National Park Service
U.S. Department of the Interior
Yellowstone National Park
Wyoming, Montana, Idaho

Norris to Golden Gate Road Reconstruction
Environmental Assessment

April 2011

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Environmental Assessment

Summary

Yellowstone National Park proposes to reconstruct a 25.6-kilometer (15.9-mile) segment of the Grand Loop Road between its intersection with the Norris campground road, and north to a point just north of Swan Lake Flats, in an area known as Golden Gate. The project would reconstruct the road, associated parking areas and turnouts, and bridges. Construction of the first phase of this project is scheduled to begin in 2012.

Improvement of the road is needed in order to establish a road that meets acceptable engineering safety standards to provide safe and pleasant driving experiences, to facilitate park operations and emergency services, to improve resources protection, and to enable more efficient use of park funds.

The proposed project is part of the Yellowstone National Park road reconstruction program. The source of funding for this program is the Federal Lands Highway Program (FLHP) as a part of the Highway Trust Fund. The Yellowstone National Park road reconstruction program is a partnership effort between the National Park Service (NPS) and the Federal Highway Administration (FHWA) and was initiated at the request of the park. The FHWA is an official cooperator in this project. The *Parkwide Road Improvement Plan* and Environmental Assessment, approved in June 1992, describes the general scope of the entire program.

This environmental assessment evaluates two alternatives: a no-action alternative and an action alternative. The no-action alternative describes the current condition if no reconstruction of the road occurs, and the action alternative addresses the reconstruction of the road to a 30-foot paved width (an increase from its current 19-22' width), including the rehabilitation/reconstruction of two bridges. The action alternative also addresses alignment shifts at Frying Pan Spring, Semi-Centennial Geyser, and the road curve just north of Grizzly Lake Trailhead, as well as other connected actions such as increasing parking and turnouts at various locations along, or near, this road segment.

This environmental assessment has been prepared in compliance with the National Environmental Policy Act (NEPA) to provide the decision-making framework that 1) analyzes a reasonable range of alternatives to meet objectives of the proposal, 2) evaluates potential issues and impacts to Yellowstone National Park's resources and values, and 3) identifies mitigation measures to lessen the degree or extent of these impacts. Resource topics included in this document because the resultant impacts may be greater-than-minor include: topography, geology, and soils; vegetation; wildlife; special status species; water resources; wetlands; floodplains; hydrothermal resources; historic structures; archeological resources; ethnographic resources; visitor use and experience; and park operations. All other resource topics were dismissed because the project would result in negligible or minor effects to those resources. No major effects are anticipated as a result of this project. Public scoping was conducted to assist with the development of this document and three comments were received, mostly related to road width of the action alternative.

Public Comment

If you wish to comment on the environmental assessment, you may post comments online at http://parkplanning.nps.gov/yell or mail comments to: Superintendent; Yellowstone National Park, P.O. Box 168, Yellowstone National Park, Wyoming 82190.

This environmental assessment will be on public review for 30 days. Before including your address, phone number, e-mail address, or other personal identifying information in your

comment, you should be aware that your entire comment – including your personal identifying information – may be made publicly available at any time. 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.

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PURPOSE AND NEED

Introduction

Yellowstone National Park is located in the northwest portion of Wyoming and crosses the border into Montana and Idaho. The park was established by an act of Congress on March 1, 1872 and is managed by the National Park Service. The 2.2 million acres of the park were set apart as a public park or pleasuring-ground for the benefit and enjoyment of the people…and to…provide for the preservation, from injury or spoliation, of all timber, mineral deposits, natural curiosities, or wonders within said park, and their retention in their natural condition.

This environmental assessment was prepared to examine the environmental impacts associated with the proposal to reconstruct a 15.9-mile (25.6 kilometer) segment of road between Norris Junction and Golden Gate (Figure 1). Dependent upon funding, this project is expected to be completed in two construction phases. Phase one covers the portion from approximately 0.8 miles north of Norris Junction (just south of the Gibbon River Bridge) to Obsidian Cliff (7.8 miles) and phase 2 from Obsidian Cliff to Golden Gate, at a point about 0.5 miles north of Rustic Falls (8.25 miles). The preferred alternative would reconstruct and widen the existing road to a 30-foot paved width from its existing 19-22 foot width, and address issues and concerns with associated parking areas along the road.

Park roads, such as those in Yellowstone National Park, are intended to accommodate park visitors safely and efficiently while enhancing visitor experiences (NPS Park Road Standards 1984). The National Park Service is responsible for construction, operation, and maintaining its roads in a safe and aesthetically pleasing condition to the greatest extent possible.

In keeping with this mandate, the National Park Service, in cooperation with the Federal Highway Administration, is in the process of rehabilitation or reconstructing the principal park roads in Yellowstone. The Surface Transportation Assistance Act (PL 97-424), passed in 1982, established the federal lands highways program (FLHP). This program distributes funds from federal motor fuel tax revenues for work on park roads and on other federally administered lands. Reconstruction of park roads between Madison and Norris, Sylvan Pass and the East Entrance, and Canyon to the Chittenden Road are recent examples of work performed under this program.

This environmental assessment was prepared in accordance with the National Environmental Policy Act (NEPA) of 1969, regulations of the Council on Environmental Quality (CEQ) (40 CFR §1508.9), and the National Park Service Director's Order (DO)-12 (*Conservation Planning, Environmental Impact Analysis, and Decision-Making*).

Background

The Norris to Golden Gate Road Segment connects the Mammoth Hot Springs area to Norris. It provides a road corridor between Yellowstone National Park and communities such as Gardiner and West Yellowstone, Montana. This road provides a critical link in the Grand Loop road system and access to Swan Lake Flat, Sheepeater Cliffs, the Indian Creek and Norris campgrounds, Apollinaris Spring and Beaver Lake picnic areas, Obsidian Cliff, Roaring Mountain, and many trailheads and thermal features.

The road segment was originally constructed during the early 1880s to provide access between the only two entrances to the park at that time, the north and west. This road was part of a larger scheme which included the construction of a wagon road that would connect almost all of the major points of interest and also connect the two entrances into the Park (NPS 1994). The top width and base material were not designed to accommodate the greater traffic volumes and

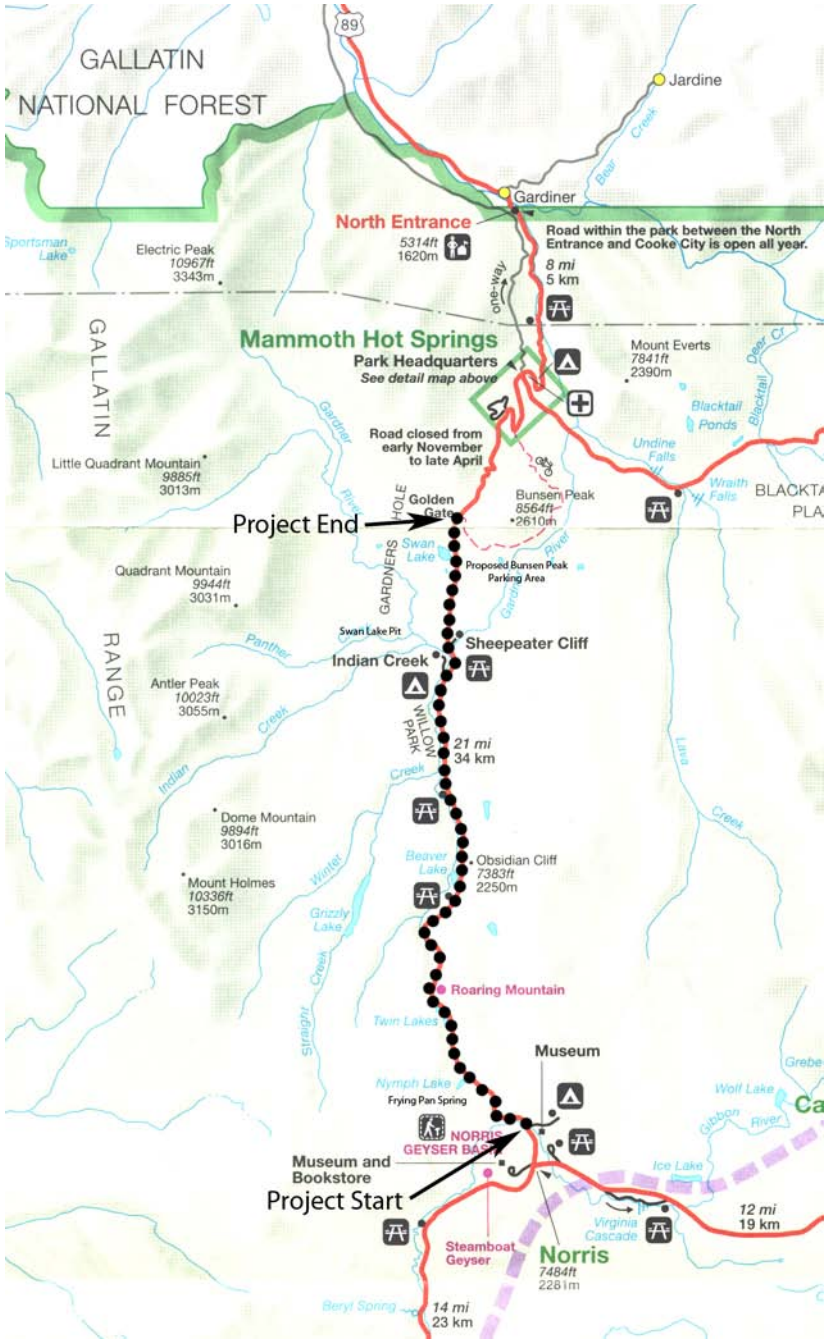


Figure 1 Project Location

wider and heavier vehicles of today. As with other older park roads, maintenance costs are escalating at an accelerating rate just to keep the road passable.

The volume of traffic on this road, in conjunction with the narrow and winding road alignment, result in congested traffic flow with a high probability of long delays to road users. In 2010 the park set a new record for visitation receiving in excess of 3.6 million visitors. These visits represented more than one million vehicles entering the park and using the road system within the six-month period from May through October. The seasonal average daily traffic for this road was 3,835 in 2003. The NPS Park Road Standards (NPS 1984) recommend minimum widths of 3.4 meters (11-feet) per lane and 0.9 meter (3 feet) per shoulder for an Average Daily Traffic (ADT) of 1,000-4,000, or with a 1.2 meter (4 feet) shoulder for an ADT of 4,000-8,000.

Since the preparation of the *Parkwide Road Improvement Plan* (NPS 1992), Yellowstone National Park has been working towards reconstructing much of the Grand Loop Road and entrance roads to a 30-foot paved width standard. This width has allowed traffic to continue to flow in the event of the frequent wildlife jams that typically stop vehicular traffic in much of the park. These traffic jams continue with frequency on many of the roads that have not yet been reconstructed to this standard.

The condition of the Norris to Golden Gate Road segment is generally poor. Lack of drainage, frost heaving, infiltration of water into the base and sub-base and poor road building materials all contribute to the continuing deterioration of the road and the need for improvement. The road crosses over or very near thermal features causing impacts to these features from runoff

from the road, contamination due to petroleum products, and activities such as snow clearing and road maintenance. Repairs have been made to the road in the past due to hot areas under the road that required venting and steel plates to support traffic loads. There are not enough turnouts, of sufficient size along the road, for vehicles to pull over allowing others to pass.

The deterioration of the road surface and the lack of proper base material under the road have resulted in increased maintenance costs and a degraded visitor experience. Drainage deficiencies contributing to the rough and rutted surface include ditches and culverts clogged or overgrown with vegetation, resulting in surface water not draining away from the road structure. Culvert headwalls are in need of repair due to age and erosion.

Numerous overlays of asphalt have raised the road surface to a point that dangerous drop-offs exist at the pavement edge of this narrow road. Lack of attention by the driver has caused many accidents due to a wheel dropping off the edge leading to an unrecoverable trip into the ditch or worse.

The lack of parking in the area of Bunsen Peak, Swan Lake Flats, Sheepeater Cliff, and the Norris Geyser Basin combined with the popularity of the area for horsepacking trips, have led to a dangerous situation where pedestrians, horses, and vehicles are all in close proximity to each other. This same area serves as a backcountry gateway for entering Swan Lake Flats from the north, and the views of snow-capped mountains vie for the attention of the driver increasing the danger in the area. The turnouts and parking areas along this road segment do not accommodate the number and size of vehicles currently visiting the park. Parking numbers and turning radii are insufficient throughout the area and contribute to congestion during peak seasons resulting in: deteriorated road structure, impacts to surrounding vegetation, pedestrian vs. vehicular conflicts and ineffective traffic flow. In the Golden Gate area, rockfall on the roadway, numerous overlays that have lowered the height of guardwalls, damage to guardwalls from vehicle strikes, and pedestrian viewing needs all need to be addressed.

Visitor use areas along this road have a high prevalence of social trails, informal parking, erosion, and other various repair and revegetation needs.

Purpose and Need

The purpose of this project is to provide a safe road for visitors and employees while protecting park resources in compliance with the goals and objectives of current plans and policy.

The project is needed to accomplish the following objectives:

1. Provide an appropriate park-like visual character and visitor experience along this road corridor.
2. Provide a balance between reducing resource and visual impacts and provide for visitor safety, transportation, and an appropriate national park experience as well as effective park operations.
3. Improve traffic flow on this road segment by addressing increasing traffic volume, inadequate parking, events such as wildlife jams, lack of parking turnouts and accessibility features, and frequent maintenance needs.
4. Identify, restore, and rehabilitate impacted riparian or other sensitive resource areas within the project limits wherever feasible.

Relationship to Other Plans and Policies

- This project is consistent with the intent of the Yellowstone National Park's *Parkwide Road Improvement Plan* (NPS 1992), which is to preserve and extend the service life of principal

park roads, enhance their safety, and continue access to Yellowstone National Park and its features.

- The reconstructed road would be designed to comply with the NPS's *Park Road Standards* (NPS 1984). These standards recommend a road with 11-foot traffic lane widths and 3-foot shoulders at a minimum for a road with an average daily traffic of 1,000-4,000.
- The proposal is consistent with the goals and objectives of the *2006 National Park Service Management Policies* (NPS 2006) that state that park roads will be well constructed, sensitive to natural and cultural resources, reflect the highest principles of park design, and enhance the visitor experience. The proposed road reconstruction would be designed to minimize harm to all park resources, particularly geothermal, wetland, and archeology.

Scoping

Scoping is a process to identify the resources that may be affected by a project proposal, and to explore possible alternatives for achieving the proposal while minimizing adverse impacts. Yellowstone National Park conducted internal scoping with appropriate National Park Service staff, as described in more detail in the *Consultation and Coordination* chapter. The park also conducted external scoping with the public and interested/affected groups and through Native American consultation.

External scoping was initiated with the distribution of a scoping letter to inform the public of the proposal to reconstruct the Norris to Golden Gate road segment, and to generate input on the preparation of this environmental assessment. The scoping letter dated July 20, 2009 was sent to over 150 media outlets in the Yellowstone National Park region. In addition, the scoping letter was mailed to various individuals, federal and state agencies, affiliated Native American tribes, local governments, and local news organizations. Scoping information was also posted on the park's Planning, Environment, and Public Comment (PEPC) website.

During the 30-day scoping period, three public responses were received. Comments dealt primarily with road width alternatives. One favored a 30-foot wide road, one was against widening the road, and one recommended alternatives other than no-action and a 30-foot road be looked at. Other road width alternatives were examined by the interdisciplinary team and ultimately dismissed as not meeting the other objectives of the project, particularly resolving wildlife jam issues with the current road width (see also *Alternatives Dismissed from Further Consideration*). These responses included some in favor of the project, some opposed to the project, and some requesting more project information. No Native American tribes responded to the request for comment on the proposed project. More information regarding external scoping and Native American consultation can be found in *Comments and Coordination*.

Impact Topics Retained For Further Analysis

In this section and the following section on *Impact Topics Dismissed from Further Analysis*, the NPS evaluates all potential impacts by considering the direct, indirect, and cumulative effects of the proposed action on the environment, along with connected and cumulative actions. Impacts are described in terms of context and duration. The context or extent of the impact is described as localized or widespread. The duration of impacts is described as short-term, ranging from days to three years in duration, or long-term, extending up to 20 years or longer. The intensity and type of impact is described as negligible, minor, moderate, or major, and as beneficial or adverse. The NPS equates "major" effects as "significant" effects. The identification of "major" effects would trigger the need for an EIS. Where the intensity of an impact could be described quantitatively, the numerical data is presented; however, most impact analyses are qualitative and use best professional evaluation and judgment in making the assessment.

Impact topics for this project have been identified on the basis of federal laws, regulations, and orders; 2006 *Management Policies*; and National Park Service knowledge of resources at Yellowstone National Park. Impact topics that are carried forward for further analysis in this environmental assessment are listed below along with the reasons why the impact topic is retained and further analyzed.

Natural Resources

Topography, Geology, and Soils

According to the 2006 *Management Policies*, the National Park Service will preserve and protect geologic resources and features from adverse effects of human activity, while allowing natural processes to continue (NPS 2006). These policies also state that the National Park Service will strive to understand and preserve the soil resources of park units and to prevent, to the extent possible, the unnatural erosion, physical removal, or contamination of the soil, or its contamination of other resources.

Because the proposed project would reconfigure topography and disturb soils in the area adjacent to the existing road, the topic of topography, geology, and soils has been carried forward for further analysis.

Vegetation

According to the National Park Service's 2006 *Management Policies*, the National Park Service strives to maintain all components and processes of naturally evolving park unit ecosystems, including the natural abundance, diversity, and ecological integrity of plants (NPS 2006). The existing vegetation in the project area primarily consists of a mosaic of lodgepole pine forest, wet meadows and seeps, and sagebrush steppe. Much of the area burned in 1988.

Vegetation impacts would come from construction activities along the road edge, at culverts, and at widened or new turnout areas. The disturbance associated with construction would provide an opportunity for invasive plant species to become established and spread. Revegetation efforts and control measures to reduce exotic plant species would occur as part of the proposed project. Vegetation would be displaced, disturbed, and/or compacted in the areas of construction particularly in the expanded footprint of the reconstructed road. Approximately 70 acres of vegetation along the existing road edge and parking facilities would be impacted from this project. Disturbed areas would be revegetated and rehabilitated following construction; therefore, removal and/or disturbance of vegetation in the project area is expected to result in minor to moderate adverse impacts to vegetation. Because these effects exceed minor in degree, this topic has been retained for further analysis in this document.

Wildlife

According to the National Park Service's *2006 Management Policies*, the National Park Service strives to maintain all components and processes of naturally evolving park unit ecosystems, including the natural abundance, diversity, and ecological integrity of animals (NPS 2006). Wildlife commonly found in the park along this segment of road include elk, black bear, grizzly bear, moose, coyotes, deer, beavers, badgers, weasels, chipmunks, ground squirrels, rabbits, bats, mice, and birds. There are also occasional amphibians and reptiles.

The location of the proposed road reconstruction project is in a natural area of the park that contains the existing road, turnouts, nearby picnic areas, and campgrounds. Abundant water in the area and natural vegetation offer rich wildlife viewing opportunities along this road segment.

During construction, noise would increase, which may disturb wildlife in the general area. Construction-related noise would be temporary, and existing sound conditions would resume

following construction activities. Therefore, the temporary noise from construction would have an effect on wildlife.

Because the proposed project would displace some wildlife in the area during construction adjacent to the existing road, the topic of wildlife has been carried forward for further analysis.

Special Status Species

The Endangered Species Act of 1973 requires examination of impacts on all federally-listed threatened, endangered, and candidate species. Section 7 of the Endangered Species Act requires all federal agencies to consult with the U.S. Fish and Wildlife Service to ensure that any action authorized, funded, or carried out by the agency does not jeopardize the continued existence of listed species or critical habitats. In addition, the 2006 *Management Policies* and Director's Order-77 *Natural Resources Management Guidelines* require the National Park Service to examine the impacts on federal candidate species, as well as state-listed threatened, endangered, candidate, rare, declining, and sensitive species (NPS 2006). The changes to the Norris to Golden Gate road segment could have impacts on the following listed species within Yellowstone: grizzly bears, Canada lynx or gray wolves. The yellow-billed cuckoo (western) is a candidate species for listing on the threatened and endangered species list found in Wyoming, but is not known to exist within the park.

Protection under the Migratory Bird Treaty Act makes it unlawful to pursue, hunt, kill, capture, possess, buy, sell, purchase, or barter any migratory bird, including the feathers or other parts, nests, eggs, or migratory bird products. In addition, this act serves to protect environmental conditions for migratory birds from pollution or other ecosystem degradations. Some migratory birds may be potential transients of the general area, and the immediate project area contains some habitat suitable for migratory birds. There are known nesting sites in this area and these lands are vital for foraging or roosting. Construction-related noise could potentially disturb bird species, but these adverse impacts would be 1) temporary, lasting only as long as construction, and 2) negligible, as suitable habitat for transient birds is found throughout the region.

Because of the potential for effects to special status species and migratory birds, this topic has been retained for further analysis.

Water Resources

National Park Service policies require protection of water quality consistent with the Clean Water Act. The purpose of the Clean Water Act is to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters." To enact this goal, the U.S. Army Corps of Engineers has been charged with evaluating federal actions that result in potential degradation of waters of the United States and issuing permits for actions consistent with the Clean Water Act. The U.S. Environmental Protection Agency also has responsibility for oversight and review of permits and actions that affect waters of the United States.

The proposed project area contains surface waters such as the Gibbon River, Obsidian Creek, the Gardner River, Glen Creek, Nymph Lake, Twin Lakes, Beaver Lake, and Swan Lake, and numerous springs, seeps, and thermal features. Water quality, water quantity, and drinking water are not expected to be affected by the project. The widening of road and additional parking would increase pavement in the area by approximately 27-37 percent, which could increase the erosion potential of the area; however, the installation of both temporary and permanent erosion control features such as water speed dissipaters, and silt fence and barriers should offset or mitigate this effect. To further assist with erosion and water quality, disturbed areas would be revegetated and recontoured following construction, erosion control measures would be employed until background vegetation levels reach 70 percent of level prior to

construction. Because this project has the potential for measureable effects to water resources, this topic has been retained for further analysis in this document.

Wetlands

For regulatory purposes under the Clean Water Act, the term wetlands means "those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas."

Executive Order 11990 *Protection of Wetlands* requires federal agencies to avoid adversely impacting wetlands where possible. Further, §404 of the Clean Water Act authorizes the U.S. Army Corps of Engineers to prohibit or regulate, through a permitting process, discharge of dredged or fill material or excavation within waters of the United States. National Park Service policies for wetlands as stated in 2006 *Management Policies* and Director's Order 77-1 *Wetlands Protection* strive to prevent the loss or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands. In accordance with DO 77-1 *Wetlands Protection*, proposed actions that have the potential to adversely impact wetlands must be addressed in a statement of findings for wetlands.

231 wetlands have been identified within 200 feet of either side of the Norris to Golden Gate road segment. Wetlands within the 200 foot wide survey area are at risk of alteration by road building activities; therefore a statement of findings for wetlands has been prepared (see Appendix B). Because there are wetlands in the project area and because there is the potential for measurable impacts, the topic of wetlands has been retained for further analysis in this document.

Floodplains

Executive Order 11988 *Floodplain Management* requires all federal agencies to avoid construction within the 100-year floodplain unless no other practicable alternative exists. The National Park Service under 2006 *Management Policies* and Director's Order 77-2 *Floodplain Management* will strive to preserve floodplain values and minimize hazardous floodplain conditions. According to Director's Order 77-2 *Floodplain Management*, certain construction within a 100-year floodplain requires preparation of a statement of findings for floodplains.

The Norris to Golden Gate segment of road is located within, or near to the 100-year floodplain of the Gibbon River, Obsidian Creek, and the Gardner River; therefore, a statement of findings for floodplains is found in Appendix B. Because there are floodplains in the project area and because there is the potential for measurable impacts, the topic of floodplains has been retained for further analysis in this document.

Hydrothermal Resources

There are hydrothermal features located in the general vicinity of the road corridor at Frying Pan Spring, Roaring Mountain, Semi-Centennial Geyser, and other unnamed features. These thermal areas would be avoided where possible. In some instances the existing road is overlying hot ground from thermal features, therefore the topic of Hydrothermal Resources has been retained for further analysis in this document.

Cultural Resources

Historic Structures

The National Park Service, as steward of many of America's most important cultural resources, is charged to preserve historic properties for the enjoyment of present and future generations. According to the National Park Service's 2006 *Management Policies and* Director's Order-28 *Cultural Resource Management*, management decisions and activities throughout the National Park System must reflect awareness of the irreplaceable nature of these resources (NPS 2006). The National Park Service will protect and manage cultural resources in its custody through effective research, planning, and stewardship and in accordance with these policies and guidelines.

Section 106 of the National Historic Preservation Act requires federal agencies to take into account the effects of their undertakings on historic properties and to afford the Advisory Council on Historic Preservation an opportunity to comment in the consultation process. The term "historic properties" is defined as any site, district, building, structure, or object eligible or listed in the National Register of Historic Places, which is the nation's inventory of historic places and the national repository of documentation on property types and their significance. More information about this consultation can be found in the *Consultation and Coordination* chapter.

The Grand Loop Road within Yellowstone National Park is a historic structure. Reconstructing the road would involve relocating various headwalls, retaining walls, and stone curbing, as well as working in the vicinity of properties/structures eligible for, or listed on the National Register of historic sites. The potential for adverse effect, or measureable impacts to these properties exists, therefore, the topic of historic structures has been retained for further analysis.

Archeological Resources

In addition to the National Historic Preservation Act and the National Park Service 2006 *Management Policies*, the National Park Service's Director's Order-28B *Archeology* affirms a long-term commitment to the appropriate investigation, documentation, preservation, interpretation, and protection of archeological resources inside units of the National Park System. As one of the principal stewards of America's heritage, the National Park Service is charged with the preservation of the commemorative, educational, scientific, and traditional cultural values of archeological resources for the benefit and enjoyment of present and future generations. Archeological resources are nonrenewable and irreplaceable, so it is important that all management decisions and activities throughout the National Park System reflect a commitment to the conservation of archeological resources as elements of our national heritage.

Park staff surveys found that the location of the Norris to Golden Gate road segment and the proposed reconstruction project bisect six National Register sites identified in the immediate project area. Appropriate steps would be taken to protect any archeological resources that are inadvertently discovered during construction. Because the project has the potential to disturb known archeological sites, the affect of the project on archeological resources is expected to be measurable. Because these effects could exceed minor in degree, this topic has been retained for further analysis in this document.

Ethnographic Resources

National Park Service's Director's Order-28 *Cultural Resource Management* defines ethnographic resources as any 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. According to DO-28 and Executive Order 13007 on sacred sites, the National Park Service should try to preserve and protect ethnographic resources.

In 2002 consultation letters, phone calls, and on-site visits were conducted with Native American tribes to determine whether any ethnographic resources would be impacted by the proposed road reconstruction project. Two ethnographic studies were completed in 2003 that were used in the preparation of this document, one by the University of Wyoming, and the other by an affiliated tribe. While we clearly understand that many ethnographic resources exist in the vicinity of the Norris to Golden Gate road segment, and that there are ethnographic resources that we may not be aware of, this project should avoid impacts to these known resources. Additional consultation with tribes in 2009 did not yield any further information regarding the ethnographic significance of the area. Of the ethnographic resources identified from input from various tribes, no impacts to significant ethnographic resources greater than a minor degree are expected. It was recommended that monitoring during construction in the Obsidian Cliff area be done in part to look for evidence of ancient trails. Many other ethnographic resources identified were located some distance from the road so that this proposed project would not impact them. The avoidance of impacts to ethnographic resources would not result in any unacceptable impacts; the proposed actions are consistent with §1.4.7.1 of NPS *Management Policies* 2006. While the anticipated effects would be minor or less in degree and would not result in any unacceptable impacts, this topic has been retained for further analysis in this document to ensure that a dialog remains open with interested tribes regarding how this project could impact ethnographic resources.

Cultural Landscapes

According to the National Park Service's Director's Order-28 *Cultural Resource Management Guideline*, a cultural landscape is a reflection of human adaptation and use of natural resources, and is often expressed in the way land is organized and divided, patterns of settlement, land use, systems of circulation, and the types of structures that are built. In January the National Park Service Historic American Building Survey/Historic American Engineering Record/Historic American Landscape Survey (HABS/HAER/HALS) completed recording the parks' historic road systems providing documentation titled "Yellowstone Roads, A Cultural Landscape". The documentation included historic context, measured drawings, and photographs addressing the evolution of the park's transportation modes and roads, representative samples of each segment of road, entrance stations, evolution of roadway construction methods, landscape vegetation schemes, scenic drives and by-passes, waysides, turnouts, and barriers, and construction of the Norris road past Obsidian Cliff. The documentation has been received by the Library of Congress and is available to the public through their website.

As the Cultural Landscape documentation of the roads identifies, the significance of Yellowstone roads is adherence to the early philosophy, developed by the Army Corp of Engineers that called for roads to blend harmoniously with the landscape. In 1918, the NPS adopted that approach through its landscape architects involved in road design. The current road reconstruction again adheres to the philosophy of "laying lightly on the land" and using natural materials to blend with the landscape. The continued adherence to this philosophy and continued consultation with WYSHPO should result in no unacceptable impacts to cultural landscapes; this topic is retained for further analysis in this document.

Socio-economic Environment

Socioeconomics

The proposed action would neither change local and regional land use nor appreciably impact local businesses or other agencies. Implementation of the proposed action could provide a negligible beneficial impact to the economies of nearby Gardiner, Montana, and West Yellowstone, Montana, as well Park County due to minimal increases in employment opportunities for the construction workforce and revenues for local businesses and governments generated from these additional construction activities and workers. Any increase in workforce and revenue, however, would be temporary and negligible, lasting only as long as construction. As the socioeconomic environment could be impacted, this topic is retained for further analysis.

Visitor Use and Experience

According to 2006 *Management Policies*, the enjoyment of park resources and values by people is part of the fundamental purpose of all park units (NPS 2006). The National Park Service is committed to providing appropriate, high quality opportunities for visitors to enjoy the parks, and will maintain within the parks an atmosphere that is open, inviting, and accessible to every segment of society. Further, the National Park Service will provide opportunities for forms of enjoyment that are uniquely suited and appropriate to the superlative natural and cultural resources found in the parks. The National Park Service 2006 *Management Policies* also state that scenic views and visual resources are considered highly valued associated characteristics that the National Park Service should strive to protect (NPS 2006).

The average visitor length of stay in Yellowstone National Park is 9.8 hours for about half the visitors, the other half spends an average of 3.9 days visiting the park. The most commonly visited areas of the park are Old Faithful (90%), and Mammoth Hot Springs (69%).

Because the proposed project will change the experience of driving the Norris to Golden Gate road segment, the topic of visitor use and experience has been carried forward for further analysis.

Park Operations

Employees must regularly travel between park locations in order to meet with other employees, make deliveries, transport goods, and render aid. Wildlife jams regularly halt traffic on the road segment between Norris and Golden Gate. Visitors, park staff, and park partners are all inconvenienced with these delays. Past road reconstruction projects within the park that have widened the road to the park standard of a 30-foot paved width have seen reductions in these delays. Reconstruction of the Norris to Golden Gate road segment would have a measurable effect on the park's staff and park partners, and how/where/when they conduct their work. For these reasons, the topic of park operations has been carried forward for further analysis in this document.

Impact Topics Dismissed From Further Analysis

In this section of the EA, NPS provides a limited evaluation and explanation as to why some impact topics are not evaluated in more detail. Impact topics are dismissed from further evaluation in this EA if:

- they do not exist in the analysis area, or
- they would not be affected by the proposal, or the likelihood of impacts are not reasonably expected, or

- through the application of mitigation measures, there would be minor or less effects (i.e. no measurable effects) from the proposal, and there is little controversy on the subject or reasons to otherwise include the topic.

Due to there being no effect or no measurable effects, there would either be no contribution towards cumulative effects or the contribution would be low. For each issue or topic presented below, if the resource is found in the analysis area or the issue is applicable to the proposal, then a limited analysis of direct and indirect, and cumulative effects is presented. There is no impairment analysis included in the limited evaluations for the dismissed topics because the NPS's threshold for considering whether there could be an impairment is based on "major" effects.

Paleontological Resources

According to 2006 *Management Policies*, paleontological resources (fossils), including both organic and mineralized remains in body or trace form, will be protected, preserved, and managed for public education, interpretation, and scientific research (NPS 2006). Vincent L. Santucci conducted *The Yellowstone Paleontological Survey* and provided the inventory report to the park in 1998. The Golden Gate to Norris road segment divides the parks' Gallatin fossil regions and the Mt. Everts fossil region from Golden Gate to the Tanker Curve area. The interior and western portions of the park were intermittently covered with lava flows from the last three volcanic eruptions starting at 1.8 million years ago and ending about 600,000 years ago. Any fossil resources that may have existed in the center portion of the park extending past the western boundary have long been covered with lava.

Within the Gallatin fossil region, potentially fossiliferous outcrops occur throughout the upper mountain ranges and not along the relatively low-lying valley road corridor. The Mt Everts fossil region is dominated by thick sequences of Cretaceous marine and non-marine rocks of the higher mountain outcrops. No fossil localities have been identified along the Norris to Golden Gate road corridor and the adjacent area of disturbance of road reconstruction activities.

Since the identified high altitude paleontological resources would be avoided no unacceptable impacts would occur; the proposed actions are consistent with §1.4.7.1 of NPS *Management Policies* 2006. Because fossil localities are not likely present within the project area, there would be no unacceptable impacts to paleontological resources; this topic is dismissed from further analysis in this document.

Museum Collections

According to Director's Order-24 *Museum Collections,* the National Park Service requires the consideration of impacts on museum collections (historic artifacts, natural specimens, and archival and manuscript material), and provides further policy guidance, standards, and requirements for preserving, protecting, documenting, and providing access to, and use of, National Park Service museum collections. Many of the Park's museum collections are stored in the Heritage and Research Center in Gardiner, Montana, or within one of the visitor centers of the park. Within the project area, collections are found in the Norris Ranger Museum and the Norris Geyser Basin Museum. This project would not affect these collections, and thus would not result in any unacceptable impacts; the proposed actions are consistent with §1.4.7.1 of NPS *Management Policies* 2006. Because these effects are minor or less in degree and would not result in any unacceptable impacts, this topic is dismissed from further analysis in this document.

Air Quality

The Clean Air Act of 1963 (42 U.S.C. 7401 *et seq.*) was established to promote the public health and welfare by protecting and enhancing the nation's air quality. The act establishes specific programs that provide special protection for air resources and air quality related values associated with National Park Service units. Section 118 of the Clean Air Act requires a park unit to meet all federal, state, and local air pollution standards. Yellowstone National Park is designated as a Class I air quality area under the Clean Air Act. A Class I designation indicates that air quality degradation is unacceptable under the Clean Air Act of 1977.

