wyoming Highway Patrol
Wyoming Office of Tourism
Wyoming State Historic Preservation Office
Wyoming State Fire Marshall
Wyoming State Forester
Wyoming State Veterinarian

State Officials

Governor Matt Mead
Senator Leland Christensen
Senator Don Dockstader
Representative Marti Halverson
Representative Ruth Ann Petroff
Representative Andy Schwartz

Local and Regional Government Agencies and Officials

Jackson Hole Airport
Teton Conservation District
Teton County
- Commissioners
- Engineer
- Fire Department
- Historic Preservation Board
- Planning & Development
- Sheriff

Town of Jackson
- Mayor
- Planning Director
- Town Council
- Town Manager

American Indian Tribes Traditionally Associated with Grand Teton National Park

Apache Tribe of Oklahoma
Arapaho Tribe of the Wind River Reservation, Wyoming
Assiniboine and Sioux Tribes of the Fort Peck Indian Reservation, Montana
Blackfeet Tribe of the Blackfeet Indian Reservation of Montana
Burns Paiute Tribe
Cheyenne and Arapaho Tribes, Oklahoma
Coeur D'Alene Tribe
Comanche Nation, Oklahoma
Confederated Salish & Kootenai Tribes of the Flathead Reservation
Confederated Tribes of the Colville Reservation
Confederated Tribes and Bands of the Yakama Nation
Crow Tribe of Montana
Fort Belknap Indian Community of the Fort Belknap Reservation of Montana
Kiowa Indian Tribe of Oklahoma
Kootenai Tribe of Idaho
Nez Perce Tribe
Northern Cheyenne Tribe of the Northern Cheyenne Indian Reservation, Montana
Oglala Sioux Tribe
Rosebud Sioux Tribe of the Rosebud Indian Reservation, South Dakota
Shoshone-Bannock Tribes of the Fort Hall Reservation
Shoshone Tribe of the Wind River Reservation, Wyoming
Standing Rock Sioux Tribe of North & South Dakota
Yankton Sioux Tribe of South Dakota

Libraries

Teton County Library
University of Wyoming Library
Wyoming State Library

Media

Jackson Hole News and Guide
Wyoming Public Radio
AP Cheyenne

Organizations and Businesses

A&E Architects
AAC/Climbers Ranch
Abegglen Construction, Inc.
Adventure Cycling Association
Alliance for Historic Wyoming
American Packrafting Association
Audubon Wyoming
Back Country Horsemen
Bank of Jackson Hole
Barker-Ewing Scenic Tours, Inc.
Biota Research & Consulting, Inc.
BIO-WEST, Inc.
Black Diamond Real Estate
Brushbuck Guide Service
Casper Mountain Biathlon Club
Center for Biological Diversity
Cheyenne High Plains Audubon Society
Coalition of National Park Service Retirees
Cooper Roberts Simonsen Assoc.
Cougar Fund
Craighead Beringia South
Craighead Institute
Defenders of Wildlife
Dubbe-Moulder Architects
Earth Friends
Exum Mountain Guides
Fabian & Clendenin, P.C.
Fish Creek Ranch
Flitner Communications
Friends of Pathways
Grand Teton Association
Grand Teton Lodge Company
Grand Teton National Park Foundation
Greater Yellowstone Coalition
Gros Ventre River Ranch
HandsOn Design
Hatchet Resort
Headwaters Lodge & Cabins at Flagg Ranch
Heart 6 Ranch Float Trips
Herbst Lazy TY Cattle Co.

Idaho Falls Chamber of Commerce
Idaho Wildlife Federation
International Mountain Bicycling Association
Jack Dennis Fishing Trips
Jackson Hole & Greater Yellowstone Visitor Center
Jackson Hole Bird Club
Jackson Hole Chamber of Commerce
Jackson Hole Conservation Alliance
Jackson Hole Historical Society
Jackson Hole Land Trust
Jackson Hole Mountain Resort
Jackson Hole Preserve, Inc.
Jackson Hole Wildlife Foundation
Jenny Lake Boating
JH Conservation Alliance
Jorgensen Associates
Lander Chamber of Commerce
League of American Bicyclists
Lost Creek Ranch
Meridian Institute
Mountain Weather
National Museum of Wildlife Art
National Outdoor Leadership School, Rocky Mountain Branch
National Park Float Trips
National Park Foundation
National Parks Conservation Association
National Trust for Historic Preservation
Nelson Engineering
Northern Rockies Conservation Cooperative (NRCC)
O.A.R.S., Inc.
Pinto Ranch
R Lazy S Ranch
Rails-to-Trails Conservancy
Rendezvous Ski Tours
Richard Pack Construction
Rocky Mountain Elk Foundation
Sammons Dutton LLC
Save Historic Jackson Hole
Sierra Club, Wyoming Chapter
Signal Mountain Lodge
Snake River Angler and Float Trips
Snake River Audubon Society
Snake River Fund
Snake River Ranch
Society for Wilderness Stewardship
Solitude Float Trips
START
Sublette County Chamber of Commerce
Teton Back Country Horsemen
Teton Mountain Bike Tours
Teton Regional Land Trust
Teton Science Schools
Teton Valley Trails & Pathways
Teton Village Improvement and Service District
The Art Association of Jackson Hole
The Hole Hiking Experience
The Murie Center
The Nature Conservancy
The Nature Conservancy in Idaho
The Wilderness Society
Trail Creek Ranch
Traditional Building Skills Institute
Trachtenberg Donor Advised Fund
Treasure Valley Cycling Alliance
Trout Unlimited
TVRC Education Foundation
Union Telephone
Voices of the South
Western Wyoming Community College
Wilcox Gallery
Wilderness Ventures
Wilderness Watch
Wildlife Trust
Wyoming Native Plant Society
Wyoming Outdoor Council
Wyoming Pathways
Wyoming Wildlife Federation
Yellowstone Association

Appendixes, Selected References, Preparers, Consultants, and Index

APPENDIX A

VISITOR USE MANAGEMENT: VISITOR CAPACITY DETERMINATION

Overview

A visitor use management framework has been developed and discussed as part of this planning effort. Broadly speaking, visitor use management is the proactive and adaptive process of planning for and managing characteristics of visitor use and its physical and social setting, using a variety of strategies and tools to sustain desired resource conditions and visitor experience. Within this framework, desired conditions, indicators and thresholds, and adaptive management strategies have been drafted. Another component of this framework is the development of a visitor capacity. Visitor capacity is a component of visitor use management consisting of the maximum amount and types of visitor use that an area can accommodate while sustaining desired resource conditions and visitor experiences, consistent with the purpose for which the area was established. Visitor capacity will be used to inform and implement the adaptive management strategies selected as part of this comprehensive management plan / environmental impact statement (plan). Visitor use refers to human presence in an area for recreational purposes, including education, interpretation, inspiration, and physical and mental health.

Terms and Definitions

Characteristics of visitor use include the amount, type, timing, and distribution of visitor activities and behaviors.

Visitor use management is the proactive and adaptive process of planning for and managing characteristics of visitor use and its physical and social setting, using a variety of strategies and tools, to sustain desired resource conditions and visitor experiences.

Visitor capacity, a component of visitor use management, is the maximum amounts and types of visitor use that an area can accommodate while achieving and maintaining desired resource conditions and visitor experiences consistent with the purposes for which the area was established.

Desired conditions are statements of aspiration that describe resource conditions, visitor experiences and opportunities, and levels of facilities and services that an agency strives to achieve and maintain in a particular area.

Visitor experience is the perceptions, feelings, and reactions that a visitor has before, during, and after a visit to a park site. This includes planning for the visit, engaging with all aspects of the area (resources, facilities, staff), gaining knowledge of and developing attitudes toward the cultural and natural resources, and taking home memories and emotions associated with the visit. It also includes how one views the opportunities available and the quality of service provided at the park site.

Indicators are specific resource or experiential attributes that can be measured to track changes in conditions so that progress toward achieving and maintaining desired conditions can be assessed.

Thresholds are minimally acceptable conditions associated with each indicator.

[*Note: The above definitions are currently in development by the Interagency Visitor Use Management Council and will be updated as new guidance is available.]

Moose-Wilson Corridor Context – The amount, timing, distribution, and types of visitor use in the Moose-Wilson corridor influence both resource conditions and visitor experiences. Currently, there is high demand for and high levels of use in the corridor during peak summer months. The levels and patterns of visitation are causing some negative impacts and influencing the ability of the National Park Service to achieve desired conditions. A visitor capacity is one tool to help the National Park Service to effectively implement some of the adaptive management strategies outlined in the plan that are tied to when and how visitors access the corridor. These strategies (seasonal gate at the Laurance S. Rockefeller Preserve, timed sequencing, and a reservation system) would allow an equitable distribution of opportunities while supporting desired conditions.

The corridor is primarily reached via personal vehicles. The experience of driving in the corridor is a sought after visitor experience and consistent with desired conditions of the corridor. For destinations within the corridor, desired resource and social conditions associated with each area determine the number of visitors that can be accommodated. The linear nature and patterns of use in the corridor make managing use levels at the entrances to the corridor most efficient. The visitor capacities for the corridor's primary destinations and the Moose-Wilson Road have all been assessed based on best available information and consideration of the desired conditions and management strategies identified in this plan. The relationship of the destinations and road capacities has been assessed to develop an overall corridor capacity that can be used to manage visitation levels in the corridor whether visitors are reaching the corridor by personal vehicle or any other mode of transportation.

Approach

Four key locations within the Moose-Wilson corridor that are integral to considering a corridor-wide capacity were identified and discussed during planning workshops: Death Canyon Trailhead, the Laurance S. Rockefeller Preserve, Granite Canyon Trailhead, and Moose-Wilson Road. See figure A-1 for an overview of these locations in the context of determining visitor capacity. For each of these locations, major contributing factors of how the locations are used by visitors have been summarized and presented below. Key datasets analyzed include: vehicular traffic levels, vehicle stopping and parking behavior, parking accumulation, and pedestrian use levels. It is important that the visitor capacity focus on visitation levels (number of people), which relate more directly to desired conditions rather than number of parking spaces or vehicles. Vehicular-related datasets have, as mentioned, been used below to inform a visitor capacity due to their relevancy to current use levels and patterns as visitors most often access the corridor via personal vehicle. However, in the future alternative transportation systems could be implemented as part of this plan. To protect resources and meet desired conditions, the number of people using these sites would need to remain the same, regardless of how visitors reach those destinations. If a shuttle or other system were to be implemented, increased numbers of visitors could be brought into this area, likely resulting in unintentional consequences to resources and visitor experiences. By establishing a visitor capacity related to visitation levels, a shuttle or other system could be managed around that number, therefore maintaining desired conditions and avoiding unintended consequences to resources.

