4

Environmental Consequences

INTRODUCTION

The National Environmental Policy Act requires that environmental documents discuss the environmental impacts of a proposed federal action, feasible alternatives to that action, and any adverse environmental effects that cannot be avoided. In this case, the proposed federal action would be the construction of a bridge, boardwalks, and a barge landing site at Brooks Camp in Katmai National Park and Preserve. This chapter analyzes the environmental impacts of five alternatives on natural resources, cultural resources, visitor experience, visual resources/scenery, and socioeconomics

This chapter begins with a description of the methods and assumptions used for each impact topic. Impact analysis discussions are organized by impact topic and then by alternative under each impact topic. All of the impact topics are assessed for each alternative.

The analysis of the no-action alternative (the continuation of current management) identifies the future conditions in the Brooks River area if no major changes to facilities or NPS management occurred. The four action alternatives are compared to the no-action alternative to identify the changes in conditions that would occur because of changes in park facilities

Each alternative discusses cumulative impacts; these are identified when this project is considered in conjunction with other actions occurring in the park and preserve and the region. The discussion of cumulative impacts is followed by a conclusion statement. The impacts of each alternative are briefly summarized at the end of "Chapter 2: Alternatives Including the Preferred Alternative."

METHODS AND ASSUMPTIONS FOR ANALYZING IMPACTS

The planning team based the impact analysis and the conclusions in this chapter primarily on past environmental assessments, information provided by NPS and other experts, review of existing literature and studies, and staff insights and professional judgment. The team's method of analyzing impacts is further explained herein. It is important to remember that all the impacts have been assessed assuming that mitigation measures would be implemented to minimize or avoid impacts (e.g., timing of construction). If mitigation measures described in the "Alternatives Including the Preferred Alternative" chapter were not applied, the potential for adverse resource impacts and the magnitude of those impacts would increase.

The environmental consequences for each impact topic were identified and characterized based on impact type, intensity, context, and duration.

Impact intensity refers to the degree or magnitude to which a resource would be beneficially or adversely affected. Each impact was identified as minor, moderate, or major, in conformance with the definitions for these classifications provided for each impact topic.

Context refers to the setting within which an impact may occur, such as the affected region or locality. In this document, most impacts are localized (site-specific).

Impact duration refers to how long an impact would last. Impacts can either be short term and temporary in nature, generally occurring during the construction period, or long term, lasting several years beyond the construction period or perhaps permanently. Although an impact might only occur for a short duration at one time, if it occurs regularly over a longer period of time the impact may be considered a long-term impact. For example, the noise from an administrative small vehicle driving over the bridge would be heard for a short time and intermittently, but because vehicles would be driving over the bridge for many years, the impact on the natural soundscape would be considered long term.

Impact intensity, context, and duration are defined for each impact topic.

Effects also can be direct or indirect. Direct effects are caused by an action and occur at the same time and place as the action. Indirect effects are caused by the action and occur later or further away, but are still reasonably foreseeable. This document discloses and analyzes both direct and indirect effects, but does not differentiate between them in the discussions to simplify the narrative.

The project area for this draft environmental impact statement includes Brooks Camp, Brooks River between the oxbow and river mouth, and the land south of the river from approximately the Valley Road Administrative Area east to Naknek Lake.

The impacts of the action alternatives describe the difference between the no-action alternative and the action alternatives. To understand a complete "picture" of the impacts of any of the action alternatives, the reader must also take into consideration the impacts that would occur under the no-action alternative.

For purposes of analysis, it is assumed that the new barge landing site and access road would be built before the bridge and boardwalk system. The bridge, boardwalk, electric utility line, and septic pump-out line would be built concurrently.

It is also assumed that all of the viewing/pullout areas proposed for each alternative would be built.

NATURAL RESOURCES

The effects of the alternatives on brown bears, bald eagles, salmon and other fish, wetlands and vegetation, hydrology and floodplains, and natural soundscapes are analyzed in this chapter. For all of these impact topics, the effects of the action alternatives are compared against the no-action alternative (alternative 1).

Note: The following context and duration threshold definitions apply to all natural resource impact topics except the natural soundscape impact topic.

Duration

- **Short-term impacts:** Effects that occur during implementation and up to three years after the project is completed.
- **Long-term impacts:** Effects that occur beyond three years after project is completed.

Context

- **Localized impacts:** Effects would occur in the project area and/or in the immediate vicinity of the project area, including the lands and waters of Brooks Camp, the mouth of Brooks River, the adjacent Naknek Lake shoreline, and areas along the river corridor within visual or audible range.
- **Regional or parkwide impacts:** Effects would occur beyond the vicinity of the project area and would extend to the surrounding habitats and adjacent waterbodies throughout and beyond the park.

Brown Bear

The analysis of the effects of the alternatives on brown bears was based on the importance of affected habitat type, habitat location, and changes in habitat quality. Behavioral changes of brown bears and the potential for habituation to humans could result from changes in habitat quality. *Adverse impacts* are defined as reduced area or reduced quality of brown bear habitat. *Beneficial impacts* increase the area or improve the quality of brown bear habitat.

The impact intensities for brown bear are defined as follows:

- **Minor:** Effects on brown bear habitat quality would not be expected to be outside the natural range of variability and would not be expected to have any notable effects on brown bear or the natural processes sustaining habitat. The effects could result in minimal changes to bear habituation to humans, if any.
- **Moderate:** Effects on brown bear habitat quality would cause changes to brown bear feeding, mating, or caring for young. The effects could be intermittently outside the natural range of variability. Some limited changes to bear habituation to humans would be expected. Less than half of the brown bears using the Brooks River area would be affected. Changes to the regional brown bear population would be minimal.
- **Major:** Effects on brown bear habitat quality would cause substantial changes to brown bear feeding, mating, or caring for young. The effects would be expected to be outside the natural range of variability. Distinct changes to bear habituation to humans would be expected. More than half of the brown bears using

the Brooks River area would be affected. Changes to regional brown bear populations would be apparent.

Bald Eagle

The analysis of the effects of the alternatives on bald eagles was based on the importance of affected habitat type, habitat location, and changes in habitat quality. *Adverse impacts* are defined as reduced area or reduced quality of bald eagle habitat. *Beneficial impacts* increase the area or improve the quality of bald eagle habitat.

The impact intensities for bald eagle are defined as follows:

- **Minor:** Effects on bald eagle habitat quality would not be expected to be outside the natural range of variability and would not be expected to have any notable effects on bald eagles or the natural processes sustaining habitat.
- **Moderate:** Effects on bald eagle habitat quality would cause changes to bald eagle feeding, mating, nesting, or caring for young. The effects could be intermittently outside the natural range of variability. Changes to the regional bald eagle population would be minimal.
- **Major:** Effects on bald eagle habitat quality would cause substantial changes to bald eagle feeding, mating, nesting, or caring for young. The effects would be expected to be outside the natural range of variability. Changes to regional bald eagle populations would be apparent.

Salmon and Other Fish

This topic includes all fish species (anadromous and nonanadromous) that use Brooks River and surrounding wetland habitats at some time during the populations' life cycles. The analysis of impacts was based on changes to aquatic habitat quality due to changes in water surface area, water quality, and/or riverbed substrate area. *Adverse impacts* reduce the area or quality of fish habitat; *beneficial impacts* increase the area or improve the quality of fish habitat.

The intensities of impacts on salmon and other fish are defined as follows:

- **Minor:** Effects on fish habitat quality would not be outside the natural range of variability and would not be expected to have any notable changes to native fish or the natural processes sustaining aquatic habitat.
- **Moderate:** Effects on fish habitat quality could be intermittently outside the natural range of variability and would result in some changes to native fish or the natural processes sustaining aquatic habitat. Changes to the regional fish populations would be minimal.
- **Major:** Effects on fish habitat area or quality would be expected to be outside the natural range of variability and would result in substantial changes in native fish or the natural processes sustaining aquatic habitat. Changes to regional fish populations would be perceptible.

Wetlands and Upland Vegetation

This impact topic covers wetlands and all vegetation within the project area. Measurement of impacts was based on area, quality, or continuity of wetlands and upland vegetation communities. Affected wetland values could include habitat, biomass production, groundwater recharge/discharge, water quality control, and flood control. *Adverse impacts* reduce

the area, reduce the quality, or disrupt the continuity of wetlands or upland vegetation communities. *Beneficial impacts* increase the area, improve the quality, or enhance the continuity of wetlands or upland vegetation communities. (**Note:** Wetland impacts are also addressed in appendix D.)

The following thresholds define the intensity of the impacts on wetlands and vegetation:

- **Minor:** Effects on wetland area, quality, or continuity would be slight. The overall viability of the wetland resource(s) or upland vegetation would not be affected. Effects on upland vegetation communities would be slight. This could include changes in abundance, distribution, or composition of individual plant species, but would not involve changes that would affect the viability of the local vegetation communities.
- **Moderate:** Effects on wetland(s) would be sufficient to cause measurable changes in wetland area, quality, or continuity. Small losses or gains of wetland acreage could occur. Effects on upland vegetation communities would result in measurable changes in abundance, distribution, or composition of individual plant species and could affect the viability of portions of the local vegetation communities.
- **Major:** Effects on wetland(s) would result in measurable change to all three parameters (area, quality, and continuity). Losses or gains of wetland acreage would occur. Effects on upland vegetation communities would either be severe or highly favorable. This could include changes in abundance, distribution, or composition of individual plant species and would affect the viability of large areas of the local vegetation communities and possibility surrounding communities.

Hydrology and Floodplains

This impact topic covers changes to the Brooks River hydrology and floodplains. Impacts were determined based on river water flow, hydraulics, channel and riverbank erosion, and river geomorphology during both low and high river flows. *Adverse impacts* reduce hydrological functions and values for natural river and floodplain processes; *beneficial impacts* improve hydrological functions and values for natural river and floodplain processes. (**Note:** Floodplain impacts are also addressed in appendix D.)

The impact intensities for hydrology and floodplains are as follows:

- **Minor**: Isolated and minimal changes to hydrology, channel or bank erosion, river geomorphology, or floodplain processes could occur within the project area but would not be outside the range of natural variability. These changes would not have any measurable effect on the overall hydrologic system of the area.
- **Moderate**: Multiple changes to hydrology, channel or bank erosion, river geomorphology, or floodplain processes would occur in the project area and could exceed the range of natural variability. These changes could have detectable effects on the overall hydrological system of the project area.

Major: Multiple substantial changes to hydrology, channel or bank erosion, river geomorphology, or floodplain

processes would occur in the project area and far exceed the range of natural variability. These changes would have substantial effects on the overall hydrologic system of the project area.

Natural Soundscape

- **Short-term impacts:** Impacts would last during implementation and up to one year after the project is completed.
- **Long-term impacts:** Impacts would last more than one year after project is completed.

The impacts on the natural soundscape were based on the type, intensity, and consistency of human-induced sounds. *Adverse impacts* reduce the quality of the natural soundscape, while *beneficial impacts* improve the quality of the natural soundscape.

The intensities of the impacts on the natural soundscape are defined as follows:

- **Minor:** Noise would be greater than natural ambient sound levels for a small portion of the day, and/or there would often be substantial periods of time between noise events. Noise would rarely cover up or mask natural ambient sounds in the area.
- **Moderate:** Noise would often be greater than natural ambient sound levels for part of the day, but there still would be large periods of time between noise events. Although noise would often cover up or mask natural ambient sounds, there still would be many opportunities to hear natural ambient sounds in the area.
- **Major:** Noise would be greater than natural ambient sound levels for most of the day, and/or there would rarely be more than short periods of time between noise events. Noise would frequently mask natural ambient sounds, and there would be few, if any, times that natural ambient sounds would be heard in an area.

CULTURAL RESOURCES

The effects of the alternatives on archeological resources; historic structures, sites, and cultural landscapes; and ethnographic resources are described in this chapter.

Section 106 of the National Historic Preservation Act and Impacts to Cultural Resources

Impacts on cultural resources are described in terms of type, context, duration, and intensity, which is consistent with the regulations of the Council on Environmental Quality that implement the National Environmental Policy Act. These impact analyses are intended, however, to comply with the requirements of both that act and section 106 of the National Historic Preservation Act. In accordance with Advisory Council on Historic Preservation (ACHP) regulations implementing section106 of the National Historic Preservation Act (36 CFR 800, *Protection of Historic Properties*), impacts on cultural resources were also identified and evaluated by (1) determining the area of potential effects; (2) identifying cultural resources present in the area of potential effects that are either listed in or eligible to be listed in the National Register of Historic Places; (3) applying the criteria of adverse effect to affected national register eligible or listed cultural resources; and (4) considering ways to avoid, minimize or mitigate adverse effects.

Under ACHP regulations, a determination of either *adverse effect* or *no adverse effect* must also be made for affected national register-listed or -eligible cultural resources. An *adverse effect* occurs

whenever an impact alters, directly or indirectly, any characteristic of a cultural resource that qualifies it for inclusion in the National Register of Historic Places, e.g., diminishing the integrity (or the extent to which a resource retains its historic appearance) of its location, design, setting, materials, workmanship, feeling, or association. Adverse effects also include reasonably foreseeable effects caused by the alternatives that would occur later in time, be farther removed in distance, or be cumulative (36 CFR 800.5, *Assessment of Adverse Effects*). A determination of *no adverse effect* means there is an effect, but the effect would not diminish the characteristics of the cultural resource that qualify it for inclusion in the national register.

CEQ regulations and NPS Director's Order 12: *Conservation Planning, Environmental Impact Analysis, and Decision-making* also call for a discussion of mitigation, as well as an analysis of how effective the mitigation would be in reducing the intensity of a potential impact, e.g., reducing the intensity of an impact from major to moderate or minor. Any resultant reduction in intensity of impact due to mitigation, however, is an estimate of the effectiveness of mitigation under the National Environmental Policy Act only. It does not suggest that the level of effect as defined by section 106 is similarly reduced. Cultural resources are nonrenewable resources, and adverse effects generally consume, diminish, or destroy the original historic materials or form, resulting in a loss in the integrity of the resource that can never be recovered. Therefore, although actions determined to have an adverse effect under section 106 may be mitigated, the effect remains adverse.

For the action alternatives section 106 summaries are included in the impact analyses for archeological resources; ethnographic resources; historic structures, sites and districts; and cultural landscapes. The section 106 summary is an assessment of the effect of the undertaking (implementation of the alternative), based upon the criterion of effect on national register eligible or listed cultural resources only, and criteria of adverse effect found in ACHP regulations.

From a NEPA standpoint, the following definitions for duration and context apply to all of the cultural resources being analyzed:

Duration

- **Short-term impacts:** Changes that occur to cultural resources during project implementation.
- **Long-term impacts:** Changes that occur after (and extend beyond) project completion.

Context

- **Localized impacts:** Effects would occur to cultural resources (e.g., archeological and ethnographic resources/sites, historic structures, cultural landscape features) and/or portions of these resources within the boundaries of the Brooks River Archeological District.
- **Regional or parkwide impacts:** Effects on cultural resources would occur beyond the Brooks River Archeological District and would extend to other areas of cultural significance throughout and beyond the park and preserve.

Archeological Resources

The impacts on archeological resources are described in terms of the potential to diminish or protect the ability of archeological resources to yield information important in prehistory or history.

The intensities of impacts on archeological resources are defined as follows:

- **Minor:** *Adverse*—Disturbance of a site(s) results in little loss of integrity. *Beneficial*—Minimal efforts are undertaken to maintain and preserve a site(s) in situ.
- **Moderate:** *Adverse*—Site(s) is disturbed with a noticeable loss of integrity, but is not obliterated. *Beneficial*—Efforts are undertaken to stabilize a site(s) in situ.
- **Major:** *Adverse*—Site(s) is disturbed to the extent that most or all of its informational potential is lost or obliterated. *Beneficial*—Measures to preserve a site(s) in situ include more extensive and/or active intervention.

Historic Structures, Sites, and Cultural Landscapes

Impacts on these cultural resources were measured by analyzing the potential to diminish or protect their integrity or character-defining features.

The impact intensity thresholds for historic structures are defined as follows:

- **Minor:** *Adverse*—Impacts would affect a character-defining feature(s), but would not diminish the overall integrity of the structure, site, or cultural landscape. *Beneficial*—Stabilization/preservation of character-defining features is conducted in accordance with the *Secretary of the Interior's Standards for the Treatment of Historic Properties*.
- **Moderate:** *Adverse*—Impacts would alter a character-defining feature(s), diminishing the overall integrity of the structure, site, or cultural landscape to the extent that its national register eligibility could be jeopardized. *Beneficial*—Rehabilitation is conducted in accordance with the *Secretary of the Interior's Standards for the Treatment of Historic Properties*.
- **Major:** *Adverse*—Impacts would alter a character-defining feature(s), diminishing the integrity of the structure, site, or cultural landscape to the extent that it would no longer be eligible to be listed in the national register. *Beneficial*—Restoration is conducted in accordance with the *Secretary of the Interior's Standards for the Treatment of Historic Properties*.

Ethnographic Resources

Impacts on ethnographic resources were analyzed by examining changes in the potential to diminish or protect the integrity of (and access to) resources and places having particular importance and value to culturally associated groups

The following intensity thresholds were used to describe impacts to ethnographic resources:

- **Minor:** *Adverse*—Impacts would be slight and would neither appreciably alter resource conditions, such as traditional access or site preservation, nor alter the relationship between the resource and the associated group's body of beliefs and practices. *Beneficial*—Impacts would allow access to and/or accommodate a group's traditional practices or beliefs.
- **Moderate:** *Adverse*—Impacts would be apparent and would alter resource conditions or interfere with traditional access, site preservation, or the relationship between the resource and the associated group's beliefs and practices, even though the group's practices and beliefs would survive.

Beneficial—Impacts would facilitate traditional access and/or accommodate a group's practices or beliefs.

- **Major:** *Adverse*—Impacts would alter resource conditions. Proposed actions would block or greatly affect traditional access, site preservation, or the relationship between the resource and the associated group's body of beliefs and practices to the extent that the survival of a group's beliefs and/or practices would be jeopardized. *Beneficial*—Impacts would encourage traditional access and/or accommodate a group's practices or beliefs.

VISITOR EXPERIENCE

Visitor experiences are multidimensional and involve a variety of characteristics or components. This impact analysis considers various qualitative aspects of visitor use and experience in the Brooks River Camp area, including recreational opportunities (such as visitor activities), visitor use levels and crowding, visitor transportation and access, and visitor safety.

- **Recreational Opportunities**—analyzes the opportunity for visitors to participate in various kinds of recreational activities. For example, fishing, watching bears, and hiking are all activities commonly participated in by Brooks Camp visitors. This analysis identifies whether visitors would have greater or fewer opportunities to participate in recreational activities.
- **Visitor Use Levels and Crowding**—examines whether the proposed alternative would have an effect on visitor use levels and perceived crowding in the Brooks Camp area, especially at key attraction areas and points in time that are integral to the overall experience such as when watching bears from a platform during fish spawning runs.
- **Visitor Transportation and Access**—describes the impacts associated with the way in which visitors arrive to and circulate through the Brooks Camp area, including accommodations for visitors with mobility impairments.
- **Visitor Safety**—focuses on potential risk or safety concerns that may arise as a direct result of the actions proposed in each alternative. Very few incidents have historically occurred at Brooks Camp. Nevertheless, this analysis focuses on the likelihood of the alternative to improve or reduce the potential risks to visitor safety, particularly associated with human-bear and pedestrian-vehicle interactions or conflicts.

The analysis was based on the results of public scoping, scientific research, and management experience. Other information that was considered in the analysis includes the park's annual visitor use levels (information was gained from the NPS Public Use Statistics Office), including overnight stays and travel and tourism data. Qualitative measures from these sources were used to determine the overall effect on visitor experience.

The duration and context of visitor experience impacts are defined as follows:

Duration

- **Short-term impacts:** Changes that occur during implementation and up to one year after the project is completed.

- **Long-term impacts:** Changes that occur more than one year after the project is completed.

Context

- **Localized impacts:** Effects would occur in the project area and/or in the immediate vicinity of the project area, including the lands and waters of Brooks Camp, the mouth of Brooks River, the adjacent Naknek Lake shoreline, and areas along the river corridor within sight or sound.
- **Regional or parkwide impacts:** Effects would occur beyond the vicinity of the project area and would extend to the surrounding areas throughout and beyond the park.

Adverse impacts are considered changes that would reduce visitor experience quality, including recreational opportunities, use levels, visitor access and accessibility, and visitor safety. *Beneficial impacts* are changes that would improve visitor experience quality, including recreational opportunities, use levels, visitor access and accessibility, and visitor safety.

The intensities of impacts to visitor experience are defined as follows:

- **Minor**: Changes to visitor experience would be slight, affecting a few visitors (less than 10 percent), and not appreciably affect recreational opportunities, use levels, visitor access, and risk to visitor safety in the Brooks Camp area.
- **Moderate:** Changes to visitor experience would affect many visitors (up to 50 percent) and result in some changes to recreational opportunities, use levels, visitor access, and risk to visitor safety in the Brooks Camp area.
- **Major**: Changes to visitor experience would affect most visitors (greater than 50 percent) and result in several changes to recreational opportunities, use levels, visitor access, and risk to visitor safety in the Brooks Camp area.

VISUAL/SCENIC RESOURCES

This impact topic focuses on changes this project would have to visual resources or to the natural scenery of the Brooks Camp area. The analysis focuses on the immediate Brooks Camp area and in particular those sites affected by the proposed project—the current and proposed bridge and barge landing sites. Bridge, boardwalk, and barge landing infrastructure and design elements are considered in relation to the surrounding natural landscape. The analysis is based on professional judgment and design renderings and principles.

The duration of impacts would be the same as previously described for visitor experience. The context for scenic resources impacts includes both views from the immediate vicinity of the bridge, such as along the shores of the river or from boardwalks, as well as from a distance, such as from a plane. *Localized impacts* would be considered those effects that would occur in the project area and/or in the immediate vicinity of the project area, including the lands and waters of Brooks Camp, the mouth of Brooks River, the adjacent Naknek Lake shoreline, and areas along the river corridor within visual or audible range. *Regional or parkwide impacts* would include effects that would occur beyond the vicinity of the project area and would extend to the surrounding landscape, throughout and beyond the park.

Impacts on visual/scenic resources were based on qualitative measures of the extent to which the existing and proposed Brooks River bridge, barge landing, and related infrastructure would intrude into the predominantly natural landscape. Impacts are based on the extent and type of development compared to the foreground, middle ground, and background of the viewshed. An *adverse impact* would increase the extent to which the bridge and supporting infrastructure intrude into the natural landscape; a *beneficial impact* would decrease the extent to which the bridge and related infrastructure intrude into the surrounding natural landscape.

The impact intensity of a development on visual resources would depend on the type of development, its location, and what mitigation is applied. For example, a development in the foreground of a viewshed has a much larger impact than the same development located 3 miles away. Mitigation could involve unobtrusive design or colors. All three factors are evaluated together to determine the level of impact a proposed development would have.

For the purposes of this analysis, a viewshed is defined as the landscape seen from key observation points identified in "Chapter 3: Affected Environment." The foreground is defined as that part of the viewshed from the observation point to the first horizon/line of sight (e.g., a ridge top) or a line 2 miles away, whichever is closer. Middle ground is defined as that part of the viewshed 2 to 5 miles from the observation point. The background is everything more than 5 miles from the observation point.

The intensities of impacts on visual/scenic resources are as follows:

- **Minor:** The action would be noticeable to some observers but would not detract from or improve natural views. There could be small changes to existing form, line, texture, or color in the background.
- **Moderate:** The action would be noticeable to most observers and may detract from or improve natural views in a limited portion of a viewshed. There could be modest changes to existing form, line, texture, or color in the middle ground or background.
- **Major:** The action would be immediately noticeable and would detract from or improve views of the natural setting in most of a viewshed. It would result in large changes to existing form, line, texture, or color in the foreground, middle ground, or background, or portions of the natural viewshed would be obstructed.

SOCIOECONOMICS

This section focuses on the effects of the alternatives on components of the economy, including employees and employers. Available economic, visitor use, and park data were used to identify and evaluate likely effects. The analysis relied on the following main factors in the alternatives:

- construction spending and jobs
- federal spending on equipment, supplies, and staffing
- commercial services and CUA services in the park
- visitor spending

The duration and context of socioeconomic impacts are defined as follows:

Duration*

- **Short-term impacts:** Effects that occur during project

implementation and up to three years after the project is completed.

- **Long-term impacts:** Effects that occur beyond three years after the project is completed.

*Note: *Duration* differs from other impact topics; the longer time frame better captures general time frames of socioeconomic conditions in response to changes in management actions.

Context

- **Localized impacts:** Effects would occur within Bristol Bay Borough, including the communities of King Salmon, Naknek, and South Naknek.
- **Regional impacts:** Effects would occur over a broad geographic region of south central and southwest Alaska, including communities in Bristol Bay Borough, as well as in Anchorage and communities on the Alaska Peninsula, Kenai Peninsula, Lake and Peninsula Borough, and Kodiak Island.
- **Multistate:** Effects would occur in Alaska as well as areas in the Lower 48.

Adverse impacts are changes that would diminish the social and economic environment.

Beneficial impacts are changes that would improve the social and economic environment.

The intensities of socioeconomic impacts are defined as follows:

- **Minor:** The action would affect few people and would not be expected to alter the social and economic environment.
- **Moderate:** The action would affect a relatively small number of people and could alter the social and economic environment.
- **Major**: The action would affect a large number of people and could have a substantial effect on the social and economic environment.

CUMULATIVE IMPACT ANALYSIS

A cumulative impact is described in CEQ regulation 1508.7 as follows:

> *Cumulative impacts* are the impacts that result from incremental impacts of the action when added to other past, present, and reasonably foreseeable actions, regardless of what agency (federal or nonfederal) or person undertakes such other action. Cumulative impacts can result from individually minor, but collectively significant, actions taking place over time.

Each cumulative impact analysis is additive, considering the overall impact of the alternative when combined with effects of other actions—both inside and outside the park—that have occurred or that would likely occur in the foreseeable future.

To determine potential cumulative impacts, past, present, and reasonably foreseeable future potential actions and developments within and surrounding Brooks Camp were considered by the planning team. The primary area considered for cumulative impacts is the Naknek River drainage basin, including Lake Brooks and part of Naknek Lake. The area considered for socioeconomic cumulative impacts was broader, primarily focused on the Bristol Bay Borough, including the communities of King Salmon and Naknek.

Katmai National Park and Preserve is a remote park. Brooks Camp is only accessible by air or boat, and it is surrounded by federal lands (with a few native allotments). Virtually all of the actions considered in the cumulative impact analysis were NPS actions. No new actions or developments are foreseen adjacent to the Brooks Camp area that would affect park resources and uses. No changes in landownership and management of adjacent lands are expected to occur that would directly or indirectly affect the area. No new uses of the area or changes in transportation to Brooks Camp are considered likely, independent of what is proposed in the alternatives. Brooks Camp visitation has risen in the recent past, but it is not known how much use will increase in the future.

PAST ACTIONS

Past NPS actions considered in the cumulative impact analysis include the following:

- past actions that have occurred in the Brooks Camp area (e.g., initial construction of visitor and operational facilities, installation of the floating bridge, and improvements to the Brooks Camp picnic area)
- past, present, and future operation of the above facilities and infrastructure, including repairs

PRESENT AND FUTURE ACTIONS

The development of the Valley Road Administrative Area and removal of the facilities at Lake Brooks are ongoing and future actions that are considered in the cumulative impact analysis, while the relocation of Brooks Camp to the Beaver Pond Terrace area is considered as a future action. Figure __ in chapter 1 shows the locations of all of these facilities.

Of all the present and future actions considered in this cumulative impact analysis, the relocation of Brooks Camp

would have by far the highest potential for creating an additive impact to the alternatives considered in this environmental impact statement. (See chapter 1 for the probable timeline for relocation of the Brooks Camp facilities.)

For the cumulative impact analysis it is expected that visitation at Brooks Camp would not substantially change over the time frame being analyzed.

Valley Road Administrative Area

The Valley Road Administrative Area complex would include maintenance facilities and employee housing (two duplex cabins), which would be replaced or relocated from Brooks Camp and Lake Brooks. The goal is to reduce administrative activity at Brooks Camp to protect natural and cultural resources, reduce the potential for human-bear encounters, and address failing utilities and infrastructure. The placement of facilities at the Valley Road Administrative Area will take place in a sequential process as funding and labor become available. The maintenance building is largely complete, and utility infrastructure construction is in progress. The existing gravel pit along the Valley of Ten Thousand Smokes Road would be used as a gravel source.

Maintenance Facility. The National Park Service has taken steps to relocate some maintenance facility operations to the south side of the river to address goals identified in the 1996 development concept plan (NPS 1996). In 2008, site development for the new maintenance building area within the Valley Road Administrative Area was initiated. The area is intended to serve as the core area for electrical, water and sewer line utilities for the south side of Brooks Camp. In addition, the Lake Brooks' generators and fuel storage would be relocated to the new maintenance facility area. During 2008, the access road and gravel pad were constructed. The gravel pad is approximately 250 ft by 200 ft, has a 400-foot-long access road, and would support the new maintenance facilities. This project is expected to be completed in 2013 (NPS 2009e).

Housing. Employee housing would be located on a single loop road, which would be constructed adjacent to the recently constructed gravel pad for the new maintenance facility. The west side of the loop would contain service buildings, a community building, and housing for NPS employees, while the east side of the loop would contain building sites and service facilities for the Brooks Lodge concessioner. This layout incorporates long sweeping curves to enhance visibility for potential bear encounters. The loop maintains its role as an infrastructure corridor, minimizing the impact of development on the forest vegetation. The utilities (water, wastewater, power, heat) would run on a central spine; the building placement on each side of the path would allow branching of the utility lines (NPS 2009e).

A driveway would connect the head of the loop with the Valley of Ten Thousand Smokes Road. The gravel roadway will be approximately 1,800 ft long and 11 ft wide. A utility corridor/foot trail approximately 280 ft long and 8 ft wide would connect with the maintenance facility (NPS 2009e).

The project site would be cleared of the existing trees and stripped of the organic materials only as required for the construction of the access road, housing units, and utilities. Approximately 6 acres will be cleared. Vegetation clearing for building construction or relocation would occur in phases and only when a facility is ready to be sited. A 30-foot fire perimeter would be maintained around all structures (NPS 2009e).

Lake Brooks Facilities

Maintenance facilities at Lake Brooks consist of several small sheds totaling approximately 2,300 ft^2 of interior floor space, and approximately 32,000 ft^2 (0.73 acre) of yard space, all of which are located immediately adjacent to the 1 mile, 14-foot-wide road from Lake Brooks to Brooks Camp. All facilities on the shore of Lake Brooks would be removed and the area revegetated, except the historic fisheries cabin. Other structures associated with the fisheries cabin would either be preserved and adaptively reused or removed. The cabin will be retained and used as a visitor contact station and shuttle stop during times when floatplanes land on Lake Brooks (NPS 1996). Any of these structures nominated for the National Register of Historic Places would undergo consultation with the state historic preservation officer before any adverse action is taken.

Beaver Pond Terrace Area

Brooks Camp (including the lodge) would be moved to the Beaver Pond Terrace area south of Brooks River. Proposed facilities as described in the 1996 *Brooks River Area—Final Development Concept Plan and Environmental Impact Statement* would include a lodge and related facilities, campground, and interpretive facilities. A one lane, hardened gravel access road (about 0.5 mile long and 14 ft wide) would be constructed to connect the Valley of Ten Thousand Smokes Road with the Beaver Pond Terrace area (NPS 1996).

North Side of Brooks River

After relocation of Brooks Camp, the only facilities on the north side of the river would be the existing floatplane access, ranger/visitor contact station, and day use facilities (vault toilet and picnic area).

Note: The cumulative impact analysis does not address the future of the national register-listed ranger station, boathouse, and other potential historic structures in the area. Although the 1996 development concept plan called for the relocation of Brooks Camp, the above structures were subsequently determined to be historic structures. It is premature to analyze what would happen to these facilities in this current document; before the actual relocation of Brooks Camp, the future of the structures would be reevaluated and the effects of these options would be assessed.

BROWN BEAR (*URSUS ARCTOS*)

Alternative 1

Analysis. Under Alternative 1, bears would continue to encounter NPS staff, contractors, and pedestrians at ground level between Brooks Camp and the bus parking area and along the south bank and near the river mouth during barge landing activities. Certain portions of the trail/road between Brooks Camp and the bus parking area would continue to have high levels of pedestrian use. In the areas near the floating bridge access points at the Corner and along the south bank, park visitors and NPS service vehicles would continue to congregate and encounter bears while waiting to cross the floating bridge if a bear forces adherence to the 50-yard buffer regulation. Under alternative 1, this would continue to result in extended periods with people standing near bears at ground level. Generally, there would continue to be no clear path from along the north bank of Brooks River to the Naknek Lake beach that bears could traverse without the likelihood of encountering people at ground level.