There is the possibility of short-term temporary impacts on air quality or visibility in the Norris to Golden Gate road segment area. Construction activities such as hauling materials and operating heavy equipment could result in temporary increases of vehicle exhaust, emissions, and fugitive dust in the general project area. Any exhaust, emissions, and fugitive dust generated from construction activities would be temporary and localized and would likely dissipate rapidly. Overall, the project could result in a negligible degradation of local air quality, and such effects would be temporary, lasting only as long as construction. The Class I air quality designation for Yellowstone National Park would not be affected by the proposal. Further, because the Class I air quality would not be affected, there would be no unacceptable impacts; the proposed actions are consistent with §1.4.7.1 of NPS *Management Policies* 2006. Because the effects on air quality would be negligible, and the proposed actions would not result in any unacceptable impacts, this topic is dismissed from further analysis in this document.

Wilderness

None of the alternatives proposed in this document would occur in Yellowstone National Park's recommended wilderness areas; therefore, this topic is dismissed from further analysis in this document.

Soundscape Management

In accordance with 2006 *Management Policies* and Director's Order-47 *Sound Preservation and Noise Management*, an important component of the National Park Service's mission is the preservation of natural soundscapes associated with national park units (NPS 2006). Natural soundscapes exist in the absence of human-caused sound. The natural ambient soundscape is 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 frequencies, magnitudes, and durations of human-caused sound considered acceptable varies among National Park Service units as well as potentially throughout each park unit, being generally greater in developed areas and less in undeveloped areas.

The proposed road construction activity would occur in what can be considered the developed road corridors of Yellowstone National Park. Existing sounds in this area are most often generated from vehicular traffic (visitors and employees using park roads within the park), people, some wildlife such as birds, and wind. Sound generated by the short-term construction of this park road segment may include equipment such as dozers, dump trucks, paving equipment, and asphalt plants. Some temporary displacement of wildlife could occur, but concentrated noise levels would only be expected to appreciably increase at the short segments of road where the construction activities are occurring on a given day.

During construction, human-caused sounds would likely increase due to construction activities, equipment, vehicular traffic, and construction crews. Any sounds generated from construction would be temporary, lasting only as long as the construction activity is generating the sounds,

and would have a negligible to minor adverse impact on visitors and employees. Further, such negligible or minor impacts would not result in any unacceptable impacts; the proposed actions are consistent with §1.4.7.1 of NPS *Management Policies* 2006. Because these effects are minor or less in degree and would not result in any unacceptable impacts, this topic is dismissed from further analysis in this document.

Lightscape Management

In accordance with 2006 *Management Policies*, the National Park Service strives to preserve natural ambient lightscapes, which are natural resources and values that exist in the absence of human caused light (NPS 2006). Yellowstone National Park strives to limit the use of artificial outdoor lighting to that which is necessary for basic safety requirements. The park also strives to ensure that all outdoor lighting is shielded to the maximum extent possible, to keep light on the intended subject and out of the night sky. Localized lighting for road construction activities during night hours would be the primary sources of light generated from this project within the park.

The proposed action may incorporate minimal exterior lighting for safety purposes near roadside hazards or barricades. The amount and extent of exterior lighting for this road construction project would have negligible effects on the existing outside lighting or natural night sky of the area. The lighting would be temporary in nature, and last only as long as this project. Further, such negligible impacts would not result in any unacceptable impacts; the proposed actions are consistent with §1.4.7.1 of NPS *Management Policies* 2006. Because these effects are minor or less in degree and would not result in any unacceptable impacts, this topic is dismissed from further analysis in this document.

Prime and Unique Farmlands

The Farmland Protection Policy Act of 1981, as amended, requires federal agencies to consider adverse effects to prime and unique farmlands that would result in the conversion of these lands to non-agricultural uses. Prime or unique farmland is classified by the U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS), and is defined as soil that particularly produces general crops such as common foods, forage, fiber, and oil seed; unique farmland produces specialty crops such as fruits, vegetables, and nuts. According to the NRCS definitions, the project area does not contain prime or unique farmlands (Farmland Protection Policy Act, 1984). Because there would be no effects on prime and unique farmlands, this topic is dismissed from further analysis in this document.

Indian Trust Resources

Secretarial Order 3175 requires that any anticipated impacts to Indian trust resources from a proposed project or action by the Department of Interior agencies be explicitly addressed in environmental documents. The federal Indian trust responsibility is a legally enforceable fiduciary obligation on the part 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.

Trust resources would not be affected by this project; therefore this topic has been dismissed from further analysis in this document.

Environmental Justice

Executive Order 12898 *General Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* requires all federal agencies to incorporate environmental justice into their missions by identifying and addressing disproportionately high and adverse human health or environmental effects of their programs and policies on minorities

and low-income populations and communities. Because the reconstructed road would be available for use by all park staff regardless of race or income, and the construction workforces would not be hired based on their race or income, the proposed action would not have disproportionate health or environmental effects on minorities or low-income populations or communities. Because there would be no disproportionate effects, this topic is dismissed from further analysis in this document.

Climate Change and Sustainability

Although climatologists are unsure about the long-term results of global climate change, it is clear that the planet is experiencing a warming trend that affects ocean currents, sea levels, polar sea ice, and global weather patterns. Although these changes will likely affect winter precipitation patterns and amounts in the parks, it would be speculative to predict localized changes in temperature, precipitation, or other weather changes, in part because there are many variables that are not fully understood and there may be variables not currently defined. This project would not increase the number of vehicles entering the park, or vehicle emissions from those vehicles. Reconstruction of the Norris to Golden Gate road segment is not anticipated to increase the amount of traffic on the road, only to improve traffic conditions. While there may be a net increase in emissions from construction equipment, these would be short-term and not a scale that would influence the decision about whether to implement the project. Therefore, the analysis in this document is based on past and current weather patterns and the effects of future climate changes are not discussed further in this document.

ALTERNATIVES

An interdisciplinary team of National Park Service employees in conjunction with employees of the Federal Highway Administration developed the following project alternatives. These alternatives are based on meeting the project objectives described in the *Purpose and Need* chapter of this environmental assessment. A total of five action alternatives and the no-action alternative were originally identified for this project. Of these, four of the action alternatives were dismissed from further consideration for various reasons, as described later in this chapter. One action alternative (the preferred alternative would reconstruct segment to a 30-foot paved width, and 45 mph design speed) and the no-action alternative are carried forward for further evaluation in this environmental assessment. A summary table comparing alternative components is presented at the end of this chapter.

Alternatives Carried Forward

Alternative A – No Action/Continuation of Current Practices

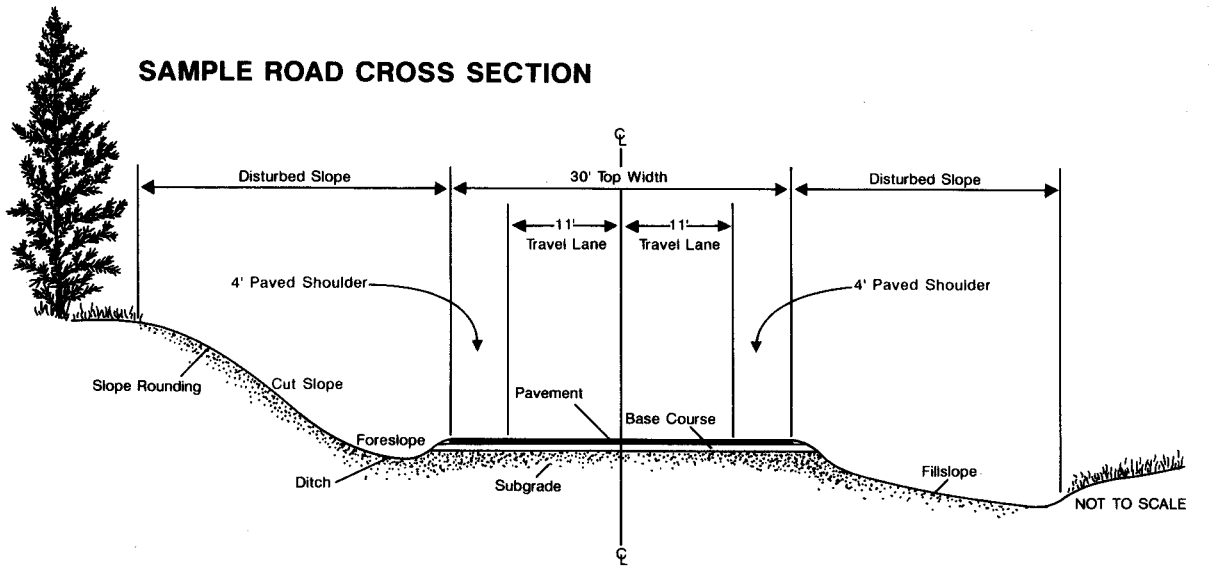
Under this alternative the current alignment would remain unchanged. Periodic maintenance would be performed by the park to maintain the road as much as possible. The road width would remain at its existing 19-22 feet in width. The travel speed would remain at 45 mph with slower sections as presently marked. This road would likely need increasing amounts of maintenance to maintain a drivable surface into the future. These road maintenance projects would require traffic delays and closures to complete the work. Safety issues such as steep drops at pavement edge, vehicles stopping in road to view wildlife, and narrow road surface would not be addressed. High visitor use in the area of the Bunsen Peak and Glen Creek trailheads could be addressed through a previously approved project to expand parking in this area.

Alternative B (Preferred) – Reconstruct and Rehabilitate portions of the Grand Loop Road – 30 foot width

This alternative consists of reconstructing a segment of the Grand Loop Road from an inconsistent pavement width of 19 to 22 feet, to the park standard, a 30-foot paved width. The new width is based upon an American Association of State Highway and Transportation Officials (AASHTO) design speed of 45 mph, with exceptions in both width and design speed in certain areas. The 30-foot width would consist of two 11-foot travel lanes and two 4-foot paved shoulders. Shifts in the centerline of the road may be necessary to accommodate the wider width of the road and to avoid sensitive areas. Realignment recommendations are proposed for known sensitive areas at Frying Pan Thermal Spring, near the trailhead to Grizzly Lake, and near Semi-Centennial Geyser.

The following text further describes the components of alternative B:

- **Driving Surface** – The reconstructed road would be approximately 25.6-kilometers (15.9-miles) in length. The typical cross section of the road is shown in the following figure and includes a 30-feet paved width consisting of two 11-foot lanes, and two 4-foot shoulders.



- **Scheduling of Work Activities** – The first phase of this project would reconstruct the road from the bridge over the Gibbon River located near the intersection of the Grand Loop Road with the Norris Campground access Road, to a point near the Obsidian Cliff Kiosk and parking area (approximately 7.70 miles). The second phase of the project would reconstruct the road from Obsidian Cliff to a point approximately 0.50 miles north of Swan Lake Flat at Golden Gate (approximately 8.25 miles). Each construction phase would take approximately two to three years to complete. The first phase of the project is scheduled to begin as early as 2012, and the second phase in 2014 depending upon the availability of funding.
- **Water Source(s)** - The water source for this alternative would be attained from pumping water from any of four sources: the Gibbon River near the bridge located at the intersection of the Norris Campground road and the Grand Loop Road; near the bridge over Obsidian Creek on the spur road to the Indian Creek Campground; from the Gardner River near the parking area at Sheepeater Cliff; near the NPS water intake near the Swan Lake Pit; and Obsidian Creek near the Obsidian Cliff turnout. Water would be used for dust control, compaction of road base material, and for water needed in the production of asphalt at the plant that would be located at either the Norris staging and stockpile area, or the Swan Lake staging and stockpile area. Whirling disease is not known to infect any fish in the Gardner River, Obsidian Creek or the Gibbon River within the project area. Any water pulled from water sources within the project area would be used for dust control or other construction purposes, such as wash water for aggregate or asphalt production, and would not be used where it could potentially run into tributaries outside this watershed.
- **Closures and/or Delays for Public Access -** The flow of vehicle traffic on the road would be maintained as much as possible during the construction period. Construction delays would normally be limited to 30 minutes. There may be some periods when the nature of the construction work may require temporary road closures. These closures could consist of regular nighttime closures, and/or full day closures lasting up to a few days in duration. A complete road closure of approximately 6 weeks late in the season could be required for work in the Golden Gate area. All efforts would be made to reduce these as much as possible and to alert the public and park staff as soon as possible if delays longer than

normal are expected. Visitors would be informed of construction activities and associated delays. If the need for closures occurs, the gate just south of the Upper Terrace Loop parking area would be used to prohibit traffic flow, as would a gate placed just north of the entrance road to the Norris Campground. Intermediate gates would be placed to allow visitor use of areas along the road where it would not conflict with construction. The Bunsen Peak Road could be used for emergency vehicle use and administrative traffic during the road closure. Some maintenance work would be done to allow for this use (road grading, some potential culvert maintenance, and potentially some added gravel surfacing in areas prone to staying damp. Use of this road would only be considered during the time that the main road is closed for construction.

- **Parking and Turnouts** - The existing parking areas and turnouts along this road segment would, for the most part be repaved on their existing footprint. In some situations, the turnouts could be enlarged or decreased in order to allow for a safe and consistent design of these turnouts. Some informal turnouts would be obliterated, others would be formalized and paved, and some turnouts may be relocated. Parking areas could have minor changes to improve functionality; the size would generally not increase by over 5 percent of the existing size (with the exception of the Norris Geyser Basin parking area as described later in this chapter). New parking areas would be constructed at Glen Creek for horse packer use, and at the Bunsen Pit for hiker use. Currently 37 turnouts exist along the Norris to Golden Gate Road segment. Approximately one third of these would be removed due to safety issues or in order to protect resources. As part of this project, approximately 30 new turnouts would be constructed along the road for wildlife viewing, passing opportunities, and resting areas. A net increase of approximately 20 turnouts would exist on this road after project completion.
- **Utilities** – To improve NPS communications infrastructure and reduce costs, two-inch extruded duct/conduit would be placed within, or adjacent to the road corridor within the disturbed area of construction for the entire length of the project. Splice boxes would be installed approximately every 5,000 feet. These boxes would be neutral in color and about 18x24x24 inches in size and buried flush with the ground. Installation of fiber optic cable would be placed in the duct, and spliced after road reconstruction is complete, and conduit has been placed along the entire route.
- **Reclamation/Revegetation** – Revegetation plantings would use native species from genetic stock originating in the park. Revegetation efforts would be implemented to reconstruct the natural spacing, abundance, and diversity of native plant species. All disturbed areas would be restored as nearly as possible to pre-construction conditions shortly after construction activities are completed. The principal goal is to avoid interfering with natural processes. In many areas soils and vegetation are already impacted to a degree by various human and natural activities.
- **Temporary Offices and Contractor Housing** – A temporary office facility (trailer) would be placed (within the administrative area at Norris or Mammoth) to provide office space for employees during reconstruction of the Norris to Golden Gate road segment. This trailer would be removed following completion of road reconstruction. Contractors would be allowed to use trailer/RV spaces in the Canyon Contractor Camp located adjacent to the administrative/housing area north and west of the Canyon Junction intersection.
- **Construction Staging, Stockpiling, and Disposal Sites** – To implement this alternative, various areas near the Norris to Golden Gate road segment would be used for construction staging, material stockpiling, equipment storage, and asphalt production. These areas would be sited in previously disturbed areas, away from visitor use areas. The Swan Lake

Pit and the Norris staging area (old asphalt plant area) would both be used for staging of equipment and supplies and asphalt production. The areas along portions of the existing road, existing turnouts, and parking lots may be used for construction purposes such as staging and stockpile of equipment and materials. Disposal of excess unusable fill material would occur at the Ice Lake Pit, Gibbon Meadows Pit, Swan Lake Pit, and a limited quantity at Bunsen Peak Pit.

- **Blasting** – Blasting is likely to occur in the cliff area of Golden Gate in order to provide room for road widening, and a rockfall ditch. Blasting would conform to NPS-65, Explosives Use and Blasting Program (1991) specifications. All blasting would use the minimum amount of explosive necessary to accomplish the task. All blasting would be used to shatter, not distribute, any material. Protective devices would be designed and used to protect historic guard walls from, and to contain material removed during the blasting process. If blasting is needed, it would not occur from April 15 through June 22 to avoid impacting nesting eagles, peregrine falcons and other migratory birds.
- **Bridge Rehabilitation/Reconstruction** – Two bridges would be rehabilitated/reconstructed as part of this project, the 7-mile bridge located over the Gardner River near the Indian Creek Campground, and the Obsidian Creek Bridge on the access road to the Indian Creek Campground. The Obsidian Creek Bridge would be replaced in its present location after the campground closes and would remain a single lane bridge with a wood driving surface and metal railing. The 7-mile bridge would be constructed in its present location while traffic is maintained on a temporary road and bridge to be located directly west of the existing bridge. The railing on the bridge at the Gibbon River (near the Norris Campground Entrance) would be replaced to match the railing on the other Gibbon River Bridges south of Norris. The superstructure (abutments and girders) of the Gibbon River Bridge would be replaced to conform to current standards. The existing modern approach walls would be replaced or faced with stone masonry using native stone from road cuts to blend with the historic character of the road.
- **Road Realignment** – Minor realignments of the road would occur in the vicinity of Frying Pan Thermal Spring, Semi-Centennial Geyser, and the Grizzly Lake Trailhead. A total of approximately 10,550 linear feet of road would be realigned in five locations along Obsidian Creek. These realignments would be done with the sole purpose of protecting resources and improving safety for those driving the road. In the area of Frying Pan Spring, the road would be shifted to the east up to 250 feet for a distance of about 3,000 feet in order to remove the road from an existing thermal area it presently crosses. This area produces heavy concentrations of steam on cold days, reducing visibility and increasing icing of the road pavement. In the area of Semi-Centennial Geyser approximately 900 feet of roadway would be shifted approximately 50 feet to the east to allow for less encroachment into this thermal feature. In the area of the Grizzly Lake Trailhead, approximately 3,650 feet of roadway would be shifted up to approximately 100 feet to the east in order to improve the horizontal alignment of the road and improve safety, and remove the roadway from the wetlands. The road shift of the road to the east in the area of the Grizzly Lake Trailhead would occur in order to reduce the sharpness of a curve that has very little sight distance for drivers. This area also gets very little sunshine on the pavement which leads to icing on the curve, and a site of motor vehicle accidents for this reason. A fill-side retaining wall may be constructed at the Grizzly Lake area to minimize the amount of area that would be impacted by the road shift.

  Minor centerline shifts would also occur in the area of Obsidian Cliff. South of the kiosk turnout retaining walls may be needed on both sides of the road to avoid impacts both into the wetlands on the west, or impacts of cutting into the cliff area on the east. A fill-side wall

(up to approximately 15 feet in height) on the west side of the road could extend for a distance of approximately 1,150 feet. A crenulated stone guardwall would be placed on top of this stone-faced mechanically stabilized earth (MSE) wall. A slight shift in the road to the west up to approximately 15 feet would take place north of the kiosk turnout, for a distance of approximately 3,500 feet. This would allow for the potential restoration of approximately 0.21 acre of wetlands along the west bank of Obsidian Creek adjacent to the road. As in other areas along this road segment, the shifting and widening of the road in this area would require some cutting into the slope on the west side of the roadway.

- **Culverts and Headwalls** – The culverts and headwalls would be rehabilitated and reconstructed according to the provisions of the road programmatic agreement with the Wyoming State Historic Preservation Office and the Advisory Council on Historic Preservation, which allows the masonry headwalls to be moved to a more functional location when necessary but they must retain their original historic look. Approximately 143 historic stone masonry headwalls would be reconstructed as part of this project.
- **Retaining Walls** – Retaining walls would be rehabilitated and reconstructed according to the provisions of the road programmatic agreement with the Wyoming State Historic Preservation Office and the Advisory Council on Historic Preservation. New retaining walls could be constructed in areas to help minimize impacts to wetlands, rare plant or archeological sites, and areas of steep slopes adjacent to the road.
- **Material Sources** – Materials used for stone masonry, road base aggregate, and asphalt mix, would be from sources outside the park, likely located north or west of the park. Much of the existing road base material would be conserved from the existing roadway and reused on the job. Some of the materials obtained would be from rock cuts required for road widening within the project area. Table 1 lists estimates of imported materials required for the job.

Table 1 – Assumed Material Needs

Assumed Imported Material	Approximate Quantity	
Select Borrow	65,900	tons
Riprap (8280 cuyd)	16,350	tons
Roadway Aggregate		tons
Mainline	5,200	
Parking Areas	2,995	
Asphalt Concrete Pavement		tons
Mainline +Golden Gate	65,500	
Parking Areas	15,540	
Asphalt (Tack, Emulsion, Fog)		tons
Mainline + Golden Gate	1,605	
Parking Areas	275	
Blotter		tons
Mainline + Golden Gate	10,310	
Parking Areas	1,435	
SUBTOTAL	185,110	tons
Miscellaneous for Project	4,890	tons
TOTAL	190,000	tons
Estimated Trucks Count @ 25 Tons Each	7,600	trucks

- **Geology/Thermal Features** – Thermal areas would be avoided in all areas feasibly possible, though some hot ground could be encountered during reconstruction of parts of the road in areas of known thermal activity. A thermal design for the road may be necessary in these areas to allow heat to dissipate and/or vent, and thus not build up below the roadbed. Possible construction options would include placement of thermal insulation board beneath the road surface, placement of horizontal pipes to vent heat off to the side of the road, or placement of quartzite aggregate to reduce degradation of road base material.

  Subject to the availability of funding, the project would also repair approximately 600 feet of roadway located south of Norris Junction near Elk Park. Cracks have developed in this area due to geothermal heat from below the road surface. Work may involve excavating up to 40 inches below the pavement surface, applying a layers of sand, crushed aggregate, geo-membrane fabric, and insulation board prior to repaving with asphalt.

- **Wetlands** – Fill-side walls would be constructed at selective locations, to eliminate or reduce impacts, in areas where the fill material needed for widening of the road template would spill into wetlands. The road alignment would typically be designed so that impacts only occur on one side of the road. The centerline of the road would be routinely shifted to help minimize these impacts. Wetland mitigation would be accomplished by the restoration of previously impacted wetlands within the park adjacent to the Norris to Golden Gate road segment. These areas include restoration of a wetland near the Norris Picnic area adjacent to the Gibbon River, by removal of fill material from an abandoned road segment; removal of old roadbed fill material from wetlands on the east side of the road in the vicinity of the Grizzly Lake Trailhead; west of the Grizzly Lake Realignment Area; removal of fill material on the east side of the road adjacent to Obsidian Creek, just north of the Obsidian Cliff area; and removal of fill material from east of a wetland pond south of Frying Pan Spring and on the west side of the road.

- **Wildlife** – Road maintenance and reconstruction activities could temporarily displace wildlife.

- **Cultural Resources** – The road corridor and adjacent vicinity of the Golden Gate to Norris road segment is rich with precontact archeological sites, many of which are associated with the Obsidian Cliff tool stone quarries and many of which have not been previously impacted by the current road and will continue to be avoided by the proposed road improvements. The precontact sites represent places native people stopped, as long as 11,000 years ago to about 300 years ago, after having procured obsidian from the cliff quarry site or as cobbles along the river banks, to reduce the stone down to shapes and sizes that were more easily transported. Six precontact sites eligible for listing on the National Register of Historic Places are bisected by the current road alignment, constructed in the 1930's. Archeological sites 48YE128, near Seven-Mile Bridge, site 48YE201, near a turnout area, and site 48YE357 on the south end of Swan Lake Flats are all north of Obsidian Cliff National Historic Landmark. Sites 48YE114, in the Nymph Lake area, site 48YE116, in the Solfatara area, and site 48YE406 north of Norris campground are all south of Obsidian Cliff. Data recovery plans have been developed for all six sites and the Wyoming State Historic Preservation Office has previously approved all of the plans. Excavation, processing and analysis of the artifacts are complete for sites 48YE114, 48YE116, and 48YE406 and the data recovery reports are being drafted. Excavation is completed for site 48YE357 with artifact processing and analysis almost completed. Geophysical testing is completed for site 48YE201 and geophysical testing and data recovery excavations were conducted in the

2010 field season for site 48YE128. Completion of the remaining data recovery work is scheduled for the near future and will be complete before any construction activity begins.

Several historical archeological sites have been documented in support of the proposed road rehabilitation. The site of the 1890's Norris Hotel which burned shortly after construction was documented and the road improvements designed to avoid any impact to the site. The Apollinaris Springs constructed landscape was documented using the Cultural Landscape Inventory format and, again the park will avoid new impact through road design. Design and implementation would be sympathetic to, and not detract from the existing road landscape.

The archeological site 48YE433, Obsidian Cliff, is a National Historic Landmark the extreme western boundary of which is just outside of the area of potential effect of the road reconstruction project. The Obsidian Cliff Kiosk wayside exhibit and parking area is listed on the National Register as locally significant and the minor changes proposed for the kiosk area would not adversely impact the historic values of the area. The Grand Loop Road, of which the Golden Gate to Norris segment is a part, is listed on the National Register of Historic Places as nationally significant for the design philosophy of harmonizing with nature and laying lightly upon the land. The road Programmatic Agreement provides guidance for reconstruction of the roadway, in consultation with the WYSHPO, to avoid adverse impact to the historic roadway through design.

The historic Seven-Mile Bridge (Gardner River Bridge), built in 1932 and the Obsidian Creek Bridge, built in 1910, would both be rehabilitated/reconstructed in place. The rehabilitation/reconstruction of the Seven Mile Bridge would include dismantling the stone abutments and piers, carefully conserving the stone, replacing the spalling, deteriorated three span concrete tee beam bridge with a concrete bulb tee single span superstructure. The bridge deck width would be widened to the new 30-foot pavement width. The concrete abutments would be faced with the stone conserved from the original abutment and piers to produce a pattern of stone masonry similar to the original bridge. The stone placement and mortar specifications of the original bridge construction would be spelled out in the contract special requirements for the new bridge. The concrete post and timber rail detail of the original bridge would be replicated with new materials on the rehabilitated bridge. Due to the low profile of the bridge and the strength of the single span bulb tee construction, the short stone piers are not needed and would not be replaced, similar to what was done with the historic Gibbon River Bridge, previously rehabilitated during another project. Traffic will be routed on an adjacent temporary road alignment and temporary bridge while the Seven-Mile Bridge is being rehabilitated.

The historic bridge over Obsidian Creek provides access to the Indian Creek campground via a single lane of traffic. The Wyoming State Historic Preservation Office staff visit to the bridge and subsequent documentation identified the distinctive steel lattice railing and ornamental end posts and the wood plank driving surface as unique character defining features of the bridge, one of only two Army constructed bridges left in the park. The steel lattice railing and ornamental end posts would be conserved and repaired and reinstalled on the rehabilitated bridge. The abutments of the bridge, which are currently subject to erosion, would be rebuilt and four new weathered steel beams would be installed to provide a more stable superstructure than the current three rolled steel beams provides. The timber deck would be replaced with a Glulam timber deck and timber running planks, as are currently on the bridge deck. Due to adequate visibility and available turnout areas on both sides of the bridge it is possible to keep this bridge as a one-lane structure. The rehabilitated bridge would retain its historic appearance while providing a strong, modern structure.

Improvements will also be made at the Sheepeater Cliff parking area to enlarge the area to allow for larger vehicle access. The expansion would be done in an area of the NR eligible archeological site that does not contribute to the sites eligibility.

The stone masonry guardwall and retaining wall on both ends of the Golden Gate Viaduct are historic and contributing features of this section of the Grand Loop Road. Years of overlain asphalt, failure of base materials, and poor drainage have caused slumping of the guard walls. Bulging, raveling of stones, and displacement of portions of the retaining walls caused by the earthquake of 1959 also compromise their function. Proposed project work would involve removing, carefully preserving, and reseting the entire length of guard wall using the crash-tested concrete core construction technique previously used in rehabilitation of similar walls through the park. Some masonry guard wall would be slightly relocated to enlarge viewing areas, and improve their association with the stone retaining walls correcting previous earthquake damage. Great care would be taken to restore stone masonry and drylaid features in this area to their original historic appearance. All of the historic stone features of the road corridor will be repaired and rehabilitated according to the provisions of the road Programmatic Agreement to retain the historic feeling of the road.

- **Visitor Information** – Information on this road project would be distributed to the visitors in the form of press releases, within the visitor newspaper available at entrance stations to the park, through uniformed employees, and road signs and postings.

This alternative is based on preliminary designs and best information available at the time of this writing. Specific distances, areas, and layouts used to describe the alternative are only estimates and could change during final site design. The estimates used are at the upper limits of the expected impact for given resources. If changes during final site design are inconsistent with the intent and effects of the selected alternative, then additional compliance would be completed, as appropriate.

The following are areas or features located along the road starting from the south and progressing north, with a brief description of project work for each area:

- **Norris/Elk Park Thermal Repair** – This portion of the project would involve repairing portions of asphalt from a previous (1992-1994) road reconstruction project. Approximately 300 feet in each of two areas of roadway located south of Norris Junction would be repaired. This portion of road had cracks develop due to geothermal heat from below the road surface. This portion of road would be repaired as part of this project if funding is available. Work would involve excavating up to 40 inches below the pavement surface, applying layers of sand, a geo-membrane fabric, insulation board, and aggregate base material prior to repaving with asphalt.
- **Norris Geyser Basin parking lot** – This parking area would be expanded to increase capacity by about 25 percent. The existing parking lot provides 154 auto spaces and 15 oversized vehicle spaces. After expansion, approximately 210 auto spaces and 20 oversized vehicle spaces would exist. The project would also provide Americans with Disabilities Act/Architectural Barriers Act (ADA/ABA) compliant access to the geyser basin museum, and restrooms adjacent to the parking lot. Some grading of the slopes would be required to reduce the steepness of some of these pedestrian walkways. Some changes to the vehicular circulation patterns would be done to increase efficiency, and reduce confusion for visitors. Utility and drainage adjustments and drainage structure replacement work would also occur. The entire parking lot and access road would receive an overlay of asphalt, while the existing concrete curbs of the parking lot would be

evaluated as to need for replacement. The expanded portion of the lot would be designed to match the existing walks and curb styles. In the pedestrian areas adjacent to the parking lot, fencing consisting of masonry piers and log rails would be added to help in guiding and controlling foot traffic. The existing vault toilets adjacent to the parking area would be removed and relocated within the parking area, or replaced.

- **Norris Picnic Area Parking Lot and Access Road** – The pavement would receive an overlay of asphalt on the access road and parking area of the Norris Picnic Area.
- **Gibbon River Bridge** (near the Norris Campground entrance road) – The existing walkway on the bridge would be removed, and a marked shoulder on the bridge would allow for pedestrians to cross on the bridge. Reconstruction of the bridge deck would occur and the existing deck and girder system would be replaced to increase the load-bearing capacity of the bridge. Work would likely be done at half width, closing one lane only and allowing traffic on the other lane during construction. Efforts to ensure surface drainage off the bridge would be facilitated in order to remove existing scuppers on the bridge that drain directly into the Gibbon River. The existing modern approach walls would be replaced with stone masonry approach walls using native stone from road cuts to give a more natural feeling, and to blend with the historic road. New bridge railings similar to railing used on the Gibbon River Bridge just south of Madison Junction, and other bridges along this road segment, would be constructed to replace the modern looking bridge rails currently on the bridge.
- **Norris Ranger Station/Museum Area** – An overlay of asphalt would occur on the access roads into the Norris Ranger Station and Campground. Some areas adjacent to the road and parking areas that are experiencing erosion problems would have structures installed to slow storm water runoff and reduce erosion. Visitor access would be constructed from the parking area to allow access to the Gibbon River (approximately 150 feet away). Accessible curb cuts would be installed as necessary.
- **Norris Basin overlooks** – The viewpoint of each overlook would be formalized and the vehicular circulation areas of both would be paved.
- **Frying Pan Thermal Spring** – Due to the close proximity of the road to the thermal feature, the road would be rerouted to the east of its existing alignment in the area of Frying Pan Springs to reduce the impact on this thermal feature. The shifted road alignment would not cut into thermal ground in this area. In areas of hot ground, the road would be raised with fill material and no cutting would occur. If needed insulating board and a venting system to transfer heat from under the road would be constructed if deemed necessary. A turnout for a small number of vehicles (3-5) would be constructed along the road with a pedestrian trail/boardwalk to Frying Pan Spring. In accordance with the roads programmatic agreement, the stone culvert headwall at Frying Pan Springs would be carefully removed and reused on the relocated segment of road.
- **Roaring Mountain** – The road could be shifted up to approximately 15 feet to the west in this area to allow for improved parking on the east side of roadway, and to allow for greater separation of traffic and pedestrians on both sides of the road. A pedestrian walkway would be constructed on both the east and west sides of the turnout. Some post and rail fencing would be added to help control pedestrian traffic. The existing kiosk could be moved depending upon the final design.
- **Clearwater Spring** – A boardwalk would be constructed in this area to provide access for viewing at the edge of the spring. The boardwalk viewing area would be accessed from a trail/boardwalk beginning at the vehicle turnout on the Grand Loop Road.

- **Grizzly Lake Trailhead** – The trailhead would be relocated north of its existing location. Approximately 3,650 linear feet of road alignment would be shifted to the east in this area to improve curve geometry and improve safety for users of the road and remove it from wetlands.
- **Solfatara trailhead** – The parking area would be expanded by a few feet in order to allow for a better turning radius, and the parking area would be paved.
- **Beaver Lake picnic area** – The apron into the access road would be paved, and the area could serve as a potential work area for the project.
- **Obsidian Cliff Alignment South of Kiosk** – In this area there may be a need to construct both cut and fill side walls, and extend the existing box culvert in this area to allow for a wider road template. This would be done to avoid impacts both into the wetlands on the west, or impacts of cutting into the cliff area on the east. A fill-side wall (up to 15 feet in height) on the west of the road could extend up to 1,000 feet. A crenulated stone guardwall would be placed on top of this stone-faced mechanically stabilized earth (MSE) wall. On the east side of the road, a rockery-type (stacked boulder) retaining wall would be constructed.
- **Obsidian Cliff Area** – The turnout would be kept as is to the extent possible. The majority of trees in the island between the turnout and the main road would remain. The stone curbing along the east side of the vegetated parking island would be removed and reset approximately 2 feet to the west, at the new edge of pavement for the west side of the main road to accommodate widening. The historic kiosk would be rehabilitated to maintain it into the future. An accessible paved pathway up to 5 feet wide and a wood viewing platform would be constructed in the area adjacent to the southwest side of the parking area for viewing of the meadow and cliff area. This pathway would be about 250-300 feet long. Some earthwork and tree removal would be required to create a level cross slope for the trail. The trail and platform would be constructed in this area as an effort to increase safety by providing pedestrians viewing opportunities of the cliff that do not require them to cross the road. The road corridor along the base of Obsidian Cliff is narrowly bounded by the Obsidian Cliff National Historic Landmark and sensitive wetlands. A rockery wall would be constructed using obsidian boulders along a short narrow portion of the cliff side of the road and a retaining wall to support the roadway on the wetland side of the road to allow for the construction for the 30-feet road. The masonry headwall on the nearby box culvert would be carefully removed and reconstructed to facilitate extending the concrete box culvert, as has been done in many other areas to facilitate the wider reconstructed road.
- **Alignment North of Obsidian Cliff** – A slight shift in the road would take place north of the kiosk parking area. For a distance of approximately 3500 feet north of the kiosk, the road would be shifted to the west up to 15 feet. This would allow for restoration to occur along the west bank of Obsidian Creek. As in other areas along this road segment, the shifting and widening of the road in this area would require some cutting into the slope on the west side of the roadway.
- **Mount Holmes trailhead** – This parking area would be formalized to allow for five oversized vehicle spaces.
- **Apollinaris Spring Area** – The road in this area would be widened to the west, then shifted to the east just south of the spring area. The parking areas within the picnic area would be better defined and the turnout on the road would likely be reconstructed near its existing location after road widening. Some trees to the west of the road in this area

would need to be cut to allow for road widening and the turnout. No change would occur to the historic masonry work at Apollinaris Spring. A short segment of creek channel is proposed to be rerouted just south of the spring. The existing box culvert, that carries water from Obsidian Creek south of the spring, would be removed and a new culvert would be constructed and the existing headwall moved approximately 80-100 feet south of the existing culvert. This water would be placed into an existing swale which may be the remnant of an old channel of the creek located in an existing wetland area west of the road. A portion of the existing creek channel (approximately 210 linear feet) east of the road is anticipated to form a riparian/wetland area. Approximately 140 linear feet of new stream channel would be constructed on the west side of the road. The existing turnout on the west side of the road would be formalized and paved.