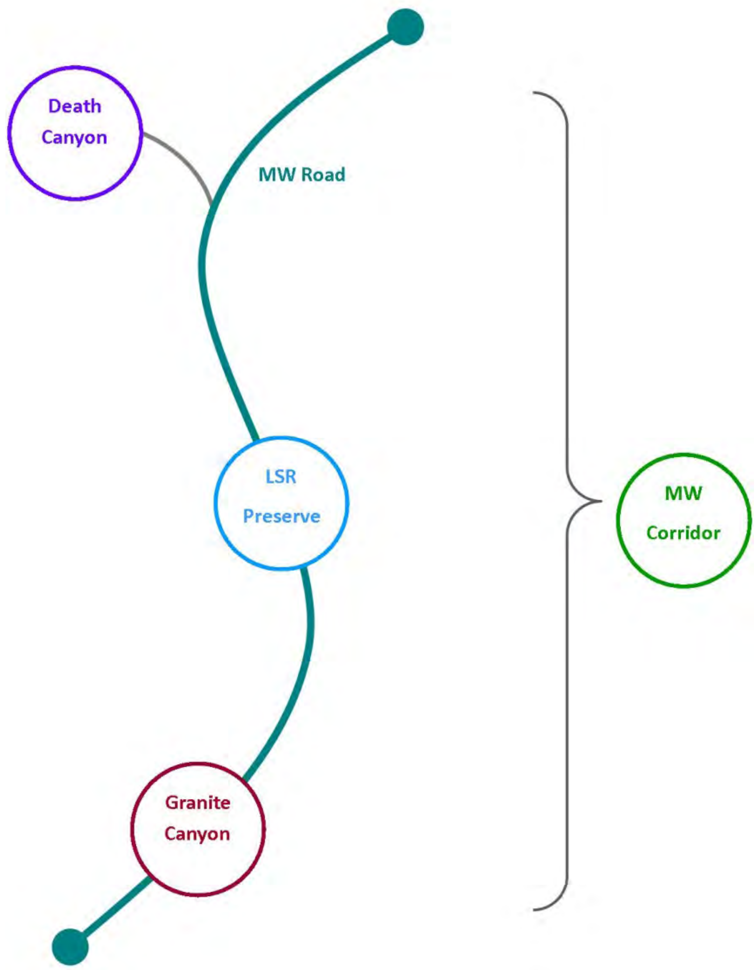


Figure A-1. Overview of Key Locations Analyzed

For each key location, the following will be presented. A visitor capacity for the Moose-Wilson corridor will be presented after the key locations.

- Desired Conditions
- Relevant Indicators
- Overview of Visitor Use Issues
- Current Use Levels
- Visitor Capacity

Data Rationale

Research was conducted by the Utah State University on the use levels, types, patterns, and impacts within the Moose-Wilson corridor during the summer and fall of 2013 and the winter of 2014. Results from these research efforts were reported in both average and peak levels in the technical reports provided to the National Park Service. For the purpose of visitor capacity, the average figures from late July and early August have been used as they represent the highest reported average. Maximum use levels observed were not used as the highest use days or instances are not representative of typical use patterns within the corridor; they instead represent extreme conditions that occur occasionally. By using datasets reporting the average levels of use, and focusing on the highest of those averages, visitor capacity and therefore management strategies will be designed to address conditions in the corridor found most often. Of the sampling periods, data have been drawn from those that reported the highest average levels of use. Numbers below have been approximated.

DEATH CANYON

Desired Conditions

Conditions at this location should support wilderness character values. The trailhead is a portal into wilderness. As visitors approach the trailhead, designated parking areas should be clearly visible and intuitive but also aesthetically aligned with the rustic character of the corridor. The integrity of the White Grass Ranch Historic District and other nearby cultural resources should be retained.

Relevant Indicators

- peak levels of use on trails
- number of people at one time at key destinations
- amount of use-created overflow parking at destination trailheads
- condition of historic and archeological sites
- amount of user-created roadside disturbance
- number of user-created social trails

Overview of Visitor Use Issues

The largest visitor use issue at Death Canyon is overflow parking and the condition of Death Canyon Road. Designated parking areas become full early in the morning during peak season and vehicles park in undesignated areas along the roadway. More vehicles were parking in undesignated parking areas at this location than any other in the corridor during the 2013 season. Action alternatives within the plan address these issues by formalizing parking so that parking occurs in one clearly defined area rather than haphazardly along the road. Condition of the road is addressed by either eliminating or improving the unpaved segment of Death Canyon Road. A secondary, but increasing, issue near the trailhead is human-caused impacts at “jump rock,” which is within potential wilderness and the type of activity, particularly yelling, is not consistent with wilderness character and the desired conditions of the corridor. Social trailing and soil compaction are also increasing in the immediate vicinity.

Current Use Levels

Vehicle Use. On average, peak traffic levels occur late morning to early afternoon on Death Canyon Road. The first half of August had the highest averages of vehicular use with approximately 280 vehicles per day traveling on Death Canyon Road. From August 1–15, 38% of vehicles spend more than 3 hours at Death Canyon Road parking lots and associated visitor-created parking areas. Roughly 40% of vehicles remained in the area between 6 minutes to under 3 hours; with 25% staying 5 minutes or less. According to hourly averages of observed vehicular parking at Death Canyon in the first half of August, use peaks at 1:00 p.m. with 25 vehicles observed in designated parking areas and 62 vehicles in undesignated and visitor-created parking. The peak number of vehicles at Death Canyon during the peak period of August 1–15 is therefore approximately 90. Observed parking amounts correspond to traffic counter data along Death Canyon Road.

During peak times of the season, an average of 90 vehicles are parked in both designated and visitor-created parking areas within Death Canyon. Using the people per vehicle average of 2.7 (as determined during the research period) this level of parking translates to 245 people in the Death Canyon area at one time during peak times of the season. It is presumed that the parking lot turns over at least once during the day since a large portion of people stay in Death Canyon for 3 hours or less.

Pedestrian Use. According to data on the number of people on the Death Canyon Trail within one day, average peak use occurred with 851 people being observed on the Death Canyon Trail during weekend days from August 1–15. If, on average, visitors are hiking out and back to the Death Canyon Trailhead, this number represents 425 people per day on the Death Canyon Trail during peak use. The anticipated 245 people at one time resulting from an average of 90 cars being parked at Death Canyon, roughly corresponds to the 425 people per day trail data, this is assuming the parking lot turns over at least once therefore correlating with the trail use data.

Draft Capacity

When considering the above data results, the current conditions indicate that roughly 245 people at one time are being accommodated at the Death Canyon Trailhead during peak use periods of the summer.

Discussions surrounding desired conditions and indicators and thresholds concluded that the amount of roadside disturbances and overflow parking is currently unacceptable. The same discussions concluded that peak levels of use on trails is the most influential factor when considering if desired conditions are being met at the Death Canyon Trailhead. The current levels of use on trails are acceptable according to park staff. The sense of discovery is a desired condition for visitor experience throughout the corridor. In keeping with this desired condition, parking areas would be managed for 90% of space to be full during peak use times. Managing use levels so that 10% of parking spaces are available would provide visitors a greater likelihood of experiencing the key destinations within the corridor. For this reason, approximately 10% of visitation is removed from the current 245 people at one time, therefore resulting in a visitor capacity for the Death Canyon Trailhead of 220 people at one time.

LAURANCE S. ROCKEFELLER PRESERVE

Desired Conditions

While visiting the LSR Preserve, visitors should experience solitude and have the opportunity for a contemplative experience. The property management plan for the LSR Preserve identifies desired conditions of this site as self-discovery, a wilderness experience in a frontcountry setting, and intimate experiences.

Relevant Indicators

- number of people at one time at key destinations
- amount of use-created overflow parking at destination trailheads
- condition of historic and archeological sites
- amount of user-created roadside disturbance
- number of user-created social trails

Overview of Visitor Use Issues

The LSR Preserve is a popular destination in the Moose-Wilson corridor. The LSR Preserve is currently under a high level of pressure as the parking lot is routinely full and NPS staff manages the parking lot closely. Visitors often have to wait for extended periods of time to park. The LSR Preserve was established with specific visitor capacities for sites and rooms within it. For this reason, size of the current 50-vehicle parking area was intentionally designed to support levels of visitor use that are consistent with the desired conditions of this site. The action alternatives of this plan address visitor use at the LSR Preserve by continuing the use of a 50-vehicle parking lot.

Current Use Levels

Vehicle Use. On average, peak traffic levels occur late morning to early afternoon on the entrance road to the LSR Preserve. The month of September saw the highest levels of vehicular traffic on the road with an average of 262 vehicles per day during the 2013 season. Traffic levels were, however, fairly consistent over all sampling periods. During the busiest period in the corridor (August 1–15), an average of 259 vehicles per day were counted.

Data relating to parking lot use levels determined that as with other key locations in the corridor, August 1–15 is on average the busiest time period at the LSR Preserve. According to vehicle stopping and parking behavior, from August 1–15, 39% of vehicles spent between 1.5 and 3 hours at the LSR Preserve; with 13% staying over 3 hours, 13% between 30 minutes and 1.5 hours, and 35% of vehicles spending 5 minutes or less. The average vehicle duration of stay at the LSR Preserve was 90 minutes. The parking lot at the Preserve is consistently full from 10:00 a.m. to 4:00 p.m. within the August 1–15 time period. This implies that the parking lot turns over roughly four times during the day. According to hourly averages of observed vehicular parking at the LSR Preserve from August 1–15, use peaks at 1:00 p.m., with 51 vehicles observed in designated parking. While the parking lot is designed for 50 vehicles, NPS staff manages parking and are at times able to accommodate 1 or 2 more vehicles depending on vehicle size and spacing. This corresponds to the data findings of average traffic levels on the LSR Preserve entrance road.

The parking lot is designed to accommodate 50 vehicles. Using the people per vehicle average of 2.7, 50 vehicles translate into roughly 135 people visiting the Preserve at one time. This number has resulted in specific visitor capacities listed in the 2007 *Laurance S. Rockefeller Preserve Property Management Plan* to be supported and not exceeded.

Pedestrian Use. According to data on the number of people observed entering the LSR Preserve trail system from the parking lot, average peak use occurs with 900 people being observed during weekend days from August 1–15. Most visitors return along the same trail to their vehicle at the end of their stay at the Preserve; therefore, this number represents 450 individuals being on the LSR Preserve trail system per day during peak use. This number is consistent with the anticipated 135 people at one time resulting from a maximum of 50 vehicles being parked at the Preserve, assuming the parking lot turns over roughly four times per day (based on the average visit duration).

Draft Capacity

When considering the above data results, the current conditions indicate that roughly 135 people at one time are being accommodated at the LSR Preserve during peak use periods of the summer.

Discussions about desired conditions, indicators, and thresholds concluded that current levels of use are acceptable; however, those levels are still of concern as an increase could easily push them to an unacceptable range. The same discussions concluded that the amount of user-created overflow parking is the most limiting factor at the LSR Preserve and is currently acceptable. Visitor capacity of 135 people at one time will continue to result in acceptable levels of visitors on associated trails, in specific rooms, and at specific sites within the Preserve. The sense of discovery is a desired condition for visitor experience throughout the corridor. In keeping with this desired condition, parking areas would be managed for 90% of space to be full during peak use times. Managing use levels so that 10% of parking spaces are available would provide visitors a greater likelihood of experiencing the key destinations within the corridor. For this reason, approximately 10% of visitation is removed from the current 135 people at one time; therefore, resulting in a visitor capacity for the LSR Preserve of 120 people at one time.

GRANITE CANYON TRAILHEAD

Desired Conditions

The trailhead is rustic and primitive, which contributes to the character of the corridor. Granite Canyon Trailhead provides adequate information and orientation about upcoming experiences in the corridor. Trails are clearly delineated for visitors to follow. Visitors continue to find a diverse range of opportunities to experience the primitive character, which is accomplished through minimal development to maintain the rustic character through strategic and sustainable designs and decisions. Authorized parking areas are clearly outlined and overall visitors are able to find parking during both winter and summer seasons. Resource impacts and visitor impacts are minimal.

In the winter, alternative D enhances some recreation opportunities by grooming the road. The road is closed to vehicles during the winter and open during the summer season. The majority of visitors would continue to find parking during the winter season.