This frequency of encounters between bears and humans would further contribute to human habituation of bears along the Brooks River corridor. In addition to reinforcing the habituation of the bears that have occupied the Brooks Camp area in past years, these interactions with humans would also help habituate bear cubs and new bears that move into the area. As described in chapter 3, the human habituation of bears can have adverse effects on bears, particularly if the bears move off protected park lands. Habituated bears may have a greater tendency to approach people, which may lead to dangerous interactions resulting in bears being shot and injured or killed.

These effects are most important from late August through September, when bear activity near the river mouth and along the lake shoreline peaks. The presence of the floating bridge across the full width of the river during peak bear use periods would continue to be an impediment to movement of bears up and down the river—the bridge would continue to be an obstacle to bears walking in this part of the river. However, the bridge has been present for years and bears have adapted to its presence. Bears would continue to be able to swim under the bridge and walk on land around the bridge. This would have no notable effects on brown bear numbers or habitat.

With the continuation of the ground level trails in this alternative, brown bears and humans that do not see one another would continue to have ground level encounters at very close distances. This would continue the risk for human-bear interactions and/or human habituation of bears. Although it would be a violation of park policy, some park visitors would likely continue to disregard the 50-yard buffer from bears at ground level.

Because of the limited construction season, ongoing Brooks Camp operations and maintenance work would continue to necessitate relatively frequent barge loading/unloading activities near the river mouth during the summer when bear activity in the area peaks. Bear activity at the river mouth would continue to be disturbed and bears displaced by the presence of people and machinery, affecting their fishing and obtaining food from this area. There also would continue to be the potential for human-bear confrontations and bears being injured or killed.

With the ongoing ground level human activity along the trails through wooded areas, bears would continue to have limited areas in which they can reliably expect to rest and/or avoid ground level disturbances from humans in and around nearby visitor use areas of the project area and the river.

Overall, alternative 1 would continue to result in a long-term, moderate, adverse, and primarily localized impact to brown bears. (Some parkwide adverse effects could occur if habituated bears from Brooks Camp move to other areas in the region and retained their habituated behavior.) The effects on brown bear habitat could cause or continue to cause changes to brown bear feeding, resting, mating, or caring for young. These adverse effects relate to the continued types and levels of human-bear interactions at ground level, habitat disturbance, and human habituation of bears. The interactions, disturbances, and habituation would primarily result from continuing park visitor activities and park staff/concessioner activities during the visitation season. It is believed that less than half of the brown bears using the Brooks River area would be affected by continuing actions in alternative 1, and changes to the regional brown bear population would be minimal.

Cumulative Impacts. Various other past, present, and reasonably foreseeable future projects in and near the project area have and would continue to affect brown bears and their habitat. These projects relate to facility development, recreation access, site restoration, and program development.

Multiple past actions have had notable effects on brown bears in the project area, particularly in the vicinity of Brooks Camp and along the Brooks River corridor. Most of these past actions have had adverse effects on habitat and have primarily involved the facility development and expanded recreational access associated with Brooks Camp over the years (e.g., lodge, campground, visitor center, restrooms, operations facilities, utilities, guest cabins, staff housing, floating bridge, trails, and viewing platforms). The short-term adverse impacts relate to the temporary noise and human activity disturbances associated with the construction and material movement at each respective development or recreation improvement. These short-term effects could alter bear behavior, such as feeding and resting, and could temporarily displace individual bears into less desirable areas. The long-term effects have generally resulted from displaced bear habitat from facility footprints, fragmented habitat from roads and trails, and/or reduced quality of bear habitat from the resulting regular human activity in all of these areas. When all of the existing (past) developments in the Brooks River area are considered, a total of approximately 85 acres of bear habitat have been modified or lost to development (Brooks Camp: 6 acres; Brooks River area: 40 acres; Brooks Falls trail: 4 acres; Lake Brooks development: 3 acres; contractor camp: 2 acres; and access roads: 30 acres). Although these past actions generally have had little effect on local and regional bear population numbers, they have certainly led to more human-bear interactions and human habituation of bears over time.

In addition, present and reasonably foreseeable future actions would also affect brown bear habitat in the project area. Such actions could include additional facility improvements around the Brooks River area (e.g., the maintenance and housing development at the Valley Road Administrative Area); the removal (and site restoration) of Lake Brooks maintenance and housing facilities; and the overall relocation of Brooks Camp and its associated uses to the south of Brooks River (near Beaver Pond Terrace). When all new developments are considered, along with areas where vegetation would be restored (e.g., areas where current facilities are on the north side of the river), a total of approximately 57 acres of bear habitat would be modified or lost to

development in the future (proposed Beaver Pond Terrace: 45 acres; Valley Road Administrative Area: 15 acres; and the removal of facilities on north side of river and at Lake Brooks: 3 acres and 0.3 acres, respectively). Most of this habitat, however, would not be prime bear habitat. The short-term effects of these actions would relate to the disturbances to bear habitat from construction and project mobilization activities, including the transport of materials through the area's roads/trails. The adverse, long-term effects of some of these actions could involve further displacement and/or fragmentation of bear habitat in localized parts of the project area from facility improvements or expansions and the development of the Beaver Pond Terrace area and the Valley Road Administrative Area. The present and future actions would result in the removal of substantial levels of facilities and human activity from prime bear habitat in the Brooks River corridor (e.g., near the Corner area, river mouth, Naknek Lake shoreline, and near the Lake Brooks outlet into Brooks River). Restoration of this habitat would benefit brown bears.

When the likely adverse effects of alternative 1 are added to the effects of these other past, present, and reasonably foreseeable future actions, there would be a long-term, moderate, adverse, and primarily localized cumulative impact on brown bears. (Parkwide cumulative impacts could occur if bears that become habituated to humans at Brooks Camp leave the project area and move into other areas in the region.) Alternative 1 would contribute an appreciable, adverse increment to the overall moderate, adverse cumulative impact.

Conclusion. Alternative 1 would result in continuing long-term, moderate, adverse, and localized impacts on the brown bear. Adverse parkwide effects could occur if habituated bears from Brooks Camp move in to other areas in the region. These adverse effects would primarily result from continuing ground level human-bear interactions between Brooks Camp and the bus parking area on the south side of Brooks River. The interactions would continue to result from the physical overlap of human high use areas at ground level (visitors and staff) and brown bear high use areas (along the river, near the mouth, and along Naknek Lake). Occasional unsafe human-bear interactions would be expected to continue as well as the resulting human habituation of bears, with the potential for bears being injured or killed.

Alternative 2

Analysis. The proposed elevated bridge would eliminate the need for a floating bridge, which is an obstruction to bears moving up and down Brooks River (while in the water). An elevated bridge should allow for greater access to habitat, less stress, and easier movement by bears than under the current situation. Bear numbers could also increase in this area (NPS 2009f). In addition, bears would have an open travel route from the lower Brooks River to Naknek Lake via the river's north bank and the Corner and avoid interacting with humans at ground level, particularly during late summer and autumn peak use times. This could also provide greater access to habitat, reduce stress in bears, and increase the number of bears using the area.

Under alternative 2, bears would regularly encounter pedestrians (i.e., visitor groups, individual visitors, and staff) elevated overhead on the boardwalk and bridge instead of at ground level. The decks of the bridge and boardwalks would be about 10 ft above the river and ground, respectively. Alternative 2 (map 4) includes a total of about 2,045 linear ft of elevated boardwalks available for pedestrian use (760 ft for the north boardwalks, 925 ft for the south boardwalks, and 360 ft for the bridge). Approximately 1,610 ft of this total length would be used mostly by park visitors. The use of these elevated

boardwalks would result in bears having substantially less interactions with human pedestrians at ground level. People moving along raised boardwalks would generally affect bear behavior less than they would at ground level on the same trails that bears use (NPS 2009f). Bears would also have more advanced warning of approaching humans because people walking on a wooden boardwalk deck would typically emit louder noises than walking on soil or gravel, and views of approaching humans would be less obstructed by thick ground vegetation. This would benefit the bears by reducing the potential for dangerous incidents (for the involved bears or humans)—there would be a lower likelihood of bears being injured or killed. These effects could also reduce the potential for human habituation, which could benefit the bears if they move out of the Brooks Camp area into other areas in the region.

Most bears over time would be expected to become accustomed/habituated to the existence and use of the new bridge and boardwalks (NPS 2009f). However, behavioral evidence from bears near the existing elevated boardwalk to Brooks Falls indicates that overhead human activity could intimidate, alter movement/behavior of, or possibly scare off some individual bears (DeBruyn et. al. 2004). Thus, some bears may not adapt well to the 1,610 linear ft of elevated travelways for pedestrians in this alternative. This could result in these individuals altering their preferred river access routes or avoiding river stretches that provide the most favorable salmon fishing. Some bears may avoid the new structures for the short-term, but then return to the area. Some may choose to avoid the area entirely because of overhead pedestrian activity. Although humans would be separated from bears by about 10 vertical ft, park visitors on the bridge or boardwalks would not be asked/required to apply the 50-yard buffer rule that they would otherwise use at ground level. Thus, humans would regularly be near bears near the mouth of the river and near Brooks Camp under this alternative. This could contribute to human habituation of bears.

Traffic patterns and noise on raised structures have at least as much potential to affect bear behavior as the structures themselves (NPS 2009f). This alternative includes 995 linear ft of elevated access for motorized vehicles (425 ft for the north boardwalk/ramp, 360 ft for the bridge, and 210 ft for the south ramp). Bears would encounter NPS/concessioner service vehicles overhead on the boardwalk/bridge structure instead of at ground level, resulting in bears having less direct ground level interaction with vehicles and less potential for habituation. However, some bears might not adapt well to overhead vehicles and could avoid the area entirely.

In alternative 2 bears would be exposed to increased noise from motorized vehicles running on the wood deck of the bridge and boardwalks instead of gravel or soil (for about 995 ft). In addition, motorized vehicles would likely make additional noise while climbing the vehicle ramps near the south bank of the river and near the Corner. Increased noises in the area could alter the feeding and resting behavior of some bears.

Human activity (pedestrians and NPS/concessioner vehicles) would be more visible to bears that are farther upriver because of the 10-foot elevation of the bridge and the exposed portions of the north boardwalk that would run to the west of existing shrub and tree cover. However, wooded areas on the south side of the river would provide some visual boardwalk screening to views from both upriver and downriver. Although some of the visual disturbance would be at a distance, some bears may alter their behavior or activity after seeing more human activity in the area.
Sounds from human activity on the boardwalks and bridge would carry farther because of the elevation of the activity and the placement of the elevated walkway outside wooded areas that would

otherwise buffer the noises. Assuming there is judicious use of quiet vehicles on the bridge and boardwalks, there should be little effect on most bears in the area (NPS 2009f). The most notable areas of sound exposure would be on the bridge (exposed to upriver and downriver areas) and along the north boardwalk, which would be partially exposed to upriver areas. Trees and shrubs on the south side of the river would provide some screening that would limit noise propagation. However, even with the use of relatively quiet vehicles, elevating noise sources may result in some bears hearing more nearby human activity and altering their behavior or activity.

Under this alternative, bears would encounter less ground level human activity along the river corridor because the elevated structures would route pedestrians across the river with minimal time congregating along the north or south bank waiting to cross the floating bridge.

Bears would have a region of wooded area with minimal ground level human activity near the mouth of the river (on both north and south sides) where they could expect to rest or forage without human intrusion. Most notably under this alternative, the north boardwalk would avoid the Corner area (which is currently fragmented by the ground trail/road). Removing the existing trail through the Corner would allow for increased use of the trail, riverbank, woods, and beach around the point by bears (NPS 2009f). This effect would be most valuable to the bears from late August through October when the bears congregate near the mouth of Brooks River to feed on dead or dying salmon.

Under alternative 2 the separated vehicle ramp and pedestrian boardwalk on the north side of the river would enlarge the area of human activity somewhat near Brooks Camp. Similarly, the bus parking area south of the river would be served by two separate travel routes from the bridge (elevated boardwalk with pedestrian activity and the existing service road for NPS vehicles). Under alternative 1 only one shared access route is used for both pedestrians and vehicles on both sides of the river. The divergences of the pedestrian access and vehicle access in alternative 2 would create two separate corridors of regular human activity on each side of the Brooks River (although NPS vehicle use would be relatively intermittent compared to visitor/pedestrian use). In turn, this would increase the geographic area of human disturbance to bears on both sides of the river.

However, this separated boardwalk alignment would reduce the amount of pedestrian activity at ground level near the southern end of Brooks Camp because it would route pedestrians directly to the Brooks Camp lodge. The boardwalk alignment would provide a buffer to the west and north of the Corner area where human activity would be minimal. This effect would be particularly important from late August through October when the bears frequent the Corner to access the river mouth and the Naknek Lake shoreline.

Under this alternative, the barge landing site would be moved from the river mouth to a location approximately 2,000 ft south along Naknek Lake (figure 3). Thus, brown bears that are resting or foraging along both shores of the river mouth would not encounter NPS vessels being loaded and unloaded at the barge landing site or vehicles traveling along the south bank to/from the landing on the access road (which would be reclaimed under this alternative). Relocating the facilities should substantially reduce bear impacts—more bears would likely be present in the river mouth area where they could feed on fish and fewer bears would likely be present farther away from the river corridor. The effect of this relocation would be most notable from late August through October when most of the bear activity is concentrated near the mouth of Brooks River.

However, the proposed access road that would serve the new barge landing site (figure 3) would introduce occasional human disturbances into the area between Brooks River and Beaver Pond. The roadway length would be approximately 1,500 ft, and most of the disturbances to bear habitat would involve NPS/concessioner motorized vehicle traffic. Increased noises and human disturbances along the access road and at the landing could alter bear resting, movement, and other behaviors of some bears in a new area that has not been disturbed.

The construction activities associated with the bridge and elevated boardwalks would have various adverse effects on the brown bear and its habitat. Some construction would occur for a few months each year for 3 years. Construction disturbances to bears could include heavy construction equipment operation, noise from handheld construction tools (power tools and manual), construction transport vehicles, worker voices, and generators. The degree of impact on bear habitat would be dependent on the type and intensity of the construction activity and the time of year the construction activity occurs (as it relates to the June and September peaks of bear activity in the area). Construction activity during peak feeding times in July and September-October have more potential for impacts and human-bear interaction than other months (NPS 2009f). Given the proposed construction schedule, the most notable impacts would occur (1) from late August through mid-September of the first year during the construction mobilization phase; and (2) from late June through July and from late August through October in the second year (when boardwalk decking and handrail construction takes place). To help minimize these effects, particularly during July and September, work time limits, construction noise restrictions, and other mitigation measures would be applied (e.g., limiting to small power tool use, containing construction worker food and garbage) (NPS 2009f). In spite of these mitigation measures, if hazing of bears becomes necessary, which would be a small possibility, the behavior of a few bears may be altered during the construction period and some may be temporarily displaced from areas they might otherwise use. This could affect feeding activities and competition with other bears.

The construction activities associated with the new barge landing site (figure 3), new access road (about 1,500 ft long), and restoration of the existing access road (map 4) would also have various adverse impacts on the bears. These construction and restoration activities would occur over a few months in the spring and fall of one year. Most construction impacts would result from heavy construction equipment operation (e.g., road grading), material transport vehicles, and human presence. The most notable impacts would occur during the late summer and autumn construction phase (August through mid-November), a period when the bears become very active feeding on spawned-out salmon along Brooks River. The intensity of the impact to bears would lessen as the construction activity moves farther away from Brooks River. In addition, to help minimize these effects, various mitigation measures would be applied to construction activities, such as maintaining mufflers on construction equipment and generators, limiting construction to daylight hours, and actively containing food/garbage of construction workers.

Overall, alternative 2 would result in short- and long-term, moderate, adverse, and primarily localized impacts to brown bears due to human disturbances to bears and their habitat. Short-term impacts would be due to construction activities, while long-term impacts would be due to use of the facilities. (Some parkwide adverse effects could occur if habituated bears from Brooks Camp move to other areas in the region and retained their habituated behavior.) The effects of alternative 2 on

brown bear habitat could cause changes to brown bear feeding, resting, mating, or caring for young. These adverse effects relate to habitat disturbances from human activity on the proposed 2,045 ft of elevated boardwalks, increased habitat fragmentation from separated vehicle/pedestrian travel on both sides of the river, human habituation of bears, and continued human-bear interactions at ground level (in areas where people do not use the elevated boardwalks). The interactions, disturbances, and habituation would primarily result from park visitor activities and park staff/concessioner activities during the visitation season. It is believed that less than half of the brown bears using the Brooks River area would be affected by the actions and developments in alternative 2, and changes to the regional brown bear population would be minimal.

Compared to alternative 1, alternative 2 would likely result in a decrease in adverse effects on brown bears due to the elimination of the floating bridge, the restoration of an open travel route from the lower Brooks River to Naknek Lake via the river's north bank and the Corner, and the vertical separation of humans and bears throughout the project area, which would result in less ground level interactions and possibly reduced habituation. Bears along the Brooks River corridor would also benefit from the relocation of the barge landing and access road away from the river. However, because the 50-yard horizontal buffer rule would no longer apply to people on the elevated boardwalks and bridge, this alternative would result in notably shorter horizontal distances between humans and bears. This could contribute to an increase in habituation of bears.

Cumulative Impacts. Various other past, present, and reasonably foreseeable future projects in and near the project area have and would continue to affect brown bears and their habitat. These projects relate to facility development, recreation access, site restoration, and program development, and have affected (or would affect) the Brooks River area as described in the preceding "Cumulative Impacts" section under alternative 1.

When the likely effects of alternative 2 actions (e.g., construction and use of the bridge, boardwalks, and barge landing site) are added to the effects of other past, present, and reasonably foreseeable future actions, there would likely be a long-term, moderate, adverse, primarily localized cumulative impact on brown bears. (Parkwide adverse cumulative impacts could occur if bears that become habituated to humans at Brooks Camp leave the project area and move into other areas in the region.) Alternative 2 would contribute an appreciable, adverse increment to this overall adverse cumulative impact.

Conclusion. Alternative 2 would result in short- and long-term, moderate, adverse, and primarily localized impacts on brown bears due to human disturbances to bears and their habitat. There still would be potential for human habituation of bears, and some potential for occasional unsafe human-bear interactions and bears being injured or killed. These adverse effects would mainly result from the notable distance of overhead human activity above bears and bear habitat in the area (pedestrians and vehicles), a decrease in the horizontal separation between bears and humans (i.e., people on the elevated structures), an increase in the visual and audio exposure of human activities, and disturbance to the bear habitat in the project area with construction-related activities and noises. However, when compared to alternative 1, brown bears would benefit from the removal of the floating bridge, a reduced potential for ground level human-bear interactions along the Brooks River corridor, an undisturbed and buffered area for bear resting or movement near the river mouth (i.e., the Corner area), and the relocation of the barge landing site approximately

2,000 ft to the south along the Naknek Lake shoreline.

Alternative 3

Analysis. The proposed elevated bridge in alternative 3 would eliminate the need for a floating bridge, which is an obstruction to bears moving up and down Brooks River. In addition, bears would have an open travel route from the lower Brooks River to Naknek Lake via the river's north bank and the Corner and avoid interacting with humans at ground level. This should allow for greater access to habitat, less stress, easier movement by bears, and possibly increased numbers of bears using the area.

Under alternative 3, bears would regularly encounter pedestrians (i.e., visitor groups, individual visitors, and staff) elevated overhead on the boardwalk and bridge instead of at ground level. The decks of the bridge and boardwalks would be approximately 10 ft above the river and ground, respectively. Alternative 3 includes a total of about 945 ft of elevated boardwalks for pedestrian use (330 ft for the north boardwalk, 200 ft for the south boardwalk, and 415 ft for the bridge; see map 5). The entire length of the bridge and boardwalks would be shared by pedestrian visitors, staff, and NPS/concessioner vehicles. The shared use of the elevated boardwalk would result in bears having less interaction with pedestrians at ground level. People moving along raised boardwalks would generally affect bear behavior less than they would at ground level on the same trails that bears use (NPS 2009f). Bears would also have more advanced warning of approaching humans because people walking on a wooden boardwalk deck would typically emit louder noises than walking on soil or gravel, and views of approaching humans would be less obstructed by thick ground vegetation. This would benefit the bears by reducing the potential for dangerous incidents (for the involved bears or humans)—there would be a lower likelihood of bears being injured or killed. These effects could also reduce the potential for human habituation, which could benefit the bears if they travel out of the Brooks Camp area into other areas in the region.

Most bears over time would be expected to become accustomed/habituated to the existence and use of the new bridge and boardwalks (NPS 2009f). However, behavioral evidence from bears near the existing elevated boardwalk to Brooks Falls indicates that overhead human activity could intimidate, alter movement/behavior of, or possibly scare off some individual bears (DeBruyn et. al. 2004). Thus, some bears may not adapt well to the 945 ft of elevated boardwalks for pedestrians in this alternative. This could result in these individuals altering their preferred river access routes or avoiding river stretches that provide the most favorable salmon fishing. Some bears may avoid the new structures for the short-term, but then return to the area. Some may choose to avoid the area entirely because of the overhead pedestrian activity. Although humans would be separated from bears by about 10 vertical ft, park visitors on the bridge or boardwalks would not be asked/required to apply the 50-yard buffer rule that they would otherwise use at ground level. Thus, humans would regularly be very near bears near the mouth of the river and near Brooks Camp under this alternative. This reduced (horizontal) separation of humans and bears could contribute to human habituation of bears.

Bears would also encounter NPS/concessioner service vehicles overhead on the boardwalk/bridge structure instead of at ground level. This alternative includes 945 linear ft of elevated access for motorized vehicles, which would result in bears having less direct ground level interaction with vehicles and less potential for habituation. However, some bears might not adapt well to overhead vehicles and could avoid the area entirely.

In alternative 3 bears would be exposed to increased noise from motorized vehicle tires running on the wood deck of the bridge and boardwalks instead of gravel or soil (for about 945 ft). In addition, motorized vehicles would likely make additional noise while climbing the ramps near the south bank of the river and near the Corner.

Also in alternative 3 human activity (pedestrians and NPS/concessioner vehicles) would be more visible to bears that are upriver because of the 10-foot elevation of the bridge. However, the north boardwalk would be relatively screened due to its alignment through the existing trees in the Corner area. Although some of the elevated visual disturbance would be at a distance, some bears may alter their behavior or activity after seeing more human activity in the area.

Sounds from human activity on the boardwalk and bridge would carry farther due to the elevation of the activity and the placement of the elevated walkway outside wooded areas that would otherwise buffer the sounds. Assuming there is judicious use of quiet vehicles on the bridge and boardwalks, there should be little effect on most bears in the area (NPS 2009f). Noises from the elevated bridge would be somewhat muted under this alternative because this boardwalk would be routed through existing trees on the north side of the river. However, even with the use of relatively quiet vehicles, elevating noise sources may result in some bears may hear more nearby human activity and alter their behavior or activity.

Under this alternative, bears would encounter less ground level human activity along the river corridor because the elevated structures would route pedestrians across the river with no time congregating along the north bank waiting to cross the floating bridge. This alternative would still allow pedestrians to congregate along the south bank (i.e., the elevated boardwalk would not continue south of the river).

Bears would have a region of wooded area with minimal ground level human activity near the mouth of the river where they could rest or forage without human intrusion. This effect would be most valuable to the bears from late August through October, when the bears congregate near the mouth of the Brooks River to feed on dead or dying salmon. However, the routing of the elevated walkway and vehicle ramp through the Corner area would allow existing levels of human activity and potential disruption for bears to continue in this area (despite being elevated). In addition, human disturbances to bears along the south bank and near the barge landing would also continue at ground level.

Also, human activity at ground level would be prominent next to the fish freezing building because the elevated walkway would terminate here under alternative 3. The location of the boardwalk terminus would likely cause a visitor gathering area in a location that is immediately adjacent to the Corner, and an area that is frequently used by bears. This could disturb resting bears and increase the potential for habituation. This effect would have the most impact on bears from late August through October when the bear activity near the Corner is highest.

Under this alternative, the barge landing site would be moved from the river mouth (about 200 ft south along Naknek Lake), but the access road would remain relatively unchanged for most of its length (figure 5). The small offset of the proposed barge landing from the river mouth (and behind existing shrubs and trees) would reduce noise and human activity disturbances to bears in the river mouth. But, NPS/contractor activities at the landing site and along the access road would continue to disturb bear activity near and along the river.

The construction activities associated with the bridge and elevated boardwalks would have various adverse effects on the brown bear and its habitat. Most construction would be scheduled for times when bears are not present or are present in smaller numbers. However, some construction activities would still affect some bears in the summer and fall. Construction disturbances to bears could include heavy construction equipment operation, noise from handheld construction tools (power tools and manual), construction transport vehicles, worker voices, and generators. The degree of impact on bear habitat would be dependent on the type and intensity of the construction activity, and the time of year the construction activity occurs (as it relates to the June and September peaks of bear activity in the area). Construction activity during peak feeding times in July and September-October have more potential for impacts and human-bear interaction than other months (NPS 2009f). Given the proposed construction schedule, the most notable impacts would potentially occur (1) from late August through mid-September of the first year during the construction mobilization phase, and (2) from late June through July and from late August through October in the second year (when boardwalk decking and handrail construction takes place). To help minimize these effects, particularly during July and September, work time limits, construction noise restrictions, and other mitigation measures would be applied (e.g., limiting to small power tool use and containing construction worker food and garbage) (NPS 2009f). In spite of these mitigation measures, if hazing of bears becomes necessary, which would be a small possibility, the behavior of a few bears may be altered during the construction period and some may be temporarily displaced from areas they might otherwise use. This could affect feeding activities and competition with other bears.

Alternative 3 includes a relocated barge landing (approximately 200 ft south of the existing landing) and a relatively short reroute of the barge landing access road near the mouth of the Brooks River (figure 5). These construction activities would occur over a few months in the spring and fall of one year. The construction activities associated with the new barge landing site and short access road reroute would impact bear habitat. The most notable impacts would likely occur during the late summer and autumn construction phase (August through mid-November), a period when the bears become very active River feeding on spawned-out salmon along the Brooks. To help minimize these effects, various mitigation measures would be applied to construction activities, such as maintaining mufflers on construction equipment and generators and limiting construction to daylight hours, and actively containing food/garbage of construction workers.

Overall, alternative 3 would result in short- and long-term, moderate, adverse, and primarily localized impacts to brown bears, due to human disturbances to bears and their habitat. Short-term impacts would be due to construction activities, while long-term impacts would be due to use of the facilities. (Some parkwide adverse effects could occur if habituated bears from Brooks Camp move to other areas in the region and retained their habituated behavior.) The effects of alternative 3 on brown bear habitat could cause changes to brown bear feeding, resting, mating, or caring for young. These adverse effects relate to habitat disturbances from human activity on the proposed 945 ft of elevated boardwalks, human habituation of bears, and continued human-bear interactions at ground level (in areas where people do not use the elevated boardwalks). The interactions, disturbances, and habituation would primarily result from park visitor activities and park staff/concessioner activities during the visitation season. It is believed that less than half of the brown bears using the Brooks River area would be affected by the actions and developments

in alternative 3, and changes to the regional brown bear population would be minimal.

Compared to alternative 1, alternative 3 would likely result in a decrease in adverse effects on brown bears due to the elimination of the floating bridge, and vertical separation of humans and bears in portions of the project area (mainly across and north of the river), which would result in less ground level interactions and possibly reduced habituation. However, because the 50-yard horizontal buffer rule would no longer apply to people on the elevated boardwalk or bridge, this alternative would result in notably shorter horizontal distances between humans and bears. This could contribute to an increase in habituation of bears.

Cumulative Impacts. Various other past, present, and reasonably foreseeable future projects in and near the project area have and would continue to affect brown bears and their habitat. These projects relate to facility development, recreation access, site restoration, and program development, and have affected (or would affect) the Brooks River area as described in the "Cumulative Impacts" section under alternative 1.

When the likely effects of alternative 3 actions are added to the effects of these other past, present, and reasonably foreseeable future actions, there would be a long-term, moderate, adverse, primarily localized cumulative impact on brown bears. (Parkwide cumulative impacts could occur if bears that become habituated to humans at Brooks Camp leave the project area and move into other areas in the region.) Alternative 3 would contribute an appreciable, adverse increment to this overall adverse cumulative impact.

Conclusion. Alternative 3 would result in short- and long-term, moderate, adverse, and primarily localized impacts on brown bears. There still would be potential for human habituation of bears and some potential for occasional unsafe human-bear interactions and for bears being injured or killed. These adverse effects would mainly result from the proposed overhead human activity above bears and bear habitat in the area (pedestrians, staff, and vehicles), a decrease in the horizontal separation between bears and humans (i.e., people on the elevated structures), an increase in the visual and audio exposure of human activities on the boardwalks and bridge, disturbance to the bear habitat in the project area with construction-related activities and noises, and continued ground level interactions between bears and humans (primarily on the south side of the river where elevated boardwalks terminate). However, when compared to alternative 1, brown bears would benefit from the elimination of the floating bridge and a reduced potential for ground level human-bear interactions on the north side of the river.

Alternative 4

Analysis. The proposed elevated bridge would eliminate the need for a floating bridge, which is an obstruction to bears moving up and down Brooks River (while in the water). In addition, bears would have an open travel route from the lower Brooks River to Naknek Lake via the river's north bank and the Corner where they could avoid interacting with humans at ground level, particularly during late summer and autumn. This should allow for greater access to habitat, less stress, easier movement by bears, and possibly increased numbers of bears using the area.

Under alternative 4 bears would regularly encounter pedestrians on the (i.e., visitor groups, individual visitors, and staff) elevated overhead on the boardwalk and bridge structures instead of at ground level. The decks of the bridge and boardwalks would be approximately 10 ft above the river and ground, respectively. Alternative 4 includes about 1,540 linear ft of elevated boardwalk for visitor or staff pedestrian use (560 ft for the north boardwalk, 630 ft

for the south boardwalk, and 350 ft for the bridge). The entire length of the bridge and boardwalks would be shared by pedestrians and vehicles. The use of this elevated boardwalk would result in bears having substantially less interactions with human pedestrians at ground level. People moving along raised boardwalks would generally affect bear behavior less than they would at ground level on the same trails that bears use (NPS 2009f). Bears would also have more advanced warning of approaching humans because people walking on a wooden boardwalk deck would typically emit louder noises than walking on soil or gravel, and views of approaching humans would be less obstructed by thick ground vegetation. This would benefit the bears by reducing the potential for dangerous incidents (for the involved bears or humans)—there would be a lower likelihood of bears being injured or killed. These effects could also reduce the potential for human habituation, which could benefit the bears if they travel out of the Brooks Camp area into other areas in the region.

Most bears over time would be expected to become accustomed/habituated to the existence and use of the new bridge and boardwalks (NPS 2009f). However, behavioral evidence from bears near the existing elevated boardwalk to Brooks Falls indicates that overhead human activity could intimidate, alter movement/behavior of, or possibly scare off some individual bears (DeBruyn et. al. 2004). Thus, some bears may not adapt well to the 1,540 linear ft of elevated boardwalks for pedestrians in this alternative. This could result in these individuals altering their preferred river access routes or avoiding river stretches that provide the most favorable salmon fishing. Some bears may avoid the new structures for the short-term, but then return to the area. Some may choose to avoid the area entirely because of the overhead pedestrian activity. Although humans would be separated from bears by about 10 vertical ft, visitors on the bridge or boardwalks would not be asked/required to apply the 50-yard buffer rule that they would otherwise use at ground level. Thus, humans would regularly be very near bears near the mouth of the river and near Brooks Camp under this alternative. This could contribute to human habituation of bears.

Bears would also encounter NPS/concessioner service vehicles overhead on the boardwalk/bridge structure instead of at ground level. This alternative includes 1,540 linear ft of elevated access for motorized vehicles, which would result in bears having less direct ground level interaction with vehicles and less potential for habituation. However, some bears might not adapt well to overhead vehicles and could avoid the area entirely.

In alternative 4 bears would be exposed to increased noise volumes from motorized vehicle tires running on the wood deck of the bridge and boardwalks instead of gravel or soil (for 1,540 ft). However, unlike alternatives 2 and 3, motorized vehicles likely would not make additional noise climbing the boardwalk ramps because both the north and south vehicle ramps would be relatively flat (the boardwalk alignment would take advantage of local topography).

Also in alternative 4 human activity (pedestrians and NPS/concessioner vehicles) would be more visible to bears upriver because of the 10-foot elevation of the bridge and the exposed alignment of the north boardwalk that runs to the west of existing shrub and tree cover. However, wooded areas on the south side of the river would provide some visual boardwalk screening to views from both upriver and downriver. Although some of the visual disturbance would be at a distance, some bears may alter their behavior or activity after seeing more human activity in the area.