- **Moose Exhibit Turnout** – The Moose exhibit panel would be moved closer to the parking lot, which would help to mitigate wetland impacts.
- **Parking Area south of Willow Park** – This area would have an overlay of asphalt, curbs could be added and the turning radii for vehicles improved (made larger).
- **Willow Park Parking Area** – There would be no expansion of this parking area, though some slight reconfiguration to improve its function would occur.
- **Indian Creek Campground bridge** – The bridge over Obsidian Creek (built in 1910), on the access road to the campground, is in poor condition and would be rehabilitated/reconstructed. The bridge would be approximately 10 feet longer in order to reduce a man-made restriction of the creek in this area. The abutments of the bridge, which are currently subject to erosion, would be rebuilt and four new weathered steel beams would be installed to provide a more stable superstructure than the current three rolled steel beams provides. The historic look of the wood decking and planking on the existing bridge would be replicated on the new bridge. The existing steel lattice railing and ornamental end posts would be conserved, repaired and reinstalled on the rehabilitated bridge. Due to adequate visibility and available turnout areas on both sides of the bridge it is possible to keep this bridge as a one-lane structure. The rehabilitated bridge would retain its historic appearance while providing a strong, modern structure. Construction equipment may need to ford the creek just upstream of the existing bridge in this area to complete construction. Any needed permits for this purpose would be obtained prior to work being done. This bridge is anticipated to require a minimum of 6 -10 weeks construction time to complete. Construction would be coordinated with the campground closure to reduce the impacts to campers using the area. Staging of equipment and supplies would occur at the vehicle turn around area for the warming hut and on the access road to the campground. A rip rap filled trench would likely be needed at the base of the new bridge abutments. Two parking spaces would be paved, and a paved walkway would be constructed to join these spaces with the existing toilet structure on the north side of Obsidian Creek.
- **Gardner River Bridge (also known as 7-mile bridge)** – This bridge, built in 1932, would be rehabilitated/reconstructed and the existing stone masonry would be conserved and replaced into the structure. Work would include dismantling the stone abutments and piers, carefully conserving the stone for use to face the concrete abutments with a pattern of stone masonry similar to the original bridge. The bridge deck width would be widened to the new 30-foot pavement width. The concrete post and timber rail detail of the original bridge would be replicated using simulated log posts on the sides of the bridge supporting log rails that would transition to stone masonry wing walls at each of the approaches. Due to the low profile of the bridge and the strength of the new single span concrete girders,

the short stone piers are not needed and would not be replaced. By using precast girders and deck panels, it is anticipated that the construction for this bridge would take about 3 months to complete. During this time traffic would be diverted onto a temporary road located just to the west side of the existing bridge. One option for constructing this temporary detour would be to use multiple culverts at the Gardiner River to allow stream flow to continue. Temporary fill over the culverts and adjacent wetlands would be removed once the new bridge is complete. The detour road and bridge would be about 22 feet in width and consist of two traffic lanes (one in each direction). Depending upon final design, rip rap could contain the road fill for the detour road, and temporary concrete jersey barriers would likely be used to contain traffic to the road. This detour would need to be in place for approximately 4-5 months. The temporary detour could also serve as the dewatering structure while building the new bridge. Revegetation and rehabilitation efforts of the detour road would occur to bring the area back to preconstruction levels as much as feasible.

- **Sheepeater Cliff** – A left turn lane would be added to the Grand Loop Road at this location for traffic traveling south. The narrow two-way gravel spur road to the cliff area would be paved and widened up to 3-4 feet to allow for safer passage of vehicles on this two way road. The turnaround/parking area would be enlarged to allow for an expanded parking area and paved. The new parking area would allow for approximately 11 automobiles and two oversized vehicles (buses), and would have marked spaces, sidewalks and curbs. Slight expansion of the parking area would be needed to allow for large vehicles to negotiate a turn around. The shape of the parking area would change and could be pulled back to the southwest, and likely expand to the southeast nearer to the Gardner River in order to improve its function. The expansion will avoid archeological resources located in the area. Fill material (up to 24 inches) could be placed to allow for expansion of the spur road and parking improvements, though no excavation would be done in this area.
- **Swan Lake Pit** –This area would be used for staging and stockpiling of construction equipment and materials. A hot mix plant could be located and operated here, in one or both stages of the project.
- **Swan Lake Flat** – Three informal turnouts would be paved at the south portion of the flats, in an area that offers frequent wildlife viewing opportunities. Additional turnouts may be constructed in this area if space and avoidance of park resources allows.
- **Glen Creek Trailhead** – The existing parking turnouts in this area would be expanded to better accommodate horse trailers, and a new parking area would be constructed for this purpose. The new parking area would be located approximately 1,000 feet northwest of the existing turnout used for horse trailer parking. This area would be accessed by a new 22-foot wide spur road up to 900-feet long from the Grand Loop Road. The new parking area would accommodate about 16 truck/trailer units.
- **Bunsen Peak Trailhead Parking Area** – The existing gravel parking area would be obliterated and a turnout would be constructed to allow for oversized vehicle parking for two to five vehicles. A new automobile parking area would be constructed at the Bunsen Peak Pit area (see next bullet) to address deficiencies with the current area. The slope of the access drive would be reduced and turning radiuses would be improved for the road.
- **Bunsen Peak Pit** – A new parking area would be constructed on the Bunsen Peak Road about 900 feet east of Rustic Falls. The parking lot would accommodate approximately 24 vehicles. Space for two oversize vehicles would be accommodated near the intersection of the Bunsen Peak Road and the Grand Loop Road just above Rustic Falls. A series of

five 36 inch steel culverts located just east of the existing Bunsen Peak Trail parking area would be replaced with a single shallow concrete box culvert such that the water level of the existing pond upstream of these culverts would remain the same. The existing road prism is about 14 feet wide and would be widened by about 4 to 10 feet to a finished width of 18 feet in order to accommodate two-way traffic and allow for better sight distances for perceiving oncoming traffic. The remainder of the road encompassing Bunsen Peak would remain closed to vehicle traffic. Bicycle and pedestrian access would continue to be allowed. Approximately 500-600 feet of new trail would be constructed to connect to the existing trail for the Bunsen Peak summit. During construction, this area could be used for staging of contractor vehicles, equipment, and supplies. Excess fill material from the project could be hauled here to build the parking area.

- **Rustic Falls Area at Golden Gate** – Work would be done in this area to further define and improve circulation into the turnouts used for viewing the falls. The guardwalls are very low in this area, due to settling several past overlays of asphalt, and would be repaired, rehabilitated and reconstructed to retain their historic appearance. A pedestrian walkway may be constructed on the east side of the road to improve pedestrian safety in this area.
- **Golden Gate Area and Bridge** – The Bridge would not be widened, but left at its present width. Work would be done to improve the masonry guard and retaining walls both north and south of the Golden Gate Bridge. Over the years settling and the application of new asphalt overlays has contributed to raising the road bed thus depleting the protection provided by the historic masonry guard walls. Vehicle strikes and rockfall have also damaged the wall and repairs or reconstruction of the stone retaining walls would be needed and would occur as part of this project. The guard walls would be rehabilitated to retain the historic character and would likely have a concrete core design that has been crash tested. In some areas layers of asphalt could be milled away to lower the driving surface to its original height, to match the historic stone walls and curbing in this area. Designed walkways or striped shoulders are proposed to separate pedestrians from vehicular traffic at several popular spots for viewing Rustic Falls, just south of the Golden Gate Bridge. The cliff face, south of the bridge, would be carved back 10 to 45 feet in some areas to remove loose, broken, and dislodged rock, allow for the construction of a rockfall ditch on the west side of the road, allow for widening of the road, and provide additional space for pedestrians. Any cuts to the existing cliff face would be done, in a manner to replicate the existing cliff profile. Vertical cuts on the cliff face could extend in height upwards of 120 feet in this area, though efforts in the design phase would attempt to reduce this as much as possible. A construction equipment access road would be pioneered up the face of the existing cut on the west side of the road between Rustic Falls and the bridge in order to excavate the new cuts from the top down. A goal in this area is to try and maintain the existing experience the visitor gets while driving north or south on this portion of road. The road in this area would be designed for a speed of 25 mph. Some fill side wall repairs could occur if needed to the existing dry-laid wall east of the road. Any stone or aggregate gravel material gained from the scaling back of the cliff face would be used on the project or stockpiled for future projects within the Park. Full road closures would likely be needed to remove material from the cliffs adjacent to the road to allow for a wider road template and rockfall catchment ditches. It is possible that the dirt/gravel road around Bunsen Peak (used for hiking and biking) could be temporarily used as a one-way road for administrative travel late in the season when work in the Golden Gate area is being completed.
- Other retaining walls would be constructed in areas where needed to protect resources.

Mitigation Measures

The following mitigation measures were developed to minimize the degree and/or severity of adverse effects and would be implemented during construction of the action alternative, as needed:

- Temporary impacts, such as soil and vegetation disturbance and the possibility of soil erosion, associated with the reconstruction of the Norris to Golden Gate road segment would occur. In an effort to avoid introduction of exotic plant species, no hay bales would be used. Hay often contains seed of undesirable or harmful alien plant species. Therefore, on a case-by-case basis the following materials could be used for any necessary erosion control dams : wood bark mulch, straw, sand bags, coir logs, and silt fences. Wood bark mulch would be used to reduce surface erosion, help retain soil moisture and promote seed generation of native plants. Standard erosion control measures such as silt fences and/or sand bags would be used to minimize any potential soil erosion.
- Silt fencing fabric would be inspected weekly or after every major storm. Accumulated sediments would be removed when the fabric is estimated to be approximately 50% full. Silt removal would be accomplished in such a way as to avoid introduction of fine particle materials into any wetlands or flowing water bodies.
- Mitigation for wetlands destroyed would be done through restoration of disturbed wetlands located within the vicinity of the road reconstruction project, at a minimum 1:1 ratio. Wetland disturbance from the preferred alternative totals approximately 1.7 to 1.9 acres lost, 1.55 to 1.75 acres temporarily impacted, and 2.1 to 2.3 acres of wetlands restored. Locations for wetland mitigation include removal of an abandoned road between the Norris Picnic area and the Gibbon River, and through shifting the alignment of the current road to remove road fill from former wetlands.
- Although soil side-cast during construction would be susceptible to some erosion, such erosion would be minimized by placing silt fencing around the excavated soil. Excavated soil may be used in the construction project; excess soil would be stored in approved areas.
- Construction would take advantage of these previously disturbed areas wherever possible. Soils within the project construction limits would be compacted and trampled by the presence of construction equipment and workers. Soils would be susceptible to erosion until revegetation takes place. Vegetation impacts and potential compaction and erosion of bare soils would be minimized by conserving topsoil in windrows. The use of conserved topsoil would help preserve micro-organisms and seeds of native plants. The topsoil would be re-spread in as near as original location as possible. To reduce construction scars and erosion, mulching, seeding, and/or planting with species native to the immediate area. Scarification of compacted soils would occur as necessary to improve revegetation.
- Excavations to recover archeological data from six precontact sites bisected by the current road alignment would be conducted according to a plan pre-approved by the Wyoming State Historic Preservation Office prior to any ground disturbance from the reconstruction of the road.
- Should construction activity unearth previously unknown historic or prehistoric cultural remains or artifacts, work would be stopped in the area of the discovery and the park

archeologist would be notified. In accordance with the Inadvertent Discovery Procedures of the Road Programmatic Agreement, the cultural remains would be assessed and the Wyoming SHPO notified. If the cultural remains are assessed as significant and retain integrity for the archeological information they may provide, the site would be avoided and protected. If avoidance is not possible, data recovery excavations will be conducted prior to any construction activity resuming in the area. If Yellowstone National Park, with the concurrence of the Wyoming SHPO, determines the archeological remains are not sufficient to meet the definition of a National Register eligible site, or the archeological information with the site is not significant, all cultural remains will be collected and construction activity may commence with the archeological monitoring. The Road Programmatic Agreement also details procedures in the unlikely event that human remains are recovered.

- Attention to identification of Ethnographic Resources within the road corridor would be accomplished through monitoring of construction and continued consultation with the tribes.
- The park would continue to work with tribes to document and evaluate the ethnographic resources within the park ascribe native significance and protective measures for these resources.
- The interpretive wayside exhibit at the Obsidian Cliff pullout would be updated to incorporate native values for this geologic resource and archeological National Historic Landmark.
- Archeologists would monitor road building activities along the face of Obsidian Cliff, in part for the minimal likelihood of discovering portions of an old trail system that may be positioned along the Mammoth to Norris Road.
- The Obsidian Cliff area is a significant area for many tribal people, and is closed to the public. In order to encourage visitors not to cross the highway to the cliff side a boardwalk/trail to a viewing area of meadow and cliff would be constructed.
- The Sheepeater Cliff and Obsidian Cliff areas would be evaluated as Traditional Cultural Properties.
- The sign at Sheepeater Cliff would be updated to inform the public that there are descendants of the Sheepeater people who reside at the Fort Hall and Wind River Reservations, and other information about who they were and are today.
- The Cultural Landscape of the road would be retained by incorporating road designs that lay lightly on the landscape, blend with nature, and harmonize with the historic nature of the road landscape.
- Contractors would coordinate with park staff to reduce disruption in normal park activities (i.e. facilitate emergency traffic, hauling material to avoid quiet hours, allow for visitor use in areas where no conflicts or safety concerns exist).
- Construction workers and supervisors would be informed about the special sensitivity of park values, regulations, and appropriate housekeeping.
- To minimize the amount of ground disturbance, staging and stockpiling areas would be in previously disturbed sites, away from visitor use areas to the extent possible. All staging and stockpiling areas would be returned to pre-construction conditions following construction.
- Sensitive resource areas would be identified and fenced with construction tape, snow fencing, or some similar material prior to any construction activity. Fencing would be used to protect sensitive resource areas. All protection measures would be clearly stated in the

construction specifications and workers would be instructed to avoid conducting activities beyond these areas as defined by the fencing or markers.

- Revegetation and recontouring of disturbed areas would take place following construction and would be designed to minimize the visual intrusion of the structure. Revegetation efforts would strive to reconstruct the natural spacing, abundance, and diversity of native plant species using native species. All disturbed areas would be restored as nearly as possible to pre-construction conditions shortly after construction activities are completed. Weed control methods would be implemented to minimize the introduction of noxious weeds. Some trees along the road would be removed to allow for a wider road template, efforts would be made to minimize impacts to existing vegetation along the road to the extent possible.
- Fugitive dust generated by construction would be controlled by spraying water on the construction site, if necessary.
- To reduce noise and emissions, construction equipment would not be permitted to idle for long periods of time in areas near active campgrounds or residential areas.
- To minimize possible petrochemical leaks from construction equipment, the contractor would regularly monitor and check construction equipment to identify and repair any leaks. Hazardous material spill kits would be required on site.
- Equipment would not be serviced or refueled near streams; storage and refueling or construction parking and staging areas, would be at least 46 meters (150 feet) from streams or riparian areas. Fuel would be stored in fuel trucks or aboveground storage tanks, and all fuel storage would be in staging areas. Refueling would take place in staging areas and might occur at material source sites. Some stationary equipment (cranes, trackhoes, pumps), such as needed at bridge reconstruction sites, may require fueling within 150 feet of streams. In these cases, special precautions would be put in place to alleviate the risk of fuel spills.
- Construction workers and supervisors would be informed about special status species. Contract provisions would require the cessation of construction activities if a species were discovered in the project area, until park staff re-evaluates the project. This would allow modification of the contract for any protection measures determined necessary to protect the discovery.
- All project-related employees, such as contract and government construction employees, would be given orientation on how to avoid disturbing or encountering bears and how to minimize unavoidable effects or encounters. Orientation would include information about park regulations regarding food storage, disposal of garbage and other bear attractants, and approaching or harassing wildlife.
- The National Park Service would ensure that all contractors and subcontractors are informed of the penalties for illegally collecting artifacts or intentionally damaging paleontological materials, archeological sites, or historic properties. Contractors and subcontractors would also be instructed on procedures to follow in case previously unknown paleontological or archeological resources are uncovered during construction. Equipment and materials staging areas would also avoid known archeological resources.
- To minimize the potential for impacts to park visitors, variations on construction timing may be considered. One option includes conducting the majority hauling during off-peak times of the day or during shoulder seasons. Another option includes implementing daily construction activity curfews such as not operating construction equipment near

campgrounds during quiet hours (May – September). The National Park Service would determine this in consultation with the contractor.

- According to 2006 *Management Policies*, the National Park Service would strive to construct facilities with sustainable designs and systems to minimize potential environmental impacts. Development would not compete with or dominate the park's features, or interfere with natural processes, such as the seasonal migration of wildlife or hydrologic activity associated with wetlands. To the extent possible, the design and management of facilities would emphasize environmental sensitivity in construction, use of nontoxic materials, resource conservation, recycling, and integration of visitors with natural and cultural settings. The National Park Service also reduces energy costs, eliminates waste, and conserves energy resources by using energy-efficient and cost-effective technology. Energy efficiency is incorporated into the decision-making process during the design and acquisition of buildings, facilities, and transportation systems that emphasize the use of renewable energy sources.

Alternatives Considered and Dismissed

The following two alternatives were considered for project implementation, but were ultimately dismissed from further analysis. Reasons for their dismissal are provided in the following alternative descriptions.

- **Reconstruct the Road at its Present Width –** This alternative was considered to reduce overall impacts by remaining within the existing road prism. This alternative also does not address objective 2, providing for visitor safety and improved transportation flow, or objective 3 to improve traffic flow on this road segment by addressing events such as wildlife jams, lack of turnouts, and frequent maintenance needs. Therefore, this alternative was dismissed because it only partially meets the purpose and need for the project and the project objectives.
- **Reconstruct the Road at a 24-foot Width –** This alternative consisted of reconstructing the road to a 24 foot width as was done on the Dunraven Road. As with the above listed alternative, this alternative did not fully meet objective number 3; to improve traffic flow. The narrower road width would not allow traffic to flow when both lanes stop to view wildlife in the absence of turnouts along the roadway. Therefore, the alternative was eliminated for feasibility reasons and because the alternative would not meet the project's objectives.

Alternative Summaries

Table 2 summarizes the major components of Alternatives A and B, and compares the ability of these alternatives to meet the project objectives (the objectives for this project are identified in the *Purpose and Need* chapter). As shown in the following table, Alternative B meets each of the objectives identified for this project, while the No Action Alternative does not address all of the objectives.

Table 2 – Summary of Alternatives and How Each Alternative Meets Project Objectives

Alternative Elements	Alternative A – No Action	Alternative B – Reconstruct Road
30-foot paved road width	The existing road would continue to serve visitors at its present paved width of 19-22 feet. Wildlife would continue to cause traffic jams, and traffic would halt in many instances	The road would be reconstructed at a 30-foot width. The additional width would allow traffic to continue to flow if visitors pull over to the right side of the road to the extent possible.

Additional turnouts along road	37 turnouts currently exist along the Norris to Golden Gate Road segment. Some are located in areas that lead to resource damage due to their close proximity to fragile resources. No new turnouts would be constructed.	A net increase of approximately 20 turnouts would exist on this road after project completion.
Hauling/Construction Staging	Hauling and construction staging areas would be needed for maintenance activities to keep the road in a usable and safe condition. As road deterioration increases, maintenance actions that require these activities would increase.	Construction staging would take place at the Norris Pit, the Swan Lake Pit, Gibbon Meadows Pit, and the Bunsen Peak Pit. Material hauling would consist of approximately 7,600 truckloads of materials. Much of the material would likely come in from either the north or west entrance to the job site. Turnouts and parking areas along the route may be used for temporary construction staging.
Project Objectives	**Meets Project Objectives?**	**Meets Project Objectives?**
Provide an appropriate visual character and visitor experience along this road corridor.	Yes. The existing road offers a pleasing park experience, though driving it requires the driver to remain very attentive.	Yes. A reconstructed road would continue to have very nearly the same horizontal and vertical alignment of the existing road. Additional vegetation removal from some portions of the road edge would open up distant views and would allow for a more relaxed driving experience.
Provide a balance between reducing resource and visual impact and providing for visitor safety, transportation, and an appropriate national park experience as well as effective park operations.	No. Sharp drop offs at the pavement edge would remain, wildlife jams would continue to stall traffic, and the road would continue to be inefficient in keeping traffic flowing.	Yes. Sharp drop offs at the pavement edge would be reduced, additional turnouts would allow for traffic to move off road and allow others to pass, and provide for wildlife viewing opportunities. A wider road with paved shoulders would allow for an increased recovery zone for drivers that veer off course momentarily.
Improve traffic flow on this road segment by addressing events such as wildlife jams, lack of turnouts, and frequent maintenance needs.	No. A narrow road in conjunction with poorly placed traffic turnouts would not allow for traffic to flow efficiently. Maintenance requirements for this road segment would continue to increase over time.	Yes. The new wider road and additional turnouts would allow traffic to continue in most instances, though not at full speed. Maintenance requirements of the reconstructed road would be very low for the next 15 to 20 years. An improved road base would greatly reduce frost heaves, and pavement cracking in the future.
Identify, restore, and rehabilitate impacted riparian or other sensitive resource areas within the project limits wherever feasible.	No. Limited park funding would not at this time allow for restoration and rehabilitation activities of this nature to occur over other un-funded park needs.	Yes. Funding for this project would allow for impacted areas adjacent to the road to be addressed as part of the road reconstruction project.

Table 3 summarizes the anticipated environmental impacts for alternatives A and B. Only those impact topics that have been carried forward for further analysis are included in this table. The *Environmental Consequences* chapter provides a more detailed explanation of these impacts.

Table 3 – Environmental Impact Summary by Alternative

Impact Topic	Alternative A – No Action	Alternative B – Preferred Alternative
Topography, geology, and Soils	Continued minor adverse impacts to soils as a result of improperly functioning drainages. Soil erosion and undercutting would continue. No revegetation would occur, allowing for continued soil erosion. Resource damage to soil from informal turnouts would continue.	There would be some temporary disturbance to soils associated with drainage reconstruction, and road widening. Impacts to soils in these areas would be adverse but short-term and moderate. Soil erosion would be overall reduced by revegetation and reclamation. Stabilization of slopes would result in long-term beneficial impacts to soils. This project would impact approximately 70 acres of area outside the existing road prism. Approximately 114 acres are within the existing road prism that includes existing cuts, fills, and drainage ditches.
Hydrothermal	Thermal areas are currently impacted by the location of the road and ongoing road maintenance activities, impacts are minor.	Due to concerns at thermal areas along the road, the overall project would result in minor to moderate adverse impacts. No long-term effects are anticipated.
Wetlands and other waters of the US	Some ditch wetlands could be impacted by road maintenance activities. Impacts would be negligible.	Measures would be taken to minimize wetland impacts and to do on-site restoration after construction. 1.55-1.75 acres of wetlands would be temporarily impacted by the preferred alternative. 1.7-1.9 acres of wetlands would be permanently impacted. The project would also reclaim or restore 2.1-2.3 acres of wetlands. Moderate adverse long-term impacts.
Floodplains	No measureable or perceptible effect, impacts are considered negligible.	Approximately 1.66 acres of road fill would be removed from the floodplain and would enhance floodplain function. Approximately 0.09 acres of floodplain would be filled to allow road widening. None of the proposed changes would have lasting effects to floodplain function. Impacts are considered negligible to minor.
Vegetation	Use of informal turnouts would continue, with a potential for increasing amounts of vegetation trampling. The no-action alternative would have negligible effects on vegetation due to limited road maintenance activities outside the existing road prism.	Short-term minor to moderate impacts to natural vegetation would occur along road and parking lot edges, culverts, and parking lot islands including removal of trees for expansion. Natural vegetation would be re-established within the project area where social trails exist, within trampled zones, and due to new disturbances after construction. Affects to some individual native plants, but a relatively minor portion of the species' population and restricted to a very small geographic area.

Impact Topic	Alternative A – No Action	Alternative B – Preferred Alternative
Wildlife	Modification or loss of wildlife habitat associated with the project would be short-term, negligible, and insignificant.	Approximately 70 acres of roadside vegetation permanently lost. Wildlife foraging and reestablishment of migration and use patterns following construction is anticipated. Impacts to wildlife would be considered minor and adverse.
Special Status Species	Section 7 consultation has been completed for road maintenance activities through the *Parkwide Road Program Biological Assessment*. Impacts would be negligible.	There could be a temporary local minor impact on grizzly bear habitat, but the effect would be minor. Wolves could be temporarily displaced closed to the project area during construction. Section 7 consultation has been completed for road reconstruction activities through the *Parkwide Road Program Biological Assessment*. Impacts would be minor to moderate.
Archeological Resources	The current road alignment bisects 6 National Register eligible archeological sites; existing parking areas currently impact several more. Protection from unauthorized visitor collecting at Obsidian Cliff NHL is limited due to marginal visitor access along the roadside. Minor impacts to the National Register eligible historic and prehistoric archeological sites located within the road corridor.	Limited data recovery at all six sites would leave the major portion of the sites intact. Widening the roadway adjacent to Obsidian Cliff NHL limits direct impact to the site while adding a visitor viewing path and platform increases their awareness of the sites' significance. Minor to moderate impacts with the recovery of archeological data from sites where roadway to be expanded.
Historic Structures	Neglect of the historic masonry features that contribute to the character of the NR listed road would likely continue, due to a lack of funding for repairs and higher priorities. Minor to moderate adverse impacts to historic structures.	The road Programmatic Agreement provides guidance for the widening of the road without adverse impact to the road historic features. Repair and rehabilitation of the historic bridges and road features helps to ensure the integrity of the nationally significant roadway into the future. Moderate beneficial impacts to the historic road due to the repairs that would be made to the road during reconstruction activities.
Ethnographic Resources	Other than Obsidian Cliff NHL, currently protected to the highest level possible from further impact, and the Bannock trail (not documented within the road corridor) no other Traditional Cultural Properties have been documented to date. Impacts to Obsidian Cliff NHL would be considered minor and adverse due to unauthorized collecting of obsidian.	Increased protection to Obsidian Cliff NHL would have negligible to minor beneficial impacts. Other ethnographic resources within the area of construction disturbance (plants and thermal features) are common throughout the park and road reconstruction would have minor impacts.
Cultural Landscapes	Moderate adverse impacts to the Golden Gate to Norris section of the Grand Loop Road. Due to continued deterioration of historic road features such as bridges and headwalls.	Minor beneficial impacts to the segment of the Grand Loop Road cultural landscape. Character defining features would be rehabilitated.

Impact Topic	Alternative A – No Action	Alternative B – Preferred Alternative
Social and Economic	Continued minor adverse impacts from poor to no traffic flow in and near wildlife jams. Narrow roadway makes passing stopped cars and bicycles near impossible.	Improved traffic flow in and near wildlife jams would have minor beneficial effects. Improved passing of bicyclists due to the addition of a 4' wide shoulder on road. Improvements to the road and its associated parking and turnouts, culverts, drainage structures are expected to have a minor to moderate long-term beneficial impact on visitor use and experiences. Improved traffic flow, safety, and reduced maintenance delays. Construction disturbances (noise, dust, limited areas) would have a minor, temporary adverse effect to visitor use and experience.
Park Operations	Minor to moderate adverse impacts resulting from delays along the road from wildlife jams and frequent maintenance activities. Safety concerns not addressed.	Minor to moderate to beneficial effects from an improved work environment that meets health and safety standards. Safety concerns addressed.

Environmentally Preferred Alternative

The environmentally preferred alternative is determined by applying the criteria suggested in the National Environmental Policy Act of 1969 (NEPA), which guides the Council on Environmental Quality (CEQ). The CEQ provides direction that "[t]he environmentally preferable alternative is the alternative that would promote the national environmental policy as expressed in NEPA's §101:

- fulfill the responsibilities of each generation as trustee of the environment for succeeding generations;
- assure for all generations safe, healthful, productive, and esthetically and culturally pleasing surroundings;
- attain the widest range of beneficial uses of the environment without degradation, risk of health or safety, or other undesirable and unintended consequences;
- 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;
- achieve a balance between population and resource use that will permit high standards of living and a wide sharing of life's amenities; and
- enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources.

Alternative A, *No Action/Continuation of Current Practices*, only minimally meets the above six evaluation factors because it would not meet health and safety standards in terms of correcting deficiencies of the current road, such as steep drops at the pavement edge and known hazardous curves. Although Alternative A keeps potential impacts to park resources at a minimum, it does not achieve a balance between these resources and the health and safety of park visitors and staff. The road would continue to deteriorate, and would not function well during the numerous traffic jams that occur due to visitors stopping to view wildlife. This

alternative also does not meet the criteria for attaining the widest range of beneficial uses of the environment without degradation, risk of health or safety, or otherwise undesirable and unintended consequences.

Alternative B is the environmentally preferred alternative because it best addresses these six evaluation factors. Alternative B, *Reconstruct and Rehabilitate Portions of the Grand Loop Road; 30-foot Width*, would provide a working environment for park visitors and staff that meets health and safety recommendations, while minimizing environmental impacts to the extent possible. The reconstructed road would preserve important historic, cultural and natural aspects along its length, while providing a better functioning road for visitors. The new road would require much less maintenance, and therefore less impacts and delays for its users.

No new information came forward from public scoping or consultation with other agencies to necessitate the development of any new alternatives, other than those described and evaluated in this document. Because it meets the purpose and need for the project, the project objectives, and is the environmentally preferred alternative, alternative B is also recommended as the National Park Service preferred alternative. For the remainder of the document, alternative B will be referred to as the preferred alternative.

AFFECTED ENVIRONMENT

This chapter describes existing environmental conditions in areas potentially affected by the alternatives. The following resource areas are described: Natural Resources including Topography, Geology and Soils; Wetlands and other Waters of the US; Vegetation; Wildlife; Special Status Species; Migratory Bird Species Including Species of Management Concern; Climate Change and Sustainability; Cultural Resources including Archeological Resources, Historic Structures, Ethnographic Resources, and Cultural Landscapes. Also discussed are the Social and Economic Resources including Socioeconomics, Visitor Use and Experience, Health and Human Safety and Park Operations.

Natural Resources

Topography, Geology, and Soils

Yellowstone National Park lies in a geologically dynamic region of the Northern Rocky Mountains. The park is noted for its geologic formations that have resulted from glaciation and volcanism. The elevation varies from about 1,610 meters (5,300 feet) along the Yellowstone River in Montana to 3,460 meters (11,360 feet) at Eagle Peak along the eastern boundary of the park in Wyoming. The Norris to Golden Gate Road segment lies at an elevation between about 7,150 feet and 7,600 feet. Yellowstone is one of the most active hydrothermal areas in the world. The park is world-renowned for its hot springs, geysers, mudpots and fumaroles. Earth tremors are recorded frequently in and around the park. All alternatives described would take place in the northwest section of the park, outside of the caldera formed from the last explosive volcanic eruption 640,000 years ago.

Soils occurring along the Norris to Golden Gate road segment are highly influenced by the streams, wetlands and the glaciation that occurred in the park over 13-14,000 years ago. Over thirty percent of the road segment occurs within an alluvial basin landform and consists of medium textured and fine-textured alluvium with organic deposits. A rare soil type in Yellowstone called histosols occurs resulting from an accumulation of organic materials under very wet conditions. Histosols can indicate the presence of a fen, and are characterized by neutral or alkaline water chemistry. Other landforms along the roadway include rolling fluvial uplands, glaciofluvial outwash plains, and a complex of glaciofluvial plains, kames and terraces. Soils that make up these landforms vary in texture. A small percentage of the landforms along the roadway include hydrothermal rolling uplands and valleys.

Alluvial – stream influenced

Histosols – Organic soils

Fluvial – soils that have been influenced by moving water

Fen – a rare type of wetland characterized by neutral or alkaline water chemistry and highly organic /peaty soils

Glaciofluvial- material that has been moved by glaciers

Kame- an irregular, short ridge or hill of

Hydrothermal Resources.

The road segment from Norris to Golden Gate is located near extensive thermal features, most of which are contained within natural basins. Thermal features that occur along the Norris to Golden Gate Road segment include the Norris Geyser Basin, Frying Pan Spring, Bijah Spring, Roaring Mountain, Semi-Centennial Geyser, Clearwater Springs, and Crystal Spring. Of note, Norris Geyser Basin is the oldest, most unstable, and hottest geyser basin in the park. Temperatures reaching 459 degrees Fahrenheit have been measured with drill hole instruments

about 1,000 feet beneath the basin. Steamboat Geyser is located in the Norris basin and is the world's tallest geyser. Eruptions, although extremely rare and irregular (four days to five years apart), have been known to send water 390 feet, and steam an additional 350 feet or more into the air. Roaring Mountain's name comes from the steam emissions that can range from inaudible to a load roar that can be heard from miles away.

Wetlands and Other Waters of the U.S.