Relevant Indicators

- peak levels of use on trails
- amount of use-created overflow parking at destination trailheads
- condition of historic and archeological sites
- amount of user-created roadside disturbance

Overview of Visitor Use Issues

The largest visitor use issue at the Granite Canyon Trailhead is a shortage of parking during peak use periods. The amount of available parking depends largely on how vehicles are individually positioned at the beginning of the day; meaning that some days more parking is available than on others. As visitors try to find parking at this location, roadside disturbances to vegetation and soils occur during the summer season. This trailhead is a popular location for winter use and sees more winter use than at the Death Canyon Road junction. To manage full parking and unintended roadside disturbance of resources, the action alternatives of this plan would delineate parking using barriers.

Current Use Levels

Vehicle Use. Vehicle traffic data were collected at two locations near Granite Canyon; however, it was not collected directly at the trailhead along Moose-Wilson Road.

Vehicle tube counters (used to measure traffic volumes) located at Poker Flats (approximately 1 mile south of Granite Canyon Trailhead) will be used as a proxy for this site. Visitors have been observed turning around at Granite Canyon Trailhead due to poor road conditions not suitable for their vehicles or comfort levels. By referring to the Poker Flats data, this type of use is captured. Parking accumulation and trail data were collected directly at the Granite Canyon Trailhead.

On average, peak traffic levels occur mid-morning to early afternoon at Poker Flats. The first half of August 2013 saw the highest averages of vehicle use at Poker Flats, with approximately 2,190 vehicles per day. According to vehicle stopping and parking behavior, 25% of vehicles spent between 1.5 and 3.0 hours stopped at the Granite Canyon Trailhead, 25% between 6 and 30 minutes, and 50% spent less than 5 minutes stopped at this location. On average, vehicles that stopped spent 30 minutes at Granite Canyon Trailhead during peak use times. According to hourly averages of observed vehicular parking at Granite Canyon Trailhead in the first half of August, use peaks at 11:00 a.m. with 20 vehicles in designated parking spots and no vehicles in undesignated parking places.

During peak times of the season, it is therefore expected that roughly 20 vehicles are likely to be parked at the Granite Canyon Trailhead. Using the people per vehicle average of 2.7, this level of parking translates to 55 people at one time in the Granite Canyon area during peak times of the season.

Pedestrian Use. According to data on the number of people at the Granite Canyon Trailhead in one day, peak use occurred with 105 people being observed during weekdays from August 1–15. If on average, visitors are hiking out and back to the Granite Canyon Trailhead, this number represents 52 individuals a day on the Granite Canyon Trail. The anticipated 55 people at one time resulting from an average of 20 vehicles being parked at Granite Canyon during peak times does not directly correspond to the observed trail use levels. The reason for this lack of correlation may be because of how visitors use this destination. The trailhead offers a beautiful view of the Tetons behind a gorgeous aspen stand. Many visitors stop at this location, walk a short distance to the trailhead sign, read about the trailhead and take photos of the scenery. The lack of correlation between vehicles and pedestrian use levels indicates that the majority of visitors do not walk up the trail far enough to be counted as a trail user. While these datasets cannot be corroborated, the vehicle use data are representative of how visitors use this destination and will therefore be carried forward.

Draft Capacity

When considering the data results, the current conditions indicated that roughly 55 people at one time are being accommodated at the Granite Canyon Trailhead during peak use periods of the summer.

Discussions surrounding desired conditions and indicators and thresholds concluded that while thresholds are currently not being exceeded, resource damage to visitor-created parking occurs during high-use times. According to the data observed in summer 2013, overflow parking rarely occurs. The action alternatives propose that parking areas, such as the Granite Canyon Trailhead, be defined and delineated to reduce unauthorized parking and therefore resource damage. In keeping with this desired condition, parking areas would be managed for 90% of space to be full during peak use times. Managing use levels so that 10% of parking spaces are available would provide visitors a greater likelihood of experiencing the key destinations within the corridor. For this reason, approximately 10% of visitation is removed from the current 55 people at one time, therefore resulting in a visitor capacity for the Granite Canyon Trailhead of 50 people at one time.

MOOSE-WILSON ROAD

Desired Conditions

Experiences along Moose-Wilson Road include scenic driving and temporarily stopping at turnouts and viewing areas. Desired conditions for scenic driving include a slow speed, leisurely pace, uncongested roadway, and intimate experiences with the resources visible from vehicles. Desired conditions for turnouts and viewing areas are the opportunity to view spectacular scenery that includes native habitat, geologic features such as the Teton Range, and wildlife. Both summer and winter seasons offer unique experiences in this portion of Grand Teton National Park. Many user groups, including bicyclists, pedestrians, and motor vehicle users, recreate within the corridor. It is desired that users have few conflicts among one another and are aware of the rustic conditions of the corridor. It is also desired that all visitors are educated on the history of the corridor as well as appropriate behaviors that support their experiences as well as protect resources. Overall, a sense of discovery in this rustic corridor is key to desired conditions for visitors along Moose-Wilson Road.

Relevant Indicators

- vehicles per viewscape
- number of people at one time at key destinations
- amount of use-created overflow parking at destination trailheads
- condition of historic and archeological sites
- amount of user-created roadside disturbance
- number of user-created social trails
- percent of time unnatural sounds are audible
- number and type of undesirable human-wildlife encounters

Overview of Visitor Use Issues

Use levels along Moose-Wilson Road are high. Roadside disturbances caused by vehicles turning off the road at undesignated areas is highly visible as vegetation and soils are damaged. While the ability to view wildlife is desired in the corridor, impacts caused by vehicles turning off of the road are not. To address this issue, the plan's action alternatives add strategically placed turnouts along the roadway to provide space for visitors to temporarily leave the road. In addition, physical barriers would be placed where unacceptable resource impacts have occurred. Visitor conflicts have occurred and largely originate from different desires among user groups, with a desire for slow pace for tourists, and a faster pace for through traffic. To address this issue, use levels, speed limits, and commercial traffic are managed under the action alternatives. Road conditions would also be improved, either by realignment or reconstruction along key road segments.

Current Use Levels

Vehicle Use. As with the individual locations discussed above, peak traffic levels on the Moose-Wilson Road tend to occur late morning to mid-afternoon. Average daily vehicle counts were collapsed by month during data analysis to compare traffic levels over time. The month of August saw the highest levels of traffic volumes along the Moose-Wilson Road with an average of 2,102 vehicles a day. This represents a 30% increase in use since 2006 during August. According to travel pattern data, the majority of users travel from one end of the corridor to the other. Just over half, 56%, of visitors who participated in the GPS tracking data collection drove straight through the corridor without stopping, while the other 44% visited at least one of the locations within the corridor and remained for an average of just over one hour.

Vehicle use data were analyzed in conjunction with Western Federal Lands Highway Division to determine peak volumes of vehicles found in the corridor at one time. The average peak traffic volume in the corridor August 1–15 was 200 vehicles at one time. This number represents all locations within the corridor, not just visitors along the roadway itself. For this reason, determined capacities at Death Canyon Trailhead, LSR Preserve, and Granite Canyon Trailhead are subtracted. This results in current visitation along the Moose-Wilson Road being approximately 160 people at one time. The Moose-Wilson Road and turnouts and viewing areas are not being managed at 90% capacity due to the fluid nature by which they are used. Turnouts and viewing areas are meant to be temporary locations for visitors to enjoy scenery and wildlife viewing. Some visitor uses, such as equestrian and winter use, require longer-use periods for areas such as Sawmill Ponds Overlook and Death Canyon Road junction. However, these turnouts and viewing areas generally do not serve as long-term parking and are therefore not managed as such.

Pedestrian Use. Pedestrian use is not being factored into a visitor capacity for Moose-Wilson Road as trailheads and subsequent trails have been accounted for in previous discussions about key locations within the corridor. The visitor capacity for the Moose-Wilson Road includes all visitors whether they are arriving in a vehicle or through nonmotorized means such as cycling. If a multiuse pathway, as proposed under alternative D, were to be constructed, the determined visitor capacity would include nonmotorized use and management actions would be needed accordingly.

Draft Capacity

When considering the data results, the current conditions indicate that roughly 160 people at one time are being accommodated along Moose-Wilson Road during peak use periods of the summer.

Management strategies in the action alternatives aim to reduce potential impacts on resources and visitor experiences while continuing to accommodate current levels of visitation. Road realignments, defining and delineating parking and turnout areas, managing commercial uses, providing trip planning information to visitors including real-time road and parking conditions, and traffic management strategies such as a reservation system, timed sequencing, and a seasonal gate at the LSR Preserve would address congestion and resource impacts that have resulted from increases in traffic volumes along the corridor. By adaptively implementing the suite of management strategies, the current levels of visitor use in the corridor could be accommodated. The management strategies allow NPS staff to address and solve negative impacts on resources and visitor experience while still allowing current levels of use to continue. Therefore, the visitor capacity of Moose-Wilson Road has been determined to be 160 people at one time.

MOOSE-WILSON CORRIDOR

Visitor Capacity for the Moose-Wilson Corridor

Each of the four key locations within the Moose-Wilson corridor have been considered in terms of their current vehicular and pedestrian use and the goals and desired conditions that pertain to them. To develop a visitor capacity for the entire Moose-Wilson corridor, the respective visitor use capacities of the four key destinations must be added together. These four key destinations represent visitor use opportunities throughout the corridor.

As seen in figure A-2, the total visitor capacity for the Moose-Wilson corridor has been determined to be 550 people at one time. Adaptive management strategies that directly manage the volume of visitation in the corridor would be implemented to maintain visitation at or below this level. Where vehicles are specifically managed, the capacity results in approximately 200 vehicles.