Sounds from human activity on the boardwalks and bridge would carry farther

because of the elevation of the activity and the placement of the elevated walkway outside wooded areas that would otherwise buffer the sounds. Assuming there is judicious use of quiet vehicles on the bridge and boardwalks, there should be little effect on most bears in the area (NPS 2009f). The most notable areas of sound exposure would be on the bridge (exposed to upriver and downriver areas) and along the north boardwalk, which would be fully exposed to upriver areas. Trees and shrubs on the south side of the river would provide some screening that would limit noise propagation. However, even with the use of relatively quiet vehicles, as a result of elevating noise sources some bears may hear more nearby human activity and alter their behavior or activity.

Under alternative 4 bears would encounter less ground level human activity immediately along the river corridor because the path of the elevated structures would route pedestrians across the river with no time congregating along the north or south bank waiting to cross the floating bridge). The pedestrians would access the elevated boardwalk from within Brooks Camp and from near the bus parking area on the south side of the river.

Bears would have a region of wooded area with minimal ground level human activity near the mouth of the river (on both north and south sides) where they could rest or forage without human intrusion. Most notably, under this alternative, the north boardwalk avoids the Corner area, which would otherwise continue to be fragmented by the existing ground trail/road. Pedestrians and NPS/concessioner vehicles would be routed around and away from the Corner and areas on the south bank near the river mouth. Removing the existing trail would allow for increased use of the trail, riverbank, woods, and beach around the point by bears (NPS 2009f). This effect would be most valuable to the bears from late August through October, when the bears congregate near the mouth of the Brooks River to feed on dead or dying salmon.

Also, under this alternative, the barge landing site would be moved away from the river mouth to a location approximately 2,000 ft south along Naknek Lake (figure 3). Thus, brown bears that are resting or foraging along both shores of the river mouth would not encounter NPS vessels being loaded and unloaded at the barge landing, or vehicles traveling along the south bank to/from the landing on the access road (which would be reclaimed under this alternative). Relocating the facilities should substantially reduce bear impacts—more bears would likely be present in the river mouth area where they could feed on fish and fewer bears would likely be present farther away from the river corridor. The effect of this relocation would be most notable from late August through October when most of the bear activity is concentrated near the mouth of Brooks River.

However, the proposed access road that would serve the new barge landing site (figure 3) would introduce occasional human disturbances into the area between Brooks River and Beaver Pond. The roadway length would be approximately 1,500 ft, and most of the disturbances to bear habitat would involve NPS/concessioner motorized vehicle traffic. Increased noises and human disturbances along the access road and at the landing could alter bear resting, movement, and other behaviors of some bears in a new area that has not been disturbed.

The construction activities associated with the bridge and elevated boardwalks would have various adverse effects on the brown bear and its habitat. Most construction would be scheduled for times when bears are not present or are present in smaller numbers. However, some construction activities would still affect some bears in the summer and fall. Construction disturbances to bears could include heavy

construction equipment operation, noise from handheld construction tools (power tools and manual), construction transport vehicles, worker voices, and generators. The degree of impact on bear habitat would be dependent on the type and intensity of the construction activity and the time of year the construction activity occurs (as it relates to the June and September peaks of bear activity in the area). Construction activity during peak feeding times in July and September through October have more potential for impacts and human-bear interaction than other months (NPS 2009f). Given the proposed construction schedule, the most notable impacts would occur (1) from late August through mid-September of the first year during the construction mobilization phase and (2) from late June through July and possibly from late August through October in the second year (when boardwalk decking and handrail construction takes place). To help minimize these effects, particularly during July and September, work time limits, construction noise restrictions, and other mitigation measures would be applied (e.g., limiting to small power tool use and containing construction worker food and garbage) (NPS 2009f). In spite of these mitigation measures, if hazing of bears becomes necessary, which would be a small possibility, the behavior of a few bears may be altered during the construction period and some may be temporarily displaced from areas they might otherwise use. This could affect feeding activities and competition with other bears in the short term.

The construction activities associated with the new barge landing, new access road (about 1,500 ft in length), and restoration of the two existing access roads (along south bank and the road to the bus parking area) (map 6) would also have various adverse impacts on the bears. These construction and restoration activities would occur over a few months in the spring and fall of one year. Most construction impacts would result from heavy construction equipment operation (e.g., road grading), material transport vehicles, and human presence. The most notable impacts would occur during the late summer and autumn construction phase (August through mid-November), a period when the bears become very active feeding on spawned-out salmon along Brooks River. The intensity of the impact on bears would lessen as the activity moves away from Brooks River. In addition, to help minimize these effects, various mitigation measures would be applied to construction activities, such as maintaining mufflers on construction equipment and generators, limiting construction to daylight hours, and actively containing food/garbage of construction workers.

Overall, alternative 4 would result in a long-term, moderate, adverse, and primarily localized impact to brown bears, even with the bridge and boardwalks, due to human disturbances to bears and their habitat. (Some parkwide adverse effects could occur if habituated bears from Brooks Camp move to other areas in the region and retain their habituated behavior.) The effects of alternative 4 on brown bear habitat could cause changes to brown bear feeding, resting, mating, or caring for young. These adverse effects relate to habitat disturbances from human activity on the proposed 1,540 ft of elevated boardwalks, human habituation of bears, and continued human-bear interactions at ground level (in areas where people do not use the elevated boardwalks). The interactions, disturbances, and habituation would primarily result from park visitor activities and park staff/concessioner activities during the visitation season. It is believed that less than half of the brown bears using the Brooks River area would be affected by the actions and developments in alternative 4, and changes to the regional brown bear population would be minimal. Compared to alternative 1, alternative 4 would result in a decrease in adverse effects on brown bears due to the elimination of the floating bridge, the

restoration of an open travel route from the lower Brooks River to Naknek Lake via the river's north bank and the Corner, and the vertical separation of humans and bears throughout the project area, which would result in less ground level interactions and possibly reduced habituation. Bears along the Brooks River corridor would also benefit from the relocation of the barge landing and access road away from the river. However, because the 50-yard horizontal buffer rule would no longer apply to people on the elevated boardwalk and bridge, this alternative would result in notably shorter horizontal distances between humans and bears. This could contribute to an increase in habituation of bears.

Cumulative Impacts. Various other past, present, and reasonably foreseeable future projects in and near the project area have and would continue to affect brown bears and their habitat. These projects relate to facility development, recreation access, site restoration, and program development, and have affected (or will affect) the Brooks River area as described in the "Cumulative Impacts" section under alternative 1.

When the likely effects of alternative 4 actions are added to the effects of these other past, present, and reasonably foreseeable future actions, there would be a long-term, moderate, adverse, and primarily localized cumulative impact on brown bears. (Parkwide cumulative impacts could occur if bears that become habituated to humans at Brooks Camp leave the project area and move into other areas in the region.) Alternative 4 would contribute an appreciable, adverse increment to this cumulative impact.

Conclusion. Alternative 4 would result in a long-term, moderate, adverse, and primarily localized impact on the brown bear. There still would be potential for human habituation of bears and some potential for occasional unsafe human-bear interactions and for bears being injured or killed. These adverse effects would mainly result from the notable distance of overhead human activity above bears and bear habitat in the area (pedestrians, staff, and vehicles), a decrease in the horizontal separation between bears and humans (i.e., people on the elevated structures), an increase in the visual and audio exposure of human activities, and disturbance to the bear habitat in the project area with construction-related activities and noises. However, when compared to alternative 1, brown bears would benefit from the removal of the floating bridge, a reduced potential for ground level human-bear interactions along the Brooks River corridor, an undisturbed and buffered area for bear resting or movement near the river mouth (i.e., the Corner area), and the relocation of the barge landing approximately 2,000 ft to the south along the Naknek Lake shoreline.

Alternative 5

Analysis. The proposed elevated bridge would eliminate the need for a floating bridge, which is an obstruction to bears moving up and down Brooks River (while in the water). In addition, bears would have an open travel route from the lower Brooks River to Naknek Lake via the river's north bank and the Corner where they could avoid interacting with humans at ground level, particularly during late summer and autumn. This should allow for greater access to habitat, less stress, easier movement by bears, and possibly increased numbers of bears using the area.
Under alternative 5 bears would regularly encounter pedestrians elevated overhead on the boardwalk and bridge instead of at ground level structures (i.e., visitor groups, individual visitors, and park staff). The decks of the bridge and boardwalks would be about 10 ft above the river and ground. Alternative 5 includes a total of about 1,120 linear ft of elevated boardwalks for visitor or park staff pedestrian use (560 ft for the

north boardwalk, 210 ft for the south boardwalk ramp, and 350 ft for the bridge; see map 7). The entire length of the bridge and boardwalks would be shared by pedestrians and vehicles. The use of this elevated boardwalk would result in bears having substantially less interactions with human pedestrians (park visitors or staff) at ground level. People moving along raised boardwalks would generally affect bear behavior less than they would at ground level on the same trails that bears use (NPS 2009f). Bears would also have more advanced warning of approaching humans because people walking on a wooden boardwalk deck would typically emit louder noises than walking on soil or gravel, and views of approaching humans would be less obstructed by thick ground vegetation. This would benefit the bears by reducing the potential for dangerous incidents (for the involved bears or humans)—there would be a lower likelihood of bears being injured or killed. These effects could also reduce the potential for human habituation, which could benefit the bears if they move out of the Brooks Camp area into other areas in the region.

Most bears over time would be expected to become accustomed/habituated to the existence and use of the new bridge and boardwalks (NPS 2009f). However, behavioral evidence from bears near the existing elevated boardwalk to Brooks Falls indicates that overhead human activity could intimidate, alter movement/behavior of, or possibly scare off some individual bears (DeBruyn et. al. 2004). Thus, some bears may not adapt well to the 1,120 linear ft of elevated boardwalks for pedestrians in this alternative. This could result in these individuals altering their preferred river access routes or avoiding river stretches that provide the most favorable salmon fishing. Some bears may avoid the new structures for the short-term, but then return to the area. Some may choose to avoid the area entirely because of the overhead pedestrian activity. Although humans would be separated from bears by about 10 vertical ft, park visitors on the bridge or boardwalks would not be asked/required to apply the 50-yard buffer rule that they would otherwise use at ground level. Thus, humans would regularly be very close to bears near the mouth of the river and near Brooks Camp under this alternative. This could contribute to human habituation of bears.

Bears would also encounter NPS and concessioner service vehicles overhead on the boardwalk/bridge structure instead of at ground level. This alternative includes 1,120 linear ft of elevated access for motorized vehicles, which would result in bears having less direct ground level interaction with vehicles and less potential for habituation. However, some bears might not adapt well to overhead vehicles and could avoid the area entirely.

In alternative 5 bears would be exposed to increased noise from motorized vehicle tires running on the wood deck of the bridge and boardwalks instead of gravel or soil (for about 1,120 ft). In addition, motorized vehicles would likely make additional noise climbing the ramp near the south bank of the river. The ramp on the north side (near the center of Brooks Camp) would not have this effect because the boardwalk would take advantage of local topography in this area and use a flatter ramp.

Also in alternative 5 human activity (pedestrians and NPS/concessioner vehicles) would be more visible to bears that are upriver because of the 10-foot elevation of the bridge and the exposed alignment of the north boardwalk that runs to the west of existing shrub and tree cover. Although some of this visual disturbance would be at a distance, some bears may alter their behavior or activity after seeing more human activity in the area.

Sounds from human activity on the boardwalks and bridge would carry farther because of the elevation of the activity and

the placement of the elevated walkway outside wooded areas that would otherwise buffer the sounds. Assuming there is judicious use of quiet vehicles on the bridge and boardwalks, there should be little effect on most bears in the area (NPS 2009f). Noises from the elevated bridge would be exposed to upriver and downriver areas, and noises from the north boardwalk would be fully exposed to upriver areas. As a result of elevating noise sources, some bears may alter their behavior or activity after hearing more nearby human activity.

Under alternative 5 bears would encounter less ground level human activity immediately along the river corridor because the path of the elevated structures would route pedestrians across the river with no time congregating along the north bank waiting to cross the floating bridge. However, this alternative would still allow pedestrians to congregate along the south bank (i.e., the elevated boardwalk would not continue to the south of the river).

Bears would have a region of wooded area with minimal ground level human activity near the mouth of the river (on the north side) where they could rest or forage without human intrusion. Under this alternative, the north boardwalk avoids the Corner area, which would otherwise continue to be fragmented by the existing ground trail/road. Removing the existing trail would allow for increased use of the trail, riverbank, woods, and beach around the point by bears (NPS 2009f). This effect would be most valuable to the bears from late August through October, when the bears congregate near the mouth of the Brooks River to feed on dead or dying salmon.

Additionally, under this alternative, the barge landing site would be moved away from the river mouth to a location approximately 2,000 ft south along Naknek Lake (figure 3). Thus, brown bears that are resting or foraging along both shores of the river mouth would not encounter NPS vessels being loaded and unloaded at the barge landing, or vehicles traveling along the south bank to/from the landing on the access road (which would be reclaimed under this alternative). Relocating the facilities should substantially reduce bear impacts—more bears would likely be present in the river mouth area where they could feed on fish and fewer bears would likely be present farther away from the river corridor. The effect of this relocation would be most notable from late August through October when most of the bear activity is concentrated near the mouth of Brooks River.

However, the proposed access road (figure 3) that would serve the new barge landing would introduce occasional human disturbances into the area between Brooks River and Beaver Pond. The roadway length would be approximately 1,500 ft, and most of the disturbances to bear habitat would involve NPS/concessioner motorized vehicle traffic. Increased noises and human disturbances along the access road and at the landing could alter bear resting, movement, and other behaviors of some bears in a new area that has not been disturbed.

The construction activities associated with the bridge and elevated boardwalks would have various adverse effects on the brown bear and its habitat. Most construction would be scheduled for times when bears are not present or are present in smaller numbers. However, some construction activities would still affect some bears in the summer and fall. Construction disturbances to bears could include heavy construction equipment operation, noise from handheld construction tools (power tools and manual), construction transport vehicles, worker voices, and generators. The degree of impact on bear habitat would be dependent on the type and intensity of the construction activity and the time of year the construction activity occurs (as it relates to the June and September peaks of bear activity in the area). Construction activity during peak

feeding times in July and September through October have more potential for impacts and human-bear interaction than other months (NPS 2009f). Given the proposed construction schedule, the most notable impacts would occur (1) from late August through mid-September of the first year during the construction mobilization phase; and (2) from late June through July and possibly from late August through October in the second year (when boardwalk decking and handrail construction takes place). To help minimize these effects, particularly during July and September, work time limits, construction noise restrictions, and other mitigation measures would be applied (e.g., limiting to small power tool use and containing construction worker food and garbage) (NPS 2009f). In spite of these mitigation measures, if hazing of bears becomes necessary, which would be a small possibility, the behavior of a few bears may be altered during the construction period and some may be temporarily displaced from areas they might otherwise use. This could affect feeding activities and competition with other bears in the short term.

The construction activities associated with the new barge landing, new access road (about 1,500 ft in length), and restoration of the existing barge access roads (along the south bank; see map 7) would also have various adverse impacts on bears. These construction and restoration activities would occur over a few months in the spring and fall of one year. Most construction impacts would result from heavy construction equipment operation (e.g., road grading), material transport vehicles, and human presence. The most notable impacts would occur during the late summer and autumn construction phase (August through mid-November), a period when the bears become very active feeding on spawned-out salmon along Brooks River. The intensity of the impact on bears would lessen as the activity moves away from Brooks River. In addition, to helping minimize these effects, various mitigation measures would be applied to construction activities, such as maintaining mufflers on construction equipment and generators, limiting construction to daylight hours, and actively containing food/garbage of construction workers.

Overall, alternative 5 would result in a long-term, moderate, adverse, and primarily localized impact to brown bears due to human disturbances to bears and their habitat. (Some parkwide adverse effects could occur if habituated bears from Brooks River move to other areas in the region and retain their habituated behavior.) The effects of alternative 5 on brown bear habitat could cause changes to brown bear feeding, resting, mating, or caring for young. These adverse effects relate to the habitat disturbances from human activity on the proposed 1,120 ft of elevated boardwalks, human habituation of bears, and continued human-bear interactions at ground level (in areas where people do not use the elevated boardwalks). The interactions, disturbances, and habituation would primarily result from park visitor activities and park staff/concessioner activities during the visitation season. It is believed that less than half of the brown bears using the Brooks River area would be affected by the actions and developments in alternative 5, and changes to the regional brown bear population would be minimal.

Compared to alternative 1, alternative 5 would result in a decrease in adverse effects on brown bears due to removal of the floating bridge, restoration of an open travel route from the lower Brooks River to Naknek Lake via the river's north bank and the Corner, vertical separation of humans and bears throughout the project area, which would result in less ground level interactions and possibly reduced habituation. Bears along the Brooks River corridor would also benefit from the relocation of the barge landing and access road away from the river. However, because the 50-yard horizontal buffer rule would no longer apply to people on the

elevated boardwalk and bridge, this alternative would result in notably shorter horizontal distances between humans and bears. This could contribute to an increase in habituation of bears.

Cumulative Impacts. Various other past, present, and reasonably foreseeable future projects in and near the project area have and would affect the brown bear. These projects relate to facility development, recreation access, site restoration, and program development, and have affected (or would affect) the Brooks River area as described in the "Cumulative Impacts" section under alternative 1.

When the likely effects of alternative 5 actions are added to the effects of these other past, present, and reasonably foreseeable future actions, there would be a short- to long-term, moderate, adverse, and primarily localized cumulative impact on brown bears. (Parkwide cumulative impacts could occur if bears that become habituated to humans at Brooks Camp leave the project area and move into other areas in the region.) Alternative 5 would contribute an appreciable, adverse increment to this overall adverse cumulative impact.

Conclusion. Alternative 5 would result in a long-term, moderate, adverse, and primarily localized impact on the brown bear due to human disturbances to bears and their habitat. There still would be the potential for human habituation of bears, and some potential for occasional unsafe human-bear interactions and for bears being injured or killed. These adverse effects would mainly result from the notable distance of overhead human activity above bears and bear habitat in the area (pedestrians, staff, and vehicles), a decrease in the horizontal separation between bears and humans (i.e., people on the elevated structures), an increase in the visual and audio exposure of human activities, and disturbance to bear habitat in the project area with construction-related activities and noises. However, when compared to alternative 1, brown bears would benefit from the removal of the floating bridge, a reduced potential for ground level human-bear interactions along the Brooks River corridor, an undisturbed and buffered area for bear resting or movement near the river mouth (i.e., the Corner area), and the relocation of the barge landing approximately 2,000 ft to the south along the Naknek Lake shoreline.

SALMON, RAINBOW TROUT, AND ARCTIC GRAYLING

Alternative 1

Analysis. Under alternative 1, the seasonal floating bridge would continue to be a surface obstacle from May through September to salmon, rainbow trout, and arctic grayling migrating up Brooks River to spawn. The floating structure would continue to occupy the upper level of the water column for the full width of the river during the months of fish migration up the river. Because the flotation devices used to support the bridge extend down a notable length into the water column, the available channel area for migratory fish passage has become reduced by the floating bridge. It is likely, but not known, that fish are schooling below the floating bridge both because of the bridge itself (due to the bridge being a visual barrier or due to surface shadow) and because actual river morphology favors fish resting in that location (T. Hamon, pers. com., 4/8/2011). Although the floating bridge has not fully impeded fish from migrating, it has been known to slow some migrating salmon and other fish at times (e.g., when river flows are low or when fish migrations are high).

The annual placement (in spring) and removal of the floating bridge (in fall) would continue to cause some disturbances to the Brooks River spawning habitat. The placement of the floating

bridge in the spring requires heavy equipment to be driven across the river, which disturbs the riverbed and stirs up sediment and turbidity in the downstream water (in the fall, the bridge is removed by hand and no turbidity occurs from its removal). However, the minimal amounts of turbidity produced by the equipment in the river would have little effect on fish migration or spawning.

Similarly, riverbank erosion would continue on both the north and south banks of Brooks River near the floating bridge anchor points. Soil erosion near floating bridge anchor points would continue to result in increases in river turbidity and downstream sedimentation. However, the turbidity and sedimentation associated with this erosion source is quite negligible relative to the sedimentation effects of natural processes such as storm events and geomorphic shifts in the river. Thus, this turbidity and sedimentation would continue to have only limited effects on fish migration or spawning.

The presence of the floating bridge would have little effect on salmon and rainbow trout spawning, as these fish spawn along the entire river, and barely in the area where the bridge is located. The majority of arctic grayling spawn in the vicinity of the bridge, and there could be some adverse effects on some of these fish if they spawn in less desirable areas—fewer eggs and fry may survive than would occur if the bridge were not present. But, the bridge occupies a relatively small area where the grayling are spawning. Thus, it is likely the bridge would continue to have little effect on the overall population of grayling using the river.

Under alternative 1 septic waste would continue to be hauled across Brooks River every spring via a hauling tractor. Crossing at low water, the tractor would continue to stir up sediments along the river bottom and increase turbidity for short periods of time. This could affect salmon, trout, and grayling in the river, although it is likely that turbidity due to the tractor would have little effect on the overall populations of fish in the river.

Overall, the continued annual use of the floating bridge under alternative 1 would have a long-term, minor, adverse, and localized effect on salmon, rainbow trout, and arctic grayling in Brooks River. This continued obstruction to fish passage in the upper water column and riverbed disturbances during its installation and removal, and the hauling of wastes across the river in the spring would only have minimal effects on fish and the natural processes that sustain their habitat. No changes would occur under alternative 1 to regional populations of salmon, rainbow trout, and arctic grayling.

Cumulative Impacts. The past management actions that expanded recreation access in the Brooks Camp area and beyond prompted the annual use of the temporary floating bridge across Brooks River. This past action introduced annual adverse effects to fish passage and spawning in Brooks River due to the water column obstacle and riverbed disturbances from bridge placement and removal (including downstream turbidity, sedimentation, and sandbar development).

The present and reasonably foreseeable future projects in or near the project area would have no known effects on salmon, rainbow trout, and arctic grayling populations in the Brooks River.

When the likely adverse effects of alternative 1 are added to the effects of these other past, present, and reasonably foreseeable future actions, there would be a long-term, minor, adverse, localized cumulative impact on salmon, rainbow trout, and arctic grayling in the Brooks River. Alternative 1 would contribute a large, adverse increment to this overall adverse cumulative impact.

Conclusion. Alternative 1 would result in continuing short- to long-term, minor, adverse, and localized impacts on salmon, rainbow trout, and arctic grayling in Brooks River. These effects would result from the continued annual use of the floating bridge across Brooks River. The bridge would continue to be an impediment to fish migration in the upper portions of the water column, but fish could still migrate up and downriver. The presence of the bridge and the annual bridge installation would alter spawning habitat by disturbing the riverbed, and could result in some arctic grayling spawning being adversely affected.

Alternative 2

Analysis. The proposed elevated bridge under this alternative would eliminate the need for the temporary floating bridge across Brooks River and the associated impacts to fish migration and spawning habitat (e.g., impeded passage and spring riverbed disturbances, turbidity, and sedimentation).

Under alternative 2, the proposed 360-foot steel truss bridge would have 120-foot spans between foundation pile systems. Each pile system would include a set of two steel piles anchored in the riverbed. At this length and span distance, the bridge would necessitate two sets of steel piles in the river. The piles would (1) affect flow hydraulics, which could lead to riverbed scouring and downstream sediment deposition; and (2) obstruct the flow and passage of debris in the river, which could directly block fish passage and compound the scouring and sediment deposition effect.

Riverbed scouring and sediment deposition could affect the hatch rate of fish eggs deposited downstream of the bridge. These changes would most likely adversely affect arctic grayling spawning in this area and to a much lesser degree salmon and rainbow trout (which spawn along the entire river). In addition, sandbar development downstream of the bridge could reduce the channel's cross section area. The shallower water in the vicinity of the sandbars could obstruct some salmon and rainbow trout migration upstream, although this migration effect would likely be very minimal.

Tree limbs, other vegetation material, and ice chunks could build up on the upstream side of the pile systems. The debris buildup on the piles could be an obstacle to salmon and rainbow trout migration as well as compound the altered river flow hydraulics in the areas around the piles leading to additional riverbed scouring, sediment deposition, and sandbar development on the downstream side of the piles. Some of these effects could be mitigated by debris removal from the bridge piles during the periods of the year when NPS staff are present. In addition, because this alternative only includes two pile systems in the channel, these effects would be limited.

Steel truss bridge foundation construction would involve the installation of two sets of steel piles in the river channel. This construction work would generate two primary disturbance areas in the Brooks River channel (120 ft apart on center), but would also generate channelwide riverbed disturbance because of construction equipment access. The installation would stir up riverbed sediment, which could lead to increases in downstream water turbidity and sedimentation. Pile systems would also be installed on each shoreline relatively near the river, which could also generate turbidity and sedimentation in the area. To minimize some of the effects of in-river construction, various turbidity and sedimentation mitigation measures would be applied, such as diversion of river flows around work areas, cofferdams, and sediment traps. Although the construction would not occur during fish migrations, the sedimentation could negatively affect the hatch rate of the fish eggs that were deposited in the spawning beds

downstream of the bridge during the previous autumn. Arctic grayling spawning would be most likely to experience these impacts, while salmon and rainbow trout (whose eggs are present mostly upriver of the bridge) would experience impacts to a much lesser degree.

The fill that has been added over the past several decades to build up and support the trail on the north side of Brooks River (upstream of the floating bridge anchor point) would be removed. Minimal, temporary effects to downstream arctic grayling spawning could occur from turbidity and sedimentation in the river during and shortly after these construction activities. However, this action would eliminate some sedimentation that results from the river eroding the crushed gravel and other fill material over time. Thus, this action would improve fish habitat in this portion of the river.

Overall, the proposed bridge structure under alternative 2, which involves two permanent pile systems in the Brooks River channel, would have short- and long-term, minor, adverse, and localized effect on salmon, rainbow trout, and arctic grayling. In addition to construction disturbances in the riverbed, these impacts would result from the hydraulic effects of the piles and the debris caught on the piles (e.g., scouring, sedimentation), which could result in impediments to fish passage. However, the effects on the fish and the natural processes that sustain them would be minimal. Compared to alternative 1, alternative 2 would likely reduce adverse impacts to salmon, rainbow trout, and arctic grayling due to the removal of the temporary floating bridge (and its associated negative effects), elimination of hauling wastes across the river in the spring, and the limited effects of only two pile obstructions in the river. As noted by the Alaska Department of Fish and Game, "[b]ridges that span the floodplain, even with piers within the active channel, offer the best solution for crossing streams." (ADF&G 2011). There also would be a benefit to fish habitat under alternative 2 due to the removal of fill on the north side of the river, which would eliminate a sedimentation source. No changes would occur under alternative 2 to regional populations of salmon, rainbow trout, and arctic grayling.

Cumulative Impacts. The past management actions that expanded recreation access in the Brooks Camp area and beyond prompted the annual use of the temporary floating bridge across Brooks River. This past action introduced annual adverse effects to fish passage and spawning in Brooks River due to the water column obstacle and riverbed disturbances from bridge placement (including some downstream turbidity and sedimentation). However, under this alternative, the annual installation and use of the floating bridge would no longer be necessary.

Other present and reasonably foreseeable future projects in vicinity of the project area would have no known effects on salmon, rainbow trout, and arctic grayling populations in Brooks River. Thus, no cumulative impacts would occur.

Conclusion. Alternative 2 would result in short- to long-term, minor, adverse, and localized impacts on salmon, rainbow trout, and arctic grayling in Brooks River. These effects would result from the addition of two permanent flow obstructions to the channel (i.e., two bridge pile systems spaced at 120 ft) and the associated construction disturbances in the channel. The support piles, and river debris that catches on them, could obstruct fish passage and alter flow hydraulics, which may result in scouring and sediment deposition in the river. However, salmon, rainbow trout, and arctic grayling would benefit from the elimination of the temporary floating bridge and its associated negative effects on fish passage and spawning habitat.

Alternative 3

Analysis. The proposed elevated bridge under this alternative would eliminate the need for the temporary floating bridge across Brooks River and the associated impacts to fish migration and spawning habitat (e.g., impeded passage and spring/fall riverbed disturbances, turbidity, and sedimentation).

Under alternative 3, the proposed 415-foot steel/wood truss bridge would have 50-foot spans between foundation pile systems. Each pile system would include a set of two piles anchored in the riverbed. At this length and span distance, the bridge would necessitate six sets of piles in the river. The piles would (1) affect flow hydraulics, which could lead to riverbed scouring and downstream sediment deposition; and (2) obstruct the flow and passage of debris in the river, which could directly block fish passage and compound the scouring and sediment deposition effect.

Riverbed scouring and sediment deposition could affect the hatch rate of fish eggs deposited downstream of the bridge. These changes would most likely adversely affect arctic grayling spawning in this area and to a much lesser degree salmon and rainbow trout (which spawn along the entire river). In addition, sandbar development downstream of the bridge could reduce the channel's cross section area. The shallower water near the sandbars could obstruct some salmon and rainbow trout migration upstream, although this migration effect would likely be minimal.

Tree limbs, other vegetation material, and ice chunks could build up on the upstream side of the pile systems. The debris buildup on the piles could be an obstacle to salmon and rainbow trout migration, as well as compound the altered river flow hydraulics in the areas around the piles leading to additional riverbed scouring, sediment deposition, and sandbar development on the downstream side of the piles. Some of these effects could be mitigated by the removal of debris from the bridge piles during periods of the year when NPS staff are present.

Bridge foundation construction would involve the installation of six sets of piles in the river channel. This construction work would generate six primary disturbance areas in the Brooks River channel (50 ft apart on center), but would also generate channelwide riverbed disturbance because of construction equipment access. The installation would stir up riverbed sediment, which could lead to increases in downstream water turbidity and sedimentation. Pile systems would also be installed on each shoreline relatively near the river, which could also generate turbidity and sedimentation in the area. To minimize some of the effects of in-river construction, various turbidity and sedimentation mitigation measures would be applied, such as diversion of river flows around work areas, cofferdams, and sediment traps. Although the construction would not occur during fish migrations, the sedimentation could negatively affect the hatch rate of the fish eggs that were deposited in the spawning beds downstream of the bridge during the previous autumn. Arctic grayling spawning would be most likely to experience these impacts, while salmon and rainbow trout (whose eggs are present mostly upriver of the bridge) would experience impacts to a much lesser degree.

Alternative 3 would include the removal of the fill material that has been added over the past several decades to build up and support the trail on the north side of Brooks River (upstream of the floating bridge anchor point). Minimal, temporary effects to downstream arctic grayling spawning could occur from turbidity and sedimentation in the river during and shortly after these construction activities. However, this action would eliminate some sedimentation that results from the river

eroding the crushed gravel and other fill material over time. Thus, this action would improve fish habitat in this portion of the river.

Overall, the proposed bridge structure, which would involve six permanent pile systems in the Brooks River channel, would have short- and long-term, minor, adverse, and localized effect on salmon, rainbow trout, and arctic grayling. In addition to construction disturbances in the riverbed, these impacts would primarily result from the hydraulic effects of the piles and the debris caught on the piles (e.g., scouring, sedimentation), which could result in impediments to fish passage. However, the effects to the fish and the natural processes that sustain them would be relatively minimal. Compared to alternative 1, alternative 3 could increase some impacts to salmon, rainbow trout, and arctic grayling due to the installation of six permanent obstructions in the river (and their hydraulic effects on river geomorphology). Removing the temporary floating bridge and its associated negative effects would benefit fish. There also would be a benefit to fish habitat under alternative 3 due to the removal of fill on the north side of the river, which would eliminate a sedimentation source. No changes would occur under alternative 3 to regional populations of salmon, rainbow trout, and arctic grayling.

Cumulative Impacts. The past management actions that expanded recreation access in the Brooks Camp area and beyond prompted the annual use of the temporary floating bridge across Brooks River. This past action introduced annual adverse effects to fish passage and spawning in Brooks River due to the water column obstacle and riverbed disturbances from bridge placement (including some downstream turbidity and sedimentation). However, under this alternative, the annual installation and use of the floating bridge would no longer be necessary.

Other present and reasonably foreseeable future projects in and near the project area would have no known effects on salmon, rainbow trout, and arctic grayling populations in Brooks River. Thus, no cumulative impacts would result.

Conclusion. Alternative 3 would result in short- to long-term, minor, adverse, and localized impacts on salmon, rainbow trout, and arctic grayling in Brooks River. These effects would result from the addition of six permanent flow obstructions to the channel (i.e., six bridge pile systems spaced 50 ft apart) and the associated construction disturbances in the channel. The support piles, and river debris that catches on them, could obstruct fish passage and alter flow hydraulics, which may result in scouring and sediment deposition in the river. However, salmon, rainbow trout, and arctic grayling would benefit from elimination of the temporary floating bridge and its associated negative effects on fish passage and spawning habitat.

Alternative 4

Analysis. The proposed elevated bridge under this alternative would eliminate the need for the temporary floating bridge across Brooks River and the associated impacts to fish migration and spawning habitat (e.g., impeded passage and spring/fall riverbed disturbances, turbidity, and sedimentation).