Springs and Wetlands

Taxa – a group of one or more organisms

The Grand Loop Road from Norris to Golden Gate passes through a complex mosaic of lodgepole pine (*Pinus contorta*) forest, wet meadows and seeps, and sagebrush steppe. Much of the lodgepole pine forest burned in 1988, and is now composed of young rapidly growing lodgepole pines, with a typical forest understory of elk sedge (*Carex geyeri*), Ross' sedge (*Carex rossii*), pinegrass (*Calamagrostis rubescens*), and grouse whortleberry (*Vaccinium scoparium*). Several major geothermal sites are located along the road including Semi-Centennial Geyser, Bijah Spring, Frying Pan Springs, Clearwater Springs, Roaring Mountain, Apollinaris Spring and the northern portion of the Norris Geyser Basin. Many cold water springs and other springs that have some geothermal influence are also scattered along the road corridor, leading to a great variation in the temperature and chemistry of the water. The road follows the Obsidian Creek drainage for several miles with the creek abutting the road prism in several places. All of these water sources lead to a tremendous amount of variation in the wetlands present along the road corridor including peatlands, bulrush dominated wetlands, geothermally influenced wetlands, and willow dominated bottoms such as Willow Park. On the northern end of the project area, Swan Lake Flats is a heterogeneous assemblage of wetlands and sagebrush steppe with areas dominated by shrubby cinquefoil (*Pentaphylloides floribunda*) and silver sage (*Artemisia cana*), while the drier areas of the flats have mountain big sagebrush (*Artemisia tridentata*) and the wetlands are often dominated by beaked sedge (*Carex utriculata*) (Whipple 2005).

Palustrine – inland wetlands that include marshes, swamps, bogs, floodplains and fens

Riverine – Relating to a system of inland wetlands and deep-water habitats associated with non-tidal flowing water, characterized by the absence of trees, shrubs, or emergent vegetation

Emergent wetlands - characterized by erect, rooted, herbaceous hydrophytes, excluding mosses and lichens

Scrub-shrub – a transition community found shoreward of an emergent wetland which borders a lake, stream, or pond

Rhyolite – a volcanic rock formed by magma or lava cooling and becoming solid

Wetlands and "other waters of the US" within 200 feet of either side of the road were delineated and mapped in 2002-2004 (Anderson 2005) and 2010 (Anderson 2010) using "*Classification of Wetland and Deepwater Habitats of the United States* (Cowardin et al. 1979) as the standard for defining, classifying and inventorying wetlands. Wetland determinations were performed as outlined in the January 1987 *Corps of Engineers Wetlands Delineation Manual* with reference to the 1989 *Federal Manual for Identifying and Delineating Jurisdictional Wetlands*. Delineations of wetlands that would be impacted by the proposed project were reviewed and updated in 2010 following the April 2008 *Corps of Engineers' Interim Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys and Coast Region*.

A total of 231 wetland units were mapped within the survey area and are defined as either "Lacustrine," "Riverine," or "Palustrine," wetlands under the Cowardin et al. (1979) classification system (Anderson 2005, 2010).

Water Quality

Streams and lakes in Yellowstone National Park are designated as Class I, Outstanding Natural Resource Waters, by the state of Wyoming. Class I waters are anti-degradation waters, which means that existing water quality must be maintained. Chemical, physical and biological properties of surface water in the area between Norris and Golden Gate vary considerably. Thermal areas affect water temperature, acidity and contribution of dissolved chemicals. Generally, surface water near Roaring Mountain has a low pH (near 2), high water temperature, and low biological diversity. Conversely, stream surface waters near Swan Lake Flats and Golden Gate have a near neutral pH, cooler water temperatures, and greater biological diversity.

The Fisheries and Aquatic Sciences Branch staff have collected water quality and aquatic invertebrate information from this area of the park since 2002. Benthic macroinvertebrates are excellent indicators of water quality conditions because they are sensitive to environmental changes. One hundred fourteen invertebrate taxa have been collected from Obsidian and Glen Creeks. Forty-eight taxa belong to the sensitive EPT (*Ephemeroptera*, *Plecoptera*, and *Trichoptera*) insect groups which are commonly called mayflies, stoneflies, and caddisflies respectively. As a group these insects are sensitive to environmental changes and their numbers and taxa would decline if subjected to environmental stressors such as possible adverse impacts from road construction activities. These three taxa were generally more abundant within the downstream reaches of Obsidian Creek and at the Glen Creek sites. In addition, 57 taxa belonged to the pollution tolerant groups of *Diptera*, *Coleoptera*, and *Odonata* which are commonly called true flies, beetles, and dragonflies/damselflies respectively. As a group these insects are less sensitive to environmental changes and would increase in numbers if environmental stressors became evident. Insects belonging to these groups dominate the insect community near the upstream reach on Obsidian Creek because of input from thermal activity.

Vegetation (excluding wetlands)

The Grand Loop Road from Norris to Golden Gate passes through a complex mosaic of lodgepole pine (*Pinus contorta*) forest, wet meadows and seeps, and sagebrush steppe. Much of the lodgepole pine forest burned in 1988, and is now composed of young rapidly growing lodgepole pines, with a typical forest understory of elk sedge (*Carex geyeri*), Ross sedge (*Carex rossii*), pinegrass (*Calamagrostis rubescens*), and grouse whortleberry (*Vaccinium scoparium*).

Exotic Vegetation

At least 219 species of non-native plants are known to occur in Yellowstone National Park (Whipple 2010), and many of these species are invading natural communities (Olliff et al. 2001). It is estimated that of the 70 priority species identified for park containment efforts, all exist within the Norris to Golden Gate road segment. The majority of the park's containment efforts are directed at the following five species: spotted knapweed (*Centaurea maculosa*), yellow hawkweed (*Hieracium pratense*), orange hawkweed (*Hieracium aurantiacum*), St. John's wort (*Hypericum perforatum*) and ox-eye daisy (*Chrysanthemum leucanthemum*). The potential for proliferation of non-native plants during construction operations is a concern.

Rare Plants

There are no federally listed or candidate (Category I) plant species that occur in the park. The only federally listed species that occurs near Yellowstone National Park is Ute ladies'-tresses (*Spiranthes diluvialis*), which is listed by the U.S. Fish and Wildlife Service as a threatened species. Even though Ute ladies'-tresses is known from Montana, Wyoming, and Idaho, it has not been located within the confines of Yellowstone National Park. The populations in the adjacent states are at lower elevations and somewhat different plant communities than are present within the park, making the occurrence of this species within Yellowstone unlikely. Wetlands were surveyed for this species along the road segment, but it was not located.

There are two endemic plant species that occur only in Yellowstone Park, Ross' bentgrass (*Agrostis rossiae*), which occurs in geothermal areas along the Firehole River and in the Shoshone Geyser Basin, and Yellowstone sand verbena (*Abronia ammophila*), which is restricted to sandy lakeshore around Yellowstone Lake. Thermal areas similar to the occupied habitat of Ross' bentgrass were carefully surveyed early in the season to ascertain whether or not this species might be present along the road corridor. The close relative, hot springs ticklegrass was present, but there were no individuals located of Ross' bentgrass. No habitat was present from Norris to Golden Gate that would support Yellowstone sand verbena. Even though there are no plant species protected by state law in Wyoming, and only four federally listed taxa which occur in the state, there are many species that are quite rare. The Wyoming Natural Diversity Database (WYNDD), a part of the nationwide heritage program initiated by The Nature Conservancy which is now coordinated by NatureServe, maintains a list of plant species of concern within the state of Wyoming. Plant species of special concern are those species that have been recognized by the state heritage programs as being rarely encountered within the state. Because Yellowstone occurs near the state boundaries of three states, Wyoming, Montana, and Idaho, all three state lists were consulted though the primary emphasis was on surveying for Wyoming plant species of special concern.

Thermal sinter sheets – surface soil layers that are thermally influenced

The complex mosaic of vegetation types from thermal sinter sheets to fens necessitated surveying at different times of the field season so as to be able to find species with very different flowering periods. The rare plant survey was started in the summer of 2001, with the area surveyed beginning at Norris Junction and ending a little south of Frying Pan Spring. Preliminary survey was also started at the fen across from Obsidian Cliff. During 2002 the survey was continued from south of Frying Pan Spring to the Beaver Lake Picnic Area. The primary area surveyed in 2003 was from Golden Gate to the Beaver Lake Picnic Area, with some additional field work to the south. During 2004, possible alternate routes were surveyed, along with possible staging areas. The final survey work was also finished along the main roadway. The rare plant survey consisted of walking the strip within 200 feet of the road on both sides, with much more extensive coverage when the habitat was suggestive of the possibility of a particular rare plant, or when rare plants were discovered. The rare plant sites were mapped using a GPS unit. The corrected data was then used to create the location, shape, acreage, and site number of the rare plant occurrence. Species that were not recognized in the field were collected during fieldwork for identification at the Yellowstone herbarium. Problem taxa from 2001, 2002, 2003, and 2004 that could not be verified adequately at the Yellowstone herbarium were then taken to the herbarium at Montana State University in Bozeman, Montana for further investigation and identification.

Fifteen individual rare plants are known to occur along the Norris to Golden Gate road segment as listed in Table 3.1.

Table 3.1. Rare plants and species status known to occur along the Norris to Golden Gate road segment.

Species	Status (G = global rank, S =state rank, T = trinomial rank, Q = taxonomic questions 1 – 5 = least to most abundant)
Botrychium lanceolatum var. lanceolatum	Wyoming plant species of concern, G5T4/S1; Idaho state sensitive list, G5T4/S3; not tracked in Montana
Carex diandra	Wyoming plant species of concern, G5/S2; USFS Region 2 Sensitive species; not tracked in Montana; and apparently not reported to occur in Idaho
Carex livida	Wyoming plant species of concern, G5/S2; USFS Region 2 sensitive; Idaho state sensitive list, G5/S2; not tracked in Montana
Drosera anglica	Wyoming plant species of concern, G5/S2; Montana plant species of concern, G5/S2S3; USFS Region 2 Sensitive species; not tracked in Idaho
Eleocharis flavescens var. thermalis	Wyoming plant species of concern, G5T2T3Q/S2; not tracked in Montana or Idaho
Eriophorum chamissonis	Wyoming plant species of concern, G5/S2; USFS Region 2 sensitive; not tracked in Montana and Idaho
Eriophorum viridicarinatum	Wyoming plant species of concern, G5/S1S2; Idaho State Priority 1, G5/S2; not tracked in Montana
Geum rivale	Scattered throughout Rocky Mountain region but known in only one location in YELL, near Glen Creek.
Myriophyllum verticillatum	G5/S1; Wyoming plant species of concern; not tracked in Montana or Idaho
Schoenoplectus americanus	Wyoming plant species of concern, G5/S2; not tracked in Montana or Idaho; syn. = *Scirpus americanus*
Sparganium natans	Wyoming plant species of concern, G5/S2; not tracked in Montana or Idaho; syn. = *Sparganium minimum*
Stellaria crispa	Wyoming plant species of concern, G5/S1; not tracked by Idaho or Montana

Wildlife

Yellowstone has 67 species of mammals, six reptiles, four amphibians, twelve native fish, five nonnative fish, and more than 300 species of birds. Of those mammals, eight are native ungulates, two are bears, three are wild cats, three are canids, and six are members of the weasel family.

Mammals

With 67 mammals documented, Yellowstone is home to the largest concentration of mammals in the lower 48 states. Those mammals that frequent the Norris to Golden Gate road segment include bison, moose, elk, mule deer, whitetail deer, black and grizzly bears, gray wolf, coyotes, bobcats, and small mammals such as beaver, badgers, Uinta ground squirrels, pocket gophers, and pikas.

Bison

Bison utilize the study area throughout most of the year. Individuals and groups are commonly seen in and around the Norris to Golden Gate road segment from December through May with limited numbers observed during the remainder of the year. The area serves as near year-round habitat for adult males as well as wintering range for mixed groups (bulls, cows and calves). As individuals disperse following the breeding season adult males generally begin arriving during early September. The accumulation of bison in this area is dependent on both weather and population abundance (Geremia et al. in review). From late June to late August there are few if any bison along the road segment. The winter range supports many sedge meadows along the water courses and pond edges where bison tend to concentrate the most.

Counts of up to about 100 bison occur when population abundance is moderate to high and/or snow accumulation is greater than average Some winters less than 35 bison utilize this area of the park. During heavy snow fall winters many bison migrate through this corridor, often spending less than a week along the road segment, and using the road surface in many locations as their trail to access lower elevation winter range in the Gardiner Basin.

Elk

The northern range Yellowstone elk herd is one of the largest free-ranging herds in North America. Habitat in the north section of the Norris to Golden Gate road segment, especially in the Swan Lake Flats area, with mixed forest and grassland, is ideal for elk. Rutting season occurs during September and October, and bulls tend to seek open meadows to be highly visible and maintain their harems (groups of cows). The meadows of Swan Lake Fat are extensively used for calving mid-May through June. Population counts show that the elk population in the northern range has decreased 60% since 1994. Predation by wolves, grizzly bears, and other carnivores, hunting of elk migrating outside the park, and possibly drought effects on maternal condition and recruitment were factors contributing to this trend (Barber et al. 2005, Hamlin 2005, Vucetich et al. 2005, White and Garrot 2005, Barber-Meyer et al. 2008).

Moose

In the 1970's, an estimated 1,000 moose inhabited the park. It is estimated that less than 200 moose currently live in the park (NPS 2009). Moose populations decreased after the fires of 1988 that burned important winter habitat (i.e., mature spruce/fir forests) in the northern portion of the park (Tyers and Irby 1995). Moose are occasionally observed along the Norris to Golden Gate road segment.

Mule Deer

Mule deer are occasionally observed between Norris and Golden Gate in the summer months. The mule deer population in Yellowstone National Park is estimated to be stable to increasing. Less severe winters in recent years may have contributed to their increase (NPS 2007).

White-tailed Deer

White-tailed deer are native to the northern Rocky Mountains but have never been abundant in or near Yellowstone National Park. White-tailed deer are occasionally observed along the Norris to Golden Gate road segment.

Pronghorn

Yellowstone pronghorn are currently listed as a species of management concern by the National Park Service Intermountain Region and was identified as a native species of special concern in the park's Strategic Plan (2000) because they have considerable biological and historical significance. The park's population was one of only a few not exterminated or decimated by the early 20th century and, as a result, was the source for re-establishing or supplementing populations throughout much of its range (Lee et al. 1994). These pronghorn express much of the genetic variation that was formerly widespread in the species, but no longer present elsewhere (Reat 1999). Also, this population sustains one of only two long-distance migrations by pronghorn that persist in the greater Yellowstone region (White et al. 2007a). There are serious concerns about the viability of Yellowstone pronghorn because low abundance (<300) and apparent isolation have increased their susceptibility to random, naturally occurring catastrophes (National Research Council 2002). Pronghorn are rarely found within the project area.

Black Bear

The Norris to Golden Gate road segment is mostly medium and low quality bear habitat in the spring, summer, and fall based on vegetation present. However, the presence of winter-killed ungulate carrion and elk calving areas in the spring and early summer significantly increase the value of the area to bears during these seasons. Black bears are frequently observed in YNP, but there is no population estimate because there is no specific monitoring of their abundance or vital rates. Before 1970, black bears were involved in more bear-human conflicts than grizzlies. Since then, black bears have been involved in fewer conflicts because regulations prohibiting the feeding of bears have been strictly enforced.

Due to the very low level of human-caused black bear mortality, benign encounters between bears and park visitors are common. After frequent exposure to visitors, bears often habituate to the presence of people. Habituated black bears occasionally forage for native foods in roadside meadows in the area from Golden Gate to Roaring Mountain, causing large traffic jams as park visitors stop to view and photograph bears. A major bear management challenge in the Norris to Golden Gate road segment is managing park visitors so that they do not approach or feed habituated bears. Bear-jams caused by black bears are a frequent occurrence along this section of road.

Other carnivores

Other carnivores in the area include coyotes, red foxes, bobcats, pine martens, badgers, weasels, and mink. Observations of coyotes are common. Badgers are occasionally seen digging for Uinta ground squirrels in nearby meadows.

Fish

Fish, both native and introduced, are an important component of the park's wildlife. The Yellowstone fishery is comprised of 11 native species including the native westslope and Yellowstone cutthroat trout, arctic grayling, mountain whitefish, longnose and speckled dace, redside shiner, Utah chub, mottled sculpin, and the longnose, mountain and Utah suckers. Species introduced to the park include brook, brown, lake, and rainbow trout as well as lake chub. This mixture provides high-quality angling opportunities for visitors as well as food for birds, otters, grizzly bears, and other wildlife. Introduced brook trout are found in the drainages of the upper Gardner and Gibbon rivers along the Norris to Golden Gate road segment. Brown trout, and Arctic grayling, are also found in the Gibbon River. Only mottled sculpin were native to these waters and only in the Gibbon River. The upper Gardner River was historically fishless. These streams are utilized as recreational fisheries but are not considered high priority native fish restoration locations at this time (Ruhl 2010).

Non-native fish including brook and brown trout, found in waters along the road segment both spawn in the fall season (September-October). The spawning seasons for native fish including the arctic grayling and mottled sculpin are in spring (May/June) and late winter/spring respectively. The timing of these four fish spawning seasons will be taken into consideration when in-stream work is proposed as part of the road reconstruction work.

Reptiles and Amphibians

Scientists from the University of Idaho conducted amphibian and reptile surveys in the spring and summers of 1995 & 1996 from the Mammoth General Store to Norris Junction. The survey area ranged from 90 – 120 feet of the road, with up to 600 feet from the road in wetland areas (Patla and Peterson 1997). Fieldwork included careful searches of areas, calling surveys, minnow trap placement, and roadside walking. The study was conducted to determine the distribution and abundance of amphibians and reptiles along the Norris to Golden Gate road

segment and use the data to minimize the detrimental effects of road construction on amphibian and reptile populations. Of the ten species of reptiles and amphibians known to occur in the park (Patla and Peterson 2004), three species of amphibians and two species of reptiles were found to be present including: the blotched tiger salamander (*Ambystoma tigrinum melanostictum*), boreal chorus frog (*Pseudacris triseriata maculata*), and spotted frog (*Rana preiosa*), bull snake (*Pituophis catenifer sayi*)(not found in the project area) and wandering garter snake (*Thamnophis elegans vagrans*). The report identifies 19 sites that could be adversely affected by highway expansion and construction activities due to proximity to the road. Four of the sites were considered particularly important and have highest priority for protective measures. The remaining 15 sites were considered to be less important to maintaining amphibian populations in the area or were less vulnerable due to distance from the road.

The four areas of greatest consideration include: Indian Creek Campground road area pond, site #18 (across the road from Willow Park); Lilypad Pond, site #23 (south of Apollinaris Spring); Grizzly Lake Trailhead, Site #35 (near the footbridge on Grizzly Lake Trail); and Bijah Springs, site #42 (wetland adjacent to Bijah Spring). All sites are in close proximity to the road, and are confirmed amphibian breeding sites. Of the remaining 15 sites, five are breeding sites, two may provide important wintering habitat, and the eight others provide wetland connectivity among the sites, or are possible breeding sites. Four new amphibian breeding sites were recorded in surveys conducted 2005 – 2009 and are indicated as additional sites of concern (Patla, 2010).

Special Status Wildlife Species

Two threatened mammal species are present in Yellowstone: the Canada lynx (*Lynx canadensis*), and the grizzly bear (*Ursus arctos horribilis*). Gray wolves (*Canus lupus*) in Yellowstone are considered an experimental population, and are therefore afforded special status. The wolverine (*Gulo gulo*) is considered a species of special concern in Yellowstone National Park.

Canada lynx

On March 21, 2000, the U.S. Fish and Wildlife Service listed the Canada lynx as threatened under the Endangered Species Act. In the U.S. Rocky Mountains, lynx occur in cool, moist coniferous forests. These environments typically support heavy snow pack and snowshoe hares, the lynx's principal prey. Historical information suggests that lynx were present but uncommon in YNP from 1880 to 1980 (Murphy et al. 2004). Park files contain records of 73 direct or indirect (tracks) observations of lynx made by park visitors or employees from 1887–2003. Murphy et al. (2004) documented the presence and distribution of lynx in the park, detecting several individuals in the vicinity of Yellowstone Lake and the Central Plateau by snowtracking in the winter and by setting hair-snares during the summer. A lynx was photographed by a visitor in the vicinity of the Indian Creek Campground in April 2010. This sighting was the only documented sighting in 40 years (Gunther 2010)

In 2002, Yellowstone National Park mapped lynx habitat, primarily subalpine fir Engelmann spruce, and lodgepole pine stands, as lynx habitat in accordance with the Canada Lynx Conservation and Assessment Strategy (Ruediger 2000). Twenty Lynx Analysis Units (LAU) were identified per CLCAS guidelines.

Grizzly Bear

A recovery plan for grizzly bear populations in the lower forty-eight contiguous United States was implemented because grizzly bears were listed in 1975 under the Endangered Species Act

(USFWS 1982). The plan was developed to provide direction for the conservation of grizzly bears and their habitat to federal agencies responsible for managing land within the recovery zone. The following year, YNP completed an Environmental Impact Statement (EIS) for a grizzly bear management program specifically designed to recover the subpopulation of grizzly bears inhabiting the park (NPS 1983).

Management of grizzly bears in YNP has been successful in enabling grizzly bear recovery and reducing bear-human conflicts (e.g., property damage, incidents of bears obtaining human food, bear-inflicted human injuries) and human-caused bear mortalities in the park (Gunther et al.2004). The U.S. Fish and Wildlife Service removed grizzly bears in the Greater Yellowstone Ecosystem (GYE) from the Federal List of Threatened and Endangered Wildlife on April 30, 2007.

On September 21, 2009, grizzly bears were returned to federal protection under the Endangered Species Act by U.S. District Judge Donald Molloy. The decision overturned the ruling that delisted the bear in 2007 that placed the management of the bears located outside the park under the auspices of the state wildlife agencies of Montana, Wyoming and Idaho. The relisting takes into consideration the implications of global warming and other factors that would impact grizzly bears such as the decline of whitebark pine and the nuts that grizzly bear rely heavily on during certain parts of the year.

The grizzly bear population within the 5.5 million acres encompassed by the GYE has been estimated at approximately 600. The sub-population of grizzly bear inside of Yellowstone National Park is thought to be stable to slightly increasing. Nearly 40 percent of the Greater Yellowstone Area, 2.2 million acres, is within the boundaries of Yellowstone National Park. The bear management program in Yellowstone is directed toward the recovery, maintenance, and management of the grizzly bear population while also providing for safe park visitor experiences.

The Norris to Golden Gate road segment contains mostly low quality grizzly bear habitat in the spring, summer, and fall. Presence of winter-killed ungulate carcasses and elk calves in spring increases the value of the area to bears.

From 2000 – 2009, there were 360 grizzly bear sightings reported along the Norris to Golden Gate road, including 85 sightings of females with young (cubs, yearlings, two-year-olds). During that time period, park rangers responded to 191 bear-jams caused by grizzly bears along the Norris to Golden Gate road.

Gray Wolf

Gray wolves were native to the Yellowstone area when the park was established in 1872. Historically hunted for their hides and as predators, they were eliminated from the ecosystem by the 1930s. The U.S. Fish and Wildlife Service released an environmental impact statement on wolf reintroduction in May 1994. In 1995 and 1996, 31 gray wolves from Canada were released in the park. As of December 2009, 14 packs with 96-98 wolves were residing largely in the park.

The Norris to Golden Gate road segment can be a frequently used corridor for wolves; wolf use in the area can be heavy during the winter. Mid-winter breeding occurs in this general area, where at least 1-2 packs have denned within the last year and have used the area as a rendezvous site (Albers, 2010). The closest known den site is approximately 1.4 miles from the road. Many elk kills occur along the Norris to Golden Gate road segment. A small portion of these kills are made close to the roadway. The gray wolf was delisted in March 2008, but a federal court reinstated Endangered Species Act protection in July 2008.

Wolverine

The wolverine is a wide-ranging mustelid that naturally exists at low densities throughout much of northern and western North America (Banci 1994). Wolverines are highly adapted to extreme cold and life in environments that have snow on the ground all or most of the year (Aubry et al. 2007). In the contiguous United States, these habitats are highly mountainous and occur at elevations above 8,000 feet (Copeland et al. 2007). Overexploitation through hunting and trapping, as well as predator poisoning programs, likely caused wolverine populations to contract since the early 1900's along the southern portion of their historical range in North America (Banci 1994). However, recent surveys indicate wolverines are widely distributed in remote, montane regions of Idaho, Montana, Washington, and parts of Wyoming (68 FR 60113).

Wolverines have been detected in the Greater Yellowstone Ecosystem, including along the eastern, northern, and southern portions of the park (Beauvais and Johnson 2004). Wolverines have protected status in Washington, Oregon, California, Colorado, Idaho, and Wyoming (Banci 1994). In Montana, wolverines are classed as furbearers and trapper harvests are managed through a quota system that limits the number of individuals that can be taken. In response to a petition to list the wolverine as a Threatened or Endangered Species, the U.S. Fish and Wildlife Service ruled that listing in the contiguous United States was not warranted based on the best available scientific and commercial information (68 FR 60112). Although, there have been occasional reports of wolverine tracks along the Golden Gate to Norris road corridor, systematic surveys detected no wolverine home ranges in the Gallatin mountain range to the west or the Washburn mountain range to the east of the road corridor.

Migratory Bird Species Including Species of Management Concern

Migratory birds are those species that generally migrate south each fall from breeding grounds to their wintering grounds. They may winter in habitats throughout the Pacific Region and central North America or even farther south into Mexico, Central and South America, and the Caribbean. In the spring, they return north to their breeding grounds, where they have young and the cycle repeats. Migratory birds generally follow four geographic flyways during their north-south spring and fall migrations across North America: Atlantic, Mississippi, Central, and Pacific. Yellowstone is in the Pacific Flyway west of the continental divide and in the Central Flyway for most of the park.

In Yellowstone National Park, 324 bird species have been documented; 148 of these species nest in the park. Although a few species reside in Yellowstone year-round, including the common raven, Canada goose, blue grouse, gray jay, red-breasted nuthatch, American dipper, and mountain chickadee, most are migratory species. Most migrate to Mexico and Central America for the winter and migrate to the U.S. in the spring. Migration brings many birds back to the park from their winter journeys south; other birds are passing through to more northern nesting areas. Most birds migrate to lower elevations and more southern latitudes beginning in September. Fall transients include tundra swans and ferruginous hawks. A few species including rough-legged hawks and bohemian waxwings migrate here from the north for the winter.

Bird surveys have been conducted in the Park dating back as early as 1917 (Skinner, 1917). Currently five different monitoring programs are conducted in order to identify trends of which are reported annually. The five programs include the raptor monitoring program, the wetland monitoring program, the willow-songbird, breeding bird survey, and the forest-burn program. The Raptor Monitoring Program monitors bald eagle, peregrine falcon, and osprey. Birds monitored as part of the wetland monitoring program include trumpeter swan, common loon, and colonial nesting birds including the double-crested cormorant and American white pelican.

In addition, breeding bird surveys, willow-bird surveys, and a newly added forest-burn survey are part of the passerine and woodpecker monitoring programs. Since species in the passerine and woodpecker groups represent the majority of species found within the Park, this program was recently added to fill the gap in knowledge regarding these groups. The North American Bird Migration Count, also known as the International Migratory Bird Day Count, has been conducted since 1992 to determine general population and arrival trends of migratory birds in Yellowstone National Park. A 16-year summary of the data during 1993-2009 indicates the numbers of species and birds observed during these surveys have been relatively consistent among years (Baril et al. 2010)

Bird Species of Management Concern

Yellowstone bird Species of Management Concern include the bald eagle, peregrine falcon, trumpeter swan, and white pelican. Currently no listed bird species occur in Yellowstone.

Bald Eagle

Current data indicate populations of bald eagles (*Haliaeetus leucocephalus*) have recovered in the lower 48 States, with an estimated minimum of 9,789 breeding pairs today compared to 417 active nests in 1963 (71 FR 8239). Numbers of nesting and fledgling bald eagles in Yellowstone also increased incrementally during 1987-2005 (McEneaney 2006). Resident and migrating bald eagles are now found throughout the park, with nesting sites located primarily along the margins of lakes and shorelines of larger rivers. The bald eagle management plan for the Greater Yellowstone Ecosystem achieved the goals set for establishing a stable bald eagle population in the park, with a total of 26 eaglets fledged from 34 active nests during 2007 (McEneaney 2006). This is the highest number of fledged eaglets recorded to date in Yellowstone and the increasing population trend indicates habitat is not presently limiting the growth of the population. The U.S. Fish and Wildlife Service removed the bald eagle from the List of Endangered and Threatened Wildlife on August 8, 2007 (72 FR 37346).

Peregrine Falcon

The American peregrine falcon (*Falco peregrinus anatum*) was removed from the List of Endangered and Threatened Wildlife and Plants on August 25, 1999 due to its recovery following restrictions on organochlorine pesticides in the United States and Canada, and implementation of various management actions, including the release of approximately 6,000 captive-reared falcons (64 FR 46541). The U.S. Fish and Wildlife Service has implemented a post-delisting monitoring plan pursuant to Section 4(g)(1) of the Endangered Species Act that requires monitoring peregrine falcons five times at 3-year intervals beginning in 2003 and ending in 2015. Monitoring estimates from 2003 indicate territory occupancy, nest success, and productivity were above target values set in the monitoring plan and that the peregrine falcon population is secure and viable (71 FR 60563). Peregrine falcons reside in Yellowstone from April through October, nesting on large cliffs. The numbers of nesting pairs and fledglings in Yellowstone has steadily increased from zero in 1983 to 32 pairs and 47 fledglings in 2007 (Baril et. al 2010). Peregrine falcons have been observed nesting near the Norris to Golden Gate road segment in 2010 (Baril 2010).

Trumpeter Swan

Trumpeter swans (*Cygnus buccinator*) were nearly extinct by 1900, but a small group of birds survived by remaining year-round in the vast wilderness of the greater Yellowstone area. This remnant population enabled the restoration of the species and today there are approximately 34,803 trumpeter swans in North America (USFWS 2006). Yellowstone National Park supports resident, non-migratory trumpeter swans through the year, as well as regional migrants from the greater Yellowstone area and longer-distance migrants from Canada and elsewhere during

winter. The National Park Service is committed to the conservation of resident trumpeter swans and preserving habitat for winter migrants in Yellowstone because swans are part of the natural biota and a symbolic species with considerable historical significance. However, since 1977 the park has supported relatively low and decreasing numbers of nesting pairs (median = 7, range = 2-17) and fledglings (median = 3, range = 0-12), while the abundance of the overall population has increased from <1,000 to >5,000 swans (McEneaney 2006, U.S. Fish and Wildlife Service 1998). Also, Yellowstone provides limited and temporary winter habitat for migrant swans due to limited sections of ice-free water that diminish as winter progresses (McEneaney 2006). Thus, it does not appear that the dynamics of swans in Yellowstone will strongly influence the overall recovery of trumpeter swans in the Rocky Mountain region of the Pacific flyway. Counts of resident, adult trumpeter swans in Yellowstone decreased from a high of 69 in 1961 to 6 in 2009. Causes of this relatively consistent decrease are unknown, but may include decreased immigration, competition with migrants, and effects of sustained drought and predation on productivity (McEneaney 2006). The Rocky Mountain trumpeter swan population operates at a scale larger than Yellowstone, and the dynamics of resident swans in Yellowstone appear to be influenced by larger sub-populations and management actions in the greater Yellowstone area and elsewhere. Numbers of adult swans counted during autumn aerial surveys at Yellowstone and Red Rock Lakes in the Centennial Valley of Montana indicated concurrent and substantial increases in abundance during 1931-1955, followed by concurrent and substantial decreases in abundance during 1961-2005. These results suggest swan dispersal from the larger subpopulation in the Centennial Valley may be an important factor for maintaining resident swans in Yellowstone by filling vacant territories or pairing with single adult birds (McEneaney 2006). Also, increases in the number of Canadian migrants to Yellowstone during winter over the last several decades may be reducing food resources for resident swans during breeding (USFWS 1998). Resident swans in Yellowstone are also susceptible to random, naturally occurring events operating at local and regional scales (e.g., severe winter weather, droughts, and predation).

White Pelican

American white pelicans (*Pelecanus erythrorhynchos*) were identified as a Species of Management Concern and listed as a high-priority in the park's Strategic Plan because nesting attempts decreased from >400 during the mid-1990s to 128 during 1999; Yellowstone has the only current nesting colony of white pelicans in the National Park system (McEneaney 2002). Pelican control in the 1920s, followed by human disturbances in the 1940s and 1950s, kept the population at low levels. Since that time, pelican numbers have increased, but still fluctuate greatly from year to year, both in the number of nesting attempts and fledged juveniles. Flooding occasionally takes its toll on production, as does disturbance from either humans or predators (McEneaney 2002). The shallow-spawning Yellowstone cutthroat trout (*Oncorhynchus clarki bouvieri*) is the main food for white pelicans in Yellowstone. However, there are serious threats to this subspecies that could affect white pelicans, including interbreeding with introduced rainbow trout (*Oncorhynchus mykiss*), the illegal introduction of lake trout (*Salvelinus namaycush*) which prey upon cutthroat trout, and several outbreaks of whirling disease in major spawning tributaries. The recent drought in the Yellowstone area has made several spawning tributaries run dry in late summer, preventing cutthroat fry from migrating to Yellowstone Lake and making them easy prey for predators such as gulls, pelicans, and others. These threats have significantly reduced cutthroat populations in Yellowstone Lake and adjacent parts of the Yellowstone River. In 2006, a total of 427 pelicans nested and fledged 362 young, suggesting the subpopulation has recovered somewhat from the substantial decrease during the mid- to late-1990s. However, as mentioned previously, data fluctuations have been documented, and as recently as 2009, lower counts occurred. The 2009 data indicate that only 54 chicks fledged (nesting numbers are unknown due to poor quality over-

flight photos). Lower numbers than normal could be the result of nest inundation by above average June rains. The declining cutthroat trout population may be partially responsible for reduced fledging and nest success.

Climate Change and Sustainability

A growing quantity of scientific evidence and current real world examples support the reality of anthropogenic global climate change. Impacts to National Park resources are now becoming inevitable in many resource areas including decreased annual precipitation (snowpack), invasive species, habitat loss, severe weather events, and wildfire frequency and intensity. The Park Service mission to protect the nation's natural and cultural heritage unimpaired for future generations is being jeopardized by global climate change as resources are being lost and are projected to continue to be lost at unprecedented rates. Greenhouse gas emissions are a quantifiable entity, however, under the context of the Norris to Golden Gate Road Reconstruction project, it is not practicable to discuss in great detail, as the impacts are short-term in nature, will not emit significant amounts of greenhouse gases (>25,000 metric tons of carbon dioxide equivalent emissions), does not influence the decision to implement the project, and ultimately will not increase the traffic flow, only improve traffic conditions within the park.

Cultural Resources

Historic and Prehistoric Archeological Resources

Between 1997 to 2010, all prehistoric and historic archeological sites and historic structures, including road features, in most cases located within 100 feet of the centerline on both sides of the Norris to Golden Gate segment of the Grand Loop Road, were documented and evaluated for the National Register of Historic Places (NR) eligibility. Consultation with the Wyoming State Historic Preservation Officer provided concurrence on those NR eligible archeological sites and structure found with the area of potential effect of the road reconstruction and parking area up-grades between the areas known s Golden Gate approaching Swan Lake Flats to Norris Junction. Refer to the cultural resource tables found in this chapter (page 58-59) for an itemized list of the NR eligible historic properties and a description of the effect of the road project on those sites and structures.