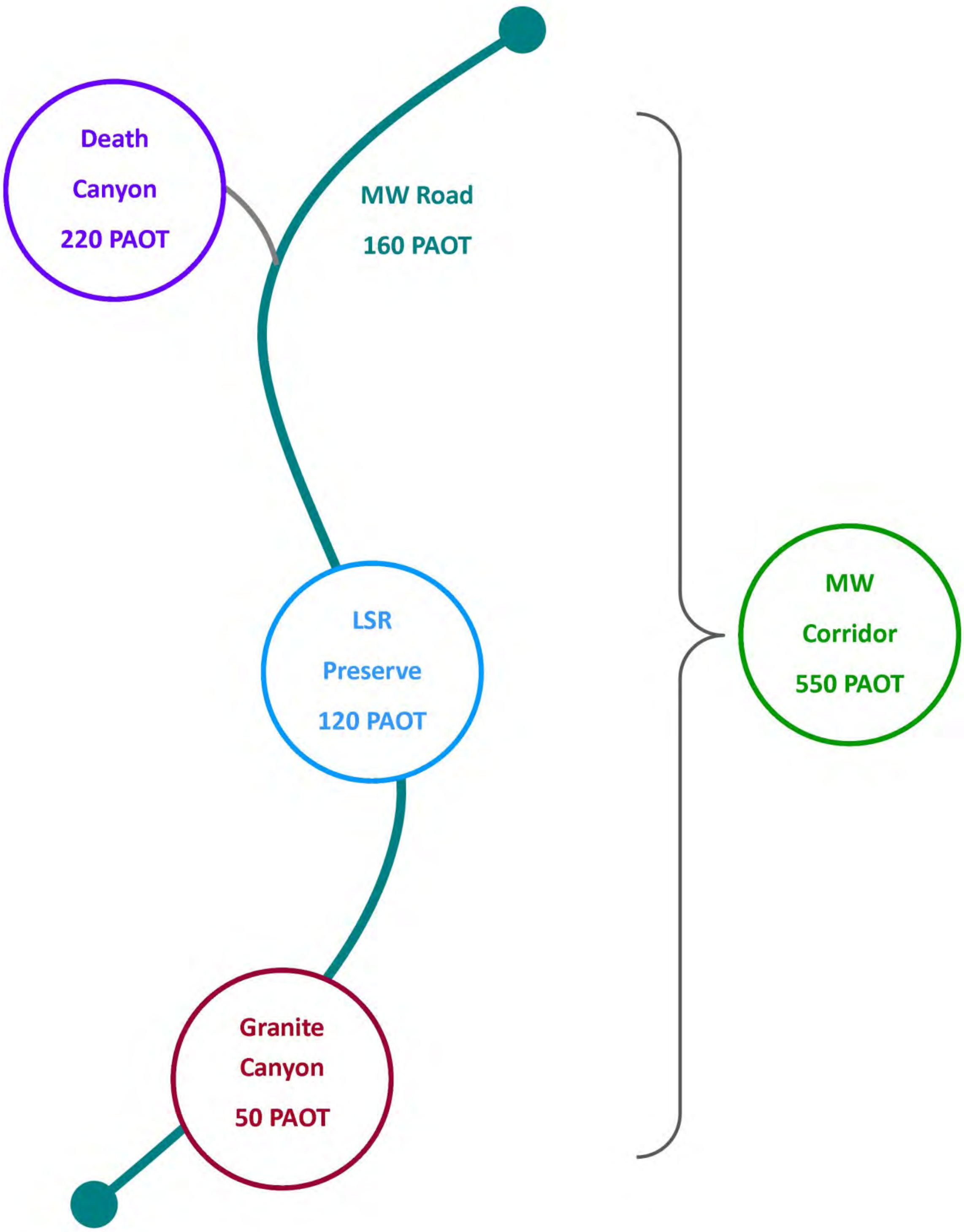


Figure A-2. Visitor Capacity of the Moose-Wilson Corridor

SELECTED REFERENCES

Archibald, W. R., R. Ellis, and A. N. Hamilton
1987 "Responses of Grizzly Bears to Logging Truck Traffic in the Kimsquit River Valley, British Columbia. *International Conference on Bear Research and Management* 7:251–258.

Anderssen, S. H., R. B. Nicolaisen, and G. W. Gabrielsen.
1993 Autonomic response to auditory stimulation. Acta Paediatrica 82:913-918.

Ashton, I. W.
2010 "Observed and Projected Ecological Response to Climate Change in the Rocky Mountains and Upper Columbia Basin: A Synthesis of Current Scientific Literature." Natural Resource Report NPS/ROMN/NRR—2010/220. National Park Service, Fort Collins, CO.

Baron, Jill S. et al.
2008 "Some Guidelines for Helping Natural Resources Adapt to Climate Change." *IHDP Update Magazine*, Issue 2, 46–52.

Baxter G. T. and M. D. Stone
1980 "Amphibians and Reptiles of Wyoming." Prepared for the Wyoming Game and Fish Department. 137 pp.

Bedrosian, B., R. Crandall and D. Craighead
2010 "Jackson Hole Sage-grouse Project Completion Report: 2007-2009." Craighead Beringia South. Kelly, WY.

Bennetts, R., S. Corn, R. Daley, W.R. Gould, C. Jean, D.A. Patla, C.R. Peterson, and A. Ray
2013 "Cooperative Amphibian Monitoring Protocol for the Greater Yellowstone Network: Narrative, version 1.0 Natural Resource Report." NPS/GRYN/NRR—2013/654. National Park Service, Fort Collings, Colorado.

Berglund, B., T. Lindvall, and D. H. Schwela, (Eds.)
1999 *Guidelines for Community Noise*. World Health Organization, Geneva.

Bjornlie, D. D., D. J. Thompson, M. A. Haroldson, C. C. Schwartz, K. A. Gunther, S. L. Cain, D. B. Tylers, K. L. Frey, B. C. Aber
2013 "Extent of Grizzly Bears in the Greater Yellowstone Ecosystem." *Wildlife Society Bulletin* 2013.

Borkowski, J.J., P.J. White, R.A. Garrott, T.D. Davis, A.R. Hardy, and D.J. Reinhart.
2006 Behavioral responses of bison and elk in Yellowstone to snowmobiles and snowcoaches. Ecological Applications 16:1911-1925.

Brown, Casey, Amanda Hardy, Jessie Barber, Kurt Fristrup, Kevin Crooks, Lisa Angeloni
2012 "The Effect of Human Activities and Their Associated Noise on Ungulate Behavior." PLoS ONE 7(7): e40505. doi:10.1371/journal.pone.0040505

Braun, C. E.
1998 "Sage-grouse Declines in Western North America: What are the Problems?" *Proceedings*

of Western Association of Fish and Wildlife Agencies 78:139–156.

Brumm, H., and H. Slabbekoorn.
2005 Acoustic communication in noise. Adv. Stud. Behav. 35: 151-209.

Burghardt Dowd, J. L.
2010 "Coyote Diet and Movements in Relation to Winter Recreation in Northwestern Wyoming: Implications for Lynx Conservation." MS Thesis, Utah State University, Logan, UT.

Burnell, K. D., J. T. Flinders, and M. L. Wolfe
2006 "Potential Impacts of Coyotes and Snowmobiles on Lynx Conservation in the Intermountain West." *Wildlife Society Bulletin* 34(3): 828-838. doi: 10.2193/0091-7648(2006)34[828:piocas]2.0.co.2.

Burson, Shan
2008 *Natural Soundscapes of Grand Teton National Park*. Prepared for the National Park Service, Grand Teton National Park, WY.

Cerovski, A., M. Gorges, T. Byer, K. Duffy, and D. Felley
2000 *Wyoming Bird Conservation Plan*, Version 1.0. Wyoming Partners in Flight, Lander, WY.

Chang, T. and A. J. Hansen
2014 "Climate Change Brief. Greater Yellowstone Ecosystem." Landscape Climate Change Vulnerability Project. Available on the Internet at: http://www.montana.edu/lccvp/documents/LCCVP_GYE_ClimateBrief.pdf

Charlier Associates, Inc.
2001 *Grand Teton National Park Transportation Study*. Charlier Associates, Inc., Boulder, CO.

n.d. "ATR Forecast Jackson Hole."

Clark, G. M., D. K. Mueller, and M. A. Mast
2000 Nutrient concentrations and yields in undeveloped stream basin of the United States. Journal of the American Water Resources Association 35:849-860.

Clarke, M. L., W. J. Sadler, and S. E. O'Ney
2004 Water-quality characteristics of the Snake River and five tributaries in the Upper Snake River Basin, Grand Teton National Park, Wyoming, 1998-2002. US Geological Survey Scientific Investigations Report 2004-5017.

Chalfoun, Anna
2011 *Effects of pathways within Grand Teton National Park on avian diversity, abundance, distribution, nesting productivity, and breeding behaviors.* Final Report. USGS Wyoming Cooperative Fish & Wildlife Research Unit. University of Wyoming. Laramie, WY

Clough, G.
1982 Environmental Effects on Animals Used in Biomedical Research. Biological Reviews 57: 487-523.

Cogan, D., K. Varga, G. Kittel, K. McCloskey, D. Abendroth, J. Gremer, and C. Bolen
2005 *Grand Teton National Park 2002–2005 Vegetation Mapping Project*. Final Report. Technical Memorandum 8260-06-02. Prepared by Bureau of Reclamation Technical Service Center for the US Geological Survey and the National Park Service. Denver. CO.

Connelly, J. W., H. W. Browers, and R. J. Gates
1988 "Seasonal Movements of Sage-grouse in Southeastern Idaho." *Journal of Wildlife Management* 52:116–122.

Connelly, J. W., M. A. Schroeder, A. R. Sands, and C. E. Braun
2000 "Guidelines to Manage Sage-grouse Populations and their Habitats." *Wildlife Society Bulletin* 28(4): 967-985.

Costello, C. M., S. I. Cain, R. M. Nielsen, C. Servheen, and C. C. Schwartz
2014 Response of American black bears to the non-motorized expansion of a road corridor in Grand Teton National Park. *Ursus* 25: 54–69.

Cowardin, L. M., V. Carter, F. C. Golet, and E. T. LaRae
1979 Classification of Wetlands and Deep Water Habitat of the United States, US Fish and Wildlife Service. FWS/OBS-79/31, 103 pp.

Cox, E. R.
1977 Preliminary study of wastewater movement in and near Grand Teton National Park, Wyoming, through October 1976. US Geological Survey Open File Report 77-275. p. 35.

D. R. Horne & Company
2007 "Laurance S. Rockefeller Preserve Property Maintenance Plan." January 4, 2007. On file at park headquarters.

Dooling, R., and A. Popper
2007 *The Effects of Highway Noise on Birds*. Environmental BioAcoustics, LLC. Rockville, MD.

Dustin, J. S.
1998 Continuation of the Trophic State Evaluation of Selected Lakes in Grand Teton National Park. Department of Civil and Environmental Engineering at BYU; Master's Thesis.

Dustin J. S. and A. Woodruff Miller
2001 Trophic status evaluation for selected lakes in Grand Teton National Park. *Journal of the American Water Resources Association* 37(4) pp. 887–898.

Fahrig, L.
2003 "Effects of Habitat Fragmentation on Biodiversity." *Annual Review of Ecology, Evolution, and Systematics* Vol. 34:487–515.

Federal Highway Administration (FHWA)
2014 Grand Teton National Park Moose-Wilson Corridor Road Safety Audit. Prepared for Grand Teton National Park by V. Brinkly and C. Allred.

Franklin, A. B., B. R. Noon, and T. L. George
2002 "What is Habitat Fragmentation?" *Studies in Avian Biology* No. 25:20–29.

Garton, E. O., A. G. Wells, J. A. Baumgardt, and J. W. Connelly
2015 "Greater Sage-Grouse Population Dynamics and Probability of Persistence." Final Report to the Pew Charitable Trusts. Available on the Internet at: http://www.pewtrusts.org/en/about/news-room/press-releases/2015/04/24/pew-sage-grouse-report-points-to-need-for-balanced-land-management

Gates, R. J.
1985 "Observations of the Formation of a Sage-grouse Lek." *Wilson Bulletin* 97:219-221.

Gese, E. M., J. L. Burghard Dowd and L. M. Aubry
2013 "The Influence of Snowmobile Trails on Coyote Movements During Winter in High-Elevation Landscapes." PLOS One 8(12):1–10. doi: 10.1371/journal.pone.0082862.

Gonzalez, P.
2012 "Climate Change and Ecological Impacts at Yellowstone National Park, USA." NPS Climate Change Response Program. Washington, D.C.

Grand Teton National Park Foundation
2010 Visitor Center. Jackson, Wyoming http://www.gtnpf.org/projects.php (accessed February 13, 2014).

Gunther, K. A., M. J. Biel, and H. L. Robison
1998 "Factors Influencing the Frequency of Road-killed Wildlife in Yellowstone National Park." pp 32–42 In G. L. Evink, editor. Proceedings of the International Conference on Wildlife Ecology and Transportation, Florida Department of Transportation, Tallahassee, FL.

Gunther, K. A. and T. Wyman
2008 "Human Habituated Bears: The Next Challenge in Bear Management in Yellowstone National Park" *Yellowstone Science* 16(2):35–41.

Gunther, K. A., R. R. Shoemaker, K. L. Frey, M. A. Haroldson, S. L. Cain, F. T. van Manen, and J. K. Fortin.
2014 "Dietary Breadth of Grizzly Bears in the Greater Yellowstone Ecosystem." *Ursus* 25(1): 60-72.

Haas, G., and T. Wakefield
1998 *National parks and the American public: a national public opinion survey on the national park system.* National Parks and Conservation Association and Colorado State University, Washington, D.C. and Fort Collins, CO.