Under alternative 4, the proposed 350-foot wooden and steel short-span bridge would have a minimum of 24-foot spans between foundation pile systems. Each pile system would include a set of two piles anchored in the riverbed. At this length and span distance, up to 14 sets of piles would be needed in the river. The piles would (1) affect flow hydraulics, which could lead to riverbed scouring and downstream sediment deposition; and (2) obstruct the flow and passage of debris in the river, which could directly block fish passage and

compound the scouring and sediment deposition effect.

Riverbed scouring and sediment deposition could affect the hatch rate of fish eggs deposited downstream of the bridge. These changes would most likely adversely affect arctic grayling spawning in this area and to a much lesser degree salmon and rainbow trout (which spawn along the entire river). In addition, sandbar development downstream of the bridge could reduce the channel's cross section area. The shallower water near the sandbars could obstruct some salmon and rainbow trout migration upstream, although this migration effect from sandbars would likely be minimal.

Tree limbs, other vegetation material, and ice chunks could build up on the upstream side of the pile systems. The debris buildup on the piles could be an obstacle to salmon and rainbow trout migration, as well as compound the altered river flow hydraulics in the areas around the piles leading to additional riverbed scouring, sediment deposition, and sandbar development on the downstream side of the piles. Some of these effects could be mitigated by the removal of debris from the piles during the periods of the year when NPS staff are present. However, given the number of piles in the river under this alternative, the altered flow hydraulics (and the associated direct and indirect adverse effects) would likely occur regardless of seasonal debris removal.

Bridge foundation construction would involve the installation of 14 sets of piles in the river channel. This construction work would generate 14 primary disturbance areas in the Brooks River channel (24 ft apart on center) and could also generate channelwide riverbed disturbance because of construction equipment access. The installation would stir up riverbed sediment, which could lead to downstream increases in water turbidity and sedimentation. Pile systems would also be installed on each shoreline relatively near the river, which could also generate turbidity and sedimentation in the area. To minimize some of the effects of in-river construction, various turbidity and sedimentation mitigation measures would be applied, such as diversion of river flows around work areas, cofferdams, and sediment traps. Although the construction would not occur during fish migrations, the sedimentation could negatively affect the hatch rate of the fish eggs that were deposited in the spawning beds downstream of the bridge during the previous autumn. Arctic grayling spawning would be most likely to experience these impacts, while salmon and rainbow trout (whose eggs are present mostly upriver of the bridge) would experience impacts to a much lesser degree.

Alternative 4 would include the removal of the fill that has been added over the past several decades to build up and support the trail on the north side of Brooks River (upstream of the floating bridge anchor point). Minimal, temporary effects to downstream arctic grayling spawning could occur from turbidity and sedimentation in the river during and shortly after these construction activities. However, this action would eliminate some sedimentation that results from the river eroding the crushed gravel and other fill material over time. Thus, this action would improve fish habitat in this portion of the river.

Overall, the proposed bridge structure, which would involve up to 14 permanent pile systems in the Brooks River channel, would have short- and long-term, moderate, adverse, and localized effect on salmon, rainbow trout, and arctic grayling. In addition to construction disturbances in the riverbed, these impacts would primarily result from the hydraulic effects of the piles and the debris caught on the piles (e.g., scouring, sedimentation). The resulting changes to the river flow and morphology (e.g., sandbar development) could alter the natural processes that maintain the aquatic habitat and impede

fish passage. Compared to alternative 1, alternative 4 would increase overall adverse impact to salmon, rainbow trout, and arctic grayling fish primarily due to the installation of several permanent obstructions in the river (and their hydraulic effects on river geomorphology). Removal of the temporary floating bridge and its associated negative effects on fish passage and spawning habitat, and the elimination of hauling wastes across the river in the spring, would benefit fish. There also would be a benefit to fish habitat under alternative 4 due to the removal of fill on the north side of the river, which would eliminate a sedimentation source. Although some minor changes to fish populations in the area could occur (particularly arctic grayling), no changes would occur under alternative 4 to regional populations of salmon, rainbow trout, and arctic grayling.

Cumulative Impacts. The past management actions that expanded recreation access in the Brooks Camp area and beyond prompted the annual use of the temporary floating bridge across Brooks River. This past action introduced annual adverse effects to fish passage and spawning in Brooks River due to the water column obstacle and riverbed disturbances from bridge placement and removal (including some downstream turbidity and sedimentation). However, under this alternative, the annual installation and use of the floating bridge would no longer be necessary.

Other present and reasonably foreseeable future projects in and near the project area would have no known effects on salmon, rainbow trout, and arctic grayling populations in Brooks River. Thus, no cumulative impacts would result.

Conclusion. Alternative 4 would result in short- to long-term, moderate, adverse, and localized impacts on salmon, rainbow trout, and arctic grayling in Brooks River. These effects would result from the addition of up to 14 permanent flow obstructions in the channel (i.e., 14 bridge pile systems spaced at 24 ft) and the associated construction disturbances in the channel. The support piles, and river debris that catches on them, could obstruct fish passage and alter flow hydraulics, which may result in scouring and sediment deposition in the river. However, salmon, rainbow trout, and arctic grayling would benefit from elimination of the temporary floating bridge and its associated negative effects on fish passage and spawning habitat.

Alternative 5

Analysis. The proposed elevated bridge under this alternative would eliminate the need for the temporary floating bridge across Brooks River and the associated impacts to fish migration and spawning habitat (e.g., impeded passage and spring/fall riverbed disturbances, turbidity, and sedimentation).

Under alternative 5 the proposed 350-foot wooden short-span bridge would have a minimum of 24-foot spans between foundation pile systems. Each pile system would include a set of two piles anchored in the riverbed. At this length and span distance, up to 14 sets of piles would be needed in the river. The piles would (1) affect flow hydraulics, which could lead to riverbed scouring and downstream sediment deposition; and (2) obstruct the flow and passage of debris in the river, which could directly block fish passage and compound the scouring and sediment deposition effect.

Riverbed scouring and sediment deposition could affect the hatch rate of fish eggs deposited downstream of the bridge. These changes would most likely adversely affect arctic grayling spawning in this area and to a much lesser degree salmon and rainbow trout (which spawn along the entire river). In addition, sandbar development downstream of the bridge could reduce the channel's cross section

area. The shallower water near the sandbars could obstruct some salmon and rainbow trout migration upstream, although this migration effect from sandbars would likely be minimal.

Tree limbs, other vegetation material, and ice chunks could build up on the upstream side of the pile systems. The debris buildup on the piles could be an obstacle to salmon and rainbow trout migration, as well as compound the altered river flow hydraulics in the areas around the piles resulting in additional riverbed scouring, sediment deposition, and sandbar development on the downstream side of the piles systems. With the pile systems only 24 ft apart, sandbar development downstream of each pile system could eventually run together, resulting in a shallower river cross section downstream of the bridge. Some of these effects could be mitigated by debris removal from the piles during periods of the year when NPS staff are present. However, given the number of piles in the river under this alternative, the altered flow hydraulics (and the associated direct and indirect adverse effects) would likely occur regardless of seasonal debris removal.

Bridge foundation construction would involve the installation of up to 14 sets of piles in the river channel. This construction work would generate 14 primary disturbance areas in the Brooks River channel (24 ft apart) and channelwide riverbed disturbance because of construction equipment access. The installation would stir up riverbed sediment, which could lead to increases in downstream water turbidity and sedimentation. Pile systems would also be installed on each shoreline relatively near the river, which could also generate turbidity and sedimentation in the area. To minimize some of the effects of in-river construction, various turbidity and sedimentation mitigation measures would be applied, such as diversion of river flows around work areas, cofferdams, and sediment traps. Although the construction would not occur during fish migrations, the sedimentation could negatively affect the hatch rate of the fish eggs that were deposited in the spawning beds downstream of the bridge during the previous autumn. Arctic grayling spawning would be most likely to experience these impacts, while salmon and rainbow trout (whose eggs are present mostly upriver of the bridge) would experience impacts to a much lesser degree.

Alternative 5 would include the removal of the fill that has been added over the past several decades to build up and support the trail on the north side of Brooks River (upstream of the floating bridge anchor point). Minimal, temporary effects to downstream arctic grayling spawning could occur from turbidity and sedimentation in the river during and shortly after these construction activities. However, this action would eliminate some sedimentation that results from the river eroding the crushed gravel and other fill material over time. Thus, this action would improve fish habitat in this portion of the river.

Overall, the proposed bridge structure, which would involve up to 14 permanent pile systems in the Brooks River channel, would have short- and long-term, moderate, adverse, and localized effect on salmon, rainbow trout, and arctic grayling. In addition to construction disturbances in the riverbed, these impacts would primarily result from the hydraulic effects of the piles and the debris caught on the piles (e.g., scouring, sedimentation). The resulting changes to the river flow and morphology (e.g., sandbar development) could alter the natural processes that maintain the aquatic habitat and impede fish passage. Compared to alternative 1, alternative 5 would increase overall adverse impact to salmon, rainbow trout, and arctic grayling fish primarily due to the installation of the several permanent obstructions in the river (and their hydraulic effects on river geomorphology). Removal of the temporary floating bridge and its associated negative effects on fish

passage and spawning habitat and elimination of hauling wastes across the river in the spring would benefit fish. Although some minor changes to fish populations in the area could occur (particularly arctic grayling), no changes would occur under alternative 5 to regional populations of salmon, rainbow trout, and arctic grayling.

Cumulative Impacts. The past management actions that expanded recreation access in the Brooks Camp area and beyond prompted the annual use of the temporary floating bridge across Brooks River. This past action introduced annual adverse effects to fish passage and spawning in Brooks River due to the water column obstacle and riverbed disturbances from bridge placement and removal (including downstream turbidity and sedimentation). However, under this alternative, the annual installation and use of the floating bridge would no longer be necessary.

Other present and reasonably foreseeable future projects in and near the project area would have no known effects on salmon, rainbow trout, and arctic grayling populations in Brooks River. Thus, no cumulative impacts would result.

Conclusion. Alternative 5 would result in short- to long-term, moderate, adverse, and localized impacts on salmon, rainbow trout, and arctic grayling in Brooks River. These effects would result from the addition of up to 14 permanent flow obstructions to the channel (i.e., 14 bridge pile systems spaced at 24 ft) and the associated construction disturbances in the channel. The support piles, and river debris that catches on them, could obstruct fish passage and alter flow hydraulics, which may result in scouring and sediment deposition in the river. However, salmon, rainbow trout, and arctic grayling would benefit from the elimination of the temporary floating bridge and its associated negative effects on fish passage and spawning habitat.

BALD EAGLE

Alternative 1

Analysis. Under alternative 1, the human activity and the related noises associated with Brooks Camp and its facilities would continue to occur throughout the project area during the visitation season. The human disturbances in the vicinity of the slower water near the oxbow and near the mouth of Brooks River would continue to have the most effect on bald eagles. This continued activity would include visitor and staff movement along and across Brooks River; at the bear viewing platform by the floating bridge; and on trails/roads that connect the campground, Brooks Camp, and the bus parking area. Disturbances would also continue to include motorized NPS and concessioner vehicle movement along the various roads in the project area. Collectively, these effects would continue to have the potential to disturb bald eagle behavior in the area (e.g., roosting). Eagles can be flushed from perches due to the presence of people. Flushing distances vary depending on location and individual eagle behavior. In the case of the Brooks River eagles, flushing from ground disturbance occurs at an average distance of 100 ft from the base of the nesting tree (D. Noon, pers. comm., 4/8.2011).

During the breeding season, bald eagles are sensitive to a variety of human activities. Eagle pairs react to human activities in different ways—some pairs nest close to areas of human activity while others abandon nest sites in response to activities much farther away. This variability is probably related to a variety of factors including visibility, duration, noise levels, extent of area affected by the activity, prior experience with people, and tolerance of the individual nesting pair (USFWS 2007c). In the case of the Brooks River nesting pair, these birds have continued to nest in an area with all the disturbances noted above in the area. In addition, as noted in

"Chapter 3: Affected Environment," ground level human activity near the existing nest is generally uncommon. Thus, although the potential for disturbances would continue under alternative 1, there is no reason to expect that the eagles would abandon their nest near Beaver Pond.

Overall, the continued visitor activities and park operations in the Brooks River area, such as along the barge landing site and access road, under alternative 1 would have a long-term, minor, adverse, and localized effect on bald eagles. These impacts would continue to occur during the visitation season at Brooks Camp, but would only have minimal effects on bald eagle behavior or the natural processes that sustain their habitat. No changes would occur to the regional bald eagle population.

Cumulative Impacts. Various past actions have had effects on bald eagles in the project area, particularly in the vicinity of Brooks Camp and along the Brooks River corridor. Most of these past actions have had adverse effects on eagle habitat and have primarily involved the facility development and expanded recreational access associated with Brooks Camp over the years (e.g., lodge, campground, visitor center, restrooms, operations facilities, utilities, guest cabins, staff housing, floating bridge access, trails, and viewing platforms). Motorized vehicle use on roads associated with this development in the area (e.g., maintenance access, Valley Road) and motorboat use on Naknek Lake and near the mouth of Brooks River have also contributed to disturbances of eagles. In addition, the flight paths for floatplanes flying between Brooks Camp and King Salmon have crossed over the project area (particularly over the existing nest site at Beaver Pond). This plane activity has brought loud, low-altitude noises and plane presence near valuable eagle habitat. UFWS guidelines provide a buffer distance of 1,000 vertical ft for fixed-wing aircraft during nesting periods (USFWS 2007c). The planes flying over the Beaver Pond nest are often below this level. However, it should be noted that even with these disturbances, eagles have still made use of the nest on the north side of Beaver Pond in some years. Indeed, airplanes landing and taking off directly over the nest at less than 50 ft has no apparent effect on behavior. This may be due to adaptation and familiarity of these eagles to the low floatplanes (T. Hamon, pers. comm., 4/8/2011). The overall short-term adverse impacts of the above past actions relate to the temporary noise and human activity disturbances associated with the construction and material movement at each respective development or recreation improvement. The long-term adverse effects have generally involved displaced and degraded eagle habitat for foraging, nesting, and/or roosting that resulted from facilities, roads and trails, vehicles, and the associated human activity in these areas.

Other present and reasonably foreseeable future actions would also affect bald eagles in the project area. In addition to the continuation of low floatplane flights over the nest site and occasional ground level disturbances by visitors to Beaver Pond, other actions could include additional facility improvements around the project area (e.g., the maintenance and housing development at Valley Road Administrative Area), removal (and site restoration) of Lake Brooks maintenance and housing facilities, and overall relocation of Brooks Camp and its associated uses to the Beaver Pond Terrace area). Because eagles use Beaver Pond for fishing, roosting, and nesting, future development near and around Beaver Pond could have the most notable adverse effects. The short-term, adverse effects of these actions would relate to the disturbances to eagle habitat from construction and project mobilization activities, including the transport of materials through the area. The adverse, long-term effects of some of these actions could involve further displacement and/or degradation of eagle habitat in parts of the project area from facility improvements or expansions and the development of the

Beaver Pond Terrace area. With the additional impacts from the construction and use of the planned developments near the eagles' nests and adjacent foraging areas (e.g., Beaver Pond Terrace development), there would be substantial changes to bald eagle habitat. Consequently, the likelihood of this area being used for eagle nesting would be reduced. However, this would not result in an apparent change to the regional bald eagle population.

When the effects of alternative 1 are added to the effects of these other past, present, and reasonably foreseeable future actions, there would be a long-term, moderate, adverse, and localized cumulative impact on bald eagles. Alternative 1 would contribute a small, adverse increment to this overall adverse cumulative impact.

Conclusion. Alternative 1 would result in a continuing long-term, minor, adverse, and localized impact on the bald eagles in the Brooks River area. These adverse effects would primarily result from the continuance of seasonal human activity throughout the project area. However, the disturbances resulting from alternative 1 would not be expected to affect bald eagle nesting in the area.

Alternative 2

Analysis. The proposed access road that would serve the new barge landing site (roughly 2,000 ft south of the existing barge landing, figure 3) would introduce occasional human disturbances and noises to an area of bald eagle nesting, foraging, and roosting. The proposed road alignment is immediately adjacent to a bald eagle nest (north of Beaver Pond) and very near the eagle foraging/fishing area on Beaver Pond. The noises and human presence would primarily be associated with NPS and concessioner operations (e.g., motorized vehicles and barge loading/unloading), and these disturbances would primarily occur shortly before, during, and shortly after the Brooks Camp visitation season (May to October). The disturbances at the barge landing site and along the access road that occur in spring and early summer would have the most impact on the bald eagle, because this would coincide with the critical nesting and fledgling period. Because eagles are sensitive to ground disturbance during this time, the eagles would likely be flushed from the nest more frequently, which could affect the survival of eggs and/or young—eggs would be susceptible to cooling, loss of moisture, overheating, and predation, which could lead to failure of the eggs to hatch, while the young would be vulnerable to the elements and increased potential for mortality. Frequent disturbances near the nest could deter future use of the nest and could possibly lead to permanent nest abandonment (USFWS 2007c; Cain n.d.).

The construction activities associated with the new barge landing and new access road (about 1,500 ft in length) could also have various adverse impacts on the bald eagles. Most of these construction impacts would result from noises and disturbances associated with heavy construction equipment operation (e.g., road grading), material transport vehicles, and human presence. The impacts would primarily occur in two phases. First, during late summer and autumn (when earthwork and excavation construction is proposed), most of the impacts would involve disturbances to eagle foraging and roosting around Beaver Pond. Effects on nesting would be avoided because the eaglets would have fledged by then. Then in the following spring (when the barge landing site construction is proposed), the impacts would involve disturbances to eagle nesting at the nest site. To help minimize these effects, various mitigation measures would be applied to construction activities, such as maintaining mufflers on construction equipment and generators. However, there still would be the potential for the eagles to be flushed from the nest,

which would increase the potential for egg and/or nestling mortality.

The construction and future pedestrian/vehicle use of the proposed elevated bridge and boardwalk in this alternative would have little or no effects on bald eagle habitat. The eagles do not currently use these areas for foraging or roosting due to the level of human activity in the surrounding area. Thus, increased noise and visual exposure from the boardwalk and bridge would not be expected to affect eagle activity.

Likewise, removal of the existing barge landing site and the access road along the river would have no effect on the bald eagles. These areas also are not used by eagles due to human activity in the surrounding area. Restoration of vegetation along the access road and barge landing site would not be expected to affect eagle activity so long as human activity continues in the project area.

Overall, the construction and future use of the proposed barge landing site and access road under alternative 2 would have short- and long-term, moderate, adverse, and localized effects on the bald eagles in the Brooks River area. These impacts would primarily occur during the visitation season at Brooks Camp, and could cause changes to bald eagle feeding, mating, nesting, or caring for young. Bald eagle behaviors and activities associated with the existing nest site near Beaver Pond would be particularly affected by the construction and use of the proposed barge landing site and access road. Depending on the timing, these activities could adversely affect eagle nesting and Beaver Pond use by bald eagles. However, changes to the regional bald eagle population would be minimal. Compared to alternative 1, alternative 2 would likely increase the adverse impacts on bald eagles and their habitat. The increase in adverse effects primarily relate to the disturbances associated with the new barge landing site and access road (immediately adjacent to the nest site).

Cumulative Impacts. Various other past, present, and reasonably foreseeable future projects in and near the project area have and would continue to affect the bald eagle. These projects relate to facility development, recreation access, transport vehicle noises, site restoration, and program development, as described in the "Cumulative Impacts" section under alternative 1 (including the future planned development around Beaver Pond).

When the likely adverse effects of alternative 2 are added to the effects of these other past, present, and reasonably foreseeable future actions, there would be a long-term, moderate, adverse, and localized cumulative impact on the Brooks River bald eagles. The alternative 2 actions would contribute an appreciable adverse increment to this overall adverse cumulative impact.

Conclusion. Alternative 2 would result in short- and long-term, moderate, adverse, localized impacts on the bald eagles in the Brooks River area. These adverse effects would primarily result from the construction and future use of a new barge landing area and access road near an eagle nest and Beaver Pond foraging and roosting areas. These activities could adversely affect bald eagle nesting in the Beaver Pond area.

Alternative 3

Analysis. The construction and future pedestrian/vehicle use of the proposed elevated bridge and boardwalk in this alternative would have little or no effects on bald eagle habitat. The eagles do not currently use these areas for foraging or roosting due to the level of human activity in the surrounding area. Thus, increased noise and visual exposure from the boardwalk and bridge would not be expected to affect eagle activity.

Under alternative 3, the relatively small changes to the existing barge landing site

and access road (figure 5) would not affect the eagles. The eagles would continue to avoid using this area due to the level of human activity in the surrounding area.

Overall, the construction and future use of the proposed elevated boardwalks, bridge, and changes to the barge landing site and access road under alternative 3 would have no effects on the Brooks River bald eagles. Compared to alternative 1, alternative 3 would have similar effects from human activity in the area, along the access road and barge landing site—a long-term, minor, adverse, and localized impact.

Cumulative Impacts. Various other past, present, and reasonably foreseeable future projects in and near the project area have and would continue to affect the bald eagle. These projects relate to facility development, recreation access, transport vehicle noises, site restoration, and program development, as described in the "Cumulative Impacts" section under alternative 1 (including the future planned development around Beaver Pond).

When the effects of alternative 3 are added to the effects of these other past, present, and reasonably foreseeable future actions, there would be a long-term, moderate, adverse, and localized cumulative impact on bald eagles. The actions in alternative 3 would contribute a small, adverse increment to this cumulative impact.

Conclusion. Alternative 3 would result in short- to long-term, minor, adverse, and localized impacts on the bald eagles in the Brooks River area. These effects would result from general human activity in the Brooks River area, including continued use of the barge landing site and access road.

Alternative 4

Analysis. The proposed access road that would serve the new barge landing site (roughly 2,000 ft south of the existing barge landing, figure 3) would introduce occasional human disturbances and noises to an area of bald eagle nesting, foraging, and roosting. The proposed road alignment is immediately adjacent to a bald eagle nest (north of Beaver Pond) and near the eagle foraging/fishing area on Beaver Pond. The noises and human presence would primarily be associated with NPS and concessioner operations (e.g., motorized vehicles, barge loading/unloading) and would primarily occur shortly before, during, and shortly after the Brooks Camp visitation season (May to October). The disturbances at the barge landing site and along the access road that occur in spring and early summer would have the most impact on the bald eagle because this would coincide with the critical nesting and fledgling period. Because eagles are sensitive to ground disturbance during this time, the eagles would likely be flushed from the nest more frequently, which could affect the survival of eggs and/or young—eggs would be susceptible to cooling, loss of moisture, overheating, and predation, which could lead to failure of the eggs to hatch, while the young would be vulnerable to the elements and increased potential for mortality. Frequent disturbances near the nest could deter future use of the nest and could possibly lead to permanent nest abandonment (USFWS 2007c; Cain n.d.).

The construction activities associated with the new barge landing and new access road (about 1,500 ft in length, figure 3) could also have various adverse impacts on the bald eagles. The impacts on the eagles would be the same as described in alternative 2. Although mitigation measures would be applied in alternative 4 to minimize impacts of construction, there still would be the potential for the eagles to be flushed from the nest, which would increase the potential for egg and/or nestling mortality.

The construction and future pedestrian/vehicle use of the proposed elevated bridge and boardwalk in alternative 4 would have little or no effects

on bald eagle habitat. The eagles do not currently use these areas for foraging or roosting due to the level of human activity in the surrounding area. Thus, increased noise and visual exposure from the boardwalk and bridge would not be expected to affect eagle activity.

Likewise, removal of the existing barge landing site and the access road along the river would have no effect on the bald eagles. These areas also are not used by eagles due to human activity in the surrounding area. Restoration of vegetation along the access road and barge landing site would not be expected to affect eagle activity so long as human activity continues in the project area.

Overall, the construction and future use of the proposed elevated boardwalks, bridge, barge landing, and access road under alternative 4 would have short- and long-term, moderate, adverse, and localized effects on bald eagles in the Brooks River area. These impacts would primarily occur during the visitation season at Brooks Camp, and could cause changes to bald eagle feeding, mating, nesting, or caring for young. Bald eagle behaviors and activities associated with the existing nest site near Beaver Pond would be particularly affected by the construction and use of the proposed barge landing site and access road. Depending on the timing, these activities could adversely affect eagle nesting and Beaver Pond use by bald eagles. However, changes to the regional bald eagle population would be minimal. Compared to alternative 1, alternative 4 would likely increase the adverse impacts on bald eagles and their habitat. The increase in adverse effects primarily relate to the disturbances associated with the new barge landing site and access road (immediately adjacent to nest site).

Cumulative Impacts. Various other past, present, and reasonably foreseeable future projects in and near the project area have and would continue to affect the bald eagle. These projects relate to facility development, recreation access, transport vehicle noises, site restoration, and program development, as described in the "Cumulative Impacts" section under alternative 1 (including the future planned development around Beaver Pond).

When the adverse effects of alternative 4 are added to the effects of these other past, present, and reasonably foreseeable future actions, there would be a long-term, moderate, adverse, and localized cumulative impact on bald eagles. The actions of alternative 4 would contribute an appreciable, adverse increment to this overall adverse cumulative impact.

Conclusion. Alternative 4 would result in short-and long-term, moderate, adverse, localized impacts on the bald eagles in the Brooks River area. These adverse effects would primarily result from the construction and future use of a new barge landing area and access road near an eagle nest and near Beaver Pond foraging and roosting areas. These activities could adversely affect bald eagle nesting in the Beaver Pond area.

Alternative 5

Analysis. The proposed access road that would serve the new barge landing (roughly 2,000 ft south of the existing barge landing, figure 3) would introduce occasional human disturbances and noises to an area of bald eagle nesting, foraging, and roosting. The proposed road alignment is adjacent to and below a bald eagle nest (north of Beaver Pond) and near the eagle foraging/fishing area on Beaver Pond. The noises and human presence would primarily be associated with NPS and concessioner operations (e.g., motorized vehicles and barge loading/unloading) and would primarily occur shortly before, during, and shortly after the Brooks Camp visitation season (May to October). The disturbances at the barge landing and along the access road that occur in spring and early summer

would have the most impact on the bald eagle because this would coincide with the critical nesting and fledgling period. Because eagles are sensitive to ground disturbance during this time, the eagles would likely be flushed from the nest more frequently, which could affect the survival of eggs and/or young—eggs would be susceptible to cooling, loss of moisture, overheating and predation, which could lead to failure of the eggs to hatch, while the young would be vulnerable to the elements and increased potential for mortality. Frequent disturbances near the nest could deter future use of the nest and possibly lead to permanent nest abandonment (USFWS 2007c; Cain n.d.).

The construction activities associated with the new barge landing and new access road (about 1,500 ft in length, figure 3) could also have various adverse impacts on the bald eagles. The impacts on the eagles would be the same as described in alternative 2. Although mitigation measures would be applied in alternative 5 to minimize impacts of construction, there still would be the potential for the eagles to be flushed from the nest, which would increase the potential for egg and/or nestling mortality.

The construction and future pedestrian/vehicle use of the proposed elevated bridge and boardwalk in alternative 5 would have little or no effects on bald eagle habitat. The eagles do not currently use these areas for foraging or roosting due to the level of human activity in the surrounding area. Thus, increased noise and visual exposure from the boardwalk and bridge would not be expected to affect eagle activity.

Likewise, removal of the existing barge landing site and the access road along the river would have no effect on the bald eagles. These areas also are not used by eagles due to human activity in the surrounding area. Restoration of vegetation along the access road and barge landing site would not be expected to affect eagle activity so long as human activity continues in the project area.

Overall, the construction and future use of the proposed barge landing site and access road under alternative 5 would have short- and long-term, moderate, adverse, and localized effects on bald eagles in the Brooks River area. These impacts would primarily occur during the visitation season at Brooks Camp, and could cause changes to bald eagle feeding, mating, nesting, or caring for young. Bald eagle behaviors and activities associated with the existing nest site near Beaver Pond would be particularly affected by the construction and use of the proposed barge landing site and access road. Depending on the timing, these activities could adversely affect eagle nesting and Beaver Pond use by bald eagles. Changes to the regional bald eagle population would be minimal. Compared to alternative 1, alternative 5 would likely increase the adverse impacts on bald eagles and their habitat. The increase in adverse effects primarily relate to the disturbances associated with the new barge landing site and access road (immediately adjacent to nest site).

Cumulative Impacts. Various other past, present, and reasonably foreseeable future projects in and near the project area have and would continue to affect the bald eagle. These projects relate to facility development, recreation access, transport vehicle noises, site restoration, and program development, as described in the "Cumulative Impacts" section under alternative 1 (including the future planned development around Beaver Pond).

When the likely adverse effects of alternative 5 are added to the effects of these other past, present, and reasonably foreseeable future actions, there would be a long-term, moderate, adverse, and localized cumulative impact on bald eagles in the Brooks River area. The alternative 5 actions would contribute an appreciable, adverse increment to this cumulative impact.

Conclusion. Alternative 5 would result in short- and long-term, moderate, adverse, and localized impacts on the bald eagles in the Brooks River area. These adverse effects would primarily result from the construction and future use of a new barge landing area and access road near an eagle nest and near Beaver Pond foraging and roosting areas. These activities could adversely affect bald eagle nesting in the Beaver Pond area.

WETLANDS AND UPLAND VEGETATION

Alternative 1

Analysis. Under the alternative 1, ground level pedestrian and vehicle use on maintained trail surfaces would continue throughout the project area. Minimal vegetation trampling, trail widening, and some social trail development from pedestrian and vehicle use would continue, especially in high use areas such as The Corner and along each bank of the river. In addition to native vegetation displacement, these disturbances would also create areas that are suitable for the establishment and propagation of nonnative invasive plant species.

No new areas of vegetation or wetlands would be displaced by structure, road, or trail development because alternative 1 does not include any such site developments. However, the wetland hydrology and vegetation community of delineated wetlands E, F, and G would continue to be adversely affected by the existing access roads that run along the south bank of the river and from the bridge site to the bus parking area (see wetland delineation report in appendix D for descriptions of these wetlands). The raised roadbeds of fill material and the compaction of native soils below these road surfaces are impediments to surface water and groundwater movement between these wetlands, respectively. Because the access roads run along the wetland perimeters, any eroded sediment or pollutants from the roads would continue to be deposited in the adjacent wetlands.

The construction of a ramp at the barge landing site would be in a lacustrine wetland, classified as a limnetic, unconsolidated bottom, permanently flooded wetland (L1UBH) (URS 2009b). Although the ramp would not affect wetlands vegetation, it would affect hydric soils and hydrology—some soils would be altered with the placement of the ramp below the high water mark and on the lake bottom, and shoreline geomorphology and possibly shoreline erosion may occur (see also the discussion of hydrology impacts). However, these adverse effects would be very small and localized, given the size of the ramp and the abundance of this wetland in Naknek Lake.

Overall, alternative 1 would result in the continuation of long-term, minor, adverse, and localized impacts on wetlands and upland vegetation. These adverse effects would relate to a continuation of vegetation trampling from human activity in various portions of the project area on both sides of the river and the continuation of wetland hydrology impacts (wetlands E, F, and G). However, these effects on wetland area, quality, and continuity and on upland vegetation communities would be minimal. The overall viability of the wetland and upland vegetation communities would not be affected.

Cumulative Impacts. Several past management actions in and around the project area have had notable effects on vegetation and wetlands. Most of these past actions have had adverse effects on these resources because they resulted in direct displacement of plant communities and/or altered hydrology and habitat value in or near wetland areas. The past actions that have displaced vegetation include the facility development and recreational access associated with Brooks Camp over

the years (e.g., lodge, campground, visitor center, restrooms, operations facilities, utilities, guest cabins, staff housing, trails, and access roads). The past actions that have caused disturbances to wetlands primarily relate to access road/trail development and maintenance. Some of these roads appear to have displaced wetland acreage. Others roads have altered wetland surface and subsurface hydrology. The human presence associated with management and recreational use of these facilities and roads/trails has also caused wetland habitat disturbances in various areas through the project area.

Present and reasonably foreseeable future actions would also affect vegetation communities and wetlands in and around the project area. Such actions could include additional facility improvements around the project area (e.g., the maintenance and housing development at Valley Road Administrative Area, removal (and site restoration) of Lake Brooks maintenance and housing facilities, development of an alternative trail between the campground and Brooks Camp, and overall relocation of Brooks Camp and its associated uses to the south of Brooks River (near Beaver Pond Terrace). Most of these effects would be long term. The adverse effects of some of these actions could involve displacement of vegetation and wetlands by structures and roads, altered wetland hydrology, and the introduction of human activity near wetland habitats. The beneficial effects on vegetation would result from the ecological restoration associated with the relocation projects that would remove park facilities from areas along the Brooks River corridor (e.g., the Lake Brooks maintenance area and Brooks Camp).

Although the present and future actions would have notable areas of both vegetation restoration and vegetation displacement, the overall effects would generally be adverse because restored areas often do not fully return to their natural condition (e.g., due to weeds and altered vegetation succession).