Prehistoric Archeological Sites

The park's prehistoric archeological sites provide evidence of human occupation in this area for approximately 11,000-13,000 years when small groups of Paleo-Indians moved through the area hunting large and small game animals, and likely fishing, as evidenced by riverbank and lakeside campsites. By about 7,500 years ago, major environmental changes greatly altered the range and quantity of plant and animal species. Archaic groups adapted to these changing conditions by developing new lithic technologies for hunting smaller game and increased their use of gathered plants. From around 5,000 years ago to about 500 years ago, native peoples such as the McKean, Pelican Lake, and Avonlea cultures utilized the area now within Yellowstone National Park and its resources, leaving behind archeological traces of campsites, hunting camps, some food processing areas, quarries, and lithic workshops. Around AD 1400 to about AD 1850 the climate cooled during a period known as the Little Ice Age with archeological evidence in YNP indicating there was significantly less use of the area than the preceding 1,000 years.

Archaic – of or relating to a more primitive period

Lithic – stone tools or artifacts

Obsidian hydration dating – geochemical method of determining age of artifacts made of obsidian

Yellowstone has archeological artifacts of cultures whose core areas were the Northern Great Plains, the

Great Basin, and the Intermountain Plateau. These tangible remains provide an important means of understanding past cultures, which left no discernable written records. The prehistoric artifacts also provide the basis for continued scientific research expanding our knowledge of their use of the parks resources, their travel patterns, and their day-to-day living experiences.

The significant prehistoric archeological evidence within the Golden Gate to Norris road corridor is related to the early and continued quarry activities to procure obsidian tool stone from what is now the Obsidian Cliff National Historic Landmark archeological site, significant because it is an outstanding example of a prehistoric quarry with processing stations associated with the early peopling of North America and the Plains Hunter-Gatherer cultures. Because Obsidian can be chemically fingerprinted to its quarry source and its human use dated through hydration, Obsidian Cliff obsidian has been identified as far to the east as the Hopewellian complex in Ohio over 2000 years ago and to Mound City, near the Hopewell site, even earlier. The current road alignment north and south of Obsidian Cliff NHL bisects prehistoric lithic workshops and camp sites occupied from 7,000 years ago (and possibly as early as 10,000 years ago) to 500 years ago. These represent places native people stopped, after having procured the obsidian from the quarry or as cobbles along the river banks, to reduce the stone down to shapes and sizes that were more easily transported. During this time they also engaged in hunting and gathering of resources. Archeological excavations indicate that some of these sites were located in thermal areas.

The Norris to Golden Gate road segment and surrounding area is rich with precontact archeological sites, many of which have not been impacted by the current road alignment. Archeological excavation of the sites already impacted by the road provides the park with significant information on the environment early humans encountered, tool stone procurement practices and the technology involved in making tools, season of occupation, animal and plant resources used by these early visitors, and the travel and trade networks of the early cultures. Combined together the chronological information provides a history of cultural use of the park and its resources.

Archeological data recovery is currently being conducted on six National Register eligible sites bisected by the current road alignment. The data recovery plan for each of the excavations was approved by the Wyoming State Historic Preservation Office and the detailed excavations are being conducted through a cooperative agreement between YNP and the University of Wyoming Office of the Wyoming State Archaeologist.

Contact Period

A number of tribes are known to have used this area historically, including the Crow and Blackfeet, both of whom had early treaty interests in the greater Yellowstone River drainage area. Early Euro-American explorers documented summer occupation of areas within the park by Shoshonean-speaking bands known as “Sheepeaters” and occasioned upon raiding bands of Blackfeet during the early and middle nineteenth century. By 1840, the great bison herds west of the continental divide had been decimated and some native peoples began traveling through Yellowstone National Park and the surrounding area in search of the bison herds to the north and east of the park. The 1878 Hayden survey party, undertaking the first mapping of Yellowstone National Park, found Bannock, Shoshone, and Crow people traveling through the park on ancient trails. The Nez Perce, in their flight of 1877, also traveled through YNP on ancient trails. With the creation of reservations around 1868, the remaining Native Americans were moved out of the park to the Wind River, Shoshone, Lemhi, and other reservations.
To date, only a few contact period (the earliest time when Native Indian People came in contact with the first Euro-Americans) archeological sites have been identified in the park, several of

which can be culturally identified to the Nez Perce as they passed through the park fleeing capture by the Army. None of those sites are located within the Norris to Golden Gate road segment.

Today the tribes who are affiliated with Yellowstone National Park, and with whom consultation occurs are (listed in alphabetical order): Assiniboine and Sioux Tribes of Ft. Peck; Blackfoot; Cheyenne River Sioux; Confederated Tribes of Salish & Kootenai; Couer d'Alene Tribe; Crow Tribe; Crow Creek Sioux; Eastern Shoshone; Flandreau Santee Sioux; Gros Ventre & Assiniboine; Kiowa Tribe of Oklahoma; Lower Brule Sioux; Nez Perce of Lapwai; Nez Perce of Nespelem; Nez Perce of Colville; Northern Arapaho; Northern Cheyenne; Oglala Sioux; Rosebud Sioux; Shoshone-Bannock; Sisseton-Wahpeton Sioux; Spirit Lake Sioux; Standing Rock Sioux; and Yankton Sioux.

Historical Archeological Sites.

During the latter part of the nineteenth century, Euro-Americans homesteaded the upper Yellowstone River area. Increasing numbers of explorers, scientists, and visitors publicized Yellowstone's resources and scenery, leading to formal establishment of the area as Yellowstone National Park in 1872 under the Department of the Interior. Conflicts with the Nez Perce and Bannock Indians combined with inadequate funding and personnel needed to control poaching and vandalism resulted in transfer of park management to the U.S. Army in 1886. Early park management (the Army, and after 1918 the National Park Service) helped to shape the philosophical direction for the park. This philosophy carried over into design and construction of visitor facilities, including roads, stage stops, resorts, hotels, camps, and dumps.

Yellowstone's historic resources reflect a number of noteworthy historic themes, including the growth of tourism, Yellowstone as a "proving ground" for America's national park system, Army protection and management of the park's resources, and the park's pioneer road transportation system. Both the Norris Hotel and Larry's Lunch Station were located along the road near Norris and both were of early rustic construction, now only the archeological ruins of the two remain. Beginning its service to park visitors during the early wagon travel era, the Wiley Swan Lake Tent Camp on Swan Lake Flats continued to be used in the 1920's when automobiles traveled the park's roadways. There are also some remnants of crown and ditch constructed corduroy roads where the early road system passed through marshes and wetlands along this segment of road.

The archeological ruins of early cabins associated with late 1800s purveyors of wood to the hotels are located near the present day Norris campground. The Swan Lake Pit area has the remains of the slaughter house that provided meat to the concessionaires in the late 1880s until the early 1910's. The first water supply diversion dams and pipeline, which supplied water to the Mammoth Area are still present today, although upgraded to some extent.

Historic Structures

The Grand Loop Road Historic District is listed on the National Register of Historic Places as nationally significant under Criterion A as one of the first, large-scale designed road systems planned by the Federal government, and Criterion B, for U.S. Army Corps of Engineering Officer Hiram Martin Chittenden for his vital and innovative role in the development of Yellowstone's road system, for his role in the very early recognition of Yellowstone's place in history in the United States, for his important historical contributions to the literature of the American West, and for his role toward the development of the design philosophy which the NPS later adopted for its roads and building programs. The Grand Loop Road is also significant at the State level under Criterion C representing the continuing design philosophy of blending with nature.

Along this road segment, the Obsidian Creek Bridge providing access into the Indian Creek Campground is constructed from the remnants of an early park (1920's) metal bridge with a wood deck, moved from elsewhere (unknown) in the park. The 1930's constructed masonry and concrete Seven Mile Bridge is also located within the road project. Both historic road structures provide character to this segment of the Grand Loop Road.

The Obsidian Cliff Kiosk parking area is also listed on the National Register of Historic Places as a locally significant 1930's designed landscape for interpretation of Obsidian Cliff.

National Register Eligible Historic Properties within the Area of Potential Effect of the Proposed Golden Gate to Norris Road Project

Site #	Name	Description --Action
Prehistoric Archeological Sites (NR Eligible)		
48YE29	Sheepeater site	Lithic reduction camp site of undetermined age –part of site washed out by old stream channel –avoid contributing portions of site
48YE114	Nymph Lake site	Small Late Archaic campsite on thermal soils with multiple activity areas and associated with Obsidian Cliff NHL –data recovery
48YE116	Solfatara site	Large lithic workshop site associated with Obsidian Cliff toolstone procurement –data recovery
48YE128		Late Archaic camp site near confluence of several streams associated with Obsidian Cliff toolstone procurement – data recovery
48YE141		A long, dense obsidian lithic scatter with Late Archaic diagnostics and possible features –avoid site
48YE143		A large Late Prehistoric lithic scatter with historic road Construction trash –avoid site
48YE201	Moose Exhibit site	Lithic workshop site associated with Obsidian Cliff where small flake size suggests specialized tool manufacture – data recovery
48Y357		Large prehistoric lithic scatter site related to procurement and reduction of secondary sources of obsidian –data recovery
48YE406		A very large Late Archaic camp site near the Gibbon River associated with Obsidian Cliff obsidian tool manufacture – data recovery
48YE433	Obsidian Cliff NHL	Obsidian quarry area with 50+ quarry sites known to have been used by aboriginal peoples for over 10,00 years – avoid site
Historic Archeological Sites (NR Eligible)		
48YE402	Norris I Hotel site	Site of the 1886-87 Norris hotel which burned and was replaced by Larry's Lunch Station which also burned around 1920 –previously bisected by road –avoid
Historic Structures (NR Eligible)		
48YE520	Grand Loop Road	The Norris to Golden Gate road is a segment of the Grand Loop Road, listed as nationally significant on the NR --avoid adverse impact through design and consultation
48YE683	Obsidian Cliff Kiosk	A historically designed landscape listed on the National Register as locally significant –avoid adverse impact
48YE809	Obsidian Ck. Bridge	NR eligible bridge connecting the Grand Loop Road to the Indian Creek Campground –avoid adverse effect through

		design and consultation
48YE810	7-Mile Bridge	NR eligible masonry and log bridge –avoid adverse effect through design and consultation
	Apollinaris Spring	A historically designed landscape eligible for the NR --avoid
HS-111	Norris Ranger Museum	A contributing structure to the Fort Yellowstone NHL –avoid

Ethnographic Resources

Consultation with Yellowstone's affiliated tribes (previously identified) on the Golden Gate to Norris road reconstruction project began in September, 1997 with the development of a contract for ethnographic survey of the Mammoth to Norris segment of the Grand Loop Road. Maps of the project area were provided and the construction project discussed. Additionally, each of the affiliated tribes was contacted by mail in 2002 to gather input on ethnographic resources located within the road corridor for this project. In February, 2003 a newsletter/scoping letter providing information on this road project was sent out to the general public, including the tribes affiliated with YNP. No specific tribal comments were received.

A preliminary trip report from the "Shoshone-Bannock Tribes' Ethnographic Survey of the Mammoth Hot Springs to Norris Junction Road Segment" conducted September 26-27, 2001, was provided by Rosemary Sucec, former YNP Ethnographer. Additional ethnographic surveys for this road segment were conducted and resulted in the production of the *Ethnographic Survey for Yellowstone National Park's Mammoth Hot Springs to Norris Junction Road Segment: A Report of Shoshone and Bannock Tribal Uses of Resources Along the Road Segment***,** completed in December 2003, and the *Ethnographic Resources on the Mammoth Hot Springs to Norris Junction Road*, completed in 2003 and incorporating the Crow, Northern Cheyenne, and Kiowa information on ethnographic resources along the road segment.

The results of the ethnographic surveys were similar. Within the Norris to Golden Gate road segment, the Shoshone-Bannock survey identified the Obsidian Cliff and the Sheepeater Cliff areas as ethnographically important, recommending road construction should avoid unnecessary impact to the sites but that people should be encouraged to visit the sites. The thermal hot springs at Mammoth and Norris Geyser Basin were identified as ethnographically significant and should be protected. A variety of common plants along the roadside were identified as having been used for food, medicinal, and other purposes many of which are still used today. Edible plants included berries, roots, greens, pine nuts, seeds, bitterroot, chokecherries, wild carrots, wild onions, sage, and peppermint. Medicinal plants such as sage, "cedar" (Juniper), yarrow, fir, balsam, and mint were gathered and used in teas and to treat bruises, cuts, sores, infections, headaches, and toothaches. Juniper "cedar" was used for purification, prayer, and curing. All of the plants identified along the road corridor are common and are plentiful in many locations within and outside the park.

The ethnographic survey conducted with the Crow, Kiowa, and Northern Cheyenne identified Sheepeater Cliff, Obsidian Cliff, ancient trails now known to them as the "Obsidian Trail" (although this trail has not yet been located and may be a reference to the ancient trails within the area) and the Bannock Trail (which has not been located on the ground and may be a larger "corridor" of passage) as being important. They also identified rock cairns along trails as being significant and plants as having been collected by their ancestors. Obsidian Cliff was clearly the most significant area of concern for this group. It is unknown by the tribal consultants and the current park resource specialists where the Bannock Trail and the "Obsidian Trail" are located in reference to the current road corridor. As recommended, the road construction will be monitored in areas where ancient trails could be present, although previous road construction

may have already impacted the ancient trail remnants. Also, as recommended, the park has funded increased research on the Bannock and other ancient trails. The Crow mentioned that lichen was used for medical purposes as well as for perfumes; buffalo beard was used for mattresses and cradle boards, and tobacco was collected near Obsidian Cliff. Lichen is common throughout the park and it is unclear what plant the Crow term "buffalo beard" references. Tobacco (*Nicotiana*) is not found in the park. The importance of thermal waters throughout the park was emphasized by all of the consultants.

Generally, tribal consultants have been very positive about improving the roads in the park. To this date no specific objections from tribal representatives have been raised about this or any other road reconstruction project.

Cultural Landscapes

According to the National Park Service, a cultural landscape is "a reflection of human adaptation and use of natural resources and is often expressed in the way land is organized and divided, patterns of settlement, land use, systems of circulation, and the types of structures that are built. The character of a cultural landscape is defined both by physical materials, such as roads, building, walls, and vegetation, and by the use reflecting cultural values and traditions."

The road system in Yellowstone National Park represents the continuing design philosophy first recognized by the Army Corps of Engineers, and later expanded upon by the landscape architects of the NPS, in which the designed features impart to the visitor a feeling of "blending with nature." The road and its features are considered part of the landscape rather than separate from the landscape, and as such, the road has evolved into a historic landscape. The design of the Grand Loop Road system, of which the Golden Gate to Norris road is a part, was intended to provide the visitor with scenic and interesting views as well as access to the geysers and other places of special beauty in the park. The designed features such as the guardrails and guardwalls, retaining walls, culvert headwalls, embankments, and designed turnouts are considered part of the system, and impart to the visitor a feeling of "blending with nature."

As previously agreed through the development of the Programmatic Agreement for the roads (signed in 1992 by the Wyoming and Montana Historic Preservation Offices, the Advisory Council on Historic Preservation, the NPS Regional Office and Yellowstone National Park) the constructed cultural landscape of the road and its character defining features, including historic bridges, were documented using the Historic American Engineering Record (HAER) process. This documentation, *Yellowstone's Roads, A Cultural Landscape* was completed by the NPS Washington DC office of the Historic American Engineering Recordation Office and transmitted to the park and to the Library of Congress in January, 2003.

Additionally, the Apollinaris Springs area, not constructed through the park's road program, was documented using a Cultural Landscape Inventory format and found to be eligible for listing on the National Register. Care will be taken to protect the cultural landscape of this road segment and Apollinaris Springs constructed cultural landscapes.

Social and Economic Resources

Socioeconomics

Yellowstone plays a prominent role in the social and economic life of the greater Yellowstone area. Gateway communities of varying sizes have developed outside the park's five entrances. The Wyoming communities include Cody, Dubois, and Jackson. Cooke City/Silvergate, Gardiner and West Yellowstone comprise the communities in Montana. The Montana gateway

communities are on the immediate border of the park or within a few miles while the Wyoming gateway communities are an hour's drive or more from the park boundary.

The gateway communities provide food, lodging, medical services, groceries, gasoline, other automotive supplies/services, gifts, souvenirs, and other goods and services to the public. The link between the gateway communities and tourism is evident. The economic viability of the gateway communities depends heavily on the recreation and tourism traffic that is generated by Yellowstone and other public recreation destinations. The flow of traffic through the park, in turn, depends on the maintenance and improvements of the park's road system. Gateway communities understand this relationship.

Less than two percent of the park is developed. Park infrastructure includes utilities, trails, roads, employee housing, administrative headquarters, and visitor services facilities in various areas throughout the park. These developed areas have evolved near popular scenic features of the park. The six developed locations along the road system include: Fishing Bridge, Lake Village, and Bridge Bay; Canyon Village; Tower/Roosevelt; Mammoth Hot Springs; Old Faithful; and Grant Village. The Norris to Golden Gate road segment connects visitors traveling from the North Entrance through Mammoth Hot Springs to Norris and points east toward Canyon or south toward West Yellowstone and Old Faithful. The use of this road is typically April – November, and is open to guided oversnow travel in the winter months beginning mid-December through early March.

Visitor use and economic activities supporting this use are highly seasonal. June, July, and August are the months of highest use; with 50 percent of the park's visitation arriving in July and August. The shoulder-season months, May and September, receive less use but the volume is still heavy. Use in the winter months is relatively low, accounting for about six percent of the overall visitation.

Visitor Use and Experience

In 2010, the park received a record number of visitors numbering over 3.6 million recreational visits. These visits represented more than one million vehicles entering the park and using the road system within the six-month period from May through October. The west entrance accounted for approximately 41 percent of the vehicles, and the south entrance provided access for approximately 22 percent of the total. The northeast entrance was the least used, providing for little more than 6 percent of the total traffic entering the park. The remaining amount was split between the north (approximately 18 percent) and east entrances (approximately 13 percent).

Some of the most popular activities along the Norris to Golden Gate road segment include: hiking, fishing, camping, picnicking, and wildlife viewing. The Norris campground is open from approximately mid-May through the end of September, while the Mammoth campground is open year round.

Health & Human Safety

The NPS is committed to providing appropriate, high-quality opportunities for visitors and employees to enjoy the parks in a safe and healthful environment. Further, the NPS strives to protect human life and provide for injury-free visits. Human health and safety concerns associated with this road segment include: providing adequate space for pull-outs to allow efficient traffic flow; maintaining safe and efficient river crossings; avoidance of active thermal features in and along the road segment; minimizing areas that have a tendency to ice up during the spring and fall, repositioning the road to decrease tendency of cars to drive off the pavement

(7-mile bridge); and placement of safety features along the road and/or along trails adjacent to thermal features to protect the public from the risk of thermal burns.

The guidelines in the Park Road Standards (NPS 1984) present design criteria to provide a safe travel route for visitors. Emphasis is placed on width to accommodate vehicle numbers and types; and grades, sight distances and consistency criteria are presented to address safety concerns. Some accident causes include: large vehicles swerving to avoid vehicles that have crossed the centerline as a result of avoiding potholes or animals, or careless drivers whose attention drifts to view an animal or scenic view, sliding on ice, dropping a wheel off the pavement and leaving the roadway, or a driver riding the centerline for fear of dropping off the edge of the road.

The Norris Geyser Basin is an area of concern due to the every-changing nature of the thermal features present, and it being one of the hottest in the park. The parking area is not well delineated and visitors often take informal trails directly to the more popular features there. This off-trail travel creates resource damage, safety hazards to visitors and burns occur regularly. Parking areas are at peak capacity much of the season, and informal parking often causes safety concerns.

In the vicinity of the Bunsen Peak trailhead parking there is a mix of use by hikers, trail ride clients, and wildlife watchers. The area is congested, and has lots of pedestrians crossing the road in a high traffic area. Parking in this area is very limited for the use it receives, and parking that is present is not adequately designed for use and safety. Guided horse riding in this area often pits users unfamiliar with horses in close proximity with other hikers and visitors in the area.

Park Operations

Park operations consist of NPS, concessioner, and contractor operations that encompass maintenance of all roads, trails, buildings and other structures in a safe and aesthetically pleasing condition, as well as preventing deterioration that would render them unsightly, unsafe, or beyond efficient repair. Maintenance activities such as road maintenance, trash removal, transportation of supplies, and snow removal are all part of park operations. Maintenance areas near the Norris to Golden Gate Road segment are located at the Norris administrative area, and the Mammoth Hot Springs administrative areas. The Swan Lake Pit is used for material storage, NPS water system access, and maintenance activities and a staging area.

National Park Service Operations

The NPS provides support operations for visitor facilities, visitor protection, and emergency services in the Norris to Golden Gate Road segment. NPS employee housing and administrative offices are located in close proximity to the road in the Norris government area. Interpretive rangers, based from Norris, staff the Geyser Basin Museum and provide formal and informal interpretation at Norris Geyser Basin, Norris Campground, and Artists' Paint Pots. The Museum of the National Park Ranger is staffed primarily with volunteers.

Maintenance Operations/Facility Management

NPS operations are carried out by the park's Maintenance Division. Operations include maintenance of the Norris Museum, Norris Ranger Station, Norris employee housing, the Museum of the National Park Ranger, Norris Campground, Indian Creek Campground, the Indian Creek Warming Hut, vault toilets, water and sewage systems, building and road maintenance and garbage collection. The 100+ site Norris Campground is staffed by volunteer

campground hosts who stay at the campground and assist with general maintenance. Indian Creek is a 75 site campground also managed by the NPS, with the help of volunteer staff. During the winter, the road from the Upper Terraces in Mammoth to Norris is not plowed and is open to oversnow travel by commercial and administrative snowmobiles and snowcoaches. This road segment is often one of the first to be plowed in the spring, and is typically open to visitor traffic by April 15.

Trails and boardwalks maintained by NPS personnel along the road segment include: Norris Geyser Basin, Solfatara Creek, Grizzly Lake, Mount Holmes, Bighorn Pass, Bunsen Peak, and the Howard Eaton.

Emergency Services

Law enforcement rangers regularly patrol this road segment and are responsible for visitor and resource protection, emergency service, as well as wildland and structural fire response along this road corridor. These functions are provided from rangers based at Norris, Mammoth, and Canyon.

Concession Operations

Xanterra Parks and Resorts is the primary concessioner that operates in the Norris to Golden Gate road segment. Xanterra operates year-round with tours in the summer, and with oversnow vehicle use from the Mammoth Hotel to Indian Creek, and destinations south of the Norris area in the winter months. Snowcoaches shuttle visitors regularly throughout the day to the Indian Creek area for cross-country ski opportunities in the vicinity of the Indian Creek Campground and Bighorn Pass Trail.

During the summer months private outfitters assist visitors in experiencing Yellowstone's backcountry with guided trips on horseback. Most are day-trips, however, three to five day trips are also available. The most heavily utilized trail for backcountry travel is the Glen Creek trail in the Swan Lake Flats area. Currently two inadequate parking areas service this heavily used trail system. The Bunsen Peak trailhead is located across the Grand Loop Road from the trailhead for Glen Creek, and often is filled beyond capacity by both outfitter customers as well as visitors using both trail systems throughout the busy summer months.

Yellowstone Association

The Yellowstone Association operates educational tours throughout the year along the Norris to Golden Gate road segment, and operates a bookstore in the Norris Geyser basin area.

ENVIRONMENTAL CONSEQUENCES

This chapter analyzes the potential environmental consequences, or impacts, that would occur as a result of implementing the proposed project. Topics analyzed in this chapter include: topography, geology, and soils; vegetation; wildlife; special status species; water resources; wetlands; floodplains; hydrothermal resources; historic structures; archeological resources; ethnographic resources, cultural landscapes, visitor use and experience; and park operations. Direct, indirect, and cumulative effects, as well as impairment are analyzed for each resource topic carried forward. Potential impacts are described in terms of type, context, duration, and intensity. General definitions are defined as follows, while more specific impact thresholds are given for each resource at the beginning of each resource section.

- **Type** describes the classification of the impact as either beneficial or adverse, direct or indirect:
  - *Beneficial*: A positive change in the condition or appearance of the resource or a change that moves the resource toward a desired condition.
  - *Adverse*: A change that moves the resource away from a desired condition or detracts from its appearance or condition.
  - *Direct*: An effect that is caused by an action and occurs in the same time and place.
  - *Indirect*: An effect that is caused by an action but is later in time or farther removed in distance, but is still reasonably foreseeable.
- **Context** describes the area or location in which the impact will occur. Are the effects site-specific, local, regional, or even broader?
- **Duration** describes the length of time an effect will occur, either short-term or long-term:
  - *Short-term* impacts generally last only during construction, and the resources resume their pre-construction conditions following construction.
  - *Long-term* impacts last beyond the construction period, and the resources may not resume their pre-construction conditions for a longer period of time following construction.
- **Intensity** describes the degree, level, or strength of an impact. For this analysis, intensity has been categorized into negligible, minor, moderate, and major. Because definitions of intensity vary by resource topic, intensity definitions are provided separately for each impact topic analyzed in this environmental assessment.

Cumulative Impact Scenario

The Council on Environmental Quality (CEQ) regulations, which implement the National Environmental Policy Act of 1969 (42 USC 4321 et seq.), require assessment of cumulative impacts in the decision-making process for federal projects. Cumulative impacts are defined as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions" (40 CFR 1508.7). Cumulative impacts are considered for both the no-action and preferred alternative.

Cumulative impacts were determined by combining the impacts of the preferred alternative with other past, present, and reasonably foreseeable future actions. Therefore, it was necessary to identify other ongoing or reasonably foreseeable future projects at Yellowstone National Park and, if applicable, the surrounding region. The geographic scope for this analysis includes

actions within the park's boundaries, while the temporal scope includes projects within a range of approximately ten years. Given this, the following projects were identified for the purpose of conducting the cumulative effects analysis.

- **Canyon Junction to Tower Junction (Dunraven Road) Road Improvement Project:** The segment of the Grand Loop Road that comprises the Dunraven Road construction project stretches from Tower Junction to Canyon Junction, a total of 18.4 miles (29.3km). The entire road will be widened from its existing 19–22 feet to 24 feet and design will address needs for better drainage, more turnouts and parking areas, and slopes that can revegetate in the short, 2–3 month growing season. Design and construction are being accomplished in two phases. The first phase, from Chittenden Road to Canyon Junction, began in 2003 and was completed in 2005. The second phase from Chittenden Road to Tower Junction is scheduled to possibly begin in 2012, but is dependent upon highway funding. The second phase of the project would include the Tower Fall Campground road and the entrance road to Roosevelt Lodge, again dependent on funding. This project may also be split into three phases due to costs and the potential lack of funding for the entire project (Federal Highways proposed project schedule, 2007). The project would also include modification of the existing parking area at Calcite Springs (26 auto spaces, 3 RV/bus spaces). The road would shift away from the existing parking area to improve safety by separating the parking from the road. A traffic island would protect some very large Douglas-fir trees. The large parking area (approximately 80 auto spaces, approximately 9 RV/bus spaces) at the Tower Fall general store would be modified.
- **Beartooth Highway and Northeast Entrance Road Construction:** (aka Beartooth Highway Segment 1, Phases 1 & 2) – This work consists of reconstructing road from the Northeast Entrance Gate on Yellowstone National Park east to the Wyoming State Line. The road was widened from a previous width of 20 feet to 28 feet. Construction completed in October 2009.
- **Beartooth Highway, Clay Butte to Montana State Line:** (aka Beartooth Highway Segment 4), – This project reconstructed 19 miles of road to a 20' width and was mostly completed in the summer of 2010. Two bridges reconstructions are included in the project (Beartooth Lake Bridges). The first bridge has been reconstructed, and the second bridge is expected to be completed by September, 2011.
- **West Yellowstone Contact Station:** Construction of a new visitor contact station located just outside the park in the town of West Yellowstone, Montana was completed in 2009. This project was a joint venture between the West Yellowstone Chamber of Commerce and the NPS.
- **New West Entrance Station:** A new entrance station was constructed to address delays that have occurred in the past with vehicles backing up at the gate due to poor queuing space, and narrow lanes. This project was completed in the summer of 2008.
- **Snowcoach Sheds at Canyon and Grant:** Construction was completed in the Fall of 2009.
- **South Entrance Seasonal Four-Plex:** This structure, used as employee housing was completed in the fall of 2007.
- **Old Faithful 8-Plex:** Used as employee housing in the Old Faithful administrative area, was completed in the Fall of 2009.
- **Albright Visitor Center Remodel:** The interior of this building would be remodeled to allow for improved exhibits, improve accessibility, and improve seismic stability. Work is currently planned for 2013.

- **Old Faithful Visitor Education Center:** Construction began during the summer 2008 and was completed in the summer of 2010.
- **OF Inn, Old West Wing Rooms:** Renovation included installing seismic, electrical, and plumbing upgrades. Historic building elements of the building will also be refinished. Work was completed in summer of 2008.
- **OF Inn, Renovate Kitchen:** Complete rehabilitation of the kitchen with new ventilation and cook line is scheduled for 2011-2012.
- **Old Faithful Lodge:** This project included the remodel of many public areas of the building including: the gift shop, the registration desk, and the public restrooms. Work was completed summer of 2008.
- **Mammoth Jail:** Rehabilitation of this historic structure was completed in 2010. The rehabilitation of the exterior of the building addressed spalling concrete and structural cracking, while new cells meeting current standards were installed within the building.
- **Mammoth Justice Center:** A justice center was constructed across from the U.S. Post Office building in Mammoth. Construction began in 2007 and was completed in 2008.
- **Canyon Rim Drives road project, ongoing:** This project was started in 2007 with the rehabilitation of the Artist Point parking area and pedestrian walkways and observation areas. The project continued in 2008, where most work is concentrated on the North Rim Drive, camper services access road, and parking area just northeast of Canyon Village. In the summer of 2010 the South Rim Drive was overlaid with a new layer of asphalt. The Canyon Developed area parking lot serving the stores, restaurants, and visitor center would be overlaid with new asphalt and modified for oversized vehicle parking as early as 2011 or 2012.
- **Lamar River Bridge Reconstruction/Replacement:** Construction for this project to replace the Lamar River Bridge began in the fall of 2010. The current bridge will be replaced with a similar bridge adjacent and just upstream of its current location. Approximately one half mile of the Tower to Northeast Entrance road will be shifted to match the alignment of the new bridge. The old roadbed would then be rehabilitated, and the old bridge removed.
- **Norris-Madison Phase 3 road reconstruction project:** This project phase began in the fall of 2008, and the third phase was completed in the summer of 2010 for the Madison to Norris road project. Work included paving the new alignment above the Gibbon Canyon, and the removal of the road along approximately two miles of the Gibbon River. A new bridge was constructed upstream of Gibbon Falls to connect the new alignment with the existing road alignment. A bridge at the north end of Gibbon Canyon and approximately two miles of road was removed along the Gibbon River.
- **Sylvan Pass Reclamation and Road Reconstruction:** This project reconstructed a 0.4 mile portion of the East Entrance Road through Sylvan Pass, and rehabilitated an area that has for many years served as a source of gravel and rock for road reconstruction projects within the park. The work for the Sylvan Pass project was completed in 2010.
- **Pavement Preservation Projects:** These projects consisted of pavement overlays or chip seal work done by NPS work crews to extend the life of the pavement on the Mammoth Hot Springs area roads, the South Rim Drive, Canyon to Fishing Bridge, Canyon to Norris, and Lewis Lake to South Entrance road segments. Work on these projects was completed during the summer of 2010, and each took approximately 2-4 weeks to complete. Proposed 2011chip seal projects include: Canyon to Chittenden Road, Mammoth Upper Terrace

Parking lot to 8 miles south, Madison Jct. to West Entrance. 2011 Fog seal projects include: Grant Village Jct. to South Entrance, Tower Jct. to 5 miles west of Tower Jct.

- **NEON:** The National Ecological Observatory Network (NEON) is a continental-scale monitoring platform for discovering and understanding impacts of climate change, land use change, and invasive species on ecology. It would consist of distributed sensor networks and experiments, linked by a cyber infrastructure to record and archive ecological data for at least 30 years. The NEON site would require permanent scientific monitoring equipment.

Natural Resources

Topography, Geology, and Soils

Intensity Level Definitions

Analyses of the potential intensity of impacts to soils were derived from the available soils information and park staff's past observations of the effects on soils from both visitor use and construction activities. Impacts to soils that are unique to Yellowstone or to soils that support important vegetation species are more significant than impacts to common soils.

The intensity of impacts to topography, geology, and soils are defined as follows:

Negligible: Topography, geology, and soils would not be affected or the effects on soils would not be detectable.

Minor: Effects on topography, geology, and soils would be detectable, although these effects would be localized and short-term. There could be some slight physical disturbance, some removal of soil material, and/or some compaction. Mitigation measures proposed to offset adverse effects would include ensuring that topsoil is preserved, ground is reshaped into the natural contours, the ground is de-compacted, and that there is no unnatural erosion of soils.

Moderate: Effects on topography, geology, and soils would be readily detectable, localized, and possibly long-term. Measurable effects could include physical disturbance, removal of large amounts of soil, compaction, and/or unnatural erosion of soils. Mitigation measures proposed to offset adverse effects would be extensive and would include measures to ensure that topsoil is preserved, ground is reshaped into the natural contours, ground is de-compacted, and that there is no unnatural erosion of soils.

Major: Effects on topography, geology, and soils would be widespread, readily detectable, and long-term. Significant measurable effects would include the physical disturbance and removal of large amounts of soil, severe compaction, and the unnatural erosion of soils. Mitigation measures proposed to offset adverse effects would be extensive.

Impacts of Alternative A (No-Action Alternative)

The no-action alternative would result in a continuation of minimal impacts to topography, geology, or soils because even though no road reconstruction activities would be conducted. The Norris to Golden Gate Road would remain as it currently exists, with no impact to the road or adjacent surroundings. Maintenance of the existing roadway and ditches would not be likely to disturb topography, soils, or geologic features beyond the existing roadside ditches. There

would be continued degradation of resources from visitors using informal/undefined turnouts along the roadway.

Cumulative Effects: Past projects in the area including the Madison to Norris road reconstruction and the Lamar River bridge replacement have impacted topography, geology, and soils within the project areas. These past activities along with ongoing and continuing maintenance activities on this road segment, this alternative would contribute to cumulative disturbance of topography, geology, and soils. When considered with other past, present, and reasonably foreseeable future actions, the impacts would be considered minor.

Conclusion: The no-action alternative would result in minor impacts to topography, geology, or soils because of on-going road maintenance activities, even though no road reconstruction activities would be conducted.