Halfpenny, J., S. J. Bissell, and D. Nead
1982 "Southern Limits of Lynx Distribution with Special Reference to Colorado." Unpublished report. Colorado Division of Wildlife, Denver, CO.

Hansen, P. L., R. D. Pfister, K. Boggs, B. J. Cook, J. Joy, and D. K. Hinckley
1996 Classification and Management of Montana's Riparian and Wetland Sites. Misc. Publ. No. 54. Montana Forestry and Conservation Experiment Station Second Edition. Missoula, 646 pp.

Haralabidis, A, K. Dimakopoulou, F. Vigna-Taglianti, M. Giampaolo, A. Borgini, M. Dudley, G. Pershagen, G. Bluhm, D. Houthuis, Babisch, and others
2008 "Acute Effects of Night-time Noise Exposure on Blood Pressure in Populations Living Near Airports." *European Heart Journal* 29:658–664. doi: 10.1093/eurheart/ehn013

Harris, C. M.
1998 *Handbook of Acoustical Measurements and Noise Control*, 3rd ed. McGraw-Hill, NY.

Haroldson, M. A., and K. A. Gunther
2013 Roadside bear viewing opportunities in Yellowstone National Park: characteristics, trends, and influence of whitebark pine. *Ursus* 24:27–41.

Herrero, S.
2002 *Bear Attacks: Their Causes and Avoidance*. The Lyons Press, Guildford, CT. 282 pp.

Herrero, S. and A. Higgins
2003 Human Injuries Inflicted By Bears in Alberta: 1960–98. *Ursus* 14:44–54.

1999 Human Injuries Inflicted By Bears in British Columbia: 1960–97. *Ursus* 11:209–218.

Herrero, S., T. Smith, T. D. Debruyn, K. Gunther, and C. A. Matt
2005 "Brown Bear Habituation to People: Safety, Risks, and Benefits." *Wildlife Society Bulletin* 33(1):362–373.

Herrero, J. and S. Herrero
2000 "Management option for the Moraine Lake Highline Trail: grizzly bears and cyclists." Report prepared for Parks Canada, Banff National Park BIOS Environmental Research, Calgary, Alberta, Canada.

Holloran, M. J. and S. H. Anderson
2004 "Greater Sage-grouse Seasonal Habitat Selection and Survival in Jackson Hole, Wyoming." Job Completion Report, Wyoming Game and Fish Department, Cheyenne, WY.

Holmes, M. and N. Berg
2009 "Endeavor Wildlife Research Foundation Greater Yellowstone Lynx Study: 2008/2009 Annual Report." Jackson, WY: Endeavor Wildlife Research Foundation. http://greateryellowstonescience.org/node/3221.

Interagency Lynx Biology Team
2013 "Canada Lynx Conservation Assessment and Strategy." 3rd edition. USDA Forest Service, USDI Fish and Wildlife Service, USDI Bureau of Land Management, and USDI National Park Service. Forest Service Publication R1-13-19. Available on the Internet at: http://www.fs.fed.us/biology/resources/pubs/wildlife/LCAS_revisedAugust2013.pdf

Jackson and Teton County
2012 "Jackson / Teton County Comprehensive Plan." April 6, 2012. http://www.tetonwyo.org/compp/topics/jacksonteton-county-comprehensive-plan/251817/

2007 "Pathways Master Plan."

Jackson Hole Conservation Alliance
2013 "The Effective Population of Teton County, Wyoming." August 9. Produced by Kara Silbernagel.

Jackson Hole Mountain Resort
2014 "The Making of Jackson Hole Mountain Resort." Accessed: June 20, 2014. Available: www.jacksonhole.com.

Kasworm, W. and T. Manley
1990 "Road and Trail Influences on Grizzly Bears and Black Bears in Northwest Montana." International Conference on Bear Research and Management 8:79–84.

Knight, R. L., and D. N. Cole
1995 "Wildlife Responses to Recreationists," In R. L. Knight and K. J. Gutzwiller, eds. "Wildlife and Recreationists: Coexistence Through Management and Research." Washington, D.C., Island Press. Chapter 4.

Koch, E. D. and C. R. Peterson
1995 Amphibians and Reptiles of Yellowstone and Grand Teton National Parks. University of Utah Press, Salt Lake City, UT. 188 pp.

Larson, J., P. R. Adamus, and P. R. Clairain
1989 "Functional Assessment of Freshwater Wetlands: A Manual and Training Outline." University of Massachusetts, Amherst, Environmental Institute Publication 87-1.

Laurance S. Rockefeller Preserve (LSR Preserve)
2009 Visitor Study. Report 222. (accessed February 13, 2014). http://psu.uidaho.edu/c5/vsp/vsp-reports/.

2008 Annual Report. Laurance S. Rockefeller Preserve. Grand Teton National Park.

2007 Reserved Conservation Easement Establishing the Laurance S. Rockefeller Preserve. October 15, 2007. On file at Grand Teton National Park headquarters.

Lawhon et al.
2013 Factors Influencing Behavioral Intentions for Leave No Trace Behavior in National Parks. *Journal of Interpretation Research*. 18 (1), pp. 23–38.

Littlefair, C. and Buckley
2008 Interpretation reduces ecological impacts of visitors to World Heritage sites. *A Journal of the Human Environment*. 37(5), pp. 338–341.

Loomis, John and Lynne Caughlan
2004 Economic Analysis of Alternative Bison and Elk Management Practices on the National Elk Refuge and Grand Teton National Park: A comparison of Visitor and Household Responses. Open-File Report 2004-1305. Prepared for US Geological Survey.

Lyon, A. G.
2000 "The Potential Effects of Natural Gas Development on Sage-grouse (*Centrocercus urophasianus*) Near Pinedale, Wyoming." Thesis, University of Wyoming, Laramie.

Mace, R. D., J. S. Waller, T. L. Manley, L. J. Lyon, and H. Zuring
1996 "Relationships among Grizzly Bears, Roads, and Habitat Use in the Swan Mountains,

Montana." *Journal of Applied Ecology* 33:1395–1404.

MacHutchon, A. G. and D. W. Wellwood
2002 "Assessing the risk of bear-human interaction at river campsites." *Ursus* 13:293–298.

MacHutchon, A. Grant
2014 "Human-Bear Interaction Risk Assessment for the July 2014 Moose-Wilson Corridor Management Plan Alternatives." Prepared for Grand Teton National Park. Nelson, BC, Canada.

Marshall, S.
2007 "Synthesis of Bear Viewing Literature." BC. Ministry of Environment, Victoria, BC. 40 pp.

Mattson, D. J., R. R. Knight, and B. M Blanchard
1987 "The Effects of Developments and Primary Roads on Grizzly Bear Habitat Use in Yellowstone National Park, Wyoming. International Conference on Bear Research and Management 7: 259–273.

McCloskey, K.
2006 "Vascular Plant Species Richness and Distribution in a Heterogeneous Landscape." PhD dissertation. Utah State University. Logan, UT.

McClure, Christopher, Heidi Ware, Jay Carlisle, Gregory Kaltenecker, and Jesse Barber
2013 "An experimental investigation into the effects of traffic noise on distributions of birds: avoiding the phantom road." Proc R Soc B 20132290. http://dx.doi.org/10.1098/rspb.2013.2290

McDonald, C. D., R. M Baumgarten, and R Iachan
1995 Aircraft management studies: National Park Service Visitors Survey. HMMH Report No. 290940.12; NPOA Report No. 94-2, National Park Service, U.S. Department of the Interior.

McGowen, P., C. Strong, and L. Liang et al.
2009 Draft Plan. "Moose-Wilson Corridor Adaptive Management Plan." Western Transportation Institute.

McKelvey, K. S., K. B. Aubry, and Y. K. Ortega
2000 "History and Distribution of Lynx in the Contiguous United States." In: Ruggiero, L. F. et al. eds. *The Ecology and Conservation of Lynx in the United States*. University Press of Colorado, Boulder.

McLellan, B. N., and D. M. Shackleton
1988 "Grizzly Bears and Resource-Extraction Industries: Effects of Roads on Behaviour, Habitat Use, and Demography." *Journal of Applied Ecology* 25:451–460.

Mech, L. D.
1970 *The Wolf: The Ecology and Behavior of an Endangered Species*. Natural History Press, Garden City, NY.

Monz, C., A. D'Antonio, and K. Heaslip
2014a "Moose-Wilson Corridor Use Levels, Types, Patterns and Impacts in Grand Teton National Park." Technical Report. Prepared for the National Park Service, Summer/Fall 2013 Data. On file at park headquarters.

Monz, C., A. D'Antonio, and K. Heaslip
2014b "Moose-Wilson Corridor Use Levels, Types, Patterns and Impacts in Grand Teton National Park." Technical Report. Prepared for the National Park Service, Winter 2014 Data. On file at park headquarters.

Monz, C., A. D'Antonio, and K. Heaslip
2015 "Moose-Wilson Corridor Use Levels, Types, Patterns and Impacts in Grand Teton National Park." Technical Report. Prepared for the National Park Service, Summer/Fall 2014 Data. On file at park headquarters.

Murie Center (The)
2013 What we do. Moose, WY. http://www.muriecenter.org/the-what-we-do/ (accessed February 12, 2014).

Murie Center (The)
2013 Ranch tours. Moose, WY. http://www.muriecenter.org/the-ranch/tours/. (accessed February 12, 2014).

Murphy, K. M., T. M. Potter, J. C. Halfpenny, K. A. Gunther, M. T. Jones, P. A. Lundberg, and N. D. Berg
2006 "Distribution of Canada Lynx in Yellowstone National Park." *Northwest Science* 80:199–206.

National Park Service (NPS)
n.d. "Menor's Ferry Historic District." Grand Teton National Park website. http://www.nps.gov/grte/learn/historyculture/menors.htm.

n.d. "Western Center for Historic Preservation." Grand Teton National Park website. http://www.nps.gov/grte/learn/historyculture/wchp.htm

2015 "Yellowstone Resources and Issues Handbook, 2015." Available on the Internet at: http://www.nps.gov/yell/planyourvisit/upload/RI_2015_wildlife_sm.pdf

2014a "Cultural Landscapes Inventory, Moose-Wilson Road Corridor, Grand Teton National Park."

2014b "Significance of the Moose-Wilson Corridor to Consulted American Indian Tribes (The Compelling Story); draft." Grand Teton National Park.

2014 Moose-Wilson Road Comprehensive Management Plan Alternatives Workshop Materials.

2014 "Public Scoping Report: Moose-Wilson Corridor Comprehensive Management Plan."

2014 "The National Park Service. Public Comment Report: Moose-Wilson Corridor Comprehensive Management Plan Preliminary Alternatives "

2013a "Snake River Headwaters Comprehensive River Management Plan and Environmental Assessment. Grand Teton National Park, Wyoming." http://parkplanning.nps.gov/document.cfm?parkID=68&projectID=31397&documentID=53254

2013 “Yellowstone Resources and Issues Handbook: 2013.” *Greater Yellowstone Ecosystem* Available on the Internet at: http://www.nps.gov/yell/planyourvisit/resourceandissues.htm.

2013 Economic Benefits to Local Communities from National Park Visitation, 2011. February 2013. Natural Resource Report NPS/NRSS/ARD/NRR-2013/632.

2012 “Class III Cultural Resource Inventory of the Moose-Wilson Road Realignment Project, Grand Teton National Park, Teton County, Wyoming.” Prepared by Joanna Mettler Chase, MA and Jennie Erikson, MA, Mettler & Associates, with contributions by James E. Chase, PhD, and Gail Evans Hatch, PhD, Cody, WY.