When the likely adverse effects of alternative 1 are added to the effects of these other past, present, and reasonably foreseeable future actions, there would be a long-term, moderate, adverse, and localized cumulative impact on vegetation and wetlands. Alternative 1 would contribute an appreciable, adverse increment to this cumulative impact.

Conclusion. Alternative 1 would result in the continuation of long-term, minor, adverse, and localized impacts on wetlands and vegetation. These adverse effects would result from continued vegetation trampling and social trails from ground level pedestrian and vehicle use in the Corner area on the north side of the river and between the floating bridge and the bus parking area on the south side of the river. The continued hydrological disturbances to wetlands E, F, and G adjacent to the access roads along the south bank and between the bridge and the bus parking area would also contribute to this adverse effect.

Alternative 2

Analysis. The elevated boardwalk on the north side of the river would reduce vegetation trampling and some social trail development from pedestrian and vehicle use in the area of the Corner and along the north bank of Brooks River. Vegetation in the Corner area and along the north bank would be rehabilitated and restored, and its use would be reserved primarily for bears. However, some social trail development and vegetation trampling would continue in these areas due to other continuing uses such as angling.

Undisturbed vegetation would be displaced by the support piles of the elevated boardwalks to the north and south of river. The 1,685 linear ft of

elevated boardwalk and ramps in this alternative would involve single- or double-pile supports spaced 12 ft to 24 ft apart along the full length of the boardwalks. For most of the boardwalk length, the support piles would directly displace native vegetation.

The elevated boardwalk on the north side of river would follow the edge of and cross a portion of delineated wetlands H and I area (see wetland delineation report in appendix D for descriptions of these and other nearby wetlands). This would result in reduced wetland habitat value because of the proximity of human activity to the wetlands. In areas where the boardwalk crosses wetlands H and I, the boardwalk pilings would displace some limited wetland area and functionality. Oils and chemicals from vehicular use of the boardwalk could drain into the adjacent wetlands.

The elevated boardwalk on the south side of river would follow the edge of and cross portions of delineated wetlands E and F. As with the effects of the boardwalk on wetlands H and I, this would result in reduced wetland habitat value and displace some limited wetland area and functionality. The 8-foot-wide boardwalks could also introduce oils and chemicals from vehicular use into the adjacent wetlands.

However, because the elevated boardwalk on the south side of the river would remove a large volume of ground level pedestrian activity between the bridge and the bus parking area, it would reduce vegetation trampling and some social trail development south of the river. The local plant communities in this area would benefit from this reduction in ground level human activity. However, social trail development and vegetation trampling would continue along the south bank and other areas south of the river due to other continuing uses such as angling.

The wetland hydrology and plant community of delineated wetland G near the existing barge landing access road would be improved when the road is removed and the landscape restored (about 600 linear ft in length).

Under alternative 2, the proposed access road that would serve the new barge landing (roughly 2,000 ft south along of the existing site on Naknek Lake shoreline, figure 3) would displace a notable acreage of native vegetation and run between a complex of small emergent wetlands (delineated wetlands A, B, and C). The roadway length would be approximately 1,500 ft. The road could alter the local wetland hydrology of the complex and would degrade wetland habitat values in this area. Because the access road would bisect this wetland complex, wetland continuity would be negatively affected. To avoid sensitive archeological resources, the southeasternmost segment of the proposed access road would need to be aligned in a way that necessitates the fill of small portions of wetlands A, B, and/or C. The proposed alignment would displace approximately 2,300 ft^2 (less than 0.1 acre) of these wetlands near the proposed barge landing site.

Throughout the project area, an estimated total of 1.6 acres of vegetation (wetland and upland) would be directly displaced by the actions in this alternative (roughly 0.3 acres for bridge and boardwalk development and 1.3 acres for barge landing access road and site development). Conversely, this alternative would include the restoration of approximately 0.45 acres of vegetation (0.15 acres for restored trails and 0.3 acres for the restored barge landing site and access road along the south bank). The construction of the bridge, elevated boardwalk, barge landing, and landing access road would have multiple short-term effects on the vegetation and wetlands near the construction activities. Delineated wetlands A, B, C, E, F, G, H, and I would be affected. Some examples of these construction-related impacts include

incidental ground disturbances to construction site periphery, sedimentation resulting from adjacent disturbed soils, fugitive dust deposition, and wetland habitat disturbance from construction activities and human presence. However, to minimize or avoid these effects on vegetation and wetlands, mitigation measures, abatement, and construction best management practices would be used. These measures would include a revegetation plan, erosion/sedimentation controls, maintained construction limits, and appropriate stockpile locations and containment.

In addition, the construction of the bridge, boardwalk, barge landing, and landing access road could have some long-term impacts on vegetation in the area. The ground disturbances associated with the construction activities would create areas that are suitable for the establishment and propagation of nonnative invasive plant species. Some areas of restoration would be reclaimed with active soil preparation and native replanting, while other areas would be left for passive, natural restoration over time. These passively restored areas would be most prone to the spread of nonnative, invasive plants. To minimize this effect, various weed control and revegetation best management practices would be employed (e.g., use of weed-free materials, construction equipment washing, and postconstruction monitoring and weed control).

Lastly, this alternative includes two utility lines (electric and septic pump-out) that would be mounted to the bridge and elevated boardwalks. The only effect these utilities could have on vegetation in the project area would be in the areas where the lines transition from above the ground (attached to boardwalk structure) to being buried underground. On the north end of the utility lines, a small ground disturbance from these lines could occur near the fish freezing station at the south end of Brooks Camp. On the south end, a small ground disturbance could occur from the septic pump-out line at the end of the vehicle ramp relatively near the south riverbank. The electric line would be buried along the existing roadbed from the end of the boardwalk to the bus parking area (about 100 ft).

Overall, alternative 2 would result in a short- to long-term, moderate, adverse, and localized impact to wetlands and upland vegetation due to the development of the bridge, boardwalk, and barge landing access road, and the continuing ground level human activities on both sides of Brooks River. The effects of alternative 2 on wetlands would cause measurable changes to wetland area, quality, and/or continuity, particularly to the wetlands along the proposed boardwalks and access road routes (wetlands A, B, C, E, F, H, and I). The effects on upland vegetation would cause measurable changes to the abundance and distribution of individual plant species, and could continue to affect the viability of portions of the local vegetation communities. These adverse effects primarily relate to direct displacement of wetland and vegetation acreage and the reduced quality of wetland and upland vegetation communities from the development of the bridge, boardwalks, and new barge landing access road. Wetland hydrology along the proposed access road would also be adversely affected. Temporary effects of construction activities would also contribute to the adverse effects. Compared to alternative 1, alternative 2 would result in an increase in adverse effects to wetlands and upland vegetation due to the expanded areas of boardwalk and road development and increases in wetland hydrology alterations (in/along wetlands A, B, and C). However, compared to alternative 1, reductions in vegetation trampling from park visitors and improved hydrology and vegetation cover near wetland G would be expected from the restoration of the adjacent access road.

Cumulative Impacts. Various other past, present, and reasonably foreseeable future

projects in and near the project area have and would continue to affect wetlands and upland vegetation. These projects relate to facility development, recreation access, site restoration, and program development, as described in the "Cumulative Impacts" section under alternative 1 above.

When the likely effects of alternative 2 actions are added to the effects of these other past, present, and reasonably foreseeable future actions, there would be a long-term, moderate, adverse, and localized cumulative impact on vegetation and wetlands. Alternative 2 would contribute an appreciable, adverse increment to this cumulative impact.

Conclusion. Alternative 2 would result in short- to long-term, moderate, adverse, and localized impacts on wetlands and vegetation. The adverse effects would primarily result from displaced and altered vegetation along the alignment of the proposed boardwalks, disturbances to wetlands H and I (to the west of Brooks Camp) and wetlands E and F (between the bridge and the bus parking area), vegetation and wetland impacts from the proposed access road to the new barge landing area (wetlands A, B, and C), and possible impacts from site construction activities (e.g., sedimentation, fugitive dust deposition, and propagation of nonnative invasive plant species). However, wetlands and vegetation would also benefit from the reduced potential for vegetation trampling and social trails on both sides of the river and the restored wetland hydrology of wetland G along the restored barge landing access road area.

Alternative 3

Analysis. The elevated boardwalk on the north side of the river would reduce vegetation trampling and social trail development from pedestrian and vehicle use in the Corner and along the north bank of Brooks River. Vegetation in the Corner area and along the north bank would be rehabilitated and restored. However, some social trail development and vegetation trampling would continue in these areas due to other continuing uses such as angling.

Some upland vegetation in the Corner area, as well as some undisturbed vegetation near the south bank of the river, would be displaced by the piling support systems of the elevated boardwalks. The 530 linear ft of elevated boardwalks in this alternative would involve single- and double-pile supports spaced at 12 ft to 24 ft apart along the full length of the boardwalks. However, because much of the proposed boardwalk alignment under alternative 3 follows existing disturbance corridors (e.g., along existing road/trail), the impact on vegetation would be relatively minimal.

Under alternative 3, a minor realignment of barge landing access road near the mouth of the river would displace a limited amount of native vegetation. The proposed end of the access road would be about 200 ft south of the existing barge landing access point (figure 5). Because much of the vegetation in this realignment area has already been displaced by past activities, the displacement of vegetation from this action would be minimal.

Throughout the project area, an estimated total of 0.54 acres of vegetation would be directly displaced by the actions in this alternative (0.04 acres for bridge and boardwalk development and 0.5 acres for barge landing site/access road development). Conversely, this alternative would include the restoration of approximately 0.25 acres of vegetation (0.07 acres for restored trails and 0.18 acres for the restored barge landing site and access near the spit).

The construction of the bridge, elevated boardwalk, barge landing, and landing access road would have some short-term effects on the native vegetation near the construction activities. Some examples of these construction-related impacts include

incidental ground disturbances of construction site periphery; sedimentation resulting from adjacent disturbed soils; fugitive dust deposition; and habitat disturbance from construction activities, noises, and human presence. However, to minimize or avoid these effects on vegetation and wetlands, mitigation measures, abatement, and construction best management practices would be used. These measures would include a revegetation plan, erosion/sedimentation controls, maintained construction limits, and appropriate stockpile locations and containment.

In addition, the construction of the bridge and boardwalks could have some long-term adverse impacts on vegetation in the area. The ground disturbances associated with the construction activities would create areas that are suitable for the establishment and propagation of nonnative invasive plant species. Some areas of restoration would be reclaimed with active soil preparation and native replanting, while other areas would be left for passive, natural restoration over time. These passively restored areas would be most prone to the spread of nonnative, invasive plants. To minimize this effect, various weed control and revegetation best management practices would be employed (e.g., use of weed-free materials, construction equipment washing, and postconstruction monitoring and weed control).

Lastly, this alternative also includes two utility lines (electric and septic pump-out) that would be mounted to the bridge and elevated boardwalks. The only effect these utilities could have on vegetation in the project area would be where the lines transition from above the ground (attached to boardwalk structure) to being buried underground. At the north end of the utility lines, a small ground disturbance from these lines could occur near the fish freezing station at the south end of Brooks Camp. On the south end, a small ground disturbance could occur from the septic pump-out line at the end of the vehicle ramp relatively near the south riverbank. The electric line would be buried and routed along the existing access roadbed from the end of the boardwalk ramp to the bus parking area (about 1,000 ft).

Overall, alternative 3 would result in a short- to long-term, minor, adverse, and localized impact to wetlands and upland vegetation due to the development of the bridge and boardwalk, and the continuing ground level human activities on both sides of Brooks River. Alternative 3 would cause only slight changes to wetland area, quality, and/or continuity and also have only slight effects on the abundance and distribution of upland vegetation species and communities. The adverse effects would relate to direct displacement of or encroachment on wetland and vegetation acreage at the fringes of the proposed developed area (e.g., boardwalk) and temporary effects of construction activities. Compared to alternative 1, alternative 3 would likely result in in similar adverse effects to wetlands and upland vegetation because the proposed boardwalks, ramps, and accesses are primarily aligned in already disturbed areas.

Cumulative Impacts. Various other past, present, and reasonably foreseeable future projects in and near the project area have and would continue to affect wetlands and upland vegetation. These projects relate to facility development, recreation access, site restoration, and program development, as described in the "Cumulative Impacts" section under alternative 1 above.
When the likely effects of alternative 3 actions are added to the effects of these other past, present, and reasonably foreseeable future actions, there would be a long-term, moderate, adverse, and localized cumulative impact on vegetation and wetlands. Alternative 3 would contribute a small, adverse increment to this cumulative impact.

Conclusion. Alternative 3 would result in a short- to long-term, minor, adverse, and localized impact on wetlands and vegetation. The adverse effects would primarily result from displaced and altered vegetation along the alignment of the proposed boardwalk and possible impacts from site construction activities (e.g., sedimentation, fugitive dust deposition, and propagation of nonnative invasive plant species). However, the proposed boardwalks, ramps, and accesses are primarily aligned in already disturbed areas, so the adverse effects would be minimal. The wetland and upland vegetation would also benefit from the reduced potential for vegetation trampling and social trails on the north side of the river.

Alternative 4

Analysis. The elevated boardwalk on the north side of the river would reduce vegetation trampling and some social trail development from pedestrian and vehicle use in the Corner and along the north bank of Brooks River. Vegetation in the Corner area and along the north bank would be rehabilitated and restored. However, some social trail development and vegetation trampling would continue in these areas due to other continuing uses such as angling.

Undisturbed vegetation would be displaced by the support piles of the elevated boardwalks to the north and south of river. The 1,190 linear ft of elevated boardwalk in this alternative would involve single- or double-pile supports spaced at 12 ft to 24 ft apart along the full length of the boardwalks. For most of the boardwalk length, the support piles would directly displace native vegetation.

The elevated boardwalk on the north side of river would follow the edge of and cross a portion of delineated wetlands H and I (see wetland delineation report in appendix D for descriptions of these and other nearby wetlands). This would result in reduced wetland habitat value because of nearby human activity. In areas where the boardwalk crosses wetlands H and I, the boardwalk pilings (spaced at 12 ft to 24 ft) would displace some limited wetland area and functionality. Oils and chemicals from vehicular use of the boardwalk could also drain into the adjacent wetlands.

The elevated boardwalk on the south side of river would follow the edge of and cross a substantial portion of delineated wetlands E and F. As with the effects of the boardwalk on wetlands H and I, this would result in reduced wetland habitat value and displace some limited wetland area and functionality. The 8-foot-wide boardwalks could also introduce oils and chemicals from vehicular use into the adjacent wetlands.

However, because the elevated boardwalk on the south side of the river would remove a large volume of ground level pedestrian and vehicle activity between the bridge and the bus parking area, it would reduce vegetation trampling and social trail development south of the river. The local plant communities in this area would benefit from this reduction in ground level human activity. However, as on the north side of the river, some social trail development and vegetation trampling would continue due to other continuing ground level uses such as angling.

The wetland hydrology and plant community of delineated wetland G near the existing barge landing access road would be improved when the road is removed and the landscape restored (about 600 ft in length).

In addition to restoring the barge landing access road area, alternative 4 would include the restoration of approximately 600 ft of the access road that currently connects the bridge to the bus parking area (rdd l `o !). This portion of the access road would no longer be needed because the pedestrians and NPS and concessioner

vehicles would use the proposed elevated boardwalk that connects the bridge with the bus parking area. This road restoration would improve conditions for upland vegetation and wetlands along the restored road corridor, as well as restore the hydrology and habitat conditions of the adjacent delineated wetlands F and G (which were previously bisected by the road).

The proposed access road that would serve the new barge landing (roughly 2,000 ft south along of the existing site on Naknek Lake shoreline, figure 3) would displace a notable acreage of native vegetation and run between a complex of small emergent wetlands (delineated wetlands A, B, and C). The roadway length would be approximately 1,500 ft. The road could alter the local wetland hydrology of the complex and would degrade wetland habitat values in this area. Because the access road would bisect this wetland complex, wetland continuity would be negatively affected. To avoid sensitive archeological resources, the southeasternmost segment of the proposed access road would need to be aligned in a way that necessitates the fill of small portions of wetlands A, B, and/or C. The proposed alignment would displace approximately 2,300 ft^2 (less than 0.1 acre) of these wetlands in this area near the proposed barge landing site.

Throughout the project area, an estimated total of 1.5 acres of vegetation (wetland and upland) would be directly displaced by the actions in this alternative (roughly 0.2 acres for bridge and boardwalk development and 1.3 acres for barge landing access road and site development). Conversely, this alternative would include the restoration of approximately 0.59 acres of vegetation (0.15 acres for restored trails and 0.44 acres for the restored access roads and barge landing).

The construction of the bridge, elevated boardwalk, barge landing, and landing access road would have multiple short-term effects on the vegetation and wetlands near the construction activities. Delineated wetlands A, B, C, E, F, G, H, and I would be affected. Some examples of these construction-related impacts include incidental ground disturbances to construction site periphery; sedimentation resulting from adjacent disturbed soils; fugitive dust deposition; and wetland habitat disturbance from construction activities, noises, and human presence. However, to minimize or avoid these effects on vegetation and wetlands, mitigation measures, abatement, and construction best management practices would be used. These measures would include a revegetation plan, erosion/sedimentation controls, maintained construction limits, and appropriate stockpile locations and containment.

The construction of the bridge, boardwalk, barge landing, and landing access road could have some long-term impacts on vegetation in the area. The ground disturbances associated with the construction activities would create areas that are suitable for the establishment and propagation of nonnative invasive plant species. Some areas of restoration would be reclaimed with active soil preparation and native replanting, while other areas would be left for passive, natural restoration over time. These passively restored areas would be most prone to the spread of nonnative, invasive plants. To minimize this effect, various weed control and revegetation best management practices would be employed (e.g., use of weed-free materials, construction equipment washing, and postconstruction monitoring and weed control).

Lastly, this alternative also includes two utility lines (electric and septic pump-out) that would be mounted to the bridge and elevated boardwalks. The only effect these utilities could have on vegetation in the project area would be in the areas where the lines transition from above the ground (attached to boardwalk structure) to being

buried underground. At the north end of the utility lines, a small ground disturbance from these lines could occur near the fish freezing station at the south end of Brooks Camp. On the south end, a small ground disturbance could occur from the septic clean-out line at the end of the ramp relatively near the bus parking area. The electric line would be buried along the existing roadbed from the end of the boardwalk ramp to the bus parking area (approximately 100 ft).

Overall, alternative 4 would result in a short- to long-term, moderate, adverse, and localized impact to wetlands and upland vegetation due to the development of the bridge, boardwalk, and barge landing access road, and the continuing ground level human activities on both sides of Brooks River. The effects of alternative 4 on wetlands would cause measurable changes to wetland area, quality, and/or continuity, particularly to the wetlands along the proposed boardwalks and access road routes (wetlands A, B, C, E, F, H, and I). The effects on upland vegetation would cause measurable changes to the abundance and distribution of individual plant species, and could continue to affect the viability of portions of the local vegetation communities. These adverse effects relate to direct displacement of wetland and vegetation acreage and the reduced quality of wetland and upland vegetation communities. Wetland hydrology along the proposed access road would also be adversely affected. Temporary effects of construction activities would also contribute to the adverse effects. Compared to alternative 1, alternative 4 would likely result in an increase in adverse effects to wetlands and upland vegetation due to the expanded areas of boardwalk and road development and increases in wetland hydrology alterations (in/along wetlands A, B, and C). However, compared to alternative 1, reductions in vegetation trampling from park visitors, restored vegetation along the existing access road corridors, and improved hydrology at wetland G would be expected.

Cumulative Impacts. Various other past, present, and reasonably foreseeable future projects in and near the project area have and would continue to affect wetlands and upland vegetation. These projects relate to facility development, recreation access, site restoration, and program development, as described in the "Cumulative Impacts" section under alternative 1 above.

When the likely effects of alternative 4 actions are added to the effects of these other past, present, and reasonably foreseeable future actions, there would be a long-term, moderate, adverse, and localized cumulative impact on vegetation and wetlands. Alternative 4 would contribute an appreciable, adverse increment to this cumulative impact.

Conclusion. Alternative 4 would result in a short- to long-term, moderate, adverse, and localized impact on wetlands and vegetation. The adverse effects would primarily result from displaced and altered vegetation along the alignment of the proposed boardwalks, disturbances to wetlands H and I (west of Brooks Camp) and to wetlands E and F (between the bridge and the bus parking area), vegetation and wetland impacts from the new access road to the new barge landing area (wetlands A, B, and C), and possible impacts from site construction activities (e.g., sedimentation, fugitive dust deposition, and propagation of nonnative invasive plant species). However, wetlands and vegetation would also benefit from the reduced potential for vegetation trampling and social trails on both sides of the river, restored vegetation between along the access road between the bridge and bus parking area, and the restored wetland hydrology of wetland G along the restored barge landing access road area.

Alternative 5

Analysis. The elevated boardwalk on the north side of the river would reduce vegetation trampling and some social trail development from pedestrian and vehicle use in the Corner and along the north bank of Brooks River. Vegetation in the Corner area and along the north bank would be rehabilitated and restored. However, some social trail development and vegetation trampling would continue in these areas due to other continuing uses such as angling.

Undisturbed vegetation would be displaced by the support piles of the elevated boardwalks to the north and south of river. The 770 linear ft of elevated boardwalk in this alternative would involve single- or double-pile supports spaced at 12 ft to 24 ft apart along the full length of the boardwalks. For most of the boardwalk length, the support piles would directly displace native vegetation.

The elevated boardwalk on the north side of river would follow the edge of and cross a portion of delineated wetlands H and I (see wetland delineation report in appendix D for descriptions of these and other nearby wetlands). This would result in reduced wetland habitat value because of human activity near the wetlands. In areas where the boardwalk crosses wetlands H and I, the boardwalk pilings (spaced at 12 ft to 24 ft) would displace some limited wetland area and functionality. Oils and chemicals from vehicular use of the boardwalk could also drain into the adjacent wetlands.
The wetland hydrology and plant community of delineated wetland G near the existing barge landing access road (approximately 600 ft in length) would be improved when the road is removed and the landscape restored.

Under alternative 5 the proposed access road that would serve the new barge landing (roughly 2,000 ft south of the existing site on Naknek Lake shoreline, figure 3) would displace a notable acreage of native vegetation and run between a complex of small emergent wetlands (delineated wetlands A, B, and C). The roadway length would be approximately 1,500 ft. The road could alter the local wetland hydrology of the complex and would degrade wetland habitat values in this area. Because the access road would bisect this wetland complex, wetland continuity would be negatively affected. To avoid sensitive archeological resources, the southeasternmost segment of the proposed access road would need to be aligned in a way that necessitates the fill of small portions of wetlands A, B, and/or C. The proposed alignment would displace approximately 2,300 ft^2 (less than 0.1 acre) of these wetlands in this area near the proposed barge landing site.

Throughout the project area, an estimated total of 1.4 acres of vegetation (wetland and upland) would be directly displaced by the actions in this alternative (roughly 0.14 acres for bridge and boardwalk development and 1.3 acres for barge landing access road and site development). Conversely, this alternative would include the restoration of approximately 0.45 acres of vegetation (0.15 acres for restored trails and 0.30 acres for the restored barge landing access road and site).

The construction of the bridge, elevated boardwalk, barge landing, and landing access road would have multiple short-term effects on the vegetation and wetlands near the construction activities. Delineated wetlands A, B, C, G, H, and I would be affected. Some examples of these construction-related impacts include incidental ground disturbances to construction site periphery; sedimentation resulting from adjacent disturbed soils; fugitive dust deposition; and wetland habitat disturbance from construction activities, noises, and human presence. However, to minimize or avoid these effects on vegetation and wetlands, mitigation measures, abatement, and

construction best management practices would be used. These measures would include a revegetation plan, erosion/sedimentation controls, maintained construction limits, and appropriate stockpile locations and containment.

In addition, the construction of the bridge, boardwalk, barge landing, and landing access road could have some long-term impacts on vegetation in the area. The ground disturbances associated with the construction activities would create areas that are suitable for the establishment and propagation of nonnative, invasive plant species. Some areas of restoration would be reclaimed with active soil preparation and native replanting, while other areas would be left for passive, natural restoration over time. These passively restored areas would be most prone to the spread of nonnative, invasive plants. To minimize this effect, various weed control and revegetation best management practices would be employed (e.g., use of weed-free materials, construction equipment washing, and postconstruction monitoring and weed control).

Lastly, this alternative also includes two utility lines (electric and septic pump-out) that would be mounted to the bridge and elevated boardwalks. The only effect these utilities could have on vegetation in the project area would be in the areas where the lines transition from above the ground (attached to boardwalk structure) to being buried underground. At the north end of the utility lines, a small ground disturbance from these lines could occur near the fish freezing station at the south end of Brooks Camp. On the south end, a small ground disturbance could occur from the septic clean-out line at the end of the vehicle ramp near the south riverbank. The electric line would be buried and routed along the existing access roadbed from the end of the boardwalk ramp to the bus parking area (approximately 1,000 ft in distance).

Overall, alternative 5 would result in a short- to long-term, moderate, adverse, and localized impact to wetlands and upland vegetation due to the development of the bridge, boardwalk, and barge landing access road, and the continuing ground level human activities on both sides of Brooks River. The effects of alternative 5 on wetlands would cause measurable changes to wetland area, quality, and/or continuity, particularly to the wetlands along the proposed boardwalks and access road routes (wetlands A, B, C, H, and I). The effects on upland vegetation would cause measurable changes to the abundance and distribution of individual plant species, and could continue to affect the viability of portions of the local vegetation communities. These adverse effects relate to direct displacement of wetland and vegetation acreage and the reduced quality of wetland and upland vegetation communities. Wetland hydrology along the proposed access road would also be adversely affected. Temporary effects of construction activities would also contribute to the adverse effects. Compared to alternative 1, alternative 5 would likely result in an increase in adverse effects to wetlands and upland vegetation due to the expanded areas of boardwalk and road development and increases in wetland hydrology alterations (in/along wetlands A, B, and C). However, compared to alternative 1, reductions in vegetation trampling from park visitors on the north side of the river and improved hydrology and vegetation cover near wetland G would be expected from the restoration of the adjacent barge landing access road.

Cumulative Impacts. Various other past, present, and reasonably foreseeable future projects in and near the project area have and would continue to affect wetlands and upland vegetation. These projects relate to facility development, recreation access, site restoration, and program development, as described in the "Cumulative Impacts" section under alternative 1 above.

When the likely effects of alternative 5 actions are added to the effects of these other past, present, and reasonably foreseeable future actions, there would be a long-term, moderate, adverse, and localized cumulative impact on vegetation and wetlands. Alternative 5 would contribute an appreciable, adverse increment to this cumulative impact.

Conclusion. Alternative 5 would result in short- to long-term, moderate, adverse, and localized impacts on wetlands and vegetation. The adverse effects would primarily result from displaced and altered vegetation along the alignment of the proposed boardwalks, disturbances to wetlands H and I (west of Brooks Camp, vegetation and wetland impacts from the proposed access road to the new barge landing area (wetlands A, B, and C), and possible impacts from site construction activities (e.g., sedimentation, fugitive dust deposition, and propagation of nonnative invasive plant species). However, wetlands and vegetation would benefit from the reduced potential for vegetation trampling and social trails on the north side of the river and the restored wetland hydrology of wetland G along the restored barge landing access road area.

HYDROLOGY AND FLOODPLAINS

Alternative 1 (No Action)

Analysis. Under alternative 1, river geomorphology, floodplains, groundwater flow, and channel flow hydraulics of Brooks River would continue to function as they have in the past. Naturally occurring changes to these attributes would continue each year because of dynamic nature of a meandering river. Because the floating bridge would remain in the upper water column of the river during visitation months, it would continue to affect or obstruct river flow hydraulics and geomorphology, particularly during periods of high runoff or flooding. Likewise, riverbank erosion would continue on both the north and south banks of Brooks River near the floating bridge anchor points, necessitating continued bank stabilization efforts. Soil erosion near floating bridge anchor points and from periodic hauling of septic waste across the river would continue to result in increases in river turbidity and downstream sedimentation. However, the turbidity and sedimentation associated with the erosion at the bridge anchor points and from the hauling operations are negligible relative to the sedimentation effects of natural processes such as storm events and geomorphic shifts in the river.

The barge landing access road along south bank of the river would continue to alter surface and subsurface hydrology between adjacent delineated wetland G and Brooks River (i.e., continuing to disrupt hydrological connectivity). Similarly, the access road that connects the bridge area with the bus parking area would continue to affect surface and subsurface hydrology between delineated wetlands F and G. The raised roadbeds of fill material and the compaction of native soils below these road surfaces are impediments to surface water and groundwater movement between these wetlands, respectively.

The periodic dredging of the barge landing site would continue to result in some impacts to the Naknek Lake floodplain. Dredging would affect sediments and turbidity in the bulkhead area. However, only a small amount of lakeshore sediments (approximately 20–60 cubic yards) would be annually removed from the site. Due to the size of the lake, wave action, and weather patterns, sediments within the bulkhead area reaccumulate in one or two years.

The construction of a hardened ramp at the barge landing site would not affect the hydrology of Naknek Lake. The ramp would alter the shoreline geomorphology, which in turn could result in some shoreline erosion in the wave zone of the

lake. However, given the size of the ramp (24 ft to 30 ft wide) a relatively small area of shoreline potentially would be affected by the ramp.

Overall, the continued annual use of the floating bridge and presence of the barge landing access road under alternative 1 would have a long-term, moderate, adverse, and localized effect on hydrology and floodplains. This continued obstruction to upper water column flow and associated hydraulic effects would trigger multiple changes to hydrology, channel or bank erosion, and river geomorphology. The continued presence of the barge landing access road would also affect floodplain processes to the south of the river. Collectively, these impact agents could have detectable effects on the overall hydrological system of the project area.

Cumulative Impacts. The past management actions that expanded recreation access in the Brooks Camp area and beyond prompted the annual use of the temporary floating bridge across Brooks River. This past action introduced annual adverse effects on river flow hydraulics, which contributes to changes in river geomorphology and bank erosion, both in the midchannel areas as well as along the banks, both upstream and downstream from the bridge anchor points on each shoreline. In addition, the placement and removal of the floating bridge each spring and fall has introduced riverbed and bank disturbances from the equipment used to move the bridge.

Past management actions have involved the development of access roads and trails along both banks of Brooks River. On the north bank, the development and use of the trail between Brooks Camp and the floating bridge has contributed to the loss of vegetation along the north bank over time. This lack of vegetation stabilization along the river shores has contributed to bank erosion in areas downstream of the bridge. However, it should be noted that the wave action and floodwaters near the river mouth (due to high water levels in Naknek Lake and/or east winds) is the primary factor causing this bank erosion. On the south bank, the development of the barge landing access road has altered the surface water and groundwater hydrology and floodplain functions of delineated wetland G (just south of the river).

Other present and reasonably foreseeable future projects in the project area would have no known effect on the hydrology and floodplain functions of the Brooks River corridor.

When the likely effects of alternative 1 are added to the effects of these other past, present, and reasonably foreseeable future actions, there would be a long-term, moderate, adverse, and localized cumulative impact on the hydrology and floodplains. Alternative 1 would contribute a large, adverse increment to this cumulative impact.

Conclusion. Alternative 1 would continue to have a long-term, moderate, adverse, and localized effect on hydrology and floodplains. These adverse effects would primarily result from the continued use of the floating bridge across Brooks River. The bridge would continue to alter river flow hydraulics and geomorphology (because of blocking upper levels of water column), as well as contribute to bank erosion in areas near the bridge anchor points.

Alternative 2

Analysis. Alternative 2 would eliminate the seasonal floating bridge and associated impacts to surface flow hydraulics (and their downstream effects) during the spring, summer, and fall. Annual bank erosion near the bridge anchor points and impacts on river hydrology and water quality from the annual floating bridge installation and removal would no longer occur.

In this alternative the fill that has been added over the past several decades to build up and support the trail on the north side of Brooks River (upstream of the floating bridge anchor point) would be removed. Minimal, temporary effects to river water turbidity and sedimentation during and shortly after these construction activities would occur. However, overall, this action would eliminate an artificial earthen obstruction to river flows and the resulting geomorphology.

Under alternative 2 the foundation for the proposed 360-foot steel truss bridge would involve two pile systems in the Brooks River channel (spaced 120 ft apart). Each pile system would include two piles anchored in the riverbed. These piles would result in altered flow dynamics around the piles, which could lead to hydraulic scouring in the riverbed around the piles. When scouring occurs, sediment deposition would likely occur, resulting in sandbar development. In addition, the pile obstructions in the channel could lead to the accumulation of debris and/or ice dam buildup. Items such as tree limbs, brush, and ice chunks could build up on the upstream side of the pile systems. The debris buildup itself would further alter the dynamics of the river's flow. The altered river hydraulics caused by the debris buildup behind the piles could compound the riverbed scouring, sediment deposition, and sandbar development immediately downstream of the pile systems. If this happens, more alterations to the river's downstream flow hydraulics would occur. Removal of the debris buildup on bridge piles would help mitigate some of these effects during the times of year when NPS staff are present. In addition, because this alternative only includes two pile systems in the channel, these effects would be limited.