Impacts of Alternative B (Preferred Alternative)

The proposed reconstruction of the Norris to Golden Gate Road would involve disturbance adjacent to the existing road. In some short segments the road could be realigned to reduce impacts to thermal features and to improve safety for visitors. Associated actions such as staging, stockpiling, disposal, and temporary asphalt plants would also impact topography, geology and soils. Minor modifications of the topography would be required to provide surfaces compatible with reconstructing and widening this road segment. Topography, geology, and soils could be affected with changes such as drainage alteration, culverts, and retaining walls adjacent to the roads and parking areas. Area soils would further be affected by revegetation and reclamation areas in places where soils erosion is occurring. The road construction would also require excavation, which would displace and disturb soils, primarily in the footprint of the reconstructed road. In areas where the road is to be shifted to improve safety near the Grizzly Lake trailhead, or to remove the road from Frying Pan Spring grading of soils and slopes would be required. Soils may also be disturbed and compacted on a temporary basis in the locations used to access the construction site as well as in the immediate area of the staging and stockpile areas that would used until construction of the new road is complete.

The preferred alternative would result in moderate short-term adverse effects to the topography, geology, or soils due to the reconstruction activities on the road. In order to effectively reconstruct and widen this road, the land adjacent to the road would need to be graded for new drainage ditches, new cut and fill slopes, and potential lessening of slope steepness to better facilitate revegetation, or reduce rockfall. In the long-term, the improvements to drainage and slope steepness adjacent to the road would have a moderate beneficial effect due to increased revegetation potential, and reduced erosion potential.

Cumulative Effects: Past road construction projects such as the Madison to Norris reconstruction project impacted topography, geology, and soils along the road segment. This project would have similar effects impacting areas directly adjacent to the existing roadway. This alternative would add to cumulative disturbance of topography, geology, and soils, when considered with other past, present, and reasonably foreseeable future actions. Adverse impacts from this alternative would be considered moderate when considered along with projects described in the cumulative impact scenario above.

Conclusion: The preferred alternative would result in short-term moderate adverse effects due to increased erosion potential during construction, but would have a long-term minor beneficial effect by reducing erosion potential and allowing for better revegetation of some existing cut and fill slopes. Earthmoving activities associated with this project would create approximately 28.33 hectares (70 Acres) of new impacts. These would occur from building road base for the

expanded width of roadway surface, constructing drainage and rockfall catchment ditches adjacent to the road, and sculpting of cut and fill slopes to allow for revegetation.

Hydrothermal Resources

Methodology and Intensity Thresholds

There are four types of hydrothermal features: geysers, hot springs, fumaroles, and mudpots). Analyses of the potential intensity of impacts to hydrothermal features were derived from information on specific hydrothermal features (temperature, chemistry, flow rates, eruption intervals, photographs), information on hydrothermal basins, and park staff's past observations of the effects of both visitor use and construction activities on hydrothermal features.

Hydrothermal features in Yellowstone are divided into five categories:

- features that are culturally significant (e.g., Old Faithful Geyser, Morning Glory Pool, Steamboat Geyser),
- features that are found within developed/boardwalked areas (e.g., Biscuit Basin, West Thumb Geyser Basin, Upper Geyser Basin),
- features that are scientifically notable (e.g., superheated features or features important to microbial researchers),
- features that are found in undeveloped areas (e.g., backcountry hydrothermal features such those found in Shoshone Geyser Basin or Pocket Basin), and
- unnamed, low-flow, low-temperature thermal seeps (features with no defined vent but having slow, diffused movement of water through cracks or soil).

The first four categories are considered when evaluating the thresholds of change to hydrothermal features. The fifth category, thermal seeps, is not considered when evaluating the thresholds of change unless the seep's flow route and/or the water temperature is interconnected and integral to a larger nearby system and/or the impacts to the seep would affect nearby features that are in other categories.

Intensity Level Definitions

The thresholds of change for the intensity of impacts to hydrothermal features are defined as follows:

Negligible: Hydrothermal features would not be affected or the impact would cause insignificant physical disturbance (there would be no effect upon the temperature, periodicity of eruption, or volume of thermal water flow).

Minor: Effects to hydrothermal features would be slight but measurable. Eruption intervals, thermal water temperature, and/or thermal water flow may change slightly due to disturbance but would return to baseline values within one day. Mitigation measures proposed to offset adverse effects would include measures to ensure that the hydrothermal feature(s) is protected.

Moderate: Effects to hydrothermal features would be measurable and would last for more than one day. Eruption intervals, thermal water temperature, and/ or thermal water flow could change for a number of days but would be expected to return to baseline values. Mitigation measures proposed to offset adverse effects would be extensive.

Major: Effects are readily apparent for either a single thermal feature or a group of features (a thermal system) and are long-term. Eruption intervals, water temperature, and/or the volume of thermal water could increase or decrease, and/or new thermal features could be created at project areas. Mitigation measures proposed to offset adverse effects would be extensive and success would not be assured.

Impacts of Alternative A (No-Action Alternative)

The no-action alternative would result in the continuation of impacts associated with having a road directly adjacent to, and over the top of the Frying Pan Spring thermal area. Runoff from the road surface finds its way directly into the thermal area after rain and snow events. A turnout directly next to the thermal area invites visitors to stop and view the area, yet there is an absence of any features to guide this pedestrian use. Trampling along the spring edge, and disturbance to the spring pool bottom has occurred.

Cumulative Effects: Impacts from this alternative would be negligible to minor, and adverse when considered with projects from the cumulative impact scenario. Past projects such as the Madison to Norris road reconstruction, the Old Faithful Visitor Education Center, and the Old Faithful 8-Plex all sought to avoid impacts to thermal features. Mitigation measures were employed in the road projects if avoidance of hot ground was unavoidable.

Conclusion: Thermal areas would be impacted by existing road location, ongoing road maintenance activities or existing use of the road. Hot ground exists under the existing roadway, and there is the potential of vehicles leaving the roadway and ending up in thermal areas adjacent to the road. Runoff from paved areas in some instances flows directly into thermal areas adjacent to the road. Impacts to the features would be considered minor from the no-action alternative.

Impacts of Alternative B (Preferred Alternative)

Along some sections of the roadway, thermal features are close to and on both sides of the road. To avoid impacting these resources where possible, steepened side slopes and rocked ditches would be used to keep fill materials from covering the feature. Of the 19 thermally influenced wetlands located along the road within the project area, eight would be impacted by road reconstruction activities. Five would have permanent impacts totaling about 1,605 square feet (0.04 acre). Four sites would sustain temporary impacts of about 7,560 square feet (0.17 acre). Three thermal wetland areas would have work done to reclaim 19,800 square feet (0.45 acre).

Road reconstruction crosses portions of 17 thermally influenced areas (primarily hot ground as defined through infrared thermography and some small unvegetated thermal seeps), and passes in close proximity to many other thermal areas along the road segment. Cutting and filling operations for widening an existing road cause concerns especially for hydrothermal areas along and under the existing road. Excavation could expose new thermal features or change gas, water, and heat pathways of the feature. Filling over the top of thermal features or hot ground can also affect gas, water, and heat flow. In each case, efforts would be taken to avoid the thermal feature by widening to the opposite side of the road. In cases where hot ground underlies the road, filling would be used rather than cutting as a first choice and the design would include avenues to vent heat, and not allow for excess build up under the road. Every effort would be made to avoid cutting into thermal areas or hot ground as this could change gas, heat, and water flow of the feature. The standard would be to fill and not cut in areas that have hydrothermal concerns. Design of the proposed road reconstruction project would continue to involve and receive input from the Park's geologist. The road design would avoid, to the extent

possible, areas of high thermal heat flow and where thermal features are located in proposed cut or fill areas. Special features such as a thermal design pavement structure could be used over hot ground areas and at underdrains, or areas of excavation into cut slopes, in order to help control heat dissipation and water flow. Further investigations during design would pinpoint thermal sites to help develop avoidance or mitigation measures.

In the Frying Pan Spring thermal area the road would be rerouted to avoid the spring and all of the surface thermal features. Some hot ground would still be impacted, though moving the road would result in moderate beneficial impacts to thermal features in the area. Adjacent to Frying Pan Spring, approximately 0.24 acre (10,415 square feet) of thermally influenced wetlands would be restored by removing the road from this area.

Cumulative Effects: Past projects located in thermal areas such as the Madison to Norris road reconstruction, the Old Faithful Visitor Education Center, and the Old Faithful 8-Plex all sought to avoid impacts to thermal features. Mitigation measures were employed in the road projects, and would be employed in this project, if avoidance of hot ground was unavoidable. This alternative would have moderate, adverse impacts to thermal features of the area when taken into account with the projects listed in the cumulative impact scenario.

Conclusion: While there would be some impacts associated with shifting the road alignment to the east of Frying Pan Spring, the overall impact, of the project, in the area of the spring would result in moderate beneficial impacts. Impacts are the result of removal of the road from the hottest and most active portion of this thermal area. New boardwalks at Clearwater Spring, and Frying Pan Spring would have minor beneficial effects by defining use areas around these thermal springs. Because of concerns at thermal areas along the road including: Bijah Hot Springs, Semi-Centennial Geyser, the Clearwater Complex, the Beaver Lake thermal area east of the road, hot ground north of the Norris Campground access road, areas north and south of Frying Pan Spring, the overall project would result in minor to moderate adverse impacts to hydrothermal resources along this road segment. No long-term effects are anticipated.

Wetlands and Other Waters of the U.S.

Intensity Level Definitions

The impact intensities for wetlands and other waters are as follows:

Negligible: Impacts to existing wetland areas or functions would not be perceptible, and no changes to riparian vegetation and wildlife communities would occur.

Minor: Impacts would be measurable and could change wetland areas and functions, or hydrologic processes in a localized area. The impact would be measurable or perceptible, but slight, and would affect a few individuals of plant or wildlife species within an existing wetland or riparian area within the park. Changes to hydrology would be considered insignificant and short-term. An action would have measurable effects on the timing or intensity of flows. Any changes would require considerable scientific effort to measure and have barely perceptible consequences to wetland, riparian habitat, or hydrologic function.

Moderate: Impacts would be measurable and long-term but relatively local. The impact would be sufficient to cause a measurable change in the size, integrity, or continuity of the wetland or would result in a small, but permanent loss or gain in wetland acreage. Mitigation measures associated with the water resources,

floodplains, and hydrology would be necessary. Impacts to existing wetland areas or functions could be mitigated by the restoration of impacted wetlands elsewhere in the park. An action would have clearly detectable effects on the timing or intensity of flows and potentially would affect organisms or natural ecological processes. The action would have a measurable effect on plant or wildlife species within an existing wetland or riparian area, but all species would remain indefinitely viable within the park.

Major: Impacts would be readily measurable and have permanent consequences for an existing wetland area or function which could not be mitigated. The impact would be substantial and highly noticeable. Wetland and riparian species dynamics would be upset, and species changes would be noticeable on a regional scale. An action would have substantial effects on the timing or intensity of flows and potentially would affect organisms or natural processes. Mitigation measures would be necessary and extensive. The action would result in a measurable change in size, integrity, and continuity (all three) or a permanent loss of large wetland areas.

Widening of the Norris to Golden Gate Road would have the potential to impact 127 of the 231 wetlands surveyed within two hundred feet of the road. Five wetlands mapped within the road corridor contain peatlands or fens, areas of saturated soils with 16 or more inches of organic soil material. Seventeen wetlands within the project area are thermally influenced. Mitigation to limit or avoid wetland impacts would occur. Measures to minimize impacts to wetlands include: a) widening a road on the side away from the wetland, b) down-cutting the road on cliff-sides rather than filling the roadside with rubble to expand roadbed width, c) the use of retaining walls to extend the road base outward over steep down-slopes, d) the use of larger culverts or bridges to avoid contact with the wetland, or e) moving the entire roadbed out of the wetland area. Prior to construction, all necessary Wetland Alterations Permits from the U.S. Army Corps of Engineers and Wyoming Department of Environmental Quality would be obtained.

Impacts of Alternative A (No-Action Alternative)

The no-action alternative would continue the status quo with potential impacts from ditch cleaning, roadside vegetation removal, and culvert repairs. No new impacts to wetlands would occur.

Water Quality. Some stormwater runoff from existing roads and parking areas would continue to find its way to adjacent tributaries and waterways. This would continue minor impacts due to sedimentation and negligible amounts of petroleum products from asphalt, vehicle accidents, and leaking vehicles found on and near the roadway. Scuppers on the existing bridge near the Norris Campground would continue to drop stormwater runoff directly into the Gibbon River.

Cumulative Effects: Negligible to minor wetland impacts would occur to ditch wetlands along the existing road from road maintenance work that would include vegetation removal and ditch cleaning. Wetland and water quality impacts from this alternative in conjunction with past and foreseeable future projects would be minor. Past and future road projects have and would continue to address road caused sedimentation and runoff into waterways. Past projects have had minor beneficial effects on water quality in the long-term. The short-term effects of road construction had had minor to moderate adverse impacts.

Conclusion: The no-action alternative would continue to have minor adverse impacts on water quality due to ongoing issues with runoff from the roadway surface, scuppers on the Gibbon River bridge, and erosion problems off some parking areas near waterways.

Impacts of Alternative B (Preferred Alternative)

A wetland survey was completed to ensure that design and location of all parking areas and turnouts would avoid or minimize impacts to wetlands. Some wetlands located within road ditches would be disturbed by ditch cleaning or subexcavation work. These wetlands were originally an outgrowth of previous disturbance to construct the road ditch and are supported by seeps found on embankments immediately adjacent to the road and in the ditch. Areas would be recontoured to allow the original roadside ditch hydrological conditions to be reestablished and maintained.

In general short-term siltation and turbidity of the rivers and other drainages adjacent to the roadside might occur as a result of construction activity and erosion of disturbed soils before vegetation became established. Scheduling and standard erosion control measures and barriers would be implemented to prevent runoff from degrading water quality. The emphasis would be on techniques that do not need to be removed later (mulch vs. silt fences). Preliminary engineering road designs sought to avoid and minimize impacts to wetlands whenever possible, through use of such techniques as shifting the centerline to avoid wetlands and steepening fill slopes or constructing rock walls to minimize the extent of fill. However, because of the prevalence of wetlands bordering the road, the increased road prism width and associated cut or fill would result in impacts to some wetlands on both sides of the road. A total of 103 individual wetlands would be affected. The total area of wetlands lost would be approximately 0.69-0.77 hectare (1.7-1.9 Acres). The majority of these wetlands are classified as palustrine wetlands, either saturated or seasonally flooded. An additional 0.63-0.71 hectare (1.55-1.75 Acres) of wetlands would be temporarily impacted. Fill from previous road construction has encroached into the edges of some wetlands and it would be removed to restore the original contours. The existing topsoil would be stripped, the fill removed and the topsoil replaced in some cases wetlands would be temporarily disturbed during construction to allow access, for example in the reconstruction of the bridges and culvert headwalls. In both types of areas, wetland species woud be planted and the wetlands would be restored to near pre-disturbance conditions following construction.

The total area of wetland mitigation for unavoidable impacts would be accomplished through restoration of a minimum of 0.85-0.93 hectares (2.1-2.3acres). This restored wetland would occur at Frying Pan Spring, Semi-Centennial Geyser, The turnout located 0.75 mile north of Semi-Centennial Geyser, by changing the location of the Grizzly Lake parking area, and by shifting the road to the left just north of the Obsidian Cliff parking area.

In the area approximately 450 feet south of Apollinaris Spring, Obsidian Creek would be re-routed to cross under the road approximately 80-100 feet south of its existing location. The existing culvert would be moved. Approximately 140 feet of new stream channel would be constructed in what appears to be an old oxbow on the west side of the road. This would allow the stream to reconnect with the existing stream channel on the east side of the road. Approximately 210 feet of the de-watered stream channel on the east side of the road would revert to wetland, while a similar length of wetland on the west side of the road would become the newly formed stream channel. No measurable net gain of wetland is anticipated for this area, conversely no net loss would occur.

Water Quality. In general short term local siltation and turbidity of Obsidian Creek and the Gardner River and other drainages adjacent to the roadside might occur as a result of construction activity and erosion of disturbed soils before vegetation becomes established. Scheduling and standard erosion control measures and barriers would be implemented to prevent runoff from degrading water quality. The emphasis would be on techniques that do not need to be removed later (mulch vs. silt fences). These impacts are expected to be short-term

and temporary. In-stream work would be done as much as possible during low flow periods to minimize disturbance of these water bodies. An oil/hazardous material spill contingency plan would be prepared prior to construction by the contractor.

In compliance with the Clean Water Act, a Section 404 permit would be obtained from the Army Corps of Engineers for all work within waters of the United States and adjacent wetlands. A National Pollutant Discharge Elimination System (NPDES) permit would also be obtained.

Cumulative Effects: All wetland impacts from the cumulative impact scenario would have come from road and bridge related projects. Impacts occurred from culvert replacement, road widening directly adjacent to wetland areas when the road was unable to be shifted away from the wetland, and from slight construction caused erosion into wetlands. The preferred alternative in conjunction with projects listed in the cumulative impacts scenario would have moderate adverse long-term impacts to wetlands, though; impacts would be mitigated through restoration of comparable wetland habitats within, or near, the project area.

Conclusion: The preferred alternative would result in moderate adverse long-term impacts to 0.69-0.77 hectare (1.7-1.9 acres) within portions of 103 wetlands. 0.63-0.71 hectare (1.55-1.75 acres) within 51 wetlands would have temporary moderate short-term impacts. The largest area of temporary impacts would result from the reconstruction of the Gardner River Bridge. A total of 0.85-0.93 hectares (2.1-2.3 acres) of wetlands would be restored. This represents the minimum possible disturbance to carry out the National Park Service's responsibility for providing adequate and safe access within Yellowstone National Park. In accordance with the NPS no new loss of wetlands policy, impacted wetlands would be replaced with comparable wetland habitats via restoration of previously disturbed wetlands. No known amphibian breeding sites would be affected by the construction.

Floodplains

Intensity Level Definitions

Negligible: Impacts would occur outside the floodplain, or there would be no measureable or perceptible effect on floodplain functions or values and no measurable or perceptible risk to facilities or visitors. No measureable or detectable effect on the timing or intensity of streamflow would occur. No measureable or perceptible changes in wetland or other waters of the US size, integrity, or continuity would occur.

Minor: Actions within the floodplain would potentially interfere with floodplain functions/values or facility/visitor risks in a limited way or in a localized area. The impact would be measureable or perceptible, but slight. A small change in size, integrity, or continuity could occur due to short-term indirect effects such as construction-related runoff. An action would have measureable effects on the timing or intensity of flows. The overall viability of the wetland or other water of the US would not be affected.

Moderate: Actions within the floodplain would interfere with floodplain function/values or facility/visitor risks in a substantial way or in a large area. Action would clearly have detectable effects on the timing of intensity of flows and potentially would affect organism or natural ecological processes. The impact would be sufficient to cause a measureable change in the size, integrity, or continuity of the wetland or would result in a small, but permanent loss or gain in wetland acreage.

Major: Actions within the floodplain would permanently and significant alter floodplain functions/values or facility/visitor risks. An action would have substantial effects on the timing or intensity of flows and potentially would affect organisms or natural processes. The action would result in a measurable change in size, integrity, and continuity (all three) or a permanent loss of large wetland areas. The impact would be substantial and highly noticeable.

Duration: Short-term effects would last only during the implementation of the project including its mitigation and monitoring measures. Long-term effects would typically constitute a permanent impact.

The floodplains within the project area have not been mapped, however portions of the road project are located within the floodplains of the Gibbon and Gardner rivers and Obsidian Creek. Every spring snowmelt causes seasonal flooding on Obsidian Creek and the Gardner and Gibbon rivers.

Impacts of Alternative A (No-Action Alternative)

The no-action alternative would result in no new structures within floodplains. Work within the floodplain could occur on a rare basis for ongoing maintenance on bridges within the project area.

Cumulative Effects: A recent road reconstruction project between Madison and Norris involved relocating approximately 1.9 miles of roadway from directly adjacent to the Gibbon River to an upland area. The road had encroached upon the river affecting stream flow and limiting channel changes. Road fill was removed from within the channel and the area along the banks was replanted with native wetland species. The Madison to Norris Road reconstruction project had moderate beneficial impacts to floodplains. When combined with the no-action alternative, cumulative impacts would be moderate and beneficial.

Conclusion: The no-action alternative would have no measureable or perceptible effect on floodplain functions or values and no measurable or perceptible risk to facilities or visitors. Any impact to floodplains would be considered negligible.

Impacts of Alternative B (Preferred Alternative)

Work within the floodplain would occur in order to rehabilitate/reconstruct the Gardner River bridge and the Obsidian Creek bridge, and working on repairs and lengthening existing culverts and headwalls. Very limited road fill would be placed in the floodplain, in some areas, to allow for widening of the road to a 30-foot width. Removal of piers from the Gardner River bridge would enhance floodplain function.

Cumulative Effects: The Madison to Norris Road reconstruction project had moderate beneficial impacts to floodplains by removing an old road from the floodplain near the Norris picnic area, and removal of the road in the Gibbon Canyon. Other road reconstruction projects have sought to remove fill from floodplains if an opportunity to do so occurred. All other projects within the cumulative impact scenario have avoided impacts to floodplains. When combined with this proposed project to reconstruct the road, cumulative impacts would be minor to moderate and beneficial.

Conclusion: Approximately 1.66 acres of existing road fill would be removed from the Obsidian Creek floodplain. A total of approximately 0.09 acres of road fill would be added to the floodplain to accommodate road widening. Where filling occurs, it would have negligible impacts to natural floodplain values including but not limited to: vegetation, wildlife habitat,

dissipation of flood energy, sedimentation processes, and groundwater. Impacts to floodplains would be considered negligible to minor, as most impacts would be temporary and in very localized areas. None of the proposed changes would have lasting affects to floodplain function.

Vegetation

Intensity Level Definitions

Park staff performed an on-site survey for rare plants (species of special concern), and one potentially rare plant was identified within the proposed project area. Additionally, available information on park native vegetation and unique plant communities was used to analyze the effects of the alternatives.

The intensity of impacts are defined as follows:

Negligible: No rare plant species or uncommon plant communities would be affected. Individual native plants might be affected, but impacts would be localized, short-term, and of no consequence to the species.

Minor: Native vegetation would be affected, but impacts would occur in a relatively minor portion of the species' occurrence(s) within the park. Mitigation measures to offset adverse effects would be proposed. Rare plants or uncommon plant communities could be present and individual plants could be affected, but proposed mitigation measures to avoid adverse impacts to the species or community would be effective.

Moderate: A sizable segment of native vegetation within the park would be affected, and proposed mitigation measures would be extensive. Rare plant species or uncommon plant communities could be affected, and proposed mitigation measures to offset adverse effects could be extensive.

Major: Effects on native vegetation within the park, potentially including rare plants or uncommon plant communities would be extensive and long-term. Proposed mitigation measures to offset the adverse effects would be extensive, and success of the mitigation measures would not be guaranteed.

Impacts of Alternative A (No-Action Alternative)

Exotic Vegetation. The no-action alternative would result in very little change to roadside vegetation other than maintenance activities to remove trees that grow in the drainage ditches along the roadside. Some trampling of vegetation adjacent to inadequate or informal turnouts and parking areas would continue.

Rare Plants. The no-action alternative would have minor impacts due to limited road maintenance activities and existing social trails in the area.

Cumulative Effects: Cumulative impacts to vegetation would be a minor and adverse as previous road widening activities have removed native vegetation and trees from areas adjacent to the roadways in much of this area. Widening of the road from Madison to Norris project has permanently removed an additional 8-10 feet of vegetation to allow for new pavement. Much of this loss was mitigated by the removal of approximately 2 miles of the road through the Gibbon Canyon, north of Gibbon Falls.

Conclusion: The no-action alternative would only have negligible effects on vegetation due to limited road maintenance activities outside the existing road prism.

Impacts of Alternative B (Preferred Alternative)

Under Alternatives B, approximately 28.33 hectares (70 acres) would be cleared. All of the clearing would be adjacent to the existing road, turnouts, or adjacent to parking areas along the Norris to Golden Gate road segment. Moderate impacts to native vegetation would occur from the expansion of the Norris Geyser Basin parking lot, which would require the removal of trees for the increased number of spaces and for changes in circulation roads. The road realignments in the Grizzly Lake and Frying pan Spring areas would require tree cutting of mature forest to allow for a new road prism to be constructed. The vegetation that would be impacted by the road reconstruction project is primarily lodgepole pine forest, wet meadows and seeps, and sagebrush steppe. No species of special concern, including Federal or State listed species, would be affected. Impacts to individual rare plant species populations are expected to be negligible.

Minimization of temporary impacts from the construction of the temporary bypass road at the Gardner River Bridge requires special design. The work would be done at low water (fall) to facilitate construction and to minimize release of sediment into the river. The timing also corresponds to the time when the willows and water birch are approaching dormancy. One example of how to minimize impacts here would be to cut shrubs within one inch of the ground surface to minimize crushing or breaking the plants. A one- to two-inch deep layer of washed sand would be placed around and over the pruned plants to further minimize breakage. A water-permeable geotextile fabric would then be installed over the sand layer to separate the shrubs from the road fill and to facilitate later removal of the road fill. The road fill for this detour would be drifted out over the geotextile in one lift, working from the existing road. A temporary base course and asphalt surface would complete the temporary road.

The temporary road would be in place 3-4 months and then would be de-constructed in the reverse order of construction. It is expected that the shrubs would sprout the following spring, but if they do not, revegetation would be accomplished by planting willow and water birch stem cuttings and/or rooted stem cuttings collected from the local area. Once the temporary embankment and geotextile are removed, temporary erosion control treatments would be placed to separate the rehabilitated detour areas from the Gardner River until the re-growing vegetation had stabilized the temporarily disturbed areas.

Exotic Vegetation. Approximately 28.34 hectares (70 acres) of soils and vegetation would be disturbed near the roadside during roadside clearing and excavation activities associated with widening, formalization and construction of turnouts, expansion or construction of new parking areas, shifting of the roadway, and repair of retaining walls and bridges.

In order to reconstruct the bridge over the Gardner River, approximately 900 feet of a detour road would need to be constructed on the west side of the road, including a temporary bridge. The detour would need to be in place for about 4-5 months. The temporary detour would temporarily affect about 0.40 acre of land. Once restored, it would be monitored for exotic vegetation and if problem weeds are found, eradication measures would be taken by the Park's resource management crews.

Approximately 1.06 hectares (2.61 acres) of new impacts would occur to expand the parking area serving the Norris Geyer Basin.

Topsoil would be salvaged during construction for later revegetation work. No imported topsoil would be used in reclamation. Removal of trees would occur that would allow for road widening, drainage ditches, and slope sculpting adjacent to the roadway. In most instances

road work for widening would be kept to one side of the roadway only in order to minimize the impacts to vegetation. Reclamation and revegetation efforts would follow the Yellowstone National Park policy on vegetation management for construction (see Appendix C). Borrow and aggregate materials from sources outside the park would be heated (or the source certified weed-free), and construction equipment would be carefully checked to avoid the importation of exotic vegetation. Indigenous native plant materials would be used for revegetation, and areas disturbed by construction would be monitored for early detection and removal of exotic species. Standard, approved erosion control techniques and structures would be implemented during and after completion of construction.

Rare Plants. A total of seven rare plant species located at 21 sites along the road would be affected by construction activities, with a total of 0.1 to 0.35 acres or rare plant populations impacted. The seven plant species affected are: *Gnaphalium microcephalum* var. *thermale*, *Eleocharis flavescens* var. *thermale, Sanicula graveolens, Sparganium natans, Pyrrocoma integrifolia, Myriophyllum verticillatum,* and *Geum rivale.*

Cumulative Effects: The Madison to Norris Road Reconstruction project was completed in 2010. As with this proposed project, the Madison to Norris project impacted vegetation adjacent to the existing roadway. Projects involving local small scale building sites have impacted vegetation that had typically already been disturbed and located within developed areas of the park. Since native vegetation would be affected, but impacts would occur in a relatively minor portion of the species' occurrence(s) within the park, cumulative impacts of this, and past projects is considered to be minor to moderate.

Conclusion: Adverse minor to moderate impacts would be short- and long-term, affecting some individual native plants, but a relatively minor portion of the species' population and restricted to a very small geographic area. No species of special concern would be adversely impacted.

Wildlife

Intensity Level Definitions

All available information on known wildlife was compiled. Where possible, map locations of sensitive species sightings in the project area were reviewed. Predictions about short- and long-term site impacts were based on existing monitoring data from Yellowstone National Park. Note that threatened and endangered species are considered separately under the impact topic immediately following wildlife.

The thresholds of change for the intensity of impacts to wildlife are defined as follows:

Negligible: Wildlife would not be affected or the effects would be below the level of detection.

Minor: Effects to wildlife would be detectable, although the effects would be localized, short-term, and of little consequence to the species' population. Mitigation measures to offset adverse effects would be proposed.

Moderate: Effects to wildlife would be readily detectable, localized but long-term, with consequences potentially at the population level. Mitigation measures proposed to offset adverse effects would be extensive.

Major: Effects to wildlife would be obvious, long-term, and would have substantial consequences to the wildlife population(s) in the park. Mitigation measures proposed to offset adverse effects would be extensive.

Impacts of Alternative A (No-Action Alternative)

Routine maintenance activities would stay within the existing footprint of development, and would not significantly affect wildlife or wildlife habitat. All activities would be very localized to address very localized problems and would be directly adjacent to the road and within the existing road prism disturbance. No existing gravel turnouts would be paved, and all work would be completed by NPS park staff that is aware of the need to reduce impacts to park wildlife. No bridges would be reconstructed and sedimentation into streams or wetlands would be from natural events only.

Cumulative Effects: Most projects in the cumulative impact scenario have occurred within developed areas of the park. Maintenance activities along roads may temporarily displace wildlife and cumulative impacts to wildlife resources resulting from implementing the no-action alternative would be negligible.

Conclusion: Implementation of the no-action alternative would result in short-term habitat-related effects to wildlife resources. Modification or loss of wildlife habitat associated with the project would be short-term, negligible, and insignificant.

Impacts of Alternative B (Preferred Alternative)

Mammals. Black bears, coyotes, and other animals such as eagles, hawks, owls, and foxes opportunistically make use of available foods, including carrion in spring. The effects on road use and construction activity in relation to these species in Yellowstone have not been studied. Most large mammals readily habituate to vehicle noise and foot traffic in the vicinity of roads if disturbance are not associated with negative stimuli such as shooting or collisions with vehicles. Thus, most mammals residing in the vicinity of this road reconstruction project probably already exhibit some tolerance of human-related disturbances. However, because the road reconstruction will temporarily introduce more and novel disturbance, some displacement of wildlife from the immediate vicinity of the road would be expected, although each animal's degree of tolerance for human activity and traffic would vary. Project-related disturbances would occur from early summer to fall, a period when stress related to temperature and snow pack is minimal. Disturbance-related effects to resident, terrestrial mammals is expected to be minor.

Elk, Bison, Mule Deer, White-tailed Deer, Pronghorn. No significant impacts to elk, bison, or other wildlife populations are anticipated because no significant increase in wildlife mortalities are expected, habitat loss would be limited, and potentially disturbing construction activities would be temporary and confined to the existing road corridor. While wildlife crosses this road segment frequently, there are not any known important travel corridors of large mammals that are migrating or dispersing. The number of people and machinery added to the road area will *not represent significant barriers to wildlife movement. Should effects occur, normal patterns of* movement should be quickly reestablished after the project is completed.

Moose. Construction is not likely to occur during the winter season and would not affect wintering moose. Traffic volumes have remained relatively constant over the last decade though the general trend has been increasing. However, this effect would be independent of this road project and cannot be accurately measured.

Black Bear. Food and garbage would be managed to ensure that it was not available to bears or other wildlife. The presence of humans and associated food attractants can lead to wildlife-human conflicts, in particular conflicts with bears, which sometimes requires removal of the animal from a roadside. Orientation sessions, including information on bears would be conducted for construction personnel to reduce the potential for conflicts at construction sites and along the project route.

Bears are predominantly active during evenings, night, and early morning time periods. The majority of construction is expected to occur during daylight hours; however, nighttime work would occur. Most observed bear activity along the road corridor was reported in spring and summer seasons, with fewer reports recorded during the fall. Most construction would occur during the late spring to fall months, thus somewhat overlapping the tie when bears are most active.

Fish. Direct effects may include the acceleration of erosion and sediment loading. Such changes can affect fish habitats. Other changes may include changes in rainfall-runoff relationships, hillslope drainage. Runoff characteristics and important sources of flow may be altered in both a short-term and long-term basis. In general, short-term effects would include increased disturbance to some riparian soils and potential increases in runoff due to the introduction of additional road fill and exposed slopes until vegetation becomes established. Disturbance to soils and vegetation may impact aquatic flora and fauna by degrading water quality. Turbidity and siltation reduce benthic invertebrate communities (Waters 1995). These invertebrates, food sources for fish, are observed at lower densities in streams subject to sedimentation. Scheduling and standard erosion control measures and barriers would be implemented to prevent runoff from degrading water quality. There would be no change to bridges or culverts on any creeks or rivers that would impede fish passage. Any proposed in-stream work would be planned for low flow periods so as have minimal effects to fish spawing.

Reptiles and Amphibians. Approximately 1.7 to 1.9 acres of wetland would be lost, and 1.55-1.7 acres temporarily impacted from this alternative. All wetland impacts are caused by the road prism expanding slightly into the wetland, and no wetland is completely affected. This project would be designed to minimize as much as possible wetland impacts. By avoiding and minimizing new impacts to wetlands and streams, this project would have minor effects on amphibian species populations.

Cumulative Effects: Past road projects on the west side of the park have occurred in recent years such as the Madison to Norris Road Reconstruction project. These projects have had a direct impact to wildlife habitat by removing acreage now used for a wider road. In some cases the road widening has encroached on wetlands along the Gibbon River. This has only occurred when no other viable options occurred for widening to the cut side of the roadway. The Madison to Norris project also had very positive effects by restoring nearly two miles of riparian habitat along the Gibbon River by removing the road, and relocating it to an upland area. As in this alternative, no past project has completely filled even a small wetland. No change in use of the road has occurred; hours of operation remain open 24 hours per day, and closed to all but over snow vehicles in the winter months. Cumulative effects to wildlife using habitat along the road, and in adjacent wetlands and streams is considered minor.

Conclusion: Road kills would continue to contribute to wildlife mortalities. However, the number of wildlife mortalities on this road is expected to remain low because there would be only very minor adjustments to the horizontal road alignment and no change in speed limits along the road. Some increase in vehicle speeds could occur due to a smoother and wider road surface, but no significant increases in wildlife mortality are anticipated under this alternative.

Approximately 28.33 hectares (70 acres) of new impacts would cause roadside vegetation to be permanently lost following road widening, formalization and addition of new turnouts or parking areas. Wildlife foraging and reestablishment of migration and use patterns following construction is anticipated. Impacts to wildlife would be considered minor and adverse. Most impacts would be associated with loss of foraging habitat, and temporary displacement during construction.

Special Status Species

Intensity Level Definitions

Yellowstone National Park biologists familiar with each of the threatened and endangered species present in Yellowstone were consulted for their knowledge and opinion on potential project impacts. These biologists consulted records of threatened and endangered species sightings within Yellowstone National Park historic records of sightings, publications, and their detailed knowledge of the life habits of the species in question. The evaluation of effects included direct, indirect, interrelated, interdependent, and cumulative impacts as defined by the Endangered Species Act (ESA).