2012 *Replace Moose Wastewater System and Address Critical Water System Deficiencies. Environmental Assessment.* Available on the Internet at: http://parkplanning.nps.gov/documentsList.cfm?parkID=68&projectID=31570

2011 “Wildlife Management: Human-Bear Interface.” Grand Teton National Park, Science and Resource Management. Available on the internet: http://www.greateryellowstonescience.org/subproducts/3685/7

2011 “Greater Yellowstone Climate Overview.” Greater Yellowstone Science Learning Center. Available on the Internet at: www.greateryellowstonescience.org/download_product/3475/0.

2011 National Park Service Cultural Landscapes Inventory. Sky Ranch. Grand Teton National Park.

2010 *Jackson Hole Airport Agreement Extension, Final Environmental Impact Statement, Grand Teton National Park*. Moose, WY. Available on the Internet at <http://parkplanning.nps.gov/document.cfm?parkID=68&projectID=12099&documentID=36416>.

2010 Moose Headquarters Rehabilitation – Site Work / Environmental Assessment. Finding of No Significant Impact. Grand Teton National Park, WY. http://parkplanning.nps.gov/document.cfm?parkID=68&projectID=22061&documentID=32220

2010 “Grizzly Bears Overview.” Greater Yellowstone Science Learning Center. Available on the Internet: http://www.greateryellowstonescience.org/topics/biological/mammals/grizzly

2009 Winter Use Plan, Finding of No Significant Impact for Grand Teton National Park and John D. Rockefeller, Jr. Memorial Parkway. WY. http://parkplanning.nps.gov/document.cfm?parkID=68&projectID=28453&documentID=30105

2009 "Gros Ventre Campground Rehabilitation Environmental Assessment / Assessment of Effect." Moose, WY: Grand Teton National Park. WY. Available on the Internet at <http://www.nps.gov/grte/parkmgmt/upload/GVCG_EA_FINAL_05-19-09.pdf>.

2009 PMIS 149677, Replace Moose Wastewater System & Address Critical Water System Deficiencies. Moose, WY: Unpublished report in the NPS Project Management Information System.

2008 *White Grass Ranch, Grand Teton National Park, Wyoming*. Cultural Landscape / Historic Structure Report, prepared for the National Park Service by Janene M. Caywood, Principal, Cultural Resources Consulting Service, Missoula, MT and James R. McDonald, AIA, Principal, A&E Architects, PC, Missoula, MT.

2007 *An Assessment of American Indian Occupation and Use of the Cultural and Natural Resources of Grand Teton National Park and the National Elk Refuge*. Prepared for the National Park Service (Grand Teton National Park) and the US Fish and Wildlife Service (National Elk Refuge) by Deward E. Walker Jr., PhD and Pamela K. Graves, MA, Walker Research Group, Ltd.

2007 Transportation Plan / Environmental Impact Statement. Record of Decision. Grand Teton National Park, WY. http://parkplanning.nps.gov/document.cfm?parkID=68&projectID=10940&documentID=39293

2006 Final Transportation Plan / Environmental Impact Statement. Grand Teton National Park, WY. http://parkplanning.nps.gov/document.cfm?parkID=68&projectID=10940&documentID=16829

2006 "Recordation of the Moose to Wilson Road, Grand Teton National Park, Teton County, Wyoming." Prepared for Grand Teton National Park, National Park Service, by William M. Harding, North Wind, Inc., Idaho Falls, ID (NW Project 2473.00).

2006 Management Policies. US Department of the Interior.

2005 "Sky Ranch Historic District." National Register of Historic Places Registration Form, prepared by Mary Humstone.

2005 White Grass Ranch Rehabilitation and Adaptive Use. Finding of No Significant Impact. Grand Teton National Park, WY. http://www.nps.gov/grte/parkmgmt/upload/fonsi_wg.pdf

2004 *White Grass Ranch Rehabilitation and Adaptive Use, Environmental Assessment / Assessment of Effect*. Grand Teton National Park, WY.

2003 "Murie Ranch Historic District." National Historic Landmark Nomination prepared by Michael Cassity, PhD, Broken Arrow, OK. Edited by Susan Escherich, National Park Service, National Historic Landmarks Survey, Washington, D.C.

2001 Murie Ranch Environmental Assessment / Finding of No significant Impact. On file at Grand Teton National Park headquarters.

1999 *A Place Called Jackson Hole: A Historic Resource Study of Grand Teton National Park*, by John Daugherty with contributions by Stephanie Crockett, William H. Goetzmann, Reynold G. Jackson, Grand Teton National Park, Intermountain Region, National Park Service. Published by Grand Teton Natural History Association, Moose, WY.

1998 *Southwest Entrance Facilities Environmental Assessment*. Grand Teton National Park, WY. On file at park headquarters.

1998 "Grand Teton National Park, Wyoming, Water Resources Scoping Report." Prepared by David N. Mott. Technical Report NPS/NRWSR/NRTR-98/154.

1988a "White Grass Dude Ranch." National Register of Historic Places Registration Form, prepared by Steven F. Mehls, Principal Investigator, Western Historical Studies, Inc., Lafayette, CO.

1994 *Report to Congress, Report on Effects of Aircraft Overflights on the National Park System*. September 12, 1994.

1988b "White Grass Ranger Station Historic District." National Register of Historic Places Registration Form, prepared by Steven F. Mehls, Principal Investigator, Western Historical Studies, Inc., Lafayette, CO.

1986 *Grand Teton National Park Trail Standards*. Grand Teton National Park, Wyoming. On file at park headquarters.

1976 *Grand Teton National Park Master Plan*, Wyoming. On file at park headquarters.

National Park Service (NPS) and US Fish and Wildlife Service (USFWS)

2013 *Snake River Headwaters Comprehensive River Management Plan / Environmental Assessment*. May.

Nelson Engineering

2011 "Draft Moose Wastewater System Feasibility Study, Moose, Wyoming, Grand Teton National Park," PMIS 149677. Jackson, WY: Report prepared for the National Park Service, Grand Teton National Park.

Nevin, O. T., and B. K. Gilbert

2005a "Perceived Risk, Displacement and Refuging in Brown Bears: Positive Impacts of Ecotourism?" *Biological Conservation* 121:611–622. doi:10.1016/j.biocon.2004.06.011.

2005b "Measuring the Cost of Risk Avoidance in Brown Bears: Further Evidence of Positive Impacts of Ecotourism." *Biological Conservation* 123:453–460. doi: 10.1111/j.1365-2664.2012.02180.x.

Newman, P., D. Taft, J. Newton, and L. Abbott
2015 "Informing Visitor Use Management Strategies for the Moose-Wilson Corridor, Grand Teton National Park." Research conducted by Pennsylvania State University's Protected Areas Research Cooperative for the National Park Service.

North Wind Resource Consulting, LLC
2012 Wetland Delineation Survey for the Moose-Wilson Road Realignment, Grand Teton National Park, WY. Document Number: P12PX29134. Title: Wetland Delineation Survey

Northrup, J. M., J. Pitt, T. B. Muhly, G. B. Stenhouse, M. Musiani, and M. S. Boyce
2012 "Vehicle Traffic Shapes Grizzly Bear Behaviour on a Multiple-use Landscape." *Journal of Applied Ecology* 49: 1159–1167.

Novak, M. A., J. L. Kershner, and K. E. Mock
2005 Molecular genetic investigation of Yellowstone cutthroat trout and finespotted Snake River cutthroat trout. Wyoming Game and Fish Commission Grant Agreement 165/04.

Patla, D. and K. Legg
2012 "Greater Yellowstone Network Amphibian Monitoring: 2010–2011 Annual Status Report." Natural Resource Data Series NPS/GRYN/NRDS—2012/332. National Park Service, Fort Collins, CO.

Patricelli, G. L., and J. L. Blickley.
2006 Avian communication in urban noise: causes and consequences of vocal adjustment. Auk 123: 639–649.

Pilcher, Ericka, Peter Newman, and Dave Stack
2007 *Grand Teton National Park Soundscape Report*. Prepared for the National Park Service by Colorado State University, Fort Collins, CO

Ray, A., A. Sepulveda, B. Hossack, D. Patla, and K. Legg
2014 "Using Monitoring Data to Map Amphibian Breeding Hotspots and Describe Wetland Vulnerability in Yellowstone and Grand Teton National Parks." *Park Science* Volume 31: Number 1. Special Issue 2014.

Reeve, A., F. Lindzey, and S. Buskirk
1986 "Historic and Recent Distribution of the Lynx in Wyoming." Unpublished report. Wyoming Cooperative Fishery and Wildlife Research Unit, Laramie, WY.

Robinson, S. K.
1997 "The Case of the Missing Songbirds." In *Consequences*, Vol 3 Number 1.

Rode, K. D., S. D. Farley, and C. T. Robbins
2006 "Sexual Dimorphism, Reproductive Strategy, and Human Activities Determine Resource Use by Brown Bears." Ecology 87:2636–2646. doi: 10.1890/0012-

9658(2006)87[2636.SDRSAH]2.0CO.2

Roggenbuck, J. W.
1992 "Use of persuasion to reduce resource impacts and visitor conflicts." In Manfredo, M. J., ed. *Influencing Human Behavior: Theory and Applications in Recreation, Tourism, and Natural Resources Management* (pp. 149–208).

Ruediger, B., J. Claar, S. Gniadek, B. Holt, L. Lewis, S. Mighton, B. Naney, G. Patton, T. Rinaldi, J. Trick, A. Vandehey, F. Wahl, N. Warren, D. Wenger, and A. Williamson
2000 "Canada Lynx Conservation Assessment and Strategy." USDA Forest Service, USDI USFWS, USDI BLM, and USDI NPS. Forest Service Publ. #R1-00-53, Missoula, MT. http://www.fs.fed.us/r1/wildlife/carnivore/Lynx/lcas.pdf.

Saether, B. E., S. Engen, and R. Andersen
1989 Resource utilization of moose (*Alces alces*) during winter: constraints and options. Finnish Game Res. 46:79–86.

St. John's Medical Center
2014 St. John's Fact Sheet. Accessed on April 17, 2014. Available at: http://www.tetonhospital.org/about/fact-sheet.

Savage, J. Chad
2009 Trophic State Evaluation of Selected Lakes and Ponds in Grand Teton National Park. Department of Civil and Environmental Engineering, Brigham Young University; Master's Thesis.

Schmor, M. R.
1999 "An Exploration into Bear Deterrents as Related to Mountain Biking and the Design of an Ultrasonic Bear Warning Device." MS Thesis, Faculty of Environmental Design, University of Calgary, Calgary, Alberta. 147 pp.

Schreck, C. and M. Kent
2013 Extent of Endocrine Disruption in Fish of Western and Alaskan National Parks. National Park Service-Oregon State University Task Agreement J8W07080024. NPS report available at https://irma.nps.gov/App/Reference/ Profile/2195337.

Schwartz, C. C., M. A. Haroldson, K. A. Gunther, and D. Moody
2002 "Distribution of Grizzly Bears in the Greater Yellowstone Ecosystem 1990–2000." *Ursus* 13:203–212.

2006 "Distribution of Grizzly Bears in the Greater Yellowstone Ecosystem in 2004." *Ursus* 17(1):63–66.

Schwartz, C. C., S. L. Cain, S. Podruzny, S. Cherry, and L. Frattaroli
2010 "Contrasting Activity Patterns of Sympatric and Allopatric Black and Grizzly Bears." *Journal of Wildlife Management* 74(8):1628–1638.

Selye, H.
1956 *The Stress of Life*. New York: McGraw-Hill.

Slabbekoorn, H., and E. A. Ripmeester.
2008 Birdsong and anthropogenic noise: implications and applications for conservation. Mol. Ecol. 17: 72-83.