The in-river construction of the bridge pilings could affect the river channel's flow hydraulics. To minimize these effects, several channel construction mitigation measures would be applied, such as diversion of river flows around work areas, cofferdams, and sediment traps. However, depending on the amount of river ice and flows during piling installation, the construction equipment and mobilization in the channel could have an adverse effect by disturbing the riverbed and stirring up sediment that would be deposited downstream.

Alternative 2 includes a relocation of the barge landing to an area farther south along the shores of Naknek Lake. This relocation would allow for the elimination and restoration of the barge landing access road along the south bank of the Brooks River, near the mouth. The restoration of the access road site would help restore the floodplain values of wetland G, and the hydrological connectivity between the wetland and Brooks River.

The construction of a hardened ramp at the barge landing site would not affect hydrology of Naknek Lake. The ramp would alter the shoreline geomorphology, which in turn could result in some shoreline erosion in the wave zone of the lake. However, given the size of the ramp (24 ft to 30 ft wide) a relatively small area of shoreline potentially would be affected by the ramp.

Overall, the proposed bridge structure, which involves two permanent pile systems in the Brooks River channel, would have short- and long-term, minor, adverse, and localized effect on hydrology and floodplains. In addition to construction disturbances in the riverbed, these impacts would result from the hydraulic effects of the piles and the debris caught on the piles (e.g., scouring, sedimentation), which could result in minimal or isolated changes to hydrology, channel or bank erosion, and river geomorphology. These changes would not have any measurable effect on the overall hydrologic system of the area. And, compared to alternative 1, alternative 2 would likely reduce adverse impacts to hydrology and floodplains due to the elimination of the periodic hauling of

septic waste across the river and the periodic dredging of the barge landing site, removal of the temporary floating bridge and barge landing access road (and their associated negative effects) and the limited effects of only two flow obstructions in the riverbed.

Cumulative Impacts. Various past projects and actions in and near the project area have affected hydrology and floodplains along the Brooks River corridor. These past effects primarily relate to the development of access roads, bank alterations, and the floating bridge installation, as described in the "Cumulative Impacts" section under alternative 1 above. However, under this alternative, the annual installation and use of the floating bridge would no longer be necessary.

Other present and reasonably foreseeable future projects in the project area would have no known effect on the hydrology and floodplain functions of the Brooks River corridor. Thus, no cumulative impacts would result.

Conclusion. Alternative 2 would have short- to long-term, minor, adverse, and localized impacts on hydrology and floodplains, primarily from the addition of two permanent flow obstructions to the channel (two bridge pile systems spaced at 120 ft) and the associated construction disturbances in the channel. The support piles, and river debris that catches on them, would alter flow hydraulics, which could also result in riverbed scouring and sandbar development. However, the hydrology and floodplains would benefit from the removal of the floating bridge (that alters river flow hydraulics and flooding, and contributes to bank erosion near its anchors) and the restoration of surface and subsurface flows between wetland G and the river (along the existing barge landing access road).

Alternative 3

Analysis. Alternative 3 would eliminate the seasonal floating bridge and associated impacts to surface flow hydraulics (and their downstream effects) during the spring, summer, and fall. Annual bank erosion near the bridge anchor points and impacts on river hydrology and water quality from the annual floating bridge installation and removal would no longer occur.

The fill that has been added over the past several decades to build up and support the trail on the north side of Brooks River (upstream of the floating bridge anchor point) would be removed. Minimal, temporary effects to river water turbidity and sedimentation during and shortly after these construction activities would occur. However, overall, this action would eliminate an artificial earthen obstruction to river flows and the resulting geomorphology.

Under alternative 3, the foundation for the 415-foot wood truss bridge would involve six sets of two piles in the Brooks River channel (spaced at 50 ft apart). These piles would result in altered flow dynamics, which could lead to hydraulic scouring in the riverbed around the piles. When scouring occurs, sediment deposition would likely occur, resulting in sandbar development. In addition, the pile obstructions in the channel could lead to the accumulation of debris (tree limbs, brush) and/or ice chunks on the upstream side of the piles. The debris buildup would also alter the dynamics of the flows and could compound the riverbed scouring, sediment deposition, and sandbar development immediately downstream of the pile systems. If this happens, more changes to the river's downstream flow hydraulics would occur. Removal of the debris buildup on bridge piles would help mitigate some of these effects during times of year when NPS staff are present.

The in-river construction of the bridge piles could affect the river channel's flow hydraulics. To minimize these effects, several channel construction mitigation measures would be applied, such as diversion of river flows around work areas, cofferdams, and sediment traps. However, depending on the amount of river ice and flows during piling installation, the construction equipment and mobilization in the channel could have an adverse effect by disturbing the riverbed and stirring up sediment that would be deposited downstream.

The construction of a hardened ramp at the new barge landing site would not affect hydrology of Naknek Lake. The ramp would alter the shoreline geomorphology, which in turn could result in some shoreline erosion in the wave zone of the lake. However, given the size of the ramp (24 ft to 30 ft wide) a relatively small area of shoreline potentially would be affected by the ramp.

Overall, the proposed bridge structure, which involves six permanent pile systems in the Brooks River channel, would have short- and long-term, minor, adverse, and localized effect on hydrology and floodplains. In addition to construction disturbances in the riverbed, these impacts would result from the hydraulic effects of the piles and the debris caught on the piles (e.g., scouring, sedimentation), which could result in minimal or isolated changes to hydrology, channel or bank erosion, river geomorphology, or floodplain processes. These changes would not have any measurable effect on the overall hydrologic system of the area. Compared to alternative 1, alternative 3 would increase some impacts to hydrology and floodplains due to the installation of six permanent flow obstructions (i.e., pile systems). However, compared to alternative 1, alternative 3 would likely reduce some adverse impacts to hydrology and floodplains due to the elimination of the periodic hauling of septic waste across the river and the periodic dredging of the barge landing site. This alternative would also benefit the Brooks River hydrology and floodplains due to the elimination of the temporary floating bridge and its associated negative effects.

Cumulative Impacts. Various past projects and actions in and near the project area have affected hydrology and floodplains along the Brooks River corridor. These past effects primarily relate to the development of access roads, bank alterations, and the floating bridge installation, as described in the "Cumulative Impacts" section under alternative 1 above. However, under this alternative, the annual installation and use of the floating bridge would no longer be necessary.

Other present and reasonably foreseeable future projects in the project area would have no known effect on the hydrology and floodplain functions of the Brooks River corridor. Thus, no cumulative impacts would result.

Conclusion. Alternative 3 would have short- to long-term, minor, adverse, and localized impacts on hydrology and floodplains, primarily from the addition of six permanent flow obstructions to the channel (i.e., six sets of bridge pile systems spaced at 50 ft) and the associated construction disturbances in the channel. The support piles, and river debris that catches on them, would alter flow hydraulics, which could also result in riverbed scouring and sandbar development. However, the hydrology would benefit from the removal of the floating bridge (that alters river flow hydraulics and flooding, and contributes to bank erosion near its anchors).

Alternative 4

Analysis. Alternative 4 would eliminate the seasonal floating bridge and associated impacts to surface flow hydraulics (and their downstream effects) during the

spring, summer, and fall. Annual bank erosion near the bridge anchor points and impacts on river hydrology and water quality from the annual floating bridge installation and removal would no longer occur.

The fill that has been added over the past several decades to build up and support the trail on the north side of Brooks River (upstream of the floating bridge anchor point) would be removed. Minimal, temporary effects to river water turbidity and sedimentation during and shortly after these construction activities would occur. However, overall, this action would eliminate an artificial earthen obstruction to river flows and the resulting geomorphology.

Under alternative 4, the foundation for the 350-foot wooden and steel short span bridge would involve up to 14 sets of two piles in the Brooks River channel (spaced at a minimum of 24 ft apart). These piles would result in altered flow dynamics, which could lead to hydraulic scouring in the riverbed around the piles. When scouring occurs, sediment deposition would likely occur, resulting in sandbar development. In addition, the pile obstructions in the channel could lead to the accumulation of debris (tree limbs, brush) and/or ice chunks on the upstream side of the piles. The debris buildup would also alter the dynamics of the flows and could compound the riverbed scouring, sediment deposition, and sandbar development immediately downstream of the pile systems. If this happens, more changes to the river's downstream flow hydraulics would occur. Given the many pile systems that would be in the channel under this alternative, there is a potential for a continuous, collective impact to flow, scouring, and sediment deposition across the width of the channel. Removal of the debris buildup on bridge piles would help mitigate some of these effects during times of year when NPS staff are present. However, the altered flow hydraulics would likely occur regardless of seasonal debris removal because of the large number and spacing of piles in the river.

The in-river construction of the bridge piles could affect the river channel's flow hydraulics. To minimize these effects, several channel construction mitigation measures would be applied, such as diversion of river flows around work areas, cofferdams, and sediment traps. However, depending on the amount of river ice and flows that exist during piling installation, the construction equipment and mobilization in the channel could have an adverse effect by disturbing the riverbed and stirring up sediment that would be deposited downstream.

Alternative 4 includes a relocation of the barge landing to an area farther south along the shores of Naknek Lake. This relocation would allow for the elimination and restoration of the barge landing access road along the south bank of Brooks River, near the mouth. The restoration of the access road site would help restore the floodplain values of wetland G, and the hydrological connectivity between the wetland and Brooks River.

The construction of a hardened ramp at the new barge landing site would not affect hydrology of Naknek Lake. The ramp would alter the shoreline geomorphology, which in turn could result in some shoreline erosion in the wave zone of the lake. However, given the size of the ramp (24 ft to 30 ft wide) a relatively small area of shoreline potentially would be affected by the ramp.

This alternative also calls for the restoration of a portion of the access road that connects the bridge area to the bus parking area. The removal of this north to south road, and the soil compaction that results from vehicular use, would allow local hydrological conditions to become restored (both surface water and groundwater flows).

Overall, the proposed bridge structure, which involves up to 14 permanent pile systems in the Brooks River channel, would have short- and long-term, moderate, adverse, and localized effect on hydrology and floodplains. In addition to construction disturbances in the riverbed, these impacts would result from the hydraulic effects of the piles and the debris caught on the piles (e.g., scouring, sedimentation), which could result in multiple changes to hydrology, channel or bank erosion, river geomorphology, and/or floodplain processes. Collectively, these changes could have detectable effects on the overall hydrological system of the project area. Compared to alternative 1, alternative 4 would increase overall adverse impact to hydrology and floodplains primarily due to the installation of several permanent flow obstructions in the riverbed. This alternative would also benefit the Brooks River hydrology and floodplains due to the elimination of the periodic hauling of septic waste across the river and the periodic dredging of the barge landing site, and the removal of the of the temporary floating bridge and barge landing access road, and their associated negative effects.

Cumulative Impacts. Various past projects and actions in and near the project area have affected hydrology and floodplains along the Brooks River corridor. These past effects primarily relate to the development of access roads, bank alterations, and the floating bridge installation, as described in the "Cumulative Impacts" section under alternative 1 above. However, under this alternative, the annual installation and use of the floating bridge would no longer be necessary.

Other present and reasonably foreseeable future projects in the project area would have no known effect on the hydrology and floodplain functions of the Brooks River corridor. Thus, no cumulative impacts would result.

Conclusion. Alternative 4 would have short- to long-term, moderate, adverse, and localized impacts on hydrology and floodplains, primarily from the addition of up to 14 permanent flow obstructions to the channel (14 bridge pile systems spaced at 24 ft) and the associated construction disturbances in the channel. The support piles, and river debris that catches on them, would alter flow hydraulics, which could also result in scouring and sandbar development. However, the hydrology would benefit from the removal of the floating bridge (that alters river flow hydraulics and flooding, and contributes to bank erosion near its anchors) and the restoration of surface and subsurface flows between wetland G and the river (along the existing barge landing access road).

Alternative 5

Analysis. Alternative 5 would eliminate the seasonal floating bridge and associated impacts to surface flow hydraulics (and their downstream effects) during the spring, summer, and fall. Annual bank erosion near the bridge anchor points and impacts on river hydrology and water quality from the annual floating bridge installation and removal would no longer occur.

The fill that has been added over the past several decades to build up and support the trail on the north side of Brooks River (upstream of the floating bridge anchor point) would be removed. Minimal, temporary effects to river water turbidity and sedimentation during and shortly after these construction activities would occur. However, overall, this action would eliminate an artificial earthen obstruction to river flows and the resulting geomorphology.

Under alternative 5 the proposed bridge design would be the same as the bridge in alternative 4. The foundation for the 350-foot wooden and steel short span bridge would involve up to 14 sets of two piles in

the Brooks River channel (spaced at a minimum of 24 ft apart). These piles would result in altered flow dynamics, which could lead to hydraulic scouring in the riverbed around the piles. When scouring occurs, sediment deposition would likely occur, resulting in sandbar development. In addition, the pile obstructions in the channel could lead to the accumulation of debris (tree limbs, brush) and/or ice chunks on the upstream side of the piles. The debris buildup would also alter the dynamics of the flows and could compound the riverbed scouring, sediment deposition, and sandbar development immediately downstream of the pile systems. If this happens, more changes to the river's downstream flow hydraulics would occur. Given the many pile systems that would be located in the channel under this alternative, there is a potential for a continuous, collective impact to flow, scouring, and sediment deposition across the width of the channel. Removal of the debris buildup on bridge piles would help mitigate some of these effects during times of year when NPS staff are present. However, the altered flow hydraulics would likely occur regardless of seasonal debris removal because of the large number and spacing of piles in the river.

The in-river construction of the bridge piles could affect the river channel's flow hydraulics. To minimize these effects, several channel construction mitigation measures would be applied, such as diversion of river flows around work areas, cofferdams, and sediment traps. However, depending on the amount of river ice and flows that exist during piling installation, the construction equipment and mobilization in the channel could have an adverse effect by disturbing the riverbed and stirring up sediment that would be deposited downstream.

Alternative 5 includes a relocation of the barge landing to an area farther south along the shores of Naknek Lake. This relocation would allow for the elimination and restoration of the barge landing access road along the south bank of Brooks River, near the mouth. The restoration of the access road site would help restore the floodplain values of wetland G, and the hydrological connectivity between the wetland and Brooks River.

The construction of a hardened ramp at the new barge landing site would not affect hydrology of Naknek Lake. The ramp would alter the shoreline geomorphology, which in turn could result in some shoreline erosion in the wave zone of the lake. However, given the size of the ramp (24 ft to 30 ft wide) a relatively small area of shoreline potentially would be affected by the ramp.

Overall, the proposed bridge structure, which involves up to 14 permanent pile systems in the Brooks River channel, would have short- and long-term, moderate, adverse, and localized effect on hydrology and floodplains. In addition to construction disturbances in the riverbed, these impacts would result from the hydraulic effects of the piles and the debris caught on the piles (e.g., scouring, sedimentation), which could result in multiple changes to hydrology, channel or bank erosion, river geomorphology, and/or floodplain processes. Collectively, these changes could have detectable effects on the overall hydrological system of the project area. Compared to alternative 1, alternative 5 would increase overall adverse impact to hydrology and floodplains primarily due to the installation of the several flow obstructions in the riverbed. This alternative would also benefit the Brooks River hydrology and floodplains due to the elimination of the periodic hauling of septic waste across the river and the periodic dredging of the barge landing site, and the removal of the temporary floating bridge and barge landing access road, and their associated negative effects.

Cumulative Impacts. Various past projects and actions in and near the project area have affected hydrology and floodplains

along the Brooks River corridor. These past effects primarily relate to the development of access roads, bank alterations, and the floating bridge installation, as described in the "Cumulative Impacts" section under alternative 1 above. However, under this alternative, the annual installation and use of the floating bridge would no longer be necessary.

Other present and reasonably foreseeable future projects in the project area would have no known effect on the hydrology and floodplain functions of the Brooks River corridor. Thus, no cumulative impacts would result.

Conclusion. Alternative 5 would have short- to long-term, moderate, adverse, and localized impacts on hydrology and floodplains, primarily from the addition of up to 14 permanent flow obstructions to the channel (14 bridge pile systems spaced at 24 ft) and the associated construction disturbances in the channel. The support piles, and river debris that catches on them, would alter flow hydraulics, which could also result in scouring and sandbar development. However, the hydrology would benefit from the removal of the floating bridge (that alters river flow hydraulics and flooding, and contributes to bank erosion near its anchors) and the restoration of surface and subsurface flows between wetland G and the river (along the existing barge landing access road).

SOUNDSCAPE

Alternative 1

Analysis. Noise can adversely affect the natural soundscape in two ways. First, if noise is loud enough, it can drown out or "mask" the natural sounds that are occurring in the area to a point where the natural sounds are not discernible. Second, the noises might alter the behavior of various mammals, birds, and amphibians. This, in turn, may preclude these animals from contributing their respective natural sounds to the surrounding soundscape.

Under alternative 1, the natural soundscape of the project area would continue to be affected by noises associated with the barge landing area (including vehicle loading and unloading) at its current location near the mouth of Brooks River. During the months when Brooks Camp area receives park operations use and visitation, the existing barge landing would be expected to continue accommodating roughly three to 13 barge landings per month, with the most barge activity occurring in August and September (T. Kay, pers. comm., April 8, 2011). Each time a barge docks at the landing, the natural soundscape of area is subjected to several hours of noise disturbances associated with the unloading and loading of supplies and material. Noises from human activity and motorized vehicles would occur at the barge landing, along the south bank access road, along other adjacent access roads and trails, over the floating bridge, and on the trail to Brooks Camp.

Collectively, these noises would continue to mask ambient natural sounds.

In addition, the day-to-day noises from park visitation and park operations near Brooks Camp, along the floating bridge, at viewing platforms, and along access roads would continue (e.g., motorized vehicle noises, visitor noises, other park operations noises, etc.). The light utility vehicles that are used to haul supplies across the floating bridge, in particular, generate considerable amounts of noise. The majority of these noises would originate at ground level, which would allow some of the noises to be reduced or dampened by ground vegetation and other natural obstructions. (Refer to the "Soundscape" section of the "Chapter 3: Affected Environment" chapter for additional description of noises.)

Overall, the continued annual use of the floating bridge, viewing platforms, roads, and barge landing in the project area under alternative 1 would have a long-term, minor, adverse, and localized effect on the natural soundscape. The noises from this human activity would be greater than natural ambient sound levels for a small portion of the average day during the visitation season. Substantial periods of time between noise events would continue. These noises would rarely mask natural ambient sounds in the area.

Cumulative Impacts. Past management actions in and around the project area have had considerable effects on the natural soundscape in the area. Most of these past actions are associated with the incremental development of Brooks Camp as a high use area for park visitors and the effects of providing for overnight stays, bear viewing, and a transportation hub for trips to Valley of Ten Thousand Smokes. The majority of the effects of these past actions have been adverse, by bringing increased noise generation to the area that masks natural ambient sounds. The short-term, adverse effects of these past actions on soundscape related to the noises from construction and development activities. The long-term, adverse effects of the past actions relate to the noise-generating human activities that have been introduced and allowed in the area, such as the use of motorboats and floatplanes, voices of park visitors and staff, motorized vehicles, park operation activities, staff and concessioner housing, and generators.

In addition, present and reasonably foreseeable future actions would also affect the natural soundscape in the project area. Such actions could include additional facility improvements around the project area (e.g., the maintenance and housing development at Valley Road Administrative Area), removal (and site restoration) of Lake Brooks maintenance and housing facilities, and overall relocation of Brooks Camp and its associated uses to the south of Brooks River (near Beaver Pond Terrace). The short-term effects of these actions would relate to the noise disturbances from construction and project mobilization activities. The adverse, long-term effects of some of these actions would involve the introduction noise-generating activities and uses into new parts of the project area (e.g., the future relocation of Brooks Camp to the Beaver Pond Terrace area, and the development of Valley Road Administrative Area). The beneficial, long-term effects would result from the removal of noise generation from high use areas such as Brooks Camp or the Lake Brooks maintenance area, including the removal of the generator in Brooks Camp. Overall, the beneficial and adverse effects of these present and future actions would offset each other somewhat, because areas of new noise disturbance and areas of soundscape restoration could be relatively similar. However, present and future developments and uses would collectively result in noise intrusion into a larger geographic area (because not all Brooks Camp facilities/uses would be relocated to the Beaver Pond Terrace area).

When the likely effects of alternative 1 are added to the effects of these other past, present, and reasonably foreseeable future actions, there would be a long-term, moderate, adverse, and localized cumulative impact on the natural soundscape. Alternative 1 would contribute a small, adverse increment to this cumulative impact.

Conclusion. The effect of alternative 1 on the natural soundscape in the project area would continue to be long-term, minor, adverse, and localized. These adverse effects would primarily result from the continued noise generation from human activities associated with Brooks Camp (e.g., visitors and staff, motorized vehicles, and generator noises from NPS/concessioner operations). The noise disturbances would primarily originate at ground level, occur in the summer, and would extend out from Brooks Camp, the

campground, the Lake Brooks area, and along the roads and trails that connect these sites.

Alternative 2

Analysis. Human and motorized vehicle noises generated along elevated boardwalk and bridge would carry further than the noises on the roads/paths in alternative 1 because the noise would originate 10 ft above ground (Flemming et al. 1995; K. Fristrup, pers. comm., March 29, 2012). The exceptions to this effect would occur where the boardwalks are routed through heavily wooded areas. Alternative 2 would have approximately 1,610 linear ft of elevated structures from which human pedestrian noises could be projected and 995 linear ft (part of the 1,610 ft) of elevated structures from which motorized vehicle noises could be projected. These noise disturbances to the natural soundscape, primarily from human voices and motorized vehicles, would occur intermittently throughout the project area on each day of the visitation months (generally from 7:00 a.m. through 10:00 p.m.). The highest occurrence of these noises projecting from the elevated boardwalks and bridge would likely occur in July and September (the periods of highest visitation and activity in the lower Brooks River).

Motorized vehicles climbing elevated boardwalk ramps (near the south edge of Brooks Camp on the north bank and near the bridge on the south bank) would likely make louder noises than when operating on the boardwalk. Higher decibels of motorized engine noise could be expected from this up-ramp acceleration, with the noise propagation being compounded by the elevated nature of the ramps (Flemming et al. 1995; K. Fristrup, pers. comm., March 30, 2012). The natural soundscape would also be exposed to increased noise from motorized vehicle tires running on the wood deck of the bridge and boardwalks instead of gravel or soil (for 995 ft) (K. Fristrup, pers. comm., March 30, 2012). These adverse effects on the soundscape from NPS and concessioner vehicle use would be expected to occur intermittently throughout each day of the Brooks Camp visitation season.

Under alternative 2 the barge landing would be relocated approximately 2,000 ft to the south along the Naknek Lake shoreline. The new barge landing location and removal of the barge landing access road parallel to the south bank would eliminate several NPS operations and motorized vehicle noises from the vicinity of the river corridor, the river mouth, and the Brooks Camp area.

Conversely, the 2,000-foot relocation of the barge landing would introduce the associated NPS operations noises to a new area to the south along Naknek Lake. Although these operations noises would no longer affect the area around the mouth of Brooks River, they would affect natural soundscape around the new location. Similarly, the relocation of the barge landing access road would introduce motorized vehicle noises and other NPS operations noises to several previously undisturbed woodland and wetland areas south of the river (for a length of approximately 1,500 ft). However, the dense tree and shrub cover in the area of the new road and barge landing would help diminish noises generated from activities in the area.

The construction of the bridge, elevated boardwalks, barge landing, and landing access road, and the restoration work on the existing barge landing access road would have multiple negative impacts on the natural soundscape of the project area from noises related to heavy construction equipment operation, the use of handheld construction tools, construction transport vehicles, and construction worker voices. The intermittent, yet frequent, noise disturbances from construction activities would vary notably in volume and occurrence frequency, depending on the

type and location of the construction activity on each given day. The entire project area would be affected at one time or another throughout the construction periods. To help minimize these effects, particularly during July and September, several noise mitigation measures would be applied, such as work time limits, construction noise restrictions, limiting to small power tool use at critical times, and maintaining mufflers on construction equipment and generators.

Overall, the construction and future use of the proposed bridge, elevated boardwalk, barge landing, and access road would have a long-term, moderate, adverse, and localized effect on the natural soundscape. The noises from this human activity would often be greater than natural ambient sound levels for notable parts of the average day during the visitation season, and these noises would often mask natural ambient sounds. Because relatively long periods of time between noise events would still occur, there would still be many opportunities to hear natural ambient sounds in the area. When compared to alternative 1, the increased noise exposure on the proposed bridge and boardwalks and the construction activities associated with alternative 2 would increase adverse impacts to the soundscape in the area. However, this alternative would benefit the soundscape along the Brooks River corridor due to the relocation of the barge landing and its access road further to the south.

Cumulative Impacts. Various other past, present, and reasonably foreseeable future projects and actions in and near the project area have and would continue to affect the natural soundscape of the area. These projects relate to facility development, park operations, recreation use, and transport vehicle use, as described in the "Cumulative Impacts" section under alternative 1 above.
When the likely beneficial and adverse effects of alternative 2 actions are added to the effects of these other past, present, and reasonably foreseeable future actions, there would be a long-term, moderate, adverse, and localized cumulative impact on the natural soundscape. Alternative 2 would contribute a small, adverse increment to this cumulative impact.

Conclusion. Alternative 2 would have short- and long-term, moderate, adverse, and localized impacts on the natural soundscape. Adverse impacts would primarily result from construction-related noise, increasing the audio exposure of human activities on the boardwalks/bridge, and introducing park operations noises to a new access corridor and barge landing area to the south. The removal/relocation of two notable noise sources along open, exposed areas of the Brooks River corridor (barge landing and access road) would benefit the soundscape along Brooks River, but introduce noise sources to a relatively undisturbed area to the south.

Alternative 3

Analysis. Human and motorized vehicle noises generated along the elevated boardwalk and bridge would carry further than the noises on the roads/paths in alternative 1 because the noise would originate 10 ft above ground (Flemming et al. 1995; K. Fristrup, pers. comm., March 29, 2012). The exceptions to this effect would occur where the boardwalks are routed through heavily wooded areas. Alternative 3 would have approximately 945 linear ft of elevated structures from which human pedestrian noises and motorized vehicle noises could be projected. The elevated boardwalks and bridge would be shared by both pedestrian visitors and NPS and concessioner vehicles. These noise disturbances to the natural soundscape, primarily from human voices and motorized vehicles, would occur intermittently throughout the project area on each day of the visitation months (generally from 7:00 a.m. through 10:00 p.m.). The highest occurrence of these noises projecting from the elevated

boardwalks and bridge would likely occur in July and September (the periods of highest visitation and activity in the lower Brooks River).

Motorized vehicles climbing elevated boardwalk ramps would likely make louder noises than when operating on the boardwalk. Higher decibels of motorized engine noise could be expected from up-ramp acceleration, with the noise propagation being compounded by the elevated nature of the ramps (Flemming et al. 1995; K. Fristrup, pers. comm., March 30, 2012). This alternative includes a vehicle ramp on north side of river that is offset roughly 200 ft from the river, providing some noise buffer. The vehicle ramp on south side is adjacent to river. The natural soundscape would also be exposed to increased noise from motorized vehicle tires running on the wood deck of the bridge and boardwalks instead of gravel or soil (for 945 ft) (K. Fristrup, pers. comm., March 30, 2012). These adverse effects on the soundscape from NPS and concessioner vehicle use would be expected to occur intermittently throughout each day of the Brooks Camp visitation season.

Under alternative 3, the barge landing would be relocated approximately 200 ft to the south along the Naknek Lake shoreline, which would provide a slight relocation of NPS operations noises away from the river mouth and Brooks Camp areas.

The construction of the bridge, elevated boardwalks, and barge landing would have multiple negative impacts on the natural soundscape of the project area from noises related to heavy construction equipment operation, the use of handheld construction tools, construction transport vehicles, and construction worker voices. The intermittent, yet frequent, noise disturbances from construction activities would vary notably in volume and occurrence frequency, depending on the type and location of the construction activity on each given day. The entire project area would be affected at one time or another throughout the construction periods. To help minimize these effects, particularly during July and September, several noise mitigation measures would be applied, such as work time limits, construction noise restrictions, limiting to small power tool use at critical times, and maintaining mufflers on construction equipment and generators.

Overall, the construction and future use of the proposed bridge and elevated boardwalk would have a long-term, moderate, adverse, and localized effect on the natural soundscape. The noises from this human activity would often be greater than natural ambient sound levels for notable parts of the average day during the visitation season, and these noises would often mask natural ambient sounds. Because relatively long periods of time between noise events would occur, there would still be many opportunities to hear natural ambient sounds in the area. When compared to alternative 1, the increased noise exposure on the proposed bridge and boardwalks and the construction activities associated with alternative 3 would increase adverse impacts to the soundscape in the area. However, this alternative would benefit the soundscape along the Brooks River corridor due to the slight relocation of the barge landing to the south.

Cumulative Impacts. Various other past, present, and reasonably foreseeable future projects and actions in and near the project area have and would continue to affect the natural soundscape of the area. These projects relate to facility development, park operations, recreation use, and transport vehicle use, as described in the *Cumulative Impacts* section under alternative 1 above.

When the likely effects of alternative 3 are added to the effects of these other past, present, and reasonably foreseeable future actions, there would be a long-term,

moderate, adverse, and localized cumulative impact on the natural soundscape. Alternative 3 would contribute a small, adverse increment to this cumulative impact.

Conclusion. Alternative 3 would have short- and long-term, moderate, adverse, and localized impacts on the natural soundscape. Adverse impacts would primarily result from construction-related noise and increasing the audio exposure of human activities on the boardwalks/bridge. The slight relocation of the barge landing away from the Brooks River mouth could benefit the soundscape.

Alternative 4

Analysis. Human and motorized vehicle noises generated along the elevated boardwalk and bridge would carry further than the noises on the roads/paths in alternative 1 because the noise would originate 10 ft above ground (Flemming et al 1995, K. Fristrup, senior scientist, NPS Natural Sounds and Night Skies Program, pers. com., 3-29-2012). The exceptions to this effect would occur where the boardwalks are routed through heavily wooded areas. Alternative 4 would have approximately 1,540 linear ft of elevated structures from which human pedestrian noises and motorized vehicle noises could be projected. The elevated boardwalks and bridge would be shared by both pedestrian visitors and NPS vehicles. These noise disturbances to the natural soundscape, primarily from human voices and motorized vehicles, would occur intermittently throughout the project area on each day of the visitation months (generally from 7:00 am through 10:00 pm). The highest occurrence of these noises projecting from the elevated boardwalks and bridge would likely occur in July and September (the periods of highest visitation and activity in the lower Brooks River).

Motorized vehicles climbing elevated boardwalk ramps would likely make louder noises than when operating on the boardwalk. Higher decibels of motorized engine noise could be expected from up-ramp acceleration, with the noise propagation being compounded by the elevated nature of the ramps (Flemming et al. 1995; K. Fristrup, pers. comm., March 30, 2012). However, alternative 4 includes vehicle ramps on both the north and south sides of river that are offset roughly 300 to 400 ft from the river and located in wooded areas, which would provide some noise buffering for vehicle noise. Equally important, the alignment of the boardwalk ramps in alternative 4 would use the local topography to make the boardwalk ramps relatively flat. The natural soundscape would also be exposed to increased noise from motorized vehicle tires running on the wood deck of the bridge and boardwalks instead of on gravel or soil (for 1,540 ft) (K. Fristrup, pers. comm., March 30, 2012). These adverse effects on the soundscape from NPS and concessioner vehicle use would be expected to occur intermittently throughout each day of the Brooks Camp visitation season.

Under alternative 4 the barge landing would be relocated approximately 2,000 ft to the south along the Naknek Lake shoreline. The new barge landing location and removal of the barge landing access road parallel to the south bank would eliminate several NPS operations and motorized vehicle noises from the vicinity of the river corridor, the river mouth, and the Brooks Camp area.

Conversely, the 2,000-foot relocation of the barge landing would introduce the associated NPS operations noises to a new area to the south along Naknek Lake. Although these operations noises would no longer affect the area around the mouth of Brooks River, they would affect natural soundscape around the new location. Similarly, the relocation of the barge landing access road would introduce motorized vehicle noises and other NPS

operations noises to several previously undisturbed woodland and wetland areas south of the river (for a length of approximately 1,500 ft). However, the dense tree and shrub cover in the area of the new road and barge landing would help diminish noises generated from activities in the area.