The gray wolf and Canada lynx are protected pursuant to the Endangered Species Act (ESA) of 1973, as amended, and present within potential project areas in the park. The Norris to Golden Gate Road is not within a Lynx Analysis Unit of the park, and would therefore be a "No Effect" per Section 107 of the ESA. No loss of wolf habitat would occur; construction activities should not significantly affect wolf behavior or travel patterns. The Parkwide Road Biological Assessment submitted to U.S. Fish and Wildlife Service (USFWS) in 2008 and the subsequent Biological Opinion prepared by the USFWS in 2009 for the Yellowstone Park Roads Program, meets the Section 7 requirements of the ESA for this project. The Norris to Golden Gate Road project is included as part of a Parkwide Roads Program for which Section 7 compliance is complete.

As part of the conservation measures listed in the biological assessment prepared for the parkwide road reconstruction program, an annual report would be sent to the U.S. Fish and Wildlife Service (USFWS) describing road reconstruction activities within that year, and any effects those activities had on listed species.

The thresholds of change for the intensity of impacts to threatened and endangered species are defined as follows:

Negligible: No federally listed species or its proposed or designated critical habitat would be affected.

Minor: Effects are insignificant, discountable, or wholly beneficial for individual members of the species. Adverse effects are very localized, temporary, and not of measurable consequence to individuals, particularly effects related to human disturbance or habitat modification that might affect breeding, sheltering, or feeding of individuals.

Moderate: Effects are readily detectable, localized, and are often long-term in nature. Actions would result in some change to a population or individuals of a species or designated critical habitat. The change would be measurable and of consequence.

Major: Effects are readily detectable at the population level and are long-term in nature.

Duration: Short-term effects would last only during the implementation of the project including its mitigation and monitoring measures. Long-term effects would typically constitute a permanent impact.

Impacts of Alternative A (No-Action Alternative)

Canada lynx. Road maintenance activities would have no direct effects on lynx because this species apparently does not occur in this area. Lynx may occasionally travel through the area when making dispersal-related or extra territorial movements, but direct visual and auditory

disturbance would probably be temporary and insignificant to a traveling individual. No additional areas would be paved as part of this alternative. Impacts to Canada lynx from the no-action alternative would be negligible.

Grizzly Bear. The potential always exists for human/grizzly bear interactions that would directly affect bears, such as vehicle accidents or habituation to human food sources from illegal feeding or available garbage. However, vehicle-caused grizzly deaths have been rare in the entire park and along this road, and current policies and enforcement seem effective in preventing human/grizzly problems along the roadway. Maintenance and use of the existing road are not expected adversely affect grizzly bears.

Gray Wolf. The no-action alternative would have no change on vehicle speeds or use and is not expected to increase wolf mortality due collisions with automobiles. This alternative would continue maintenance activities to keep the road useable and could temporarily displace wolves. Because of the potential for displacement of wolves in the short-term, this alternative may affect, but is not likely to adversely affect gray wolves.

Wolverine. While tracks have been occasionally reported along this corridor, systematic surveys have detected no wolverine home ranges in the Gallatin mountain range to the west, or the Washburn mountain range to the east of the Norris to Golden Gate road corridor. For this reason, this project may affect, but is unlikely to adversely affect wolverines

Cumulative Effects: Since road maintenance activities in the Norris to Golden Gate area would consist of many short duration projects that would occur within the existing road prism, the cumulative effects of this project on threatened and endangered species would not adversely affect the Canada lynx, grizzly bear, or the gray wolf.

Conclusion: The effect to Canada lynx, grizzly bears, gray wolves, and wolverines would be short-term, local, site-specific, indirect, and negligible, since these species and their habitat are not significantly affected by the no-action alternative. The no-action alternative would not have any significant impact on elk or any of the other species preyed upon by wolves. Effects to all species would be negligible due to limiting the project area to the existing footprint.

Impacts of Alternative B (Preferred Alternative)

Canada lynx. Road overlay and construction activities supporting minor road and parking lot improvements would have no direct effects on lynx because this species apparently does not occur in this area (Murphy et al. 2004). Lynx may occasionally travel through the area when making dispersal-related or extra territorial movements, but direct visual and auditory disturbance would probably be temporary and insignificant to a traveling individual. Heavy equipment that would be in use during the day, and typically parked at night, would not represent a significant barrier to lynx movement. The Norris to Golden Gate Road Segment does not occur in a Lynx Analysis Unit or transect lynx habitat mapped in the park. New vegetation disturbance associated with drainage ditch improvement would be insignificant. The project would pave several new turnouts in an area that likely supports few snowshoe hares (Murphy 2005). The entire project would affect approximately 28.34 hectares (70.02 acres). In conclusion, the affect would be short-term, local, site-specific, indirect, and likely negligible, since lynx, lynx prey species, and lynx habitat are insignificantly affected by the preferred alternative, and likely do not occur within the project area. For section 7 of the Endangered Species Act (ESA), Alternative B would have “may affect, not likely to adversely affect” on Canada lynx.

Grizzly Bear. Roads appear to affect bears through a variety of human activities associated with and facilitate by improved access (McLellan 1990). Increased access precipitates increased frequency of encounters between bears and humans, usually with negative consequences for bears (Mattson 1990). Park roads within or adjacent to bear habitat can affect bear populations, both directly and indirectly. Direct effects include human-caused bear mortality (including road-killed bear mortality) and loss of habitat that is paved during road and turnout construction. Indirect effects include reduction of habitat effectiveness due to human-caused displacement of bears form high quality habitat adjacent to road corridors. Bears may also be indirectly affected by roads through habituation to humans and other behavior modifications. Some increase in vehicle speed could occur due to a smoother and wider road surface, though posted speed limits would remain the same, or be decreased in some high-use pedestrian areas.

Widening the roadway, and expanding the Norris Geyser Basin parking lot would cause the greatest portion of habitat loss. The paving of informal turnouts areas would result in very little actual habitat loss. The soils within the informal turnouts have been compacted from use and much of the vegetation destroyed. The construction of widening the roadway, paving turnouts, and expanding parking would result in an estimated loss of approximately 28.33 hectares (70 acres) of habitat. This habitat loss would be partially mitigated with the removal and revegetation of some turnouts, and the revegetation of some over-steppened cut and fill slopes.

Bears may be temporarily displaced from roadside habitat by the noise and disturbance of construction activities. Human-caused displacement of bears from habitat near recreation developments (Mattson and Henry 1987, Reinhart and Mattson 1990), roads (Green and Mattson 1988, Craighead et al. 1995), backcountry campsites (Gunther 1990), and recreational trails in nonforested areas (Gunther 1990), has been documented. Bears generally exhibit the strongest avoidance of occupied front-country human developments (Mattson 1990). Displacement can be minimized by reducing the temporal and spatial overlap between bear and construction activity. Grizzly bears in Yellowstone are most active during evening, night, and early morning time periods (Schleyer 1983, Harting 1985, Gunther 1991), and most grizzly bear activity reports were recorded along the road during the spring and summer seasons. Road construction is expected to occur primarily, although not exclusively, during daylight hours, with the majority of construction likely to occur late spring through fall. For Section 7 of the ESA, the proposed project “may affect, but is not likely to adversely affect” grizzly bears.

Gray Wolf. Gray wolves use habitat in the project vicinity. While some wolves may be temporarily displaced from roadside habitat by noise and disturbance from construction activities, wolves travel widely and have not appeared to alter their habitats even when being viewed by hundreds of visitors. The formalization of many turnouts would likely enhance visitor opportunities to view wolves. The Programatic Biological Assessment for the Parkwide Road Improvement Plan, allows an incidental take of up to two wolves per year due to vehicle strikes within the park. For section 7 of the ESA, the proposed project “may affect, likely to adversely affect” wolves.

Wolverine. While tracks have been occasionally reported along this corridor, systematic surveys have detected no wolverine home ranges in the Gallatin mountain range to the west, or the Washburn mountain range to the east of the Norris to Golden Gate road corridor. For this reason, this project may affect, but is unlikely to adversely affect wolverines.

Cumulative Effects: This project along with past and foreseeable future projects would have minor to moderate impacts on threatened and endangered species. Individuals of a species

have been displaced due to construction activities, though no population level impacts have been recorded.

Conclusion: The grizzly bear, gray wolf and Canada lynx are protected pursuant to the Endangered Species Act (ESA) of 1973, as amended, and present within potential project areas in the park. The Norris to Golden Gate road segment is not within a Lynx Analysis Unit of the park, and would therefore be a "No Effect" per Section 7 of the ESA. Preliminary design has shown that 28.3 hectares (70 acres) of new impacts and 46.39 hectares (114.63 acres) of previously affected land would be impacted from this project. Some loss of wolf and grizzly habitat would occur; construction activities should not significantly affect wolf or grizzly behavior or travel patterns. The Parkwide Road Biological Assessment submitted to U.S. Fish and Wildlife Service (USFWS) in 2008 and the subsequent Biological Opinion prepared by the USFWS in 2009 for the Yellowstone Park Roads Program, meets the Section 7 requirements of the ESA for this project. The *Biological Opinion* stated that the Parkwide Road Program would have a "may affect, likely to adversely affect" gray wolves and grizzly bears. The Norris to Golden Gate road reconstruction project is included as part of a Parkwide Roads Program for which Section 7 compliance is complete.

Migratory Bird Species Including Species of Management Concern

Bald Eagle. Road overlay and construction activities supporting minor road and parking lot improvements would have no direct effects on bald eagles because eagles are mostly in the area in the winter. There are no known bald eagle nests within one mile of the Norris to Golden Gate road corridor. Bald eagles may occasionally travel through the area, but direct visual and auditory disturbance would probably be temporary and insignificant to a traveling individual. If any eagle nests are found they would be monitored throughout the project, no blasting would occur during the months of April through August to avoid impacting nesting eagles. In conclusion, the affect would be short-term, local, site-specific, indirect, and likely negligible, since bald eagles and bald eagle habitat is insignificantly affected by the preferred alternative.

Peregrine Falcon. Peregrine falcons reside in Yellowstone from April through October, nesting on large cliffs. Peregrine falcons have been observed nesting near the Norris to Golden Gate road corridor through 2010. An active peregrine eyrie occurs in the vicinity of the road. The most critical time for nesting peregrines is during the incubation period. Typically, this occurs during the entire month of May, but can extend into June. Blasting in this area during road construction would be prohibited from April 15 through June 22 to avoid disturbing peregrines during the incubation period. In addition, the nest would be monitored during construction in the nest vicinity. With the implementation of the blasting restriction described in Chapter 2, impacts to Peregrines would be adverse and minor.

Trumpeter Swan. Swans have been observed in the project area, though are not known to nest in the area. Impacts to Swans would be negligible from the proposed project.

White Pelican. White Pelicans have been observed in the project area, though are not known to nest in the area. Impacts to pelicans would be negligible from the proposed project.

Various Bird Species. Construction activities along the road corridor would temporarily displace various bird species. Where previously undisturbed ground was developed, a permanent loss of habitat would occur. Some nesting birds could be displaced by tree cutting activities that occur prior to May-July, (the typical nesting period). Reconstruction of the road

(widening/smoother surface) may allow traffic to move faster which would likely increase road-kills of owl species in general. Maintenance of existing posted road speeds, continued curves throughout the alignment, and addition of turnouts for slower traffic should minimize the potential for road kill to owl species.

Cultural Resources

Historic and Prehistoric Archeological Resources

Intensity Level Definitions

Certain important research questions about human history can only be answered by the actual physical material of cultural resources. Archeological resources have the potential to answer, in whole or in part, such research questions. An archeological site(s) can be eligible to be listed in the National Register of Historic Places if the site(s) has yielded, or may be likely to yield, information important to prehistory or history. An archeological site(s) can be nominated to the National Register in one of three historic contexts or levels of significance: local, state, or national (see National Register Bulletin #15, How to Apply the National Register Criteria for Evaluation). For purposes of analyzing impacts to archeological resources, thresholds of change for the intensity of an impact are based upon the potential of the site(s) to yield information important in prehistory or history, as well as the probable historic context of the affected site(s).

The thresholds of change for the intensity of impacts to archeological resources are defined as follows:

Negligible: The impact is at the lowest levels of detection – barely measurable with no perceptible consequences to archeological resources.

Minor: Effects to historic or prehistoric archeological resources would be detectable (e.g., minor impact to non-contributing portion of the site previously impacted by road construction or impacts that do not affect the character-defining features and whose effect would result in little, if any, loss of significance or integrity. The National Register eligibility of the historic or prehistoric archeological site would not be affected by the project. A “minor effect” corresponds to a “no adverse effect” determination by the park for Section 106 purposes as determined through consultation with the State Historic Preservation Office.

Moderate: The impact to a National Register eligible archeological site that would have the potential to diminish the significance or integrity of the site that is locally or regionally important, and may jeopardize it National Register eligibility. A “moderate effect” corresponds to either an “adverse effect” or a “no adverse effect” depending on mitigation measures proposed. Mitigation measures for historic and prehistoric archeological resources are identified in the parks’ road programmatic agreement and are identified though consultation with the State Historic Preservation Office to develop an archeological data recovery plan that would preserve as much of the site as possible and still provide significant archeological data about the site.

Major: The impact affects an archeological site that is nationally important and the effects of the impact cannot be mitigated. A “major effect would correspond to an “adverse effect” for Section 106 purposes.

The road corridor adjacent to, and in the vicinity of, the Golden Gate to Norris road segment is rich with precontact archeological sites, many of which are associated with the Obsidian Cliff tool stone quarries and many of which have not been previously impacted by the current road and will continue to be avoided by the proposed road improvements. The precontact archeological sites represent places native people stopped, as long ago as 11,000 years ago until about 300 years ago, after having procured obsidian from the cliff quarry site or as cobbles along the river banks, to reduce the stone down to shapes and sizes that were more easily transported. Six precontact sites eligible for listing on the National Register of Historic Places are bisected by the current road alignment, constructed in the 1930's. Archeological sites 48YE 128, just south of Seven-Mile Bridge, site 48YE201, at the Moose Exhibit Kiosk area, and site 48YE357 on the south end of Swan Lake Flats are all north of Obsidian Cliff National Historic Landmark. Sites 48YE114, near Nymph Lake, site 48YE116, near Solfatara trailhead parking, and site 48YE406 just north of Norris campground are south of Obsidian Cliff. Through consultation with the WYSHPO, data recovery plans for these sites have been developed to mitigate the effect of rehabilitation and widening of the road corridor through the sites. Additional impacts to all other historic or prehistoric archeological sites within the area of potential effect of the road rehabilitation will be avoided by design alterations.

Impacts of Alternative A (No-Action Alternative)

Prehistoric and Historic Archeological Sites. The no-action alternative would result in continued impact to historic and prehistoric archeological sites previously bisected by road and parking area construction, repair and maintenance of culverts and bridges, the creation of social turnouts for animal viewing and viewing of Obsidian Cliff National Historic Landmark, and unauthorized collection of surface artifacts and obsidian by park visitors.

Natural deterioration of the road structure would contribute to the deterioration of those archeological features adjacent to the roadway. Numerous short duration road and road feature repair and maintenance would not be proceeded by archeological data recovery therefore, the potential for impact to the historic or prehistoric archeological sites would exist. No additional archeological data would be gathered to further inform the staff and public about the prehistoric use of the parks resource and the historic development of the park via the road corridors.

Cumulative Effects: In areas where the road bisects the NR eligible historic and prehistoric archeological sites, effects of past construction and repeated past, present and future attempts to repair the road surface and substructure of the present road corridor, have caused the loss of archeological data at sites such as the Norris hotel and Larry's Lunch Station.

Conclusion: The no-action alternative would result in minor impacts to the National Register eligible historic and prehistoric archeological sites located within the road corridor.

Impacts of Alternative B (Preferred Alternative)

Prehistoric and Historic Archeological Sites. Data recovery plans have been developed for all six prehistoric archeological sites and the Wyoming State Historic Preservation Office has previously approved all of the data recovery plans. Excavation, processing and analysis of the artifacts are complete for sites 48YE114, 48YE116, and 48YE406 and the data recovery reports are being drafted. Excavation is completed for site 48YE357 with artifact processing and analysis almost complete. Geophysical testing is completed for site 48YE201 and data recovery excavations began in the 2010 field season for site 48YE128.

The road corridor proposed for Alternative B would be carefully designed to avoid any impact to the Obsidian Cliff National Historic Landmark, with construction activities remaining outside the landmark boundary on the east side of the road. A path and viewing area would be constructed to connect the Obsidian Cliff Kiosk with a viewing area for observing the cliff. This viewing area, it is hoped, would enhance the visitor understanding of the significance of the National Historic Landmark, along with decreasing unauthorized collection of obsidian.

Several historical archeological sites have been documented as part of the early planning for this proposed project. The site of the 1890s Norris Hotel which burned shortly after construction, the subsequently constructed Larry's Lunch station, which also burned, and the historic trash associated with the early developments at Norris were documented in the initial planning stages for the proposed undertaking and the road improvements were and will continue to be designed to avoid any impact to the historic archeological sites.

Cumulative Effects: Road construction that occurred in the 1930s caused the most impact to the historic and prehistoric archeological sites by bisecting the sites prior to the requirements for documentation and data recovery. The effect of this alternative on six prehistoric sites is mitigated by the information gained through data recovery excavations and analysis of the archeological data retrieved. The documentation of the historic and prehistoric archeological sites in the vicinity prior to the planning of this proposed project provides information necessary to avoid impact to the sites from future road repairs and rehabilitation.

Conclusion: The impact to the six prehistoric archeological sites bisected by the current road would be minor to moderate with the recovery of archeological data from the portion of the sites where the roadway is proposed to be expanded leaving the major portion of the archeological sites undisturbed, mitigates the impact by providing significant information about the characteristics of the site. Through consultation and collaboration with the Wyoming State Historic Preservation officer on the data recovery plans, the National Register eligibility status of the sites would not be affected. Impact to the Obsidian Cliff National Historic Landmark would be completely avoided by design and therefore have negligible impact. Avoidance of the historic archeological sites by road design would have negligible impact to those sites.

Historic Structures

Intensity Level Definitions

The methodology used for assessing impacts to historic structures is based on how the project will affect the features for which the structure is significant. The thresholds for this impact assessment are as follows:

Negligible: The impact is at the lowest levels of detection, barely perceptible and not measurable.

Minor: *Adverse*: The impact is measurable or perceptible, but it is slight and affects a limited area of a structure or group of structures. The impact does not affect the character defining features of a National Register of Historic Places eligible or listed structure and would not have a permanent effect on the integrity of the structure.

Beneficial: Stabilization/preservation of features is in accordance with the *Secretary of the Interior's Standards for the Treatment of Historic Properties*.

Moderate: *Adverse*: The impact is measurable and perceptible. The impact changes one or more character defining feature(s) of a historic structure, but does not diminish

the integrity of the resource to the extent that its National Register eligibility is jeopardized.

Beneficial: Rehabilitation of a structure is in accordance with the *Secretary of the Interior's Standards for the Treatment of Historic Properties*.

Major: *Adverse*: The impact is substantial, noticeable, and permanent. For National Register eligible or listed historic structures, the impact changes one or more character defining features(s) of the historic property, diminishing the integrity of the structure to the extent that it is no longer eligible for listing on the National Register.

Beneficial: The impact is of exceptional benefit and the restoration of a structure is in accordance with the *Secretary of the Interior's Standards for the Treatment of Historic Properties*.

Impacts of Alternative A (No-Action Alternative)

The no-action alternative would result in minor to moderate adverse impacts to the National Register eligible Grand Loop Road (48YE520) as no changes are proposed, but on-going benign neglect of the nationally significant road would continue. Continued deterioration of historic masonry would occur, and over time would need maintenance and repair to keep functioning and retain their historic character.

Cumulative Effects: This alternative has an overall negative effect to historic properties in the project area due to the deterioration of historic headwalls, guardwalls, and bridges. The effect of the 70-year old structures continuing to deteriorate over time, under the no-action alternative, would have an overall minor to moderate cumulative adverse affect to historic structures. Biennial inspections of the historic bridges indicate that the eminent total bridge failure of the 7-Mile Bridge (estimated life expectancy – 3 years) and Obsidian Creek Bridge (estimate life expectancy – 5 years) would cause road closures and, combined with the loss of the historic bridges, would create adverse impact to the bridges and the road. Because there is some effect (benign neglect) to historic structures from unchecked deterioration under this alternative, it would have a minor incremental adverse effect that would be added to the overall cumulative effect.

Conclusion: As there is continued deterioration of masonry headwalls, guardwalls, and bridges and pavement structure, the no-action alternative would result in minor to moderate impacts to historic structures because only very limited maintenance activities would be conducted. The cumulative disturbance of historic structures of this alternative, when considered with other past, present, and reasonably foreseeable future actions would be considered minor to moderate and adverse.

Impacts of Alternative B (Preferred Alternative)

The preferred alternative for the reconstruction of the Norris Junction to Golden Gate segment of the National Register eligible Grand Loop Road (48YE520) would have direct impacts on the road and its contributing features (including retaining walls, guardwalls, masonry box culverts and culvert headwalls, and stone curbing) and two historic bridges within the project area. The historical significance of the Norris to Golden Gate road segment derives from the overall site and setting and the long-standing function of conveying visitors to special places within the park. The road is also nationally significant for its association with Hiram Chittenden and for being one of the first federal road building projects in the nation, especially in such a remote location and difficult terrain. The importance is not in the width, alignment, surfacing, or traffic patterns, or in the road's appearance during the historic period. Work would be guided by protective and

mitigation measures described in the 1994 programmatic agreement (PA) among the NPS, MT and WY SHPOs, and ACHP.

Widening the existing road to a 30-foot width would affect some 152 culverts, several retaining walls and guard walls, a stone flume and an armored embankment. However, as described in the road programmatic agreement, rehabilitated or reconstructed bridges, culvert headwalls, retaining and guard walls, parking areas, or other features would retain the appropriate scale, form, and historic appearance to blend with the natural and historic setting. All culverts have been documented using the Historic American engineering Record and the National Register of Historic Places Nomination Form. The documentation was reviewed by the Wyoming SHPO who concurred that the park's survey responsibilities for structures, as described in the road programmatic agreement had been completed. Culvert headwalls that retain integrity and are visible from the road or other visitor areas would be carefully dismantled and reassembled to preserve their historic appearance. Existing or similar materials would be used for new/rebuilt culverts, and the original design and quality of workmanship would be retained. Parking area redesign and slope excavation in various areas may result in the addition of stone guard walls and guard rails, but stone color and workmanship would match historic appearance of documented structures.

Stone abutments of the rehabilitated 7-mile bridge across the Gardner River, the concrete abutments on the Obsidian Creek Bridge, and the culverts and walls along the road would be designed to be visually compatible with the historic roadway.

Cumulative Effects: The past effect of repair to the historic structures along this segment of roadway is minor considering the extensive number of historic features associated with the roadway and the number of conditions contributing to their disrepair. The earthquake of 1959, felt throughout the park, caused damage to the stone masonry retaining and guard walls along this road segment –damage that has not yet been adequately repaired. Naturally occurring rock fall, repeated overlays of asphalt, repeated vehicle strikes, and slumping caused by poor drainage and loss of support material behind the walls, is common, as in most areas of the park, has contributed to the current need to repair the historic road features. Although past repairs did not maintain the high quality of workmanship as the original construction, other aspects such as materials, location, design, setting, and association of the historic characteristics of the roadway and its features have been retained. The proposed reconstruction and widening of the roadway and associated features would be done in consultation with the WYSHPO and in accordance with the stipulation of the road programmatic agreement and within the Secretary of the Interiors' Standards to insure the historic integrity of the road historic district is retained. The proposed treatment for the nationally significant historic road is similar to the treatment previously completed on other segments of the roadway and would result in moderate beneficial impacts for the historic structures by maintaining them into the future. The proposed reconstruction of the roadway would greatly reduce the need for future repairs of the roadway contributing to the retention of the historic character of the road.

Conclusion: The impact to the historic road and its character defining features from the proposed reconstruction and widening of the driving surface, and the rehabilitation of the historic bridges would have a moderate beneficial impact in that the work would be done in accordance with the *Secretary of the Interior's Standards for the Treatment of Historic Properties*. Further, the work would be accomplished according to the stipulations of the road programmatic agreement so that the reconstruction does not diminish the integrity of the historic road to the extent that its National Register eligibility is jeopardized. The preferred alternative would result in moderate beneficial effects to the historic road due to the repairs that would be made to the road during reconstruction activities.

Ethnographic Resources

Intensity Level Definitions

Ethnographic resources have the potential to address questions about contemporary peoples or groups, their identity, and heritage. The ethnographic linkage is vested in specific places of traditional use with cultural meaning. Ethnographic resources can be eligible for inclusion in the National Register of Historic Places. Ethnographic resources can be documented in a variety of ways such as using state historic property forms or tribal documentation forms. To those for whom the resources hold cultural meaning, impacts to ethnographic resources range from barely perceptible, slight but noticeable, apparent, and strikingly obvious. Respectively these impacts correlate with the terms *negligible*, *minor*, *moderate*, and *major*. For purposes of analyzing potential impacts to ethnographic resources, the thresholds of change for the intensity of an impact are defined below. The thresholds for this impact assessment are as follows:

Negligible: Adverse impact – impacts(s) would be barely perceptible and would neither alter resource conditions, such as traditional access or site preservation, no the relationship between the resources and the affiliated group's body of beliefs and practices. Beneficial impact – there would be no change to a group's body of beliefs and practices. For purposes of Section 106, the determination of effect would be *no adverse effect*.

Minor: Adverse impact – impact(s) would be slight but noticeable and would neither appreciably alter resource conditions, such as traditional access or site preservation, nor the relationship between the resource and the affiliated group's body of beliefs and practices. Beneficial impact – would allow traditional access and/or facilitate a group's traditional practices or beliefs. For purposes of Section 106, the determination of effect would be *no adverse effect*.

Moderate: Adverse impact – impact(s) would be apparent and would alter resource conditions, such as traditional access, site preservation, or the relationship between the resource and the affiliated group's beliefs and practices, but the group's beliefs and/or practices would survive. For the purposes of Section 106, the determination of effect would be *adverse effect*. Beneficial impact – would accommodate a group's beliefs and practices. For purposes of Section 106, the determination of effect would be no *adverse effect*.

Major: Adverse impact – impact(s) would alter resource conditions, such as traditional access, site preservation, or the relationship between the resource and the affiliated group's body of beliefs and practices, to the extent that the survival of a group's beliefs and/or practices would be jeopardized. For purposes of Section 106, the determination of effect would be *adverse effect*. Beneficial impact – would encourage a group's beliefs or practices. For purposes of Section 106, the determination of effect would be *no adverse effect*.

Impacts of Alternative A (No-Action Alternative)

Through consultation with Yellowstone National Park's affiliated tribes initiated in 2002 and completed in 2003, including two ethnographic studies of the project area, tribes identified ethnographic resources within the project area. It is well known that there are ethnographic resources in the area, including the Obsidian Cliff National Historic Landmark and various plants and animals. The impacts of the no-action alternative would be negligible.

Cumulative Effects: Cumulatively, the effects of past projects, combined with the no-action alternative would be negligible and adverse. The present project provided ethnographic survey of the area so impacts both present and future to resources of significant cultural value to native peoples can be avoided. Additional and continued research on the Bannock Trail and other ancient travel corridors will protect these ethnographic resources from further future impact. Plant and animal resources within the project area are present in many other places within the park decreasing any cumulative effect of the road rehabilitation on those ethnographic resources.

Conclusion: The no-action alternative would result in minor and adverse impacts associated with continued unauthorized collecting of obsidian at the Obsidian Cliff National Historic Landmark and lack of knowledge and understanding about the importance of the parks natural resources to native peoples.

Impacts of Alternative B (Preferred Alternative)

The preferred alternative would widen the road avoiding impact to the Obsidian Cliff NHL area while restricting pedestrian access and unauthorized collection of obsidian. The rehabilitation of the Obsidian Cliff Kiosk area would provide better visitor understanding of the ethnographic significance of the ancient toolstone quarry and proved a safe but distant viewing area for the cliff. No ancient trail system (referred to as the "Obsidian Trail") has yet to be identified within the vicinity of Obsidian Cliff, no impacts can be anticipated. Expansion of the Sheepeater parking area would provide greater access to the area while avoiding impact to the areas where significant archeological resources are located. Since the exact location of the Bannock Trail has not yet been identified by native peoples or archeologists –the corridor of passage being more of a concept rather than a location on the landscape, there will be no new impact from widening the current road alignment. The plants and animals identified in the ethnographic surveys are plentiful in many other areas of the park, minimizing the impact to these ethnographic resources by the road widening undertaking. Thermal areas were identified in the ethnographic inventories as significant to native people. The preferred alternative will reduce impact to thermal areas at Frying Pan Springs and avoid impact to other thermal areas to the greatest extent possible.

Cumulative Effects: The past effects of road construction may have impacted yet to be identified ethnographic resources at the Obsidian Cliff, Bannock Trail, Sheepeater Cliff, and thermal areas. Knowledge gained through the recent ethnographic studies conducted for this road improvement project and continued consultation with Native Tribes, significant ethnographic resources have been identified and further impact to those resources will be avoided by design. Continued research on native trail would contribute to better protection of those resources in the future. Cumulative impacts to ethnographic resources are considered to be minor.

Conclusion: This alternative would have negligible to minor but beneficial impacts on ethnographic resources by formalizing a viewing and interpretive area at Obsidian Cliff and by ensuring that known ethnographic resources are avoided by construction activities. Implementation of the preferred alternative would not constitute an impairment to the ethnographic resources within the road improvement project area as identified through survey and consultation with native peoples.

Cultural Landscapes

Cultural landscapes are the result of the long interaction between people and the land, the influence of human beliefs and actions over time upon the natural landscape. Shaped through time by historical land-use and management practices, as well as politics and property laws,

levels of technology, and economic conditions, cultural landscapes provide a living record of an area's past, a visual chronicle of its history. The dynamic nature of modern human life, however, contributes to the continual reshaping of cultural landscapes; making them a good source of information about specific times and places, but at the same time rendering their long-term preservation a challenge. Cultural landscapes are defined by the Intermountain Region of the NPS as geographic areas that have meaning for people. Within cultural landscapes, people have been, in some cases, still are, modifying, interacting with, and giving human meaning to the land. The landscape does not need to contain visible evidence of human manipulation to be considered a cultural landscape. "Cultural Landscapes" refer to a way of seeing, where all aspects of a place –natural and cultural—are considered together as a part of an integrated, holistic system.

In order for a cultural landscape to be listed in the National Register, it must possess significance (the meaning or value ascribed to the landscape) and have integrity of those features necessary to convey its significance. The character defining features of a cultural landscape include spatial organization and land patterns; topography; vegetation; circulation patterns; water features; and structures/buildings; site furnishings and objects (see *The Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for the Treatment of Cultural Landscapes*, 1996). For purposes of analyzing potential impacts to cultural landscapes, the thresholds of change for the intensity of an impact are defined as follows:

Intensity Level Definitions

Negligible: Impact(s) is at the lowest levels of detection with neither adverse nor beneficial consequences. The determination of effect for §106 would be no adverse effect.

Minor: **Adverse impact** — alteration of a pattern(s) or feature(s) of the landscape would not diminish the overall integrity of the landscape. The determination of effect for §106 would be no adverse effect.

Beneficial impact — preservation of landscape patterns and features in accordance with the Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for the Treatment of Cultural Landscapes. The determination of effect for §106 would be no adverse effect.

Moderate: **Adverse impact** — alteration of a pattern(s) or feature(s) of the landscape would diminish the overall integrity of the landscape. The determination of effect for §106 would be adverse effect. A memorandum of agreement is executed among the National Park Service and applicable state or tribal historic preservation officer and, if necessary, the Advisory Council on Historic Preservation in accordance with 36 CFR 800.6(b). Measures identified in the MOA to minimize or mitigate adverse impacts reduce the intensity of impact under NEPA from major to moderate.

Beneficial impact — rehabilitation of a landscape or its patterns and features in accordance with the Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for the Treatment of Cultural Landscapes. The determination of effect for §106 would be no adverse effect.

Major: **Adverse impact** — alteration of a pattern(s) or feature(s) of the landscape would diminish the overall integrity of the landscape. The determination of effect for §106 would be adverse effect. Measures to minimize or mitigate adverse impacts cannot be agreed upon and the National Park Service and applicable state or tribal historic preservation officer and/or Advisory Council are unable to

negotiate and execute a memorandum of agreement in accordance with 36 CFR 800.6(b).

Beneficial impact — restoration of a landscape or its patterns and features in accordance with the Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for the Treatment of Cultural Landscapes. The determination of effect for §106 would be no adverse effect.

Impacts of Alternative A (No-Action Alternative)

The no-action alternative would result in no improvements being made to the road, continued erosion, spalling mortar joints on stone headwalls and retaining walls, and trampling in overused pedestrian areas and social vehicular turnouts would continue to occur, degrading the natural features along the roadway. Vistas and viewsheds become overgrown and not maintained while viewing areas degrade into disrepair. The masonry and log features that contribute to the historic character of the road would not be maintained. The historically designed landscape of this segment of the Grand Loop Road, designed by Hiram Chittenden and the Army Corp of Engineers to lay lightly on the land and to harmonize with the pristine natural landscape would fall into a state of deterioration. The aesthetic values that played a significant role in the development of landscape design in the national parks will be impacted by neglect and sloppy patchwork repairs. The Historic American Engineering Record recording of the Cultural Landscape of Yellowstone Roads, 2003, identify the built environment of the roads within the scenic wonders of the park as historically significant. The degradation of the historically designed landscape of any portion of the nationally significant Grand Loop Road would impact the integrity of the cultural landscape and the quality of the visitor experience.

Cumulative Effects: The no-action alternative along with past, and future projects would cumulatively have effects considered moderate and adverse. The past and present effect of not repairing and rehabilitation the bridges and road structure constitute benign neglect of characteristics of the cultural landscape of the road corridor and in the future would constitute an adverse effect on the cultural landscape due to failure of the bridges and portions of the road structure.

Conclusion: The no-action alternative would result in moderate adverse impact to historic designed cultural landscape of the Golden Gate to Norris section of the nationally significant Grand Loop Road. This would be due to continued deterioration of historic road features such as bridges, walls and headwalls.

Impacts of Alternative B (Preferred Alternative)

The road was historically designed to be part of the landscape. This design philosophy, using natural materials to harmonize with the landscape and a minimal scale that does not overpower the natural views and vistas, continues on to the present. The Grand Loop Road represents the continuation of a design philosophy in which the designed features impart to the visitor a feeling of "blending with nature." The road and its features lay lightly on the land and are considered part of the landscape rather than separate from the landscape.

Visual aspects of the cultural landscape in the vicinity of the highway would be temporarily impacted during and immediately following construction until vegetation has had a chance to grow, and rock cuts have aged and developed a patina. The design and materials used in new or reconstructed stone retaining walls and rockeries would match existing historic stonework and would not intrude on the cultural landscape. The Obsidian Cliff Kiosk is listed on the National Register as locally significant and all improvements to that historically designed

landscape will be consistent with the Secretary of the Interior's Standards for Treatment of Historic Properties with Guidelines for Treatment of Cultural landscapes. Historic features of the road landscape will be rehabilitated in-kind using natural materials to match the existing materials. The Apollinaris Springs constructed landscape was documented using the Cultural Landscape Inventory format and, again the park would avoid impact through road design. In the area of Apollinaris Spring the road surface would be widened to the west side of the road. The area containing the historic masonry and actual spring would be avoided, no impacts to the historic landscape would occur. At the Norris Geyser parking lot and pedestrian walks leading to the Norris Museum, some railing could be added to help control pedestrian traffic. These log rails and masonry posts would be designed to be compatible with the existing historic landscape. Minor changes to grades to allow for sidewalks in the vicinity of the Norris Geyser Museum to meet accessibility standards would have no effect as no character defining features would be changed.

Cumulative Effects: The past, present and future effect of the proposed preferred alternative would be moderate and beneficial. The original 1870s era rutted mud wagon road from Golden Gate to Norris was reconstructed in the 1930s to the current road alignment adding many stone culvert headwalls, stone retaining and guard walls, stone and log features at various viewing areas, and stone, log and lumber bridges to the cultural landscape of the road. The present preferred alternative for the rehabilitation of the historic designed road-scape would rehabilitate those 1930s era features and add a few new and compatible features, such as the obsidian boulder rockery at Obsidian Cliff NHL and many improved, and some new, parking areas designed to harmonize with the road cultural landscape. With the preferred alternative, future impacts to the cultural landscape of the road would be avoided.

Conclusion: The preferred alternative would have minor beneficial impacts to the Golden Gate to Norris segment of the Grand Loop Road cultural landscape. The character defining features that convey the historic significance would be rehabilitated to retain the cultural road-scapes integrity of setting, feeling, association, design, worksmanship, materials, and for the most part location. The physical "layers" of the developing constructed landscape of the road would be retained and interpreted to the visiting cyber public.

Social and Economic Resources

Intensity Level Definitions

The purpose of this impact analysis is to determine if the reconstruction of the Norris to Golden Gate road segment within the park is compatible or in conflict with the purpose of the park, its visitor experience goals, economic impacts on surrounding communities, and the direction provided by the NPS Management Policies. Thus, these policies and goals were integrated into the impact thresholds. To determine impacts, the current and past uses of an area were considered and the potential effects of road work and a wider road template on visitor experience analyzed.

The primary impacts analyzed in this section include the impact on visitor experience, both positive and negative, of providing a wider and smoother road, potentially shorter delays due to wildife jams, and any changes due to added or removed infrastructure.

Yellowstone National Park was established for the benefit and enjoyment of the people, and provide for the preservation and retention of its resources in a natural condition. The methodology used for assessing impacts to visitor use and experience is based on how a

reconstructed road would affect the visitor, particularly with regards to the visitors' enjoyment of the park's resources. The thresholds for this impact assessment are as follows:

Negligible: Visitors/businesses/economics would not be affected or changes in visitor use and/or experience would be below or at the level of detection. Any effects would be short-term. The visitor would not likely be aware of the effects associated with the alternative.

Minor: Changes in economics/visitor use and/or experience would be detectable, although the changes would be slight and likely short-term. The visitor/business would be aware of the effects associated with the alternative, but the effects would be slight.

Moderate: Changes in economics/visitor use and/or experience would be readily apparent and likely long-term. The visitor/business would be aware of the effects associated with the alternative, and would likely be able to express an opinion about the changes.

Major: Changes in economics/visitor use and/or experience would be readily apparent and have substantial long-term consequences. The visitor/business would be aware of the effects associated with the alternative, and would likely express a strong opinion about the changes.

Impacts of Alternative A (No-Action Alternative)

Socioeconomics. Under the No Action alternative, there would be no change in socioeconomic factors and no impacts would be expected.

Visitor Use and Experience. Under the No-Action alternative, traffic would still be congested and full stoppages of traffic are likely to occur at the frequent wildlife jams that occur on this road segment. Visitor use and experiences would only change as a result of annual changes in the number of visitors using the Norris to Golden Gate road segment.

Health & Human Safety. Congestion and poor traffic flow would continue to be a problem during busy times of the year, sharp drop offs at the pavement edge would remain, and an improper road base would mean that the pavement would continue to deteriorate more rapidly than it should. There would also continue to be visitor safety concerns primarily associated with traffic congestion, road condition, and pavement edge drops.

The no-action alternative would have minor effects on health and human safety because the existing safety concerns would remain unchanged. In particular, rough pavement surface, drop-offs at pavement edge, limited sight distance on some curves, and guard walls and rails that do not meet current design standards. Safety concerns at the Swan Lake/Golden Gate areas would remain, and concerns/interactions between horse use and hiker use would be unchanged.

Cumulative Effects: Any construction activities have the potential to affect visitor use and experience. The reconstruction of past road projects likely had an adverse effect on the visitor experience as a result of noise, dust, and unavailability to view some of the primary attractions in the park. Projects such as road improvements and infrastructure improvements have had or could have an adverse effect on visitor use and experience because of the inconvenience of construction noise, dust, and possible off-limit areas. Ultimately, however, these actions would have or had a beneficial effect on visitor use and experience because of long-term improvements to the human health and safety aspects of the park; the visual and natural environment; interpretive opportunities; and functionality of the park. Potential improvements to the Norris to Golden Gate road segment would also have a beneficial effect on visitor use and

experience. Under this alternative, although visitors may experiences some inconvenience from road construction activities, visitor functions in the project area are not expected to change, and past actions have had beneficial impacts on visitor use and experience. Therefore, cumulatively, visitor use and experience would not appreciably change when considered with other past, present, and reasonably foreseeable future actions.

Conclusion: The no-action alternative would result in primarily minor effects to visitor use and experience because the features and visitor functions in the project area would not change. This alternative may have a minor, long-term, adverse effect on visitor experience due to the continued deterioration of the road surface, and maintenance projects to repair it. Cumulatively, this alternative would have no effect on visitor use and experience when considered with other past, present, and reasonably foreseeable future actions.

Impacts of Alternative B (Preferred Alternative)

Socioeconomics. Under the action alternative businesses would see little change to revenues. The past road construction projects between Madison and Norris had 30 minute delays that allowed traffic through construction zones, and on to other areas of the park, and seem to have had little effect on businesses. Any change in revenues of businesses within or adjacent to the park would be negligible. Reconstruction of the Norris to Golden Gate road segment would cause short-term delays for visitors, staff, and concessioners. The reconstruction period is expected to last up to two construction seasons. Thirty minute delays are to be expected during most of this time, and night closures and temporary closures of up to a few days could cause additional impacts for visitors and businesses planning of vacations and work weeks. Delays and closures of the Norris to Golden Gate road segment during the primary visitor season (June-August) would cause minor short-term adverse impacts, primarily to concessioners operating within the park under National Park Service contracts. The park would make every effort to avoid closing the road segment during the primary visitor season and to keep the road open on weekends during the construction period. Long-term minor to moderate beneficial impacts would occur as a result of improved traffic flow, parking, and ease of loading and unloading of merchandise, supplies, and passengers.

Visitor Use and Experience. The preferred alternative would result in providing a wider and better designed driving surface, improved traffic flow, decreased congestion, and provide additional and standard turnouts along the road. The sharp drop offs at the pavement edge (due to multiple pavement overlays) would in most cases be eliminated. Visitors traveling through construction areas would experience short-term inconveniences. Dust, fumes, noise, and rough rods would be expected. There would be some increased hazards because of construction work. Some staging areas may intrude on visitor experiences if highly visible locations, or high use turnouts or trailheads are used. Most trailheads along this road segment would remain open and useable during construction. Only when construction operations are working in the direct vicinity of trailheads would those areas be closed.

Visitors would encounter up to 30-minute (or possibly longer) traffic delays waiting for one-way traffic to clear. Delays from slow-moving traffic passing through active constructing sites would occur. Nighttime and late-season closures would help facilitate the work and reduce the total time necessary to complete construction. Inconvenience and public safety concerns would be reduced by a public information program warning of closures, delays, and road hazards.

Better design and additional vehicle turnouts would provide more and higher quality opportunities for viewing scenery and wildlife along this road segment.

The new parking area serving the Bunsen Peak Trail would be visible from the main road at Swan Lake Flat to traffic traveling north. Widening the access road to this parking area would require some cutting to widen the existing road. This cut would also be visible from this same area.

A short segment of the Howard Eaton trail above the Golden Gate area cliffs, may need to be closed for a short period of time during any blasting or scaling operations in this area.

Health & Human Safety. Long-term benefits for visitors would include improved safety for motorists and bicyclists. As a result of this reconstruction work, the potential for accidents and vehicle damage would be reduced. Implementation of the preferred alternative would address a safety concern created by sharp drops at the pavement edge created by multiple asphalt overlays found in numerous locations along the road. An improved road base would decrease the amount of water migrating under the pavement and an increased number of potholes in the spring during freeze/thaw cycles. Visitor safety could be improved in the area of some thermal areas along the road by adding formal trails, signs, and controlling access with short segments of boardwalk and rail.

Cumulative Effects: Any construction activities have the potential to affect visitor use and experience. The reconstruction of this road, along with other road construction and maintenance projects within the park likely would have temporary adverse effects on the visitor experience as a result of noise, dust, and unavailability to view some of the primary attractions in the park. Road improvement projects could have temporary adverse effects on visitor use and experience because of the inconvenience of construction noise, dust, and possible off-limit areas. Ultimately, however, these actions would have or had a beneficial effect on visitor use and experience because of long-term improvements to the human health and safety aspects of the park; the visual and natural environment; interpretive opportunities; and functionality of the park. Potential improvements to the Norris to Golden Gate road segment would also have a beneficial effect on visitor use and experience. Considering past, present, and reasonably foreseeable future actions, the minor to moderate beneficial effects of reconstructing the road would have a minor cumulative benefit to the overall visitor use and experience at the park.

Conclusion: Improvements to the road and its associated parking and turnouts, culverts, and drainage structures are expected to have a minor to moderate long-term beneficial impact on visitor use and experiences. Alternative B would have a beneficial impact by improving traffic flow, safety, and reducing maintenance delays. Adverse impacts on visual quality associated with reconstruction are expected to be minor to moderate and short-term, becoming unnoticeable with time as vegetation fills in. Construction disturbances (noise, dust, limited areas) would have a minor, temporary adverse effect to visitor use and experience. This alternative is expected to have a beneficial impact on visitor use and experiences.

Park Operations

Intensity Level Definitions

Implementation of a project can affect the operations of a park such as the number of employees needed; the type of duties that need to be conducted; when/who would conduct these duties; how activities should be conducted; and administrative procedures. For the purpose of this analysis, the human health and safety of park employees is also evaluated. The methodology used to assess potential changes to park operations are defined as follows:

Negligible: Park operations would not be affected or the effect would be at or below the lower levels of detection, and would not have an appreciable effect on park operations.

Minor: The effect would be detectable, but would be of a magnitude that would not have an appreciable adverse or beneficial effect on park operations. If mitigation were needed to offset adverse effects, it would be relatively simple and successful.

Moderate: The effects would be readily apparent and would result in a substantial adverse or beneficial change in park operations in a manner noticeable to staff and the public. Mitigation measures would probably be necessary to offset adverse effects and would likely be successful.

Major: The effects would be readily apparent and would result in a substantial adverse or beneficial change in park operations in a manner noticeable to staff and the public, and be markedly different from existing operations. Mitigation measures to offset adverse effects would be needed, could be expensive, and their success could not be guaranteed.

Impacts of Alternative A (No-Action Alternative)

National Park Service Operations. Traffic jams caused by wildlife viewing or accidents would continue, driving times on this corridor would remain tentative. The narrower width of this road would likely contribute to more temporary delays from slower traffic flow around accidents and emergency situations. Road closures due to road maintenance activities for this older and inadequately designed road would continue.

Maintenance Operations/Facility Management. As the road continues to deteriorate due to improper base, drainage, and high use, maintenance needs of this road corridor would continue to increase over time. A higher percentage of park funds would need to be directed to address safety concerns and keep the road passable for visitors.

Emergency Services. Emergency vehicles would continue to respond to emergency situations along the road segment and beyond. The lack of shoulders and existing road width would increase the likelihood of traffic congestion due to wildlife jams. If these traffic jams are large, increased time would be required for emergency vehicles to negotiate through these areas.

Concession Operations. Concession-operated vehicles would continue to experience delays in delivering goods, supplies, and responding to maintenance issues due to the less efficient traffic movements on the Park's narrower roads. There would be no change in the status quo of how concession operations occurs by not reconstructing the Norris to Golden Gate Road Segment.

Yellowstone Association. The Yellowstone Association employees offer tours and classes within the park, and experience the same delays and the rest of park visitors and staff. No change in operations is expected with the no-action alternative.

The existing Norris to Golden Gate road segment would continue to be used, the road surface would continue to deteriorate due to improper base and drainage, vehicle flow would continue to be inefficient due to a narrow width preventing traffic flow at wildlife jams, and safety issues along the road would remain unaddressed.

The existing road contains numerous structural and safety deficiencies, which could potentially endanger visitors and employees. Over time, these structural deficiencies would also require the expertise and time of the maintenance crew to repair, which increases the current workload of these employees. The road also has safety issues with some curve alignments, poor sight distances, and poor recovery zones adjacent to the road. These problems pose potential

threats to visitors and employees who use the road. In time, these safety problems could have a minor to moderate adverse effect on both visitors and employees.

Cumulative Effects: Any project that occurs in the park has a potential to affect park operations; therefore, most of the actions listed in the cumulative scenario in the introduction of this chapter would have some degree of effect on employees and park operations. Projects such as the repaving of the Mammoth Area Roads in 2010, and the reconstruction of the Madison to Norris Road (completed in 2010) along with the impacts of this proposed project typically involve the many park staff to perform the work, contribute their expertise and assistance, and monitor project areas after construction is complete. Under this alternative, there would be a minor to moderate effect on park operations associated with the current and future use of the Norris to Golden Gate road; therefore, there would be a moderate effect on park operations when considered with other past, present, and reasonably foreseeable future actions.

Conclusion: The no -action alternative would have a minor to moderate adverse effect on park operations at Yellowstone National Park. The impact of increased maintenance to repair structural deficiencies of the existing Norris to Golden Gate road coupled with frequent wildlife jams and inefficient traffic flow for NPS, concession, and emergency vehicles would have adverse effects that are readily apparent. Cumulatively, these effects would have a moderate impact on park operations when considered with other past, present, and reasonably foreseeable future actions.

Impacts of Alternative B (Preferred Alternative)

The reconstruction of the Norris to Golden Gate road as described under the preferred alternative would provide a road that meets current design standards and would improve health and safety. Structural deficiencies associated with the existing road would not be present in the reconstructed road. Because of the improved integrity of the road base, maintenance crews would likely have a lighter work load than if the existing road were allowed to continue to deteriorate. Similarly, the reconstructed road would remedy many of the safety and maintenance problems that the existing road has.

National Park Service Operations. Construction delays of up to 30 minutes would decrease work efficiency minimally for those needing to travel through the construction zone. A potential six week closure of the road in the Golden Gate area in the fall would require work supervisors to plan work in advance to account for the closure. Traffic jams caused by wildlife viewing or accidents would become fewer and driving times on this corridor would be more predictable. The wider width of the road along with the fact that it is new and constructed with a proper road base should mean fewer road closures would be needed for maintenance and emergency situations.

Maintenance Operations/Facility Management. As the road would have a proper base, and drainage features would have been addressed, maintenance needs of this road corridor would be very low for a number of years. A higher percentage of park funds could be redirected to other park needs. No work on this road segment would need to be completed by NPS maintenance staff during construction, and work time for NPS staff would be diverted to other road segments within the park, thus helping increase road surface conditions parkwide.

Emergency Services. Emergency vehicles could respond to emergency situations along the road segment and would have an increased likelihood that traffic would continue to flow through traffic congestion at wildlife jams. During construction periods, emergency vehicles would be allowed through construction zones if emergency situations require.

Concession Operations. Concession-operated vehicles would have fewer delays in delivering goods, supplies, and responding to maintenance issues due to the more efficient traffic flow.

Preplanning of activities and stocking of supplies would need to be done in order to take into account travel delays and closures when they occur.
Yellowstone Association. The Yellowstone Association tours and classes within the park would also have fewer delays related to traffic on this road corridor.

The existing Norris to Golden Gate road segment would see improved traffic flow, and fewer delays related to maintenance. The road surface would be smooth, and offer additional opportunities to pull off the road to view wildlife and scenery. Safety issues along the road would be addressed.

Cumulative Effects: Projects listed in the cumulative scenario, along with this proposed alternative would have minor to moderate beneficial effects on park operations due to the increased efficiency and lower maintenance associated with the road segment.

Conclusion: The preferred alternative would have minor to moderate beneficial impacts on park operations at Yellowstone National Park. The impact of decreased maintenance, and improved traffic flow for NPS, concession, and emergency vehicles would have beneficial effects that are readily apparent. Cumulatively, these effects would have moderate beneficial impacts on park operations.

CONSULTATION AND COORDINATION

Internal Scoping

Internal scoping was conducted by an interdisciplinary team of professionals from Yellowstone National Park. Interdisciplinary team members met to discuss the purpose and need for the project; various alternatives; potential environmental impacts; past, present, and reasonably foreseeable projects that may have cumulative effects; and possible mitigation measures. The team also gathered background information and discussed public outreach for the project. Over the course of the project, team members have conducted individual site visits to view and evaluate the proposed construction site.

External Scoping

External scoping was conducted to inform various agencies and the public about the proposal to reconstruct the Norris to Golden Gate Road Segment in Yellowstone National Park and to generate input on the preparation of this environmental assessment. The scoping effort began on July 20, 2009 with a press release, mailing to interested parties, and posting of a scoping newsletter on the NPS Planning, Environment and Public Comment (PEPC) website. The 30-day scoping period ended on August 19, 2009.

A total of three written comments were received through PEPC. No comments were received from state or federal agencies, Scoping comments are discussed further in Chapter 1, *Purpose and Need*.

Agency Consultation

In accordance with the Endangered Species Act, the National Park Service contacted the U.S. Fish and Wildlife Service with regards to federally listed special status species for the Parkwide Road Improvement Plan. A biological assessment was prepared by the park, and a subsequent biological opinion was issued by the U.S. Fish and Wildlife Service. The results of these consultations are described in the *Special Status Species* section in the *Purpose and Need* and *Environmental Consequences* chapters.

In accordance with Section 106 of the National Historic Preservation Act, the National Park Service provided the Wyoming State Historic Preservation Officer an opportunity to comment on the effects of this project. The results of this consultation are described in the *Historic Structures* section in the *Environmental Consequences* chapter.

Native American Consultation

The Shoshone-Bannock Tribe completed an on-site survey of Mammoth to Norris road segment the summer of 2001. The final report of their ethnographic survey was received by the park in December of 2003. In March of 2002, letters were sent to the 26 tribes formally associated with Yellowstone National Park notifying them of plans for road improvements along the Mammoth to Norris road corridor, including copies to tribal cultural and natural resource program managers. The letter invited tribes to consult, provide information about ethnographic resources of concern, and to make on-site visits to this road segment.

During April and May of 2002, follow-up phone calls were made to the associated tribal contacts to inquire of their concerns about the proposed road project. The tribes that the park was able to make phone contact with included the Assiniboine and Sioux tribes, Blackfoot, Crow, Coeur d'Alene, Cheyenne River Sioux, Rosebud Sioux, Standing Rock Sioux, Spirit Lake Sioux,

Yankton Sioux, Crow Creek Sioux, Oglala Sioux, Kiowa, Nez Perce, Confederated Tribes of the Umatilla Indian Reservation, Confederated Tribes of the Colville Indian Reservation, Confederated Tribes of the Salish and Kootenai Tribes, Northern Cheyenne, Eastern Shoshone, and the Shoshone-Bannock. The seven tribes we were unable to make contact with during the two months included the Lower Brule Sioux, Sisseton-Wehpenton Sioux, Flandreau Santee Sioux, Northern Arapaho, Gros Ventre and Assiniboine Tribes, Trutel Mountain band of Chippewa, and the Comanche. Most tribal representatives that responded expressed little or no concern about the project and on-site visits were planned for three tribes based on their expressed interest in conducting an ethnographic inventory of the area. The Northern Cheyenne, the Kiowa and the Oglala Sioux were the initial responding tribes and later, the Crow Tribe provided information about use of ethnographic resources within the project area

With the Shoshone-Bannock information, the number of consulting groups is six –Crow, Kiowa, Cheyenne, Nez Peerce Tribe, all on the ground, the Lakota Sioux via telephone, and additional input from the Blackfoot Tribe regarding features like rock cairns. The recommendations of the tribes relating to ethnographic resources within the road corridor are reflected in the ethnographic sections of Chapters 3 and 4. Many of the recommendations did not concern ethnographic resources but policy decisions, such as developing obsidian collections policies, access to museum collections, limiting access to sites, resource gathering policies, and native based interpretive signage, etc.

Consultation with Native Americans is on-going with this document and with the continued design and cultural consultations for this road segment.

Environmental Assessment Review and List of Recipients

The environmental assessment will be released for public review on May 12, 2011. To inform the public of the availability of the environmental assessment, the National Park Service will publish and distribute a letter or press release to various agencies, tribes, and members of the public on the park's mailing list, as well as posted on the Planning, Environment and Public Comment website (link below). Copies of the environmental assessment will be available on the internet at http://parkplanning.nps.gov/yell. Copies of the document will also be provided to interested individuals, upon request by writing to the address at the beginning of this document.

The environmental assessment is subject to a 30-day public comment period. During this time, the public is encouraged to submit their written comments to the National Park Service address provided at the beginning of this document. Following the close of the comment period, all public comments will be reviewed and analyzed, prior to the release of a decision document. The National Park Service will issue responses to substantive comments received during the public comment period, and will make appropriate changes to the environmental assessment, as needed.

List of Preparers

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APPENDIX A
IMPAIRMENT

National Park Service's *Management Policies, 2006* require analysis of potential effects to determine whether or not actions would impair park resources. The fundamental purpose of the national park system, established by the Organic Act and reaffirmed by the General Authorities Act, as amended, begins with a mandate to conserve park resources and values. National Park Service managers must always seek ways to avoid, or to minimize to the greatest degree practicable, adversely impacting park resources and values.

However, the laws do give the National Park Service the management discretion to allow impacts to park resources and values when necessary and appropriate to fulfill the purposes of a park, as long as the impact does not constitute impairment of the affected resources and values. Although Congress has given the National Park Service the management discretion to allow certain impacts within park, that discretion is limited by the statutory requirement that the National Park Service must leave park resources and values unimpaired, unless a particular law directly and specifically provides otherwise. The prohibited impairment is an impact that, in the professional judgment of the responsible National Park Service manager, would harm the integrity of park resources or values, including the opportunities that otherwise would be present for the enjoyment of these resources or values. An impact to any park resource or value may, but does not necessarily, constitute an impairment, but an impact would be more likely to constitute an impairment when there is a major or severe adverse effect upon a resource or value whose conservation is:

- necessary to fulfill specific purposes identified in the establishing legislation or proclamation of the park;
- key to the natural or cultural integrity of the park; or
- identified as a goal in the park's general management plan or other relevant NPS planning documents.

An impact would be less likely to constitute an impairment if it is an unavoidable result of an action necessary to pursue or restore the integrity of park resources or values and it cannot be further mitigated.

The park resources and values that are subject to the no-impairment standard include:

- the park's scenery, natural and historic objects, and wildlife, and the processes and conditions that sustain them, including, to the extent present in the park: the ecological, biological, and physical processes that created the park and continue to act upon it; scenic features; natural visibility, both in daytime and at night; natural landscapes; natural soundscapes and smells; water and air resources; soils; geological resources; paleontological resources; archeological resources; cultural landscapes; ethnographic resources; historic and prehistoric sites, structures, and objects; museum collections; and native plants and animals;
- appropriate opportunities to experience enjoyment of the above resources, to the extent that can be done without impairing them;
- the park's role in contributing to the national dignity, the high public value and integrity, and the superlative environmental quality of the national park system, and the benefit and inspiration provided to the American people by the national park system; and

- any additional attributes encompassed by the specific values and purposes for which the park was established.

Impairment may result from National Park Service activities in managing the park, visitor activities, or activities undertaken by concessioners, contractors, and others operating in the park. The NPS's threshold for considering whether there could be an impairment is based on whether an action would have major (or significant) effects.

Impairment findings are not necessary for visitor use and experience, socioeconomics, public health and safety, environmental justice, land use, and park operations, because impairment findings relates back to park resources and values, and these impact areas are not generally considered park resources or values according to the Organic Act, and cannot be impaired in the same way that an action can impair park resources and values. After dismissing the above topics, topics remaining to be evaluated for impairment include: topography, geology, and soils; hydrothermal resources; wetlands and other waters of the U.S.; floodplains; vegetation; wildlife; special status species; migratory bird species, including species of management concern; historic and prehistoric archeological resources; historic structures; ethnographic resources; and cultural landscapes. Fundamental resources and values for Yellowstone National Park are identified in the *Master Plan* and *Foundation Statement.*

- **Topography, Geology, and Soils** – Yellowstone National Park is about 2.2 million acres in size, 98 percent of which is undeveloped. This project would impact about 70 acres of land adjacent to the roadway through widening. In the short-term, impacts are considered moderate and adverse, though long-term, the impacts would have a minor beneficial effect by reducing erosion potential and allowing for better revegetation of past over steepened slopes. As long-term impacts are minor, there would be no impairment to topography, geology, or soils.
- **Hydrothermal Resources** – Yellowstone National Park is home to half the world's geothermal features. There are over 10,000 thermal features located within the park. This project would remove the road from the Frying Pan thermal spring, and add a boardwalk here and at Clearwater Spring to control pedestrian traffic. While road widening and reconstruction would disturb some hot ground, mitigation measures keep adverse impacts in the minor to moderate range. No long term effects are anticipated. There would be no impairment to hydrothermal resources of the park.
- **Wetlands and Other Waters of the U.S.** – Yellowstone National Park has numerous wetlands located within its boundaries. Over two hundred wetlands were located within 200 feet of the road centerline. Long-term impacts to 1.7-1.9 acres within portions of 103 wetlands would occur, while temporary short-term impacts would occur to 1.55-1.75 acres within 51 wetlands. In accordance with the NPS no new loss of wetlands policy, impacted wetlands would be replaced with wetland habitats via restoration of 2.1-2.3 acres of previously disturbed wetlands. There would be no impairment to wetlands and other waters of the U.S. from the implementation of this project.
- **Floodplains** – Yellowstone National Park floodplains occur along the road within the project area. Approximately 1.66 acres of existing road would be removed from the Obsidian Creek floodplain. A total of approximately 0.09 acres of road fill would be added to the floodplain to accommodate road widening. Impacts to floodplains would be considered negligible to minor and most would be temporary, and in very localized areas, no impacts would be long-lasting, therefore, there would be no impairment to floodplain resources.
- **Vegetation** – Road widening and reconstruction activities would impact about 70 acres of vegetation along the road. Impacts would be both short- and long-term and considered

minor to moderate affecting minor portions of the species' population and restricted to a very small geographic area. No species of special concern would be adversely impacted. No impairment to park vegetation would occur.

- **Wildlife** – Yellowstone National Park has an abundance of wildlife within its 2.2 million acres. This project would cause approximately 70 acres of habitat to be lost following road widening and formalization and addition of new turnouts or parking areas. Road kills would continue, but are not expected to increase and should remain low. Speed limits along the road would remain the same. Impacts of this project to wildlife would be minor and adverse. No impairment to wildlife resources would occur.
- **Special Status Species** – Yellowstone National Park is home to the threatened Canada lynx, and grizzly bear. The gray wolf is considered an experimental population and also considered threatened within the park. A smoother road surface could increase vehicle speeds slightly in some areas, though the curvature of the road would remain relatively the same. A wider roadway would increase sight distance for animals crossing the roadway. Because of the loss of about 70 acres of habitat and a slight increase of speed in some areas, moderate adverse impacts to wolves and grizzly bears could occur. The project is outside any lynx analysis unit and Canada lynx would not be affected. With the implementation of conservation measures from the USFWS biological opinion, and mitigation measures listed in this EA, no impairment of special status species would occur.
- **Migratory Bird Species, Including Species of Management Concern** – Yellowstone National Park has populations of bald eagles, peregrine falcons, trumpeter swans, white pelicans, and other various bird species. Impacts from this project are negligible to minor and adverse on these birds. Because of the low levels of impact, no impairment to migratory bird species including species of management concern would occur.
- **Historic and Prehistoric Archeological Resources** – Yellowstone National Park has had continuum of human habitation for 11,000 years. As such, thousands of historic and prehistoric sites exist, many un-surveyed as yet. The impact to the six prehistoric areheological sites bisected by the current road would be minor to moderate. Data recovery efforts and avoidance of sites through road design have helped lesson impacts. Through consultation and collaboration with the Wyoming State Historic Preservation officer on the data recovery plans the National Register eligibility status of the sites would not be affected. For these reasons, historic and prehistoric archeological resources would not be impaired.
- **Historic Structures** – Yellowstone National Park numerous historic structures that are eligible for the National Register of Historic Places. This project involves reconstructing or rehabilitating many of the culverts, pullouts, waysides, and bridges located on this road segment. All work would be done on these structures would be in accordance with the *Secretary of the Interior's Standards for the Treatment of Historic Properties*, and accomplished according to the stipulation of the road programmatic agreement so that the reconstruction does not diminish the integrity of the historic road. Implementation of the project would result in moderate beneficial effect to the historic road due to the repairs that would be made to the road during reconstruction activities. Because the preferred alternative would result in moderate, beneficial effects, there would be no impairment to historic structures.
- **Ethnographic Resources** – Known ethnographic resources would be avoided by construction activities. Implementation of the preferred alternative would not constitute an impairment to the ethnographic resources within Yellowstone National park as identified through survey and consultation with native peoples.

- **Cultural Landscapes** – Within the project area, the character defining features that convey the historic significance would be rehabilitated to retain the cultural road-scapes integrity of setting, feeling, association, design, worksmanship, materials, and for the most part location. Reconstruction of the road segment would have minor beneficial impacts to the Golden Gate to Norris segment of the Grand Loop Road cultural landscape and would not impair cultural landscape resources within the park.

In addition, mitigation measures for these resources would further lessen the degree of impact to and help promote the protection of these resources. Park Service staff would monitor all reconstruction and rehabilitation activities to minimize potential damage to any of the park resources discussed above.

In conclusion, as guided by this analysis, good science and scholarship, advice from subject matter experts and others who have relevant knowledge and experience, and the results of public involvement activities, it is the Superintendent's professional judgment that there would be no impairment of park resources and values from implementation of the preferred alternative.

APPENDIX B
STATEMENT OF FINDINGS FOR WETLANDS/FLOODPLAINS

See Document List on PEPC
This Appendix is saved as a separate file from the Environmental Assessment

APPENDIX C
VEGETATION MANAGEMENT FOR CONSTRUCTION IN YELLOWSTONE NATIONAL PARK

Revegetation efforts within the park have focused on careful management of topsoil as the only available growing medium and seed source. This is based on a park policy that seed obtained from sources outside the park would contaminate the park gene pools. Although it is a conservative method, the topsoil management approach has worked well.

The park has an interagency agreement with the Bridger Plant Material Center to assist in the formation of a park seed bank. The park has also tested mulches and can make this information available upon request.

All construction work within the park involving ground disturbance will meet the following criteria for revegetation accepted by the park.

1. All construction will be limited to that area necessary to complete required work. No activity, including vehicle or material use or storage, will be allowed outside the predetermined zone. If vehicles are to be traveling through an area numerous times, the same tracks will be used to prevent compaction in other areas. Compacted zones will be treated (raking, aerating, and replacement of topsoil) to assist revegetation. Topsoil will not be driven on at any time.

2. Excavation and improvement will be handled in manageable sections that reflect changes in the soil and vegetation. Trenching routes and disturbance zones will be flagged and approved by the park. All flagging and debris will be removed from the area after work is completed.

3. Sections will be rehabilitated as soon as possible. Topsoil will not be stockpiled over the winter or for longer than three months in sagebrush/rabbitbrush zones or longer than six months in grass-dominated zones. Any deviation must be approved by the park.

4. Topsoil refers to the uppermost soil horizon; it is usually found in the top 2 to 6 inches. Topsoil will be removed and replaced from the same area. Care will be taken to ensure that topsoil and fill material are not mixed and are stockpiled in separate areas (e.g., topsoil to the right of the trench and fill to the left).

5. Vegetation over 3 feet in height will be removed before the removal of topsoil and in a manner that least disturbs the topsoil. Topsoil will not be driven on, gouged, or compacted as vegetation is removed. Topsoil will be removed before stumps are pushed. Any deviation from this process must be approved by the park.

6. After large trees are removed, topsoil will be removed from an area in a single cut, including any vegetation that is 3 feet tall and under. Grubbing is not permitted.

7. Irregular land surfaces are recommended for a natural effect. Some rock outcropping and boulders may be left in place to create natural pockets for revegetation (see number 11). Deadfall snags may be stockpiled for later use on slopes that are very steep to provide catch points for soil.

8. Topsoil will not be used as bedding material. Separate bedding material will be obtained from sources approved by the park.

9. Topsoil will be replaced on site in a mixture of topsoil and vegetation associated with the topsoil and will be reworked over the site in a manner that preserves the seed source while spreading the soil over the area.

10. No topsoil will be imported from outside the park or moved internally within the park unless approved by the park. Any imported fill will be checked for exotic plants.

11. Trees and shrubs will be avoided if possible during trenching or excavation. Any trees removed during construction will be removed from the site unless specified by the park.

12. If replacement seed is required for revegetation in an area, the park will provide seed at cost to the contractor. Advance notice of six months to one year is required on projects exceeding 1,000 square feet.

13. Boulders unearthed during construction may be reburied or left exposed (with lower third buried) depending upon the location and extent of rock naturally occurring in the area.

14. If a trench is required, the surface of the trench will be left mounded to allow for settling along the line.

15. If mulch is required in sensitive areas due to visibility or exotic plant infestation, the park will specify the type and depth of mulch to be used. Nitrogen will may be added in small quantities to any wood product used on slopes to balance nitrogen lost through decomposition.

16. No fertilizer will be used in any revegetation work unless requested by the park.

17. If relocated due to road reconstruction, junction boxes or cans will be placed in the field and approved by the park. Locations should be well screened by vegetation, topography, or large boulders.

18. All access to the site and stockpiling or staging areas will be identified by the contractor and approved by the park. These areas will be revegetated using approved techniques upon completion of the project.

19. All debris will be removed from the site to an approved pit or hauled away as approved by the park.

20. Final review and inspection will be made by the park before the work is accepted.