Smith, T. S., S. Herrero, and T. D. Debruyn.
2005 "Alaskan Brown Bears, Humans, and Habituation." *Ursus* 16(1):1–10.

Snake River Associates
2013 *Amended Teton Village Resort Expansion Master Plan*, PUD. Wilson, WY. http://www.tetonwyo.org/pdplan/topics/teton-village-resort-expansion-master-plan-teton-village-area-2/251722/

Spaulding, S. A., S. O'Ney, and K. Hermann
2009 Visual impacts of stalk forming diatoms in Grand Teton National Park. UW-NPS Research Station Final Report. National Park Service. 11 p.

Squires, J. R. and T. Laurion
2000 "Lynx Home Range and Movements in Montana and Wyoming: Preliminary Results." In: Ruggiero, L. F. et al. eds. *The Ecology and Conservation of Lynx in the United States*. University Press of Colorado, Boulder.

Squires, J. R. and R. Oakleaf
2005 "Movements of a Male Canada Lynx Crossing the Greater Yellowstone Area, Including Highways." Northwest Science 79:196–201.

Tanimoto, P. D.
1998 "Lynx Management Assessment and Comment to the US Fish and Wildlife Service's Proposal to List the Lynx under the Endangered Species Act of 1973." Unpublished report under contract with Biodiversity Legal Foundation, Defenders of Wildlife, and Predator Conservation Alliance, Moscow, ID, October 7, 1998.

Teton County Sheriff's Office
n.d. Department Summary. Accessed on April 16, 2014. Available at: http://www.tetonsheriff.org/default.aspx.

Teton Science Schools
2015 Teton Science Schools. Wildlife Expeditions: Home. http://www.tetonscience.org/wildlife-expeditions/home (accessed on the Internet January 12, 2015).

2014 "Home." Jackson, WY. http://www.tetonscience.org/ (accessed February 13, 2014). Upper Snake River Basin Sage-grouse Working Group (USRBSGWG).

2008 "Upper Snake River Basin Sage-Grouse Conservation Plan."

Thiel, D., E. Menoni, J. F. Brenot, and L. Jenni.
2007 Effects of recreation and hunting on flushing distance of capercaillie. *Journal of Wildlife Management* 71:1784-1792.

Town of Jackson
2014 About Jackson. Accessed on April 16, 2014. Available at: http://townofjackson.com/about-jac/

2013 Police Department Information, Accessed on April 16, 2014. Available at: http://townofjackson.com/services/police/divisions/patrol/.

Transportation for America
2011 *Dangerous by Design: Solving the Epidemic of Preventable*

Pedestrian Deaths. 35 http://www.smartgrowthamerica.org/documents/dangerous-by-design-2011.pdf.

Unc, A., M. J. Goss
2004 "Transport of Bacteria from Manure and Protection of Water Resources." Applied Soil Ecology 25, pp. 1–18.

US Army Corps of Engineers (USACE)
2010 *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region*, Version 2; Wakeley, J. S., R. W. Lichvar, and C. V. Noble, eds. ERDC/Elm TR-10-3. Vicksburg, MS: US Army Engineer Research and Development Center.

2009 Best Practices for Archaeological Site Monitoring. US Army Corps of Engineers, Washington, D.C.

1987 *Corps of Engineers Wetland Delineation Manual*. Environmental Laboratory, Technical Report Y-87-1, US Army Engineer Waterway Experiment Station, Vicksburg, MS.

US Bureau of Economic Analysis
2015 Local Area Employment and Income, Tables CA25 and CA25N, 2013. Accessed January 15, 2015. Available: http://bea.gov/iTable/iTable.cfm?reqid=70&step=1&isuri=1&acrdn=5#reqid=70&step=1&isuri=1

US Census Bureau
2012a American Community Survey. Profile of General Demographic Characteristics: 2000 Census Summary File (SF 1) 100-Percent Data. Accessed on April 16, 2014. Available at: http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml.

2012b American Community Survey. Select Demographic and Employment Characteristics. 2008–2012, five-year estimates. Tables DP03, DP04, and B03002. Accessed on March 31, 2014. Available at: http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml.

US Department of Agriculture, Forest Service
1992 Report to Congress. *Potential Impacts of Aircraft Overflights of National Forest System Wildernesses*.

US Department of Education
2014 Institute of Education Sciences. National Center for Education Statistics. Accessed on April 17, 2014. Available at: https://nces.ed.gov/.

US Environmental Protection Agency (EPA)
1994 *Water Quality Standards Handbook*. August 1994. Report: EPA-823-B-94-005a. Environmental Protection Agency, Washington, D.C.

1974 "Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety." Washington, D.C.

US Fire Administration

2014 National Fire Department Census Database. Accessed on April 16, 2014. Available at: http://apps.usfa.fema.gov/census/.

US Fish and Wildlife Service (USFWS)

2015 "Federally Listed, Proposed and Candidate Species. Whitebark Pine." Available on the Internet at: http://www.fws.gov/wyominges/Pages/Species/Species_Listed/WBP.html

2014 "Species Profile. Canada Lynx." Available on the Internet at http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=A073#recovery.

2013 "Greater Sage-grouse (*Centrocercus urophasianus*) Conservation Objectives: Final Report. US Fish and Wildlife Service, Denver, CO.

2013a "Endangered and Threatened Wildlife and Plants; Proposed Threatened Status for the Western Distinct Population Segment of the Yellow-billed Cuckoo (*Coccyzus americanus*)"; Proposed Rule. *Federal Register* 78 (192): 61622-61666.

2011 "Yellow-Billed Cuckoo (*Coccyzus americanus*), US Fish and Wildlife Service Species Assessment and Listing Priority Assignment Form." Sacramento CA: Available on the Internet at <http://ecos.fws.gov/docs/candidate/assessments/2012/r8/B06R_V01.pdf>.

2005 "Recovery Outline for the Contiguous United States Distinct Population Segment of Canada Lynx (*Lynx canadensis*)." Available on the Internet at: http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=A073#recovery

1994 "*The Reintroduction of Gray Wolves to Yellowstone National Park and Central Idaho, Final Environmental Impact Statement*." US Department of the Interior, Helena, MT. http://www.fws.gov/mountain-prairie/species/mammals/wolf/EIS_1994.pdf.

1990 Fish and wildlife coordination act report for the Jackson Hole Snake River Flood Protection/Levee Maintenance Project, Teton County, Wyoming. US Department of the Interior. Wyoming State Office Fish and Wildlife Enhancement, Region 6, Cheyenne. 155 pp.

n.d. "Primer 1. Beginner's Guide to Greater Sage-Grouse." Available on the Internet at http://www.fws.gov/mountainprairie/species/birds/sagegrouse/

US Fish and Wildlife Service (USFWS) and National Park Service (NPS)
2007 Final Bison and Elk Management Plan / Environmental Impact Statement. Record of Decision. National Elk Refuge and Grand Teton National Park. http://www.fws.gov/bisonandelkplan/.

US Geological Survey (USGS)
2014 Mercury in fishes from 21 national parks in the Western United States—Inter and intra-park variation in concentrations and ecological risk. Prepared by C. A. Eagles-Smith , J. J. Willacker, and C. M. Flanagan-Pritz for the US Geological Survey Open-File Report 2014-1051, 54 p. http://dx.doi.org/10.3133/ofr20141051.

2010 Water-Data Report 2010, 13013650 Snake River at Moose, WY. Snake Headwaters Basin, Snake Headwaters Subbasin. Washington, D.C.: National Water Information System. Available on the Internet at: <http://wdr.water.usgs.gov/wy2010/pdfs/13013650.2010.pdf>.

1999 "Water Quality and Hydrogeology Near Four Wastewater Treatment Facilities in Grand Teton National Park and John D. Rockefeller Jr. Memorial Parkway, Wyoming, September 1988 through September 1997." Report prepared by K. J. Hedmark and H. W. Young for the US Geological Survey Water Resources Investigations Report. 90 p.

US Department of Labor, Bureau of Labor Statistics
2014 Unemployment Rates. Accessed on March 27, 2014. Available at: http://www.bls.gov/lau/#tables.

van Manen, F. T., M. A. Haroldson, and K. West (ed)
2012 "Yellowstone Grizzly Bear Investigations 2012: Annual Report of the Interagency Grizzly Bear Study Team, 2012." US Geological Survey, Bozeman, MT. Available on the Internet at: http://www.nrmsc.usgs.gov/products/IGBST.

Versar, Inc.
2011 Development of DoD Guidance for Archaeological Site Monitoring and Condition Assessments. Springfield, VA.

Utah State University
2014 Moose-Wilson Corridor Use Levels, Types, Patterns and Impacts in Grand Teton National Park. Technical Report – Summer/Fall 2013 Data. February 28th. Submitted by Christopher Monz, Ashley D'Antonio, Kevin Heaslip.

Walton, Tony
2003 Methods for Monitoring the Condition of Historic Places. Department of Conservation, Wellington, New Zealand.

Warren, P. S., M. Katti, M. Ermann, and A. Brazel.
2006 Urban bioacoustics: it's not just noise. Anim. Behav. 71: 491-502.

Westerling, A., H. G. Hidalgo, D. R. Cayan, and T. W. Swetnam

2006 "Warming and earlier Spring increase western U.S. forest wildfire activity." *Science* 313:940-943.

Wilmot, K. and S. Cain

2012 "Grizzly Bear-Human Conflicts in Grand Teton National Park." In: F. T. van Manen, M. A. Haroldson, and K. West (ed). "Yellowstone Grizzly Bear Investigations: Annual Report of the Interagency Grizzly Bear Study Team, 2012." US Geological Survey, Bozeman, MT. Available on the Internet at: http://www.nrmsc.usgs.gov/products/IGBST.

Wyoming Community Development Authority

2013 Demographics Summaries of Wyoming Counties. Accessed on June 20, 2014. Available: http://www.wyomingcda.com/index.php/partners/C40.

Wyoming Department of Environmental Quality (WDEQ)

2001 Wyoming Surface Water Classification List, June 21, 2001. Wyoming Department of Environmental Quality, Cheyenne, WY.

Wyoming Department of Revenue (WY DOR)

2014a Annual Report. Accessed January 15, 2015. Available: https://sites.google.com/a/wyo.gov/wy-dor/dor-annual-reports.

2014b Total Distribution by Counties, Cities, and Towns. Accessed January 15, 2015. Available: http://revenue.wyo.gov/a/wyo.gov/wy-dor/tax-distribution-reports.

2006 Annual Report. Accessed April 13, 2014. Available: https://sites.google.com/a/wyo.gov/wy-dor/dor-annual-reports.

Wyoming Economic Analysis Division

2014 Income, Employment and Gross Domestic Product, Regional Economic Profiles for US, Wyoming, and Counties 1969 to 2011. Accessed April 15, 2014. Available: http://eadiv.state.wy.us/i&e/i&e.html

Wyoming Game and Fish Department (WGFD)

n.d. Wyoming Game and Fish Department data; seasonal distribution ungulate maps. Unpublished data.

2010 "State Wildlife Action Plan 2010." Available on the Internet at https://wgfd.wyo.gov/web2011/wildlife-1000407.aspx

2007 Wyoming Black Bear Management Plan. Prepared by: WGFD Trophy Game Section - Management/Research Branch. July 2007.

2005 "Mammalian Species of Special Concern in Wyoming." http://gf.state.wy.us/wildlife/nongame/SpeciesofSpecialConcern/SSCNSSMammalList1-2005.doc.