The construction of the bridge, elevated boardwalks, barge landing, and landing access road, and the restoration work on the barge landing access road would have multiple negative impacts on the natural soundscape of the project area from noises related to heavy construction equipment operation, the use of handheld construction tools, construction transport vehicles, and construction worker voices. The intermittent, yet frequent, noise disturbances from construction activities would vary notably in volume and occurrence frequency, depending on the type and location of the construction activity on each given day. The entire project area would be affected at one time or another throughout the construction periods. To help minimize these effects, particularly during July and September, several noise mitigation measures would be applied, such as work time limits, construction noise restrictions, limiting to small power tool use at critical times, and maintaining mufflers on construction equipment and generators.

Overall, the construction and future use of the proposed bridge, elevated boardwalk, barge landing, and access road would have a long-term, moderate, adverse, and localized effect on the natural soundscape. The noises from this human activity would often be greater than natural ambient sound levels for notable parts of the average day during the visitation season, and these noises would often mask natural ambient sounds. Because relatively long periods of time between noise events would still occur, there would still be many opportunities to hear natural ambient sounds in the area. When compared to alternative 1, the increased noise exposure on the proposed bridge and boardwalks and the construction activities associated with alternative 4 would increase adverse impacts to the soundscape in the area. However, this alternative would benefit the soundscape along the Brooks River corridor due to the relocation of the barge landing and its access road further to the south.

Cumulative Impacts. Various other past, present, and reasonably foreseeable future projects and actions in and near the project area have and would continue to affect the natural soundscape of the area. These projects relate to facility development, park operations, recreation use, and transport vehicle use, as described in the *Cumulative Impacts* section under alternative 1 above.

When the likely beneficial and adverse effects of alternative 4 actions are added to the effects of these other past, present, and reasonably foreseeable future actions, there would be a long-term, moderate, adverse, and localized cumulative impact on the natural soundscape. Alternative 4 would contribute a small, adverse increment to this cumulative impact.

Conclusion. Alternative 4 would have short- and long-term, moderate, adverse, and localized impacts on the natural soundscape. Adverse impacts would primarily result from construction-related noise, increasing the audio exposure of human activities on the boardwalks/bridge, and introducing park operations noises to a new access corridor and barge landing area to the south. The removal/relocation of two notable noise sources along open, exposed areas of the Brooks River corridor (barge landing and access road) would benefit the soundscape along Brooks River, but would introduce noise sources to a relatively undisturbed area to the south.

Alternative 5

Analysis. Human and motorized vehicle noises generated along elevated boardwalk and bridge would carry further than the noises on the roads/paths in alternative 1 because the noise would originate 10 ft aboveground (Flemming et al. 1995; K. Fristrup, pers. comm., March 29, 2012). The exceptions to this effect would occur where the boardwalks are routed through heavily wooded areas. Alternative 4 would have approximately 1,120 linear ft of elevated structures from which human pedestrian noises and motorized vehicle noises could be projected. The elevated boardwalks and bridge would be shared by both pedestrian visitors and NPS vehicles. These noise disturbances to the natural soundscape, primarily from human voices and motorized vehicles, would occur intermittently throughout the project area on each day of the visitation months (generally from 7:00 a.m. through 10:00 p.m.). The highest occurrence of these noises projecting from the elevated boardwalks and bridge would likely occur in July and September (the periods of highest visitation and activity in the lower Brooks River).

Motorized vehicles climbing elevated boardwalk ramps would likely make louder noises than when operating on the boardwalk (Flemming et al. 1995; K. Fristrup, pers. comm., March 30, 2012). Higher decibels of motorized engine noise could be expected from up-ramp acceleration, with the noise propagation being compounded by the elevated nature of the ramps. Alternative 5 includes a vehicle ramp on the north side of river offset roughly 300 ft from the river and within the Brooks Camp area (and takes advantage of local topography to allow a relatively flat ramp). However, the vehicle ramp on south side is adjacent to river and steeper. The natural soundscape would also be exposed to increased noise from motorized vehicle tires running on the wood deck of the bridge and boardwalks instead of gravel or soil (for 1,120 ft) (K. Fristrup, pers. comm., March 30, 2012). These adverse effects on the soundscape from NPS and concessioner vehicle use would be expected to occur intermittently throughout each day of the Brooks Camp visitation season.

Under alternative 5, the barge landing would be relocated approximately 2,000 ft to the south along the Naknek Lake shoreline. The new barge landing location and removal of the barge landing access road parallel to the south bank would eliminate several NPS operations and motorized vehicle noises from the vicinity of the river corridor, the river mouth, and the Brooks Camp area.

Conversely, the 2,000-foot relocation of the barge landing would introduce the associated NPS operations noises to a new area to the south along Naknek Lake. Although these operations noises would no longer affect the area around the mouth of Brooks River, they would affect natural soundscape around the new location. Similarly, the relocation of the barge landing access road would introduce motorized vehicle noises and other NPS operations noises to several previously undisturbed woodland and wetland areas south of the river (for a length of approximately 1,500 ft). However, the dense tree and shrub cover in the area of the new road and barge landing would help diminish noises generated from activities in the area.

The construction of the bridge, elevated boardwalks, barge landing, and landing access road, and the restoration work on the existing barge landing access road would have multiple negative impacts on the natural soundscape of the project area from noises related to heavy construction equipment operation, the use of handheld construction tools, construction transport vehicles, and construction worker voices. The intermittent, yet frequent, noise disturbances from construction activities would vary notably in volume and

occurrence frequency, depending on the type and location of the construction activity on each given day. The entire project area would be affected at one time or another throughout the construction periods. To help minimize these effects, particularly during July and September, several noise mitigation measures would be applied, such as work time limits, construction noise restrictions, limiting to small power tool use at critical times, and maintaining mufflers on construction equipment and generators.

Overall, the construction and future use of the proposed bridge, elevated boardwalk, barge landing, and access road would have a long-term, moderate, adverse, and localized effect on the natural soundscape. The noises from this human activity would often be greater than natural ambient sound levels for notable parts of the average day during the visitation season, and these noises would often mask natural ambient sounds. Because relatively long periods of time between noise events would still occur, there would still be many opportunities to hear natural ambient sounds in the area. When compared to alternative 1, the increased noise exposure on the proposed bridge and boardwalks and the construction activities associated with alternative 5 would increase adverse impacts to the soundscape in the area. However, this alternative would benefit the soundscape along the Brooks River corridor due to the relocation of the barge landing and its access road further to the south.

Cumulative Impacts. Various other past, present, and reasonably foreseeable future projects and actions in and near the project area have and would continue to affect the natural soundscape of the area. These projects relate to facility development, park operations, recreation use, and transport vehicle use, as described in the "Cumulative Impacts" section under alternative 1 above.
When the likely beneficial and adverse effects of alternative 5 actions are added to the effects of these other past, present, and reasonably foreseeable future actions, there would be a long-term, moderate, adverse, and localized cumulative impact on the natural soundscape. Alternative 5 would contribute a small, adverse increment to this cumulative impact.

Conclusion. Alternative 5 would have short- and long-term, moderate, adverse, and localized impacts on the natural soundscape. Adverse impacts would primarily result from construction-related noise, increasing the audio exposure of human activities on the boardwalks/bridge, and introducing park operations noises to a new access corridor and barge landing area to the south. The removal/relocation of two notable noise sources along open, exposed areas of the Brooks River corridor (barge landing and access road) would benefit the soundscape along Brooks River, but would introduce noise sources to a relatively undisturbed area to the south.

CULTURAL RESOURCES

ARCHEOLOGICAL RESOURCES

Alternative 1

Analysis. Under the no-action alternative, there would be no substantial changes in park operations or visitor use. Seasonal installation and use of the floating bridge across the river would continue at the current location. Consequently, other than routine maintenance activities, there would be little potential for impacts on archeological resources except in the case of major infrastructure failure. Archeological resources, however, would continue to be at potential risk of disturbance by natural erosional processes and by erosion associated with concentrated visitor use and NPS and concessioner operations. Archeologists would continue to monitor the condition of known archeological sites within the Brooks River Archeological District National Historic Landmark and would undertake appropriate protection and stabilization measures to reduce or avoid site impacts.

Potential disturbance resulting from erosion or other actions associated with visitor use and park/concessioner operations would have localized, long-term, minor adverse impacts on archeological resources. The overall archeological integrity of sites contributing to the significance of the national historic landmark district would not be appreciably diminished. Continuation of archeological resource protection and management actions would benefit the long-term preservation of the district's archeological resources.

Cumulative Impacts. Archeological sites in the Brooks River Archeological District have been disturbed to varying degrees, primarily by natural and human-caused erosion and by localized ground disturbance associated with previous NPS and concessioner development activities. Brooks Camp buildings and structures are typically placed on piers that do not penetrate below the upper portion of the ash layer deposited by the 1912 Katmai volcanic eruption. Although significant archeological resources are typically not identified above the 1912 ash layer, some archeological resources lying below the layer have been adversely impacted by previous projects that have penetrated through the ash layer. Despite these adverse impacts, it is believed that more than 90 percent of the district's archeological resources remain intact with overall integrity ranging from good to excellent (NPS 1992).

Other recent or foreseeable construction projects in the vicinity include improvements to the Brooks Camp picnic area (e.g., installation of a picnic shelter, restroom, and storage building); construction of a maintenance shop and water/septic system in the Valley Road Administrative Area; and construction of access roads and utilities at the Valley Road Administrative Area for phased relocation of Brooks Camp housing. Projects in the Valley Road Administrative Area would be carried out in support of the 1996 development concept plan, which calls for the phased relocation of Brooks Camp facilities and operations to a location south of the river. Although these projects could adversely affect archeological resources because of ground disturbance, the adverse impacts in the Brooks Camp area would be expected to be minor because, in most cases, project activities would not be anticipated to entail disturbance below the 1912 ash layer. Buried utility lines may be removed if removal would not damage archeological resources. The area proposed for the Valley Road

Administrative Area has been evaluated as having a low potential for archeological resources. As appropriate, archeological surveys and monitoring would precede and accompany construction for all project areas to ensure that resources are avoided or that adverse effects are adequately mitigated. Removal of facilities and operations from the Brooks Camp area has also been previously evaluated as having long-term, beneficial impacts on sensitive archeological resources by removing the threats of disturbance associated with development and park/visitor use from the area (URS Inc. 2009a).

The effects of alternative 1, when added to the effects identified above from other past present and reasonably foreseeable actions, would result in a long-term, localized, moderate adverse cumulative impact on archeological resources. Alternative 1 would contribute a small adverse increment to this cumulative impact.

Conclusion. Alternative 1 would have long-term, localized, minor adverse impacts on archeological resources contributing to the significance of the Brooks River Archeological District. Adverse impacts would occur primarily from potential disturbance resulting from erosion or other actions associated with visitor use and park/concessioner operations.

Alternative 2

Analysis. Archeological testing conducted in July 2010 confirmed the presence of intact archeological resources near Brooks Camp where the proposed boardwalk and vehicle access points to the bridge are planned to originate. The resources are likely associated with a previously recorded prehistoric site that contains human burials and associated house features. The site has sustained (and continues to be threatened by) development impacts (NPS 1992). Another site, also partially disturbed by previous development, is located to the north in the general project area of Brooks Camp. Measures to limit possible adverse effects on archeological resources include avoiding construction activities north of the fish freezing station. Archeological remains of the original Northern Consolidated Airlines camp and a native Sugpiat fish camp that predates the concessioner camp exist between the fish freezing station and the Corner. The boardwalk footings would be designed to avoid adversely impacting these archeological resources.

No archeological resources are anticipated to be affected by boardwalk and bridge construction on the south side of the river or near the Lake Brooks access road (NPS 2010a). Archeological investigations along the route of the proposed barge landing access road led to the discovery of significant prehistoric resources in addition to positively locating previously known historic archeological resources. To avoid adverse impacts to these sites by road construction, it is recommended that the proposed right-of-way be modified to avoid subsurface disturbance, particularly the final 164 ft (50 meters) to the proposed location of the barge landing (NPS 2010b).

It is anticipated that the site avoidance measures recommended above can be adequately addressed through project design modifications that restrict or direct ground-disturbing construction activities away from areas likely to contain archeological resources. Consequently, although ground-disturbing construction would occur, measures would be implemented to minimize or avoid disturbance of identified sites in the Brooks Camp area and at other project locations. Archeological monitoring would accompany construction in all areas where sensitive archeological resources have been previously identified or could be anticipated based on current project surveys. If archeological resources are discovered during construction, construction would cease in the area of the discovery until the resources are

adequately documented and assessed by NPS staff in consultation with the Alaska State Historic Preservation Office, the Council of Katmai Descendants, and/or other concerned tribal members and individuals. NPS staff would further consult on ways to avoid significant sites and/or to carry out necessary mitigation and data recovery measures if avoidance cannot be achieved.

Actions proposed by alternative 2 would be expected to have long-term, localized, minor adverse impacts on archeological resources. The overall archeological integrity of sites contributing to the significance of the national historic landmark district would not be appreciably diminished by project undertakings. The long-term preservation of archeological resources in the Brooks Camp area would also benefit following project completion because pedestrian and vehicle access to the bridge crossing would be directed along the boardwalks and ramps, thereby reducing the potential for ongoing erosion and compaction impacts on buried archeological resources by use of existing roads and trails.

After applying ACHP criteria of adverse effect (36 CFR Part 800.5, *Assessment of Adverse Effects*), the National Park Service concludes that implementing alternative 2 would result in *no adverse effect* on archeological resources.

Cumulative Impacts. Other past, present and reasonably foreseeable future projects and actions have had, or have the potential to adversely impact archeological resources in the project area. As described in the "Cumulative Impacts" section under alternative 1 above, these impacts are generally attributed to erosion and localized ground disturbance associated with NPS and concessioner development and operations.

The effects of alternative 2, when added to the effects identified above from other past, present and reasonably foreseeable actions, would result in a long-term, localized, moderate adverse cumulative impact on archeological resources. Alternative 2 would contribute a small adverse increment to this cumulative impact.

Conclusion. Alternative 2 would have long-term, localized, minor adverse impacts on archeological resources contributing to the significance of the Brooks River Archeological District. Although ground-disturbing construction activities have the potential to adversely impact archeological resources, site avoidance and protection measures would be implemented to minimize or avoid site disturbances.

Alternative 3

Analysis. Archeological testing conducted in July 2010 confirmed the presence of intact archeological resources near Brooks Camp where the proposed boardwalk and vehicle access points to the bridge are planned to originate. The resources are likely associated with a previously recorded prehistoric site that contains human burials and associated house features. The site has sustained (and continues to be threatened by) development impacts (NPS 1992). Another site, also partially disturbed by previous development, is located to the north in the general project area of Brooks Camp. Measures to limit possible adverse effects on archeological resources include avoiding construction activities north of the fish freezing station. Archeological remains of the original Northern Consolidated Airlines camp and a native Sugpiat fish camp that predates the concessioner camp exist between the fish freezing station and the Corner. The boardwalk footings would be designed to avoid adversely impacting these archeological resources. The limited extent of new boardwalks and access roads under this alternative would reduce the potential for inadvertent disturbance of archeological resources.

No archeological resources are anticipated to be affected by boardwalk and bridge construction on the south side of the river or near the Lake Brooks access road (NPS 2010a). Archeological investigations along the route of the proposed barge landing access road (for alternatives 2, 4, and 5) led to the discovery of significant prehistoric resources in addition to positively locating previously known historic archeological resources. However, under alternative 3 these resources would be avoided for proposed construction of the barge landing and access road closer to the mouth of Brooks River.

It is anticipated that the site avoidance measures recommended above can be adequately addressed through project design modifications that restrict or direct ground-disturbing construction activities away from areas likely to contain archeological resources. Consequently, although ground-disturbing construction would occur, measures would be implemented to minimize or avoid disturbance of identified sites in the Brooks Camp area and at other project locations. Archeological monitoring would accompany construction in all areas where sensitive archeological resources have been previously identified or could be anticipated based on current project surveys. If archeological resources are discovered during construction, construction would cease in the area of the discovery until the resources are adequately documented and assessed by NPS staff in consultation with the Alaska State Historic Preservation Office, the Council of Katmai Descendants, and/or other concerned tribal members and individuals. NPS staff would further consult on ways to avoid significant sites and/or to carry out necessary mitigation and data recovery measures if avoidance cannot be achieved.

Actions proposed by alternative 3 would be expected to have long-term, localized, minor adverse impacts on archeological resources. The overall archeological integrity of sites contributing to the significance of the national historic landmark district would not be appreciably diminished by project undertakings. The long-term preservation of archeological resources in the Brooks Camp area would also benefit following project completion because pedestrian and vehicle access to the bridge crossing would be directed along the boardwalks and ramps, thereby reducing the potential for ongoing erosion and compaction impacts on buried archeological resources by use of existing roads and trails.

After applying ACHP criteria of adverse effect (36 CFR Part 800.5, *Assessment of Adverse Effects*), the National Park Service concludes that implementing alternative 3 would result in *no adverse effect* on archeological resources.

Cumulative Impacts. Other past, present and reasonably foreseeable future projects and actions have had, or have the potential to adversely impact archeological resources in the project area. As described in the "Cumulative Impacts" section under alternative 1 (above), these impacts are generally attributed to erosion and localized ground disturbance associated with NPS and concessioner development and operations.

The effects of alternative 3, when added to the effects identified above from other past, present and reasonably foreseeable actions, would result in a long-term, localized, moderate adverse cumulative impact on archeological resources. Alternative 3 would contribute a small adverse increment to this cumulative impact.

Conclusion. Alternative 3 would have long-term, localized, minor adverse impacts on archeological resources contributing to the significance of the Brooks River

Archeological District. Although ground-disturbing construction activities have the potential to adversely impact archeological resources, site avoidance and protection measures would be implemented to minimize or avoid site disturbances.

Alternative 4

Analysis. Archeological testing conducted in July 2010 confirmed the presence of intact archeological resources near Brooks Camp where the proposed boardwalk and vehicle access points to the bridge are planned to originate. The resources are likely associated with a previously recorded prehistoric site that contains human burials and associated house features. The site has sustained (and continues to be threatened by) development impacts (NPS 1992). Another site, also partially disturbed by previous development, is located to the north in the general project area of Brooks Camp. Measures to limit possible adverse effects on archeological resources include avoiding construction activities north of the fish freezing station. Archeological remains of the original Northern Consolidated Airlines camp and a native Sugpiat fish camp that predates the concessioner camp exist between the fish freezing station and the Corner. The boardwalk footings would be designed to avoid adversely impacting these archeological resources.

No archeological resources are anticipated to be affected by boardwalk and bridge construction on the south side of the river or near the Lake Brooks access road (NPS 2010a). Archeological investigations along the route of the proposed barge landing access road led to the discovery of significant prehistoric resources in addition to positively locating previously known historic archeological resources. To avoid adverse impacts to these sites by road construction, it is recommended that the proposed right-of-way be modified to avoid subsurface disturbance, particularly the final 164 ft (50 meters) to the proposed location of the barge landing (NPS 2010b).

It is anticipated that the site avoidance measures recommended above can be adequately addressed through project design modifications that restrict or direct ground-disturbing construction activities away from areas likely to contain archeological resources. Consequently, although ground-disturbing construction would occur, measures would be implemented to minimize or avoid disturbance of identified sites in the Brooks Camp area and at other project locations. Archeological monitoring would accompany construction in all areas where sensitive archeological resources have been previously identified or could be anticipated based on current project surveys. If archeological resources are discovered during construction, construction would cease in the area of the discovery until the resources are adequately documented and assessed by NPS staff in consultation with the Alaska State Historic Preservation Office, the Council of Katmai Descendants, and/or other concerned tribal members and individuals. NPS staff would further consult on ways to avoid significant sites and/or to carry out necessary mitigation and data recovery measures if avoidance cannot be achieved.

Actions proposed by alternative 4 would be expected to have long-term, localized, minor adverse impacts on archeological resources. The overall archeological integrity of sites contributing to the significance of the national historic landmark district would not be appreciably diminished by project undertakings. The long-term preservation of archeological resources in the Brooks Camp area would also benefit following project completion because pedestrian and vehicle access to the bridge crossing would be directed along the boardwalks and ramps, thereby reducing the potential for ongoing erosion and compaction impacts on buried

archeological resources by use of existing roads and trails.

After applying ACHP criteria of adverse effect (36 CFR Part 800.5, *Assessment of Adverse Effects*), the National Park Service concludes that implementing alternative 4 would result in *no adverse effect* on archeological resources.

Cumulative Impacts. Other past, present and reasonably foreseeable future projects and actions have had, or have the potential to adversely impact archeological resources in the project area. As described in the "Cumulative Impacts" section under alternative 1 above, these impacts are generally attributed to erosion and localized ground disturbance associated with NPS and concessioner development and operations.

The effects of alternative 4, when added to the effects identified above from other past, present and reasonably foreseeable actions, would result in a long-term, localized, moderate adverse cumulative impact on archeological resources. Alternative 4 would contribute a small adverse increment to this cumulative impact.

Conclusion. Alternative 4 would have long-term, localized, minor adverse impacts on archeological resources contributing to the significance of the Brooks River Archeological District. Although ground-disturbing construction activities have the potential to adversely impact archeological resources, site avoidance and protection measures would be implemented to minimize or avoid site disturbances.

Alternative 5

Analysis. Archeological testing conducted in July 2010 confirmed the presence of intact archeological resources near Brooks Camp where the proposed boardwalk and vehicle access points to the bridge are planned to originate. The resources are likely associated with a previously recorded prehistoric site that contains human burials and associated house features. The site has sustained (and continues to be threatened by) development impacts (NPS 1992). Another site, also partially disturbed by previous development, is located to the north in the general project area of Brooks Camp. Measures to limit possible adverse effects on archeological resources include avoiding construction activities north of the fish freezing station. Archeological remains of the original Northern Consolidated Airlines camp and an Alaska Native fish camp that predates the concessioner camp exist between the fish freezing station and the Corner. The boardwalk footings would be designed to avoid adversely impacting these archeological resources.

No archeological resources are anticipated to be affected by boardwalk and bridge construction on the south side of the river or near the Lake Brooks access road (NPS 2010a). Archeological investigations along the route of the proposed barge landing access road led to the discovery of significant prehistoric resources in addition to positively locating previously known historic archeological resources. To avoid adverse impacts to these sites by road construction, it is recommended that the proposed right-of-way be modified to avoid subsurface disturbance, particularly the final 164 ft (50 meters) to the proposed location of the barge landing (NPS 2010b).

It is anticipated that the site avoidance measures recommended above can be adequately addressed through project design modifications that restrict or direct ground-disturbing construction activities away from areas likely to contain archeological resources. Consequently, although ground-disturbing construction would occur, measures would be implemented to minimize or avoid disturbance of identified sites in the Brooks Camp area and at other project locations. Archeological monitoring would

accompany construction in all areas where sensitive archeological resources have been previously identified or could be anticipated based on current project surveys. If archeological resources are discovered during construction, construction would cease in the area of the discovery until the resources are adequately documented and assessed by NPS staff in consultation with the Alaska State Historic Preservation Office, the Council of Katmai Descendants, and/or other concerned tribal members and individuals. NPS staff would further consult on ways to avoid significant sites and/or to carry out necessary mitigation and data recovery measures if avoidance cannot be achieved.

Actions proposed by alternative 5 would be expected to have long-term, localized, minor adverse impacts on archeological resources. The overall archeological integrity of sites contributing to the significance of the national historic landmark district would not be appreciably diminished by project undertakings. The long-term preservation of archeological resources in the Brooks Camp area would also benefit following project completion because pedestrian and vehicle access to the bridge crossing would be directed along the boardwalks and ramps, thereby reducing the potential for ongoing erosion and compaction impacts on buried archeological resources by use of existing roads and trails.

After applying ACHP criteria of adverse effect (36 CFR Part 800.5, *Assessment of Adverse Effects*), the National Park Service concludes that implementing alternative 5 would result in *no adverse effect* on archeological resources.

Cumulative Impacts. Other past, present and reasonably foreseeable future projects and actions have had, or have the potential to adversely impact archeological resources in the project area. As described in the "Cumulative Impacts" section under alternative 1 above, these impacts are generally attributed to erosion and localized ground disturbance associated with NPS and concessioner development and operations.

The effects of alternative 5, when added to the effects identified above from other past present and reasonably foreseeable actions, would result in a long-term, localized, moderate adverse cumulative impact on archeological resources. Alternative 5 would contribute a small adverse increment to this cumulative impact.

Conclusion. Alternative 5 would have long-term, localized, minor adverse impacts on archeological resources contributing to the significance of the Brooks River Archeological District. Although ground-disturbing construction activities have the potential to adversely impact archeological resources, site avoidance and protection measures would be implemented to minimize or avoid site disturbances.

HISTORIC STRUCTURES AND CULTURAL LANDSCAPES

Alternative 1

Analysis. Under the no-action alternative, there would be no new construction. Seasonal installation and use of the floating bridge across Brooks River would continue at the current location. Consequently, other than routine maintenance and other park/visitor use activities, there would be little potential for impacts on historic structures and cultural landscape features. NPS staff would continue to monitor the condition of historic structures, such as the national register-listed ranger station and boathouse at Brooks Camp, and would undertake necessary preservation maintenance, stabilization, or other appropriate treatments (e.g., rehabilitation) in accordance with the *Secretary of the Interior's Standards for the Treatment of Historic Properties*. As necessary, historic structure reports would be completed for

selected lodge buildings to identify appropriate treatments and materials for preservation maintenance. Cultural landscape features identified as contributing to the significance of the Brooks Camp historic district (e.g., buildings, patterns of circulation/spatial organization, views and vistas, small-scale features) would also be preserved and managed in accordance with the *Secretary's Standards for the Treatment of Historic Properties with Guidelines for the Treatment of Cultural Landscapes*.

Because park/visitor use and ongoing preservation management actions could entail necessary repairs, minor alterations, or replacement of deteriorated historic fabric or contributing landscape elements, these actions would have long-term, localized, minor adverse impacts on historic structures and cultural landscape features that contribute to the significance of the Brooks Camp historic district. The overall historical integrity of the district would not be diminished. Stabilization and rehabilitation of historic structures and cultural landscape elements in accordance with the secretary's standards would also benefit the long-term preservation of these resources.

Cumulative Impacts. Over the years, several historic structures associated with the early 1950s–1960s period of NPS operations and tourism development at Brooks Camp have been removed, modified, and/or moved from their original sites. Only two of the original concessioner-built buildings, originally of wall-tent construction, remain in Brooks Camp; these were later modified by the addition of asphalt shingling and were moved off their original footings (NPS 1999). These past actions have adversely impacted historic structures and cultural landscape features because of the loss of contributing properties/fabric and the alteration of character-defining features, including changes to Brooks Camp's historic pattern of spatial organization. Ongoing preservation maintenance and rehabilitation of remaining historic buildings and structures have also resulted in long-term beneficial effects.

Other recent or foreseeable construction projects in the vicinity include improvements to the Brooks Camp picnic area (e.g., installation of a picnic shelter, restroom and storage building, and re-erection of the original elevated log cache). The 1996 development concept plan calls for the phased relocation of Brooks Camp facilities and operations to the Valley Road Administrative Area south of the river. These projects could potentially result in long-term adverse impacts on historic structures and cultural landscape features as a result of the introduction of new constructed elements into the viewshed of the Brooks Camp cultural landscape and the eventual relocation of structures from the site. Final management decisions are pending regarding the ultimate disposition of national register eligible or listed structures such as the ranger station and boathouse; both structures were listed on the National Register of Historic Places following selection of the 1996 development concept plan preferred alternative that called for removal of all structures from Brooks Camp.

The effects of alternative 1, when added to the effects identified above from other past, present and reasonably foreseeable actions, would result in a long-term, localized, moderate adverse cumulative impact on historic buildings, structures and cultural landscape features. Alternative 1 would contribute a small adverse increment to this cumulative impact.

Conclusion. Alternative 1 would have long-term, localized, minor adverse impacts on historic buildings, structures and cultural landscape features contributing to the significance of the Brooks Camp historic district. Adverse impacts would occur primarily from park and visitor use and routine maintenance/preservation activities.

Alternative 2

Analysis. No historic structures would be directly impacted by proposed construction activities under this alternative. However, the introduction of new constructed elements (e.g., the boardwalk and vehicle access ramp) into the core area of the Brooks Camp historic district would be expected to adversely impact character-defining features of the cultural landscape, altering elements such as views and vistas, historic setting and feeling, historic patterns of circulation and spatial organization. The new bridge across Brooks River at the same location of the seasonal floating bridge would be constructed at an increased height (10 ft above the river) and would consequently be a more intrusive and permanent addition to the cultural landscape. Because of the relatively level topography along the river corridor, the large scale and location of the bridge and boardwalks/ramps limit the range of effective options (e.g., design modifications, use of compatible materials, screening) for minimizing adverse impacts on the viewshed and historic setting of the district.

Long-term localized, moderate adverse impacts on the Brooks Camp cultural landscape are therefore anticipated from the construction of the bridge, elevated boardwalks and ramps. After applying ACHP criteria of adverse effect (36 CFR Part 800.5, *Assessment of Adverse Effects*), the National Park Service concludes that implementing alternative 2 would result in an *adverse effect* on the Brooks Camp cultural landscape because of the bridge and boardwalk construction. Consequently, the National Park Service would execute a memorandum of agreement documenting measures to minimize or mitigate the adverse effects of construction in consultation with the Alaska State Historic Preservation Officer, associated Alaska Native groups, and other concerned parties.

Cumulative Impacts. Other past, present and reasonably foreseeable future projects and actions have had, or have the potential to adversely impact historic structures and cultural landscape elements in the project area. As described in the "Cumulative Impacts" section under alternative 1 (above), these impacts are generally attributed to the loss and alteration of historic properties, fabric, and contributing landscape features.

The effects of alternative 2, when added to the effects identified above from other past present and reasonably foreseeable actions, would result in a long-term, localized, moderate adverse cumulative impact on historic buildings, structures and cultural landscape features. Alternative 2 would contribute a substantial adverse increment to this cumulative impact.

Conclusion. Alternative 2 would have long-term, localized, moderate adverse impacts on historic structures and cultural landscape features contributing to the significance of the Brooks Camp historic district. These adverse impacts are attributed to the introduction of new constructed elements (bridge, boardwalks, and ramps) that would diminish the integrity of the Brooks Camp cultural landscape.

Alternative 3

Analysis. No historic structures would be directly impacted by proposed construction activities under this alternative. However, the introduction of new constructed elements (e.g., the boardwalk and vehicle access ramp) into the southern portion of the Brooks Camp historic district would be expected to adversely impact character-defining features of the cultural landscape, altering elements such as views and vistas, historic setting and feeling, historic patterns of circulation and spatial organization. The new bridge across Brooks River at the same location of the seasonal floating bridge

would be constructed at an increased height (10 ft above the river) and would consequently be a more intrusive and permanent addition to the cultural landscape. Because of the relatively level topography along the river corridor, the large scale and location of the bridge and boardwalks/ramps limit the range of effective options (e.g., design modifications, use of compatible materials, screening) for minimizing adverse impacts on the viewshed and historic setting of the district.

Long-term localized, moderate adverse impacts on the Brooks Camp cultural landscape are therefore anticipated from the construction of the bridge, elevated boardwalks, and ramps. After applying ACHP criteria of adverse effect (36 CFR Part 800.5, *Assessment of Adverse Effects*), the National Park Service concludes that implementing alternative 3 would result in an *adverse effect* on the Brooks Camp cultural landscape because of the bridge and boardwalk construction. Consequently, the National Park Service would execute a memorandum of agreement documenting measures to minimize or mitigate the adverse effects of construction in consultation with the Alaska State Historic Preservation Officer, associated Alaska Native groups and other concerned parties.

Cumulative Impacts. Other past, present and reasonably foreseeable future projects and actions have had, or have the potential to adversely impact historic structures and cultural landscape elements in the project area. As described in the "Cumulative Impacts" section under alternative 1 (above), these impacts are generally attributed to the loss and alteration of historic properties, fabric and contributing landscape features.

The effects of alternative 3, when added to the effects identified above from other past present and reasonably foreseeable actions, would result in a long-term, localized, moderate adverse cumulative impact on historic buildings, structures and cultural landscape features. Alternative 3 would contribute a substantial adverse increment to this cumulative impact.

Conclusion. Alternative 3 would have long-term, localized, moderate adverse impacts on historic structures and cultural landscape features contributing to the significance of the Brooks Camp historic district. These adverse impacts are attributed to the introduction of new constructed elements (bridge, boardwalks, and ramps) that would diminish the integrity of the Brooks Camp cultural landscape.

Alternative 4

Analysis. No historic structures would be directly impacted by proposed construction activities under this alternative. However, the introduction of new constructed elements (e.g., the boardwalk and vehicle access ramp) into the core area of the Brooks Camp historic district would be expected to adversely impact character-defining features of the cultural landscape, altering elements such as views and vistas, historic setting and feeling, historic patterns of circulation and spatial organization. The new bridge across Brooks River at the same location of the seasonal floating bridge would be constructed at an increased height (10 ft above the river) and would consequently be a more intrusive and permanent addition to the cultural landscape. Because of the relatively level topography along the river corridor, the large scale and location of the bridge and boardwalks/ramps limit the range of effective options (e.g., design modifications, use of compatible materials, screening) for minimizing adverse impacts on the viewshed and historic setting of the district.

Long-term localized, moderate adverse impacts on the Brooks Camp cultural landscape are therefore anticipated from the construction of the bridge, elevated

boardwalks and ramps. After applying ACHP criteria of adverse effect (36 CFR Part 800.5, *Assessment of Adverse Effects*), the National Park Service concludes that implementing alternative 4 would result in an *adverse effect* on the Brooks Camp cultural landscape because of the bridge and boardwalk construction. Consequently, the National Park Service would execute a memorandum of agreement documenting measures to minimize or mitigate the adverse effects of construction in consultation with the Alaska State Historic Preservation Officer, associated Alaska Native groups, and other concerned parties.

Cumulative Impacts. Other past, present and reasonably foreseeable future projects and actions have had, or have the potential to adversely impact historic structures and cultural landscape elements in the project area. As described in the "Cumulative Impacts" section under alternative 1 (above), these impacts are generally attributed to the loss and alteration of historic properties, fabric and contributing landscape features.

The effects of alternative 4, when added to the effects identified above from other past present and reasonably foreseeable actions, would result in a long-term, localized, moderate adverse cumulative impact on historic buildings, structures and cultural landscape features. Alternative 4 would contribute a substantial adverse increment to this cumulative impact.

Conclusion. Alternative 4 would have long-term, localized, moderate adverse impacts on historic structures and cultural landscape features contributing to the significance of the Brooks Camp historic district. These adverse impacts are attributed to the introduction of new constructed elements (bridge, boardwalks, and ramps) that would diminish the integrity of the Brooks Camp cultural landscape.

Alternative 5

Analysis. No historic structures would be directly impacted by proposed construction activities under this alternative. However, the introduction of new constructed elements (e.g., the boardwalk and vehicle access ramp) into the core area of the Brooks Camp historic district would be expected to adversely impact character-defining features of the cultural landscape, altering elements such as views and vistas, historic setting and feeling, historic patterns of circulation and spatial organization. The new bridge across Brooks River at the same location of the seasonal floating bridge would be constructed at an increased height (10 ft above the river) and would consequently be a more intrusive and permanent addition to the cultural landscape. Because of the relatively level topography along the river corridor, the large scale and location of the bridge and boardwalks/ramps limit the range of effective options (e.g., design modifications, use of compatible materials, screening) for minimizing adverse impacts on the viewshed and historic setting of the district.

Long-term localized, moderate adverse impacts on the Brooks Camp cultural landscape are therefore anticipated from the construction of the bridge, elevated boardwalks and ramps. After applying ACHP criteria of adverse effect (36 CFR Part 800.5, *Assessment of Adverse Effects*), the National Park Service concludes that implementing alternative 5 would result in an *adverse effect* on the Brooks Camp cultural landscape because of the bridge and boardwalk construction. Consequently, the National Park Service would execute a memorandum of agreement documenting measures to minimize or mitigate the adverse effects of construction in consultation with the Alaska State Historic Preservation Officer, associated Alaska Native groups, and other concerned parties.

Cumulative Impacts. Other past, present and reasonably foreseeable future projects and actions have had, or have the potential to adversely impact historic structures and cultural landscape elements in the project area. As described in the "Cumulative Impacts" section under alternative 1 (above), these impacts are generally attributed to the loss and alteration of historic properties, fabric, and contributing landscape features.

The effects of alternative 5, when added to the effects identified above from other past present and reasonably foreseeable actions, would result in a long-term, localized, moderate adverse cumulative impact on historic buildings, structures and cultural landscape features. Alternative 5 would contribute a substantial adverse increment to this cumulative impact.

Conclusion. Alternative 5 would have long-term, localized, moderate adverse impacts on historic structures and cultural landscape features contributing to the significance of the Brooks Camp historic district. These adverse impacts are attributed to the introduction of new constructed elements (bridge, boardwalks, and ramps) that would diminish the integrity of the Brooks Camp cultural landscape.

ETHNOGRAPHIC RESOURCES

Alternative 1

Analysis. Under the no-action alternative, there would be no new construction in the Brooks Camp area other than that necessary for routine maintenance activities. Seasonal installation and use of the floating bridge across Brooks River would continue at the present location, and no substantial changes in park operations or visitor use activities would occur. Because the archeological sites and burial locations of the Brooks River Archeological District National Historic Landmark are also recognized as ethnographic resources and important elements of the potential Brooks River ethnographic landscape, there would be little potential for impacts on buried ethnographic resources as a result of ground-disturbing construction. These resources, however, would continue to be at potential risk of disturbance resulting from the presence, use, and maintenance of concentrated development and infrastructure in Brooks Camp by NPS and concession operations. NPS archeologists and cultural resource specialists would continue to monitor the condition of known archeological/ethnographic sites in the archeological district and would take appropriate protection and stabilization measures to reduce or avoid site impacts.

The presence and activities of the National Park Service, concession operators, and visitors would continue to inhibit traditional uses and activities in the Brooks River area. However, the National Park Service would cooperate, plan, and consult with Sugpiat traditional users, the heirs of Palakia Melgenak, and others with cultural ties to the area in efforts to ensure access is appropriately retained to places and resources of cultural importance. The annual Brooks River redfish harvest would continue as a culturally important activity. Continuation of NPS resource protection measures and retention of access to traditionally important resources and places would have long-term, minor benefits on ethnographic resources and those with cultural ties to the area. Potential disturbance of ethnographic resources resulting from actions associated with visitor use and park/concessioner operations, along with the continuance of actions and conditions that discourage traditional use activities would have long-term, localized, minor adverse impacts on ethnographic resources.

Cumulative Impacts. Ethnographic resources in the Brooks River area have been impacted primarily by the establishment, development, and operation

of Brooks Camp and to a lesser extent by natural and human caused erosion and localized ground disturbance.

Beginning in the 1950s, development associated with operations of the park concessioner and the National Park Service at Brooks Camp resulted in the disturbance of culturally important sites and resources, and disrupted the traditional use activities of the Sugpiat people. Impacts were compounded by increasing numbers of anglers and visitors to the area. Development actions affecting traditional use of the area included construction of the road linking Brooks Camp with Valley of Ten Thousand Smokes, NPS use of the spit road and loading ramp, installation of the floating bridge over the river, and construction of the bear viewing platform and boardwalk on the south side of the river. High numbers of bears and visitors, later closing dates for Brooks Camp, and regulatory provisions have also discouraged the traditional late season redfish harvest. These actions have adversely affected ethnographic resources and the ability of the Sugpiat to carry out traditional activities on Brooks River.

Other recent or foreseeable construction projects in the vicinity include improvements to the Brooks Camp picnic area (e.g. installation of a picnic shelter, restroom and storage building); construction of a maintenance shop and water/septic system in the Valley Road Administrative Area; and construction of access roads and utilities at Valley Road Administrative Area for phased relocation of Brooks Camp housing. Projects in the Valley Road Administrative Area would be carried out in support of the 1996 development concept plan, which calls for the phased relocation of Brooks Camp facilities and operations to a location south of the river. Although these projects could adversely affect ethnographic resources because of reduced access to the lower river, the intensity of adverse impacts would be expected to be minor because they are associated primarily with temporary use of the spit area for project activities. Buried utility lines may be removed if removal would not damage buried archeological resources or graves. The area proposed for Valley Road Administrative Area has been evaluated as having a low potential for ethnographic resources. As appropriate, surveys and monitoring would precede and accompany construction for all project areas to ensure that resources are avoided or that adverse effects are adequately mitigated. Removal of facilities and operations from the Brooks Camp area has also been previously evaluated as having long-term, beneficial impacts on sensitive ethnographic resources by removing the threats of disturbance associated with development and park/visitor use from the area (URS Inc. 2009a).

The effects of alternative 1 when added to the effects identified above from other past, present and reasonably foreseeable actions, would result in a long-term, localized, moderate adverse cumulative impact on ethnographic resources. Alternative 1 would contribute a small adverse increment to this cumulative impact.

Conclusion. Alternative 1 would have long-term, localized, minor adverse impacts on ethnographic resources associated with Brooks River and the Brooks River Archeological District. Adverse impacts would occur primarily from reduced access to the lower Brooks River for native Sugpiat people to conduct traditional activities, and from erosion or other disturbance associated with visitor use and park/concessioner operations.

Alternative 2

Analysis. Ethnographic resources in the project area include natural resources and landmark features significant to the traditionally associated Sugpiat people as well as archeological sites and burial

locations of the Brooks River Archeological District National Historic Landmark. Sites comprising the archeological district are also potential elements of the Brooks River ethnographic landscape. Archeological testing conducted in 2008, 2009, and 2010 confirmed the presence of intact archeological/ethnographic resources near Brooks Camp where the proposed boardwalk and vehicle access points to the bridge are planned to originate, and at the north bank of Brooks River. The resources are part of a previously recorded prehistoric site that contains human burials and associated house features, as well as artifacts and a pit exposed in the north bank of the river associated with mid-20th Century traditional use. The sites have sustained, and continue to be threatened by, development impacts (NPS 1992). Another site, also partially disturbed by previous development, is located to the north in the general project area of Brooks Camp. Measures to limit possible adverse effects on ethnographic resources include avoiding construction activities north of the fish freezing station, and ensuring that boardwalk footings avoid resources associated with a former Sugpiat fish camp between the fish freezing station and the Corner.

Boardwalk and bridge construction on the south side of the river or near the Lake Brooks access road are not anticipated to introduce new effects to ethnographic resources. Archeological investigations along the route of the proposed barge landing access road led to the discovery of significant prehistoric resources found in association with previously known historic archeological resources in the form of post-1912 cabin ruins. Ethnographic survey may attribute ethnographic significance to the historic cabin ruins. To avoid adverse impacts to these sites by road construction, it is recommended that the proposed right-of-way be modified to avoid subsurface disturbance, particularly the final 164 ft (50 meters) to the proposed location of the barge landing (NPS 2010b).

The barge road would pass along the southern boundary of the conservation easement and terminate along the southeast edge of the private parcel owned by the heirs of Palakia Melgenak. Under this alternative, the spit road and barge landing would be removed, thereby eliminating vehicles and heavy equipment handling cargo at the river mouth. Additionally, NPS boats currently parked along the spit would be parked and stored at the barge landing. This would free the river mouth of concessioner and NPS activities, which would improve access to the spit on the south side of Brooks River for those conducting traditional activities. Frequent bear use of the spit would continue to impede traditional activities there.

It is anticipated that the site avoidance measures recommended above would be adequately addressed through project design modifications that restrict or direct ground-disturbing construction activities away from areas likely to be associated with ethnographic resources. Consequently, although ground-disturbing construction would occur, measures would be implemented to minimize or avoid disturbance of identified sites in the Brooks Camp area and at other project locations. As necessary, monitoring would accompany construction in all areas where sensitive archeological/ethnographic resources have been previously identified or could be anticipated based on current project surveys. If ethnographic resources became apparent during construction, construction would cease in the area of the discovery until the resources are adequately documented and assessed by NPS staff in consultation with the Alaska State Historic Preservation Office, the Council of Katmai Descendants, and/or other concerned tribal members and individuals. NPS staff would further consult on ways to avoid significant sites and/or to carry out necessary mitigation and data recovery measures if avoidance cannot be achieved.

In late summer 2010, the National Park Service began an ethnographic resource survey to identify the character-defining features of a potential ethnographic landscape in the general vicinity of the mouth of Brooks River. The investigations are also anticipated to include an evaluation of the landscape as a potential traditional cultural property meeting the criteria of eligibility for listing in the National Register of Historic Places. Information acquired from these investigations, together with any issues or recommendations imparted by the Council of Katmai Descendants, the heirs of Palakia Melgenak, and/or other culturally associated groups would assist the National Park Service in efforts to identify and protect ethnographic resources and places of cultural importance, and ensure continued access to these places and resources by associated groups.

Alternative 2 would be expected to have long-term, localized, minor adverse impacts on ethnographic resources. The impacts would not appreciably alter resource conditions or impede traditional access. The long-term preservation of ethnographic resources near the Brooks Camp area would also benefit following project completion because pedestrian and vehicle access to the bridge crossing would be directed along the boardwalks and ramps, thereby reducing the potential for ongoing erosion and compaction impacts on buried archeological/ethnographic resources by use of existing roads and trails. Traditional access to the spit would be improved by removing vehicular and boat traffic from the lower river below the bridge. Measures to identify and document ethnographic resources in the Brooks Camp area would also benefit the long-term preservation of these resources.

After applying ACHP criteria of adverse effect (36 CFR Part 800.5, *Assessment of Adverse Effects*), the National Park Service concludes that implementing alternative 2 would result in *no adverse effect* on ethnographic resources.

Cumulative Impacts. Other past, present and reasonably foreseeable future projects and actions have had, or have the potential to adversely impact ethnographic resources in the project area. As described in the "Cumulative Impacts" section under Alternative 1 (above), these impacts are generally attributed to the establishment, development and operation of Brooks Camp and to a lesser extent to natural and human-caused erosion and localized ground disturbance associated with NPS and concessioner development and operations. Increases in numbers of bears have inhibited human use of the spit on the south shore of Brooks River.

The effects of alternative 2, when added to the effects identified above from other past, present and reasonably foreseeable actions, would result in a long-term, localized, moderate adverse cumulative impact on ethnographic resources. Alternative 2 would contribute a small adverse increment to this cumulative impact.

Conclusion. Alternative 2 would have long-term, localized, minor adverse impacts on ethnographic resources associated with Brooks River and the Brooks River Archeological District. Adverse impacts would occur primarily from erosion or other disturbances associated with visitor use and park/concessioner operations, operational use of the spit and barge landing, and from wildlife conditions that discourage native Sugpiat people from accessing the lower Brooks River to conduct traditional activities.

Moving the spit road, barge landing, and boat mooring area from the south bank of Brooks River to the proposed barge landing and boat storage area on Naknek Lake near the Beaver Pond would have a beneficial impact on access to the south bank for traditional users. However, the high numbers of bears on Brooks River and application of minimum wildlife distance rules would continue to limit traditional use-

Although ground-disturbing construction activities have the potential to adversely impact ethnographic resources, site avoidance and protection measures would be implemented to minimize or avoid site disturbances.

Alternative 3

Analysis. Ethnographic resources in the project area include natural resources and landmark features significant to the traditionally associated Sugpiat people as well as archeological sites and burial locations of the Brooks River Archeological District National Historic Landmark. Sites comprising the archeological district are also potential elements of the Brooks River ethnographic landscape. Archeological testing conducted in 2008, 2009, and 2010 confirmed the presence of intact archeological/ethnographic resources near Brooks Camp where the proposed boardwalk and vehicle access points to the bridge are planned to originate, and at the north bank of Brooks River. The resources are associated with a previously recorded prehistoric site that contains human burials and associated house features, as well as artifacts and a pit exposed in the north bank of the river associated with traditional use in the mid-20th Century. The sites have sustained (and continue to be threatened by) development impacts (NPS 1992). Another site, also partially disturbed by previous development, is located to the north in the general project area of Brooks Camp. Measures to limit possible adverse effects on ethnographic resources include avoiding construction activities north of the fish freezing station, and ensuring that boardwalk footings avoid resources associated with a former Sugpiat fish camp between the fish freezing station and the Corner.

No ethnographic resources are anticipated to be affected by boardwalk and bridge construction on the south side of the river or near the Lake Brooks access road (NPS 2010a).This alternative includes construction of a new barge landing site approximately 200 ft south of the existing landing and construction of approximately 100 ft of new road from the spit road to the new barge landing. Moving the barge landing south would slightly improve access to the spit, but the spit road would continue to be used by the NPS and contractors. The new landing would be closer to the northwest edge of the private Melgenak property.

It is anticipated that the site avoidance measures recommended above can be adequately addressed through project design modifications that restrict or direct ground-disturbing construction activities away from areas likely to contain ethnographic resources. Consequently, although ground-disturbing construction would occur, measures would be implemented to minimize or avoid disturbance of identified sites in the Brooks Camp area and at other project locations. The effects due to moving the barge landing south would be neutral or of minor beneficial impact. As necessary, monitoring would accompany construction in all areas where sensitive archeological/ethnographic resources have been previously identified or could be anticipated based on current project surveys. If ethnographic resources became apparent during construction, construction would cease in the area of the discovery until the resources are adequately documented and assessed by NPS staff in consultation with the Alaska State Historic Preservation Office, the Council of Katmai Descendants, and/or other concerned tribal members and individuals. NPS staff would further consult on ways to avoid significant sites and/or to carry out necessary mitigation and data recovery measures if avoidance cannot be achieved.

In late summer 2010, the National Park Service began an ethnographic resource survey to identify the character-defining features of a potential ethnographic

landscape in the general vicinity of the mouth of Brooks River. The investigations are also anticipated to include an evaluation of the landscape as a potential traditional cultural property meeting the criteria of eligibility for listing in the National Register of Historic Places. Information acquired from these investigations, together with any issues or recommendations imparted by the Council of Katmai Descendants, the heirs of Palakia Melgenak, and/or other culturally associated groups would assist the National Park Service in efforts to protect ethnographic resources and places of cultural importance, and ensure continued access to these places and resources by associated groups.

Alternative 3 would be expected to have long-term, localized, minor adverse impacts on ethnographic resources. The impacts would not appreciably alter resource conditions or further impede traditional access. The long-term preservation of ethnographic resources near the Brooks Camp area would also benefit following project completion because pedestrian and vehicle access to the bridge crossing would be directed along the boardwalks and ramps, thereby reducing the potential for ongoing erosion and compaction impacts on buried archeological/ethnographic resources by use of existing roads and trails. Measures to identify and document ethnographic resources in the Brooks Camp area would also benefit the long-term preservation of these resources.

After applying ACHP criteria of adverse effect (36 CFR Part 800.5, *Assessment of Adverse Effects*), the National Park Service concludes that implementing alternative 3 would result in *no adverse effect* on ethnographic resources.

Cumulative Impacts. Other past, present and reasonably foreseeable future projects and actions have had, or have the potential to adversely impact ethnographic resources in the project area. As described in the "Cumulative Impacts" section under Alternative 1 (above), these impacts are generally attributed to the establishment, development, and operation of Brooks Camp, and to a lesser extent to natural and human-caused erosion and localized ground disturbance associated with NPS and concessioner development and operations. Increases in numbers of bears have inhibited human use of the spit on the south shore of Brooks River.

The effects of alternative 3, when added to the effects identified above from other past, present and reasonably foreseeable actions would result in a long-term, localized, moderate adverse cumulative impact on ethnographic resources. Alternative 3 would contribute a small adverse increment to this cumulative impact.

Conclusion. Alternative 3 would have long-term, localized, minor adverse impacts on ethnographic resources associated with Brooks River and the Brooks River Archeological District. Adverse impacts would occur primarily from reduced access to the lower Brooks River for native Sugpiat people to conduct traditional activities, and from erosion or other disturbance associated with visitor use and park/concessioner operations. Although ground-disturbing construction activities have the potential to adversely impact ethnographic resources, site avoidance and protection measures would be implemented to minimize or avoid site disturbances. Movement of the loading ramp and barge landing 200 ft south would have a neutral or minor beneficial effect on access to the lower river for conducting traditional practices. High numbers of bears on Brooks River and application of minimum wildlife distance rules would continue to limit traditional use.

Alternative 4

Analysis. Ethnographic resources in the project area include natural resources and

landmark features significant to the traditionally associated Sugpiat people as well as archeological sites and burial locations of the Brooks River Archeological District National Historic Landmark. Sites comprising the archeological district are also potential elements of the Brooks River ethnographic landscape. Archeological testing conducted in 2008, 2009, and 2010 confirmed the presence of intact archeological/ethnographic resources near Brooks Camp where the proposed boardwalk and vehicle access points to the bridge are planned to originate, and at the north bank of Brooks River. The resources are associated with a previously recorded prehistoric site that contains human burials and associated house features, as well as artifacts and a pit exposed in the north bank of the river associated with traditional use in the mid-20th Century. The sites have sustained (and continue to be threatened by) development impacts (NPS 1992). Another site, also partially disturbed by previous development, is located to the north in the general project area of Brooks Camp. Measures to limit possible adverse effects on ethnographic resources include avoiding construction activities north of the fish freezing station, and ensuring that boardwalk footings avoid resources associated with a former Sugpiat fish camp between the fish freezing station and the Corner.

Boardwalk and bridge construction on the south side of the river or near the Lake Brooks access road are not anticipated to introduce new effects to ethnographic resources. Archeological investigations along the route of the proposed barge landing access road led to the discovery of significant prehistoric resources found in association with previously known historic archeological resources in the form of post-1912 cabin ruins. Ethnographic survey may attribute ethnographic significance to the historic cabin ruins. To avoid adverse impacts to these sites by road construction, it is recommended that the proposed right-of-way be modified to avoid subsurface disturbance, particularly the final 164 ft (50 meters) to the proposed location of the barge landing (NPS 2010b). The barge road will pass along the southern boundary of the conservation easement and terminate along the southeast edge of the private parcel owned by the heirs of Palakia Melgenak. The National Park Service would consult with the heirs to identify their concerns about the project work and to seek ways to avoid affecting their land rights. Installation of the access road, barge landing, and boat storage area will improve access to the spit on the south side of Brooks River for conducting traditional activities.

Under this alternative, the spit road and barge landing would be removed, thereby eliminating vehicles and heavy equipment handling cargo at the river mouth. Additionally, NPS boats currently parked along the spit would be parked and stored at the barge landing, leaving the river mouth free of concessioner and NPS activities. Frequent bear use of the spit would continue to impede traditional activities.

It is anticipated that the site avoidance measures recommended above can be adequately addressed through project design modifications that restrict or direct ground-disturbing construction activities away from areas likely to contain ethnographic resources. Consequently, although ground-disturbing construction would occur, measures would be implemented to minimize or avoid disturbance of identified sites in the Brooks Camp area and at other project locations. The effects due to moving the barge landing south would be neutral or of minor beneficial impact. As necessary, monitoring would accompany construction in all areas where sensitive archeological / ethnographic resources have been previously identified or could be anticipated based on current project surveys. If ethnographic resources became apparent during construction, construction would cease in the area of the

discovery until the resources are adequately documented and assessed by NPS staff in consultation with the Alaska State Historic Preservation Office, the Council of Katmai Descendants, and/or other concerned tribal members and individuals. NPS staff would further consult on ways to avoid significant sites and/or to carry out necessary mitigation and data recovery measures if avoidance cannot be achieved.

In late summer 2010, the National Park Service began an ethnographic resource survey to identify the character-defining features of a potential ethnographic landscape in the general vicinity of the mouth of Brooks River. The investigations are also anticipated to include an evaluation of the landscape as a potential traditional cultural property meeting the criteria of eligibility for listing in the National Register of Historic Places. Information acquired from these investigations, together with any issues or recommendations imparted by the Council of Katmai Descendants, the heirs of Palakia Melgenak, and/or other culturally associated groups would assist the National Park Service in efforts to protect ethnographic resources and places of cultural importance, and ensure continued access to these places and resources by associated groups.

Alternative 4 would be expected to have long-term, localized, minor adverse impacts on ethnographic resources. The impacts would not appreciably alter resource conditions or further impede traditional access. The long-term preservation of ethnographic resources near the Brooks Camp area would also benefit following project completion because pedestrian and vehicle access to the bridge crossing would be directed along the boardwalks and ramps, thereby reducing the potential for ongoing erosion and compaction impacts on buried archeological/ethnographic resources by use of existing roads and trails. Measures to identify and document ethnographic resources in the Brooks Camp area would also benefit the long-term preservation of these resources.

After applying ACHP criteria of adverse effect (36 CFR Part 800.5, *Assessment of Adverse Effects*), the National Park Service concludes that implementing alternative 4 would result in *no adverse effect* on ethnographic resources.

Cumulative Impacts. Other past, present and reasonably foreseeable future projects and actions have had, or have the potential to adversely impact ethnographic resources in the project area. As described in the "Cumulative Impacts" section under Alternative 1 (above), these impacts are generally attributed to the establishment, development, and operation of Brooks Camp and to a lesser extent to natural and human-caused erosion and localized ground disturbance associated with NPS and concessioner development and operations. Increases in numbers of bears have inhibited human use of the spit on the south shore of Brooks River.

The effects of alternative 4, when added to the effects identified above from other past present and reasonably foreseeable actions, would result in a long-term, localized, moderate adverse cumulative impact on ethnographic resources. Alternative 4 would contribute a small adverse increment to this cumulative impact.

Conclusion. Alternative 4 would have long-term, localized, minor adverse impacts on ethnographic resources associated with Brooks River and the Brooks River Archeological District. Adverse impacts would occur primarily from reduced access to the lower Brooks River for native Sugpiat people to conduct traditional activities, and from erosion or other disturbance associated with visitor use and park/concessioner operations. The establishment of a barge landing, access road, and boat storage area near the Beaver Pond, and removal of the spit road and loading ramp on the south bank of Brooks

River would have a beneficial impact on ethnographic resources. Although ground-disturbing construction activities have the potential to adversely impact ethnographic resources, site avoidance and protection measures would be implemented to minimize or avoid site disturbances.

Alternative 5

Analysis. Ethnographic resources in the project area include natural resources and landmark features significant to the traditionally associated Sugpiat people, as well as archeological sites and burial locations of the Brooks River Archeological District National Historic Landmark. Sites comprising the archeological district are also potential elements of the Brooks River ethnographic landscape. Archeological testing conducted in 2008, 2009, and 2010 confirmed the presence of intact archeological/ethnographic resources near Brooks Camp where the proposed boardwalk and vehicle access points to the bridge are planned to originate, and at the north bank of Brooks River. The resources are associated with a previously recorded prehistoric site that contains human burials and associated house features, as well as artifacts and a pit exposed in the north bank of the river associated with traditional use in the mid-20th century. The sites have sustained (and continue to be threatened by) development impacts (NPS 1992). Another site, also partially disturbed by previous development, is located to the north in the general project area of Brooks Camp. Measures to limit possible adverse effects on ethnographic resources include avoiding construction activities north of the fish freezing station, and ensuring that boardwalk footings avoid resources associated with a former Sugpiat fish camp between the fish freezing station and the Corner.

Boardwalk and bridge construction on the south side of the river or near the Lake Brooks access road are not anticipated to introduce new effects to ethnographic resources. Archeological investigations along the route of the proposed barge landing access road led to the discovery of significant prehistoric resources found in association with previously known historic archeological resources in the form of post-1912 cabin ruins. Ethnographic survey may attribute ethnographic significance to the historic cabin ruins. To avoid adverse impacts to these sites by road construction, it is recommended that the proposed right-of-way be modified to avoid subsurface disturbance, particularly the final 164 ft (50 meters) to the proposed location of the barge landing (NPS 2010b).

The barge road will pass along the southern boundary of the conservation easement and terminate along the southeast edge of the private parcel owned by the heirs of Palakia Melgenak. The National Park Service will consult with the heirs to identify their concerns about the project work and to seek ways to avoid affecting their land rights. Installation of the access road, barge landing, and boat storage area will improve access to the spit on the south side of Brooks River for conducting traditional activities.

Under this alternative, the spit road and barge landing would be removed, thereby eliminating vehicles and heavy equipment handling cargo at the river mouth. Additionally, NPS boats currently parked along the spit would be parked and stored at the barge landing leaving the river mouth free of concessioner and NPS activities. Frequent bear use of the spit would continue to impede traditional activities there.

It is anticipated that the site avoidance measures recommended above can be adequately addressed through project design modifications that restrict or direct ground-disturbing construction activities away from areas likely to contain ethnographic resources. Consequently, although ground-disturbing construction would occur, measures would be implemented to minimize or avoid disturbance of identified sites in the Brooks Camp area and at other project locations. As necessary, monitoring would accompany construction in all areas where sensitive archeological/ethnographic resources have been previously identified or could be anticipated based on current project surveys. If ethnographic resources became apparent during construction, construction would cease in the area of the discovery until the resources are adequately documented and assessed by NPS staff in consultation with the Alaska State Historic Preservation Office, the Council of Katmai Descendants, and/or other concerned tribal members and individuals. NPS staff would further consult on ways to avoid significant sites and/or to carry out necessary mitigation and data recovery measures if avoidance cannot be achieved.

In late summer 2010, the National Park Service began an ethnographic resource survey to identify the character-defining features of a potential ethnographic landscape in the general vicinity of the mouth of Brooks River. The investigations are also anticipated to include an evaluation of the landscape as a potential traditional cultural property meeting the criteria of eligibility for listing in the National Register of Historic Places. Information acquired from these investigations, together with any issues or recommendations imparted by the Council of Katmai Descendants, the heirs of Palakia Melgenak, and/or other culturally associated groups would assist the National Park Service in efforts to protect ethnographic resources and places of cultural importance, and ensure continued access to these places and resources by associated groups.

Alternative 5 would be expected to have long-term, localized, minor adverse impacts on ethnographic resources. The impacts would not appreciably alter resource conditions or impede traditional access. The long-term preservation of ethnographic resources near the Brooks Camp area would also benefit following project completion because pedestrian and vehicle access to the bridge crossing would be directed along the boardwalks and ramps, thereby reducing the potential for ongoing erosion and compaction impacts on buried archeological/ethnographic resources by use of existing roads and trails. Measures to identify and document ethnographic resources in the Brooks Camp area would also benefit the long-term preservation of these resources.

After applying ACHP criteria of adverse effect (36 CFR Part 800.5, *Assessment of Adverse Effects*), the National Park Service concludes that implementing alternative 5 would result in *no adverse effect* on ethnographic resources.

Cumulative Impacts. Other past, present and reasonably foreseeable future projects and actions have had, or have the potential to adversely impact ethnographic resources in the project area. As described in the "Cumulative Impacts" section under alternative 1 above, these impacts are generally attributed to the establishment, development and operation of Brooks Camp and to a lesser extent to erosion and localized ground disturbance associated with NPS and concessioner development and operations. Increases in numbers of bears have inhibited human use of the spit on the south shore of Brooks River.

The effects of alternative 5, when added to the effects identified above from other past present and reasonably foreseeable actions, would result in a long-term, localized, moderate adverse cumulative impact on ethnographic resources. Alternative 5

would contribute a small adverse increment to this cumulative impact.

Conclusion. Alternative 5 would have long-term, localized, minor adverse impacts on ethnographic resources associated with Brooks River and the Brooks River Archeological District. Adverse impacts would occur primarily from reduced access to the lower Brooks River for native Sugpiat people to conduct traditional activities, and from erosion or other disturbance associated with visitor use and park/concessioner operations. The establishment of a barge landing, access road, and boat storage area near the Beaver Pond, and removal of the spit road and loading ramp on the south bank of Brooks River would have a beneficial impact on ethnographic resources. Although ground-disturbing construction activities have the potential to adversely impact ethnographic resources, site avoidance and protection measures would be implemented to minimize or avoid site disturbances.

VISITOR EXPERIENCE

ALTERNATIVE 1

Recreational Opportunities, Crowding, and Quality of Experience

The primary recreational opportunities at Brooks Camp are viewing (97 percent) and photographing (80 percent) bears, according to a study conducted in July 2006 (Littlejohn and Hollenhorst 2007).Although comprising less than 10 percent of annual visitation, anglers also come to Brooks Camp for its world-class sport fishing opportunities. Under the no-action alternative, opportunities to view bears and to fish in Brooks River would be retained.

Overall visitor use levels have steadily increased over the years at Brooks Camp. The number of visitors wishing to access the bridge and the extended bridge closures caused by bears in the area disrupt the visitor experience by creating a bottleneck of visitors as they wait for the bridge to reopen. Eighty-seven percent of visitors in the July 2006 study reported experiencing bears blocking access to facilities (Littlejohn and Hollenhorst 2007).

Consequently, crowding has been noted to affect visitor experiences. In the July 2006 study, 56 percent of visitors to Brooks Camp felt "moderately crowded", "very crowded" or "extremely crowded", and an additional 30 percent felt "a little crowded" (Littlejohn and Hollenhorst 2007). The delays caused by closures can also create stress for visitors if they need to make transport connections to leave Brooks Camp but cannot cross the bridge. The lower bear viewing platform on the south side of Brooks River can be congested at times and is subject to access restrictions when bears come too close. The no-action alternative would perpetuate these conditions.

Even though the closures cause crowding, 48 percent of visitors in the July 2006 survey indicated that bears blocking access to facilities added to their experience (Littlejohn and Hollenhorst 2007), most likely because the closures provide an atmosphere of adventure by allowing visitors to have close proximity to bears while still providing a sense of safety due to the presence of rangers. These closures also provide additional opportunities for park rangers to provide orientation, interpretation, and safety information to a captive audience of visitors as they wait for the bridge to reopen (NPS 2009f), which also contributes to a positive visitor experience.

Transportation, Access, and Circulation

The Brooks Camp area is accessed primarily by floatplane, but is also accessed by boat. The landing area