Wyoming Water Quality Division

2012 *Wyoming Water Quality Assessment and Impaired Waters List* (2012 Integrated

305(b) and 303(d) Report). Cheyenne, WY: Water Quality Division, Watershed Section. Available on the Internet at: <http://deq.state.wy.us/wqd/watershed/Downloads/305b/2012/WY2012IR.pdf>

2005 *Water Quality Rules and Regulations*. Chapter 8, Quality Standards for Wyoming Groundwaters. Cheyenne, WY: Water Quality Division, Surface Water Standards. Available on the Internet at <http://deq.state.wy.us/wqd/wqdrules/Chapter_08.pdf>.

Young, J. J.
1982 *Soil Survey of Teton County, Wyoming, Grand Teton National Park*. US Department of Agriculture, Soil Conservation Service. Prepared in cooperation with the Wyoming Agricultural Experiment Station.

PERSONAL COMMUNICATIONS

Cain, Steven
2015 Personal conversation - Jennifer Stein, Visitor Use Management Specialist. Senior Wildlife Biologist. Grand Teton National Park. January 9, 2015.

Cain, Steven
2015 January 2014. Wildlife Biologist. Office of Science and Resource Management, Grand Teton National Park, Moose, WY. Personal communication.

Cain, S.
2014 March 2014. Wildlife Biologist. Office of Science and Resource Management, Grand Teton National Park, Moose, WY. Personal communication.

Dewey, S.
2014 January 2014. Wildlife Biologist. Office of Science and Resource Management, Grand Teton National Park, Moose, WY. Personal communication.

Jackson Hole Chamber of Commerce
2014 Top Employing Companies in Teton County. Personal communication between Casey Stout at the Chamber of Commerce and Holly Bender of the Louis Berger Group on June 13, 2014 by e-mail.

Mates, Victoria
2015 Personal conversation – Jennifer Stein, Visitor Use Management Specialist. Chief of Interpretation and Partnerships. Grand Teton National Park. January 9, 2015.

McCloskey, K.
2014 January 2014. Ecologist. Office of Science and Resource Management, Grand Teton National Park, Moose, WY. Personal communication.

Mellander, K.
2014 GIS Specialist/Hydrologist. Office of Science and Resource Management, Grand Teton National Park, Moose, WY. Personal communication.

Stephenson, J.
2014 May 2014. Wildlife Biologist. Office of Science and Resource Management, Grand Teton National Park, Moose, WY. Personal communication.

PREPARERS

Denver Service Center

Scott Babcock, Community Planner
BS (Biology and Environmental Science), MEM (Master of Environmental Management). Two years with the National Park Service, 13 years of state government and private sector experience. Assisted with writing portions of chapter 1 and assisting with socioeconomics sections of the plan.

Megan Braunschweig, Landscape Architect
BLA (Landscape Architecture), MAS (Environmental Policy and Management). Four years with the National Park Service. Responsible for the development of the alternative and site planning maps and figures in chapter 2.

Chris Church, Project Manager
BS (Wildlife and Fisheries Science). Eight years with the National Park Service. Responsible for coordinating the development of the EIS and writing major portions of plan.

Sarah Conlin, Natural Resource Specialist
BS (Environmental Science), BA (Geography), MS (Master of Environmental Studies, Emphasis in Policy). Four years with the National Park Service. Responsible for writing the hydrology and water quality sections in the plan.

Tamara Delaplane, Landscape Architect
BL (Landscape Architecture). Six years with the National Park Service. Prior to NPS, 20 years private sector design and construction. Responsible for oversight of the alternative maps and site planning maps and figures in chapter 2

John Gerbich, Community Planner
BA (Journalism), MURP (Master of Urban and Regional Planning). Three years with the National Park Service. Responsible for development of the traffic and transportation section of the plan.

John Paul Jones, Visual Information Specialist
BA (Communications), BA (Graphic Design). Four years with the National Park Service. Responsible for the visual continuity of the project's graphic assets.

Wanda Gray Lafferty, Editor
Fifteen years of experience editing NPS documents, 4 years with the National Park Service, Denver Service Center, overall 31 years of related experience: undergraduate course work in communications and management; paralegal degree.

Susan McPartland, Visitor Use Management Specialist
BA (Environmental Studies, Fine Arts, MSS (Master of Social Science). Five years with the National Park Service. Responsible for development of the visual resources and visitor use and experience sections in the plan, and writing portions of the visitor use framework section.

Charles Notzon, Economist
BA (Economics), MA (International Affairs). Three years with the National Park Service. Responsible for development of staffing and cost estimates and the park operations sections of the plan.

Chris Osgood, Quality Assurance Specialist / Construction Manager
BS Construction Management. Five years with the National Park Service, 28 years private sector construction management and cost estimating. Responsible for estimating and cost formatting sections of the plan.

Peter Pettengill, Visitor Use Management Specialist
BS (Environmental and Resource Economics), MS (Environmental Law), PhD (Natural Resources). Two years NEPA experience with National Park Service. Responsible for writing Wilderness Character sections for Chapters 3 and 4 of the plan.

Ericka Pilcher, Visitor Use Planner
BS (Conservation Biology), MS (Natural Resource Management) 11 years with the National Park Service. Responsible for developing the acoustic resources, soundscapes, and wilderness sections of the plan, and assisting with the visitor use and experience sections of the plan.

Michael Rees, Natural Resource Specialist
BA (Environmental Studies), MFS (Master of Forest Science). Twenty-four years with the National Park Service. Responsible for writing the soils, vegetation, and threatened and endangered species sections in the plan, the identification of the environmentally preferable alternative, the NEPA section 101(B) consistency analysis, and for writing portions of the Consultation & Coordination chapter.

Deborah Roth, GIS Specialist
BA (Geology), MEng (Geographic Information Systems). Responsible in part for cartographic production.

Jennifer Stein, Visitor Use Management Specialist
BA (Environmental Studies), MAS (Environmental Policy and Management). Three years with the National Park Service. Responsible for writing the visitor use and experience sections in the plan, and the visitor use management framework section.

Steve Whissen, Cultural Resource Specialist
MA Historic Preservation, 25 years with the National Park Service, Denver Service Center.

Doug Wilder, GIS Specialist
BS (Geology), MS (Marine Geophysics). Thirteen years with the National Park Service. Responsible in part for cartographic production and geometrics used in the plan.

Don Wojcik, Natural Resource Specialist
BS (Civil & Environmental Engineering), MPA (Master of Public Affairs in Environmental Policy & Natural Resource Management). Six years with the National Park Service. Prior to NPS, 15 years in natural resource planning/policy for two regional land management agencies and a law/policy nonprofit, and two years in civil engineering. Responsible for writing the wildlife/habitat and wetlands sections in the plan, as well as coordinating and reviewing the writing of all other natural resource sections in chapters 3 and 4.

Contractor—Louis Berger Group, Inc.

Albert Racciatti, Socioeconomics Specialist
MCRP (City and Regional Planning), MA (International Relations/Political Economy), BS (Industrial and Labor Relations). Over 15 years of experience in economic analysis for federal agencies (e.g., National Park Service, US Army Corps of Engineers, and others), state and local agencies, and private clients. Expertise in economic impact analysis, cost benefit analysis, NEPA compliance, demographic analysis, and demand forecasting for transportation, facilities, and recreation. Responsible for response

to comments and quality assurance for the Socioeconomics sections in the plan.

Holly Wise Bender, Socioeconomics Specialist
PhD (Mineral Economics), BA (Political Science and Economics). Over 16 years consulting with federal agencies (i.e., National Park Service, Bureau of Land Management, US Army Corps of Engineers, and others) in NEPA compliance for social and economic analysis surrounding recreation and tourism, environmental restoration, agriculture and land use, energy, and construction activities and projects. Responsible for writing the Socioeconomics sections in the plan.

Todd Reveley, Socioeconomics Specialist
MS (Applied Economics), BA (Sociology). Over five years of experience in economic analysis in the public and private sectors. Expertise in economic impact analysis, forecasting and analytics. Responsible for response to comments.

PLANNING TEAM MEMBERS

Grand Teton National Park

David Vela, Superintendent
Kevin Schneider, Deputy Superintendent
Gary Pollock, Management Assistant
Jackie Skaggs, Public Affairs Officer
Brian Bergsma, Safety and Occupational Health Manager
Daniel Noon, Chief of Planning and Environmental Compliance
Margaret Wilson, Outdoor Recreation Planner
Carol Cunningham, Technical Writer/Editor
Andrew White, Assistant Public Affairs Officer
Sue Consolo-Murphy, Chief of Science and Resource Management
Dan Reinhart, Branch Chief of Vegetation Ecology and Management
Sarah Dewey, Acting Branch Chief of Wildlife and Fisheries
Shan Burson, Bioacoustic Ecologist
Steve Cain, Senior Wildlife Biologist (retired)
John Stephenson, Wildlife Biologist
Kelly McCloskey, Ecologist
Kathy Mellander, GIS Specialist and Hydrologist
Shannon Dennison, Branch Chief of Cultural Resources
Betsy Engle, Acting Cultural Resources Specialist
Bridgette Guild, Museum Curator / Tribal Liaison
Stacey Whitman, Archeologist
Mallory Smith, Chief of Business and Administration
Donna Sisson, Branch Chief of Business Resources
Chris Finlay, Chief of Facility Management
Rusty Mizelle, Chief of Project Management
Jon Christensen, Landscape Architect
Jessica Brown, Landscape Architect
Vickie Mates, Chief of Interpretation and Partnerships
Clay Hanna, Laurance S. Rockefeller Preserve Supervisor
Michael Nash, Chief Ranger
Karen Frauson, South District Ranger
Terry Roper, Fee and Revenue Business Manager

Denver Service Center

Scott Babcock, Community Planner
Don Wojcik, Natural Resource Specialist
Michael Rees, Natural Resource Specialist
Sarah Conlin, Natural Resource Specialist
Steve Whissen, Cultural resource Specialist
Susan McPartland, Visitor Use Management Specialist
Jennifer Stein, Visitor Use Management Specialist
Charles Notzon, Economist
Chris Osgood, Quality Assurance Specialist
Tamara Delaplane, Landscape Architect
Megan Braunschweig, Landscape Architect
John Gerbich, Community Planner

Ericka Pilcher, Visitor Use Management Specialist
Peter Pettengill, Visitor Use Management Specialist
Nell Conti, GIS Specialist
Doug Wilder, GIS Specialist
Deborah Roth, GIS Specialist
Jim Corbett, Publications
John Paul Jones, Visual Information Specialist
Melody Bentfield, Librarian research
Wanda Gray Lafferty, Editor
Leslie Peterson, Contracts Specialist
Kerri Cahill, Branch Chief
Dave Kreger, Branch Chief
Chris Church, Project Manager

Intermountain Regional Office

Tammy Whittington, Associate Regional Director
Deb Frye, Alternative Transportation Program Specialist

Environmental Quality Division

Michael Edwards, Environmental Protection Specialist

COOPERATING AGENCIES

Federal Highways Administration, Western Federal Lands

George Fekaris, Transportation Planner
Heather Wills, Environmental Manager

Teton County, Wyoming

Sean O'Malley, Director of Engineering
Hank Phibbs, Chairman, Teton County Commissioners (former)
Smokey Rhea, County Commissioner
Mark Newcomb, County Commissioner

Town of Jackson, Wyoming

Mark Barron, Mayor (former)
Bob McLaurin, Town Manager

Wyoming Department of Transportation

Darin Kaufman, District 3 Traffic Engineer
Bob Hammond, District 3 Resident Engineer

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As the nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering sound use of our land and water resources; protecting our fish, wildlife, and biological diversity; preserving the environmental and cultural values of our national parks and historic places; and providing for the enjoyment of life through outdoor recreation. The department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people by encouraging stewardship and citizen participation in their care. The department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

GRTE xxx/xxxxxx
September 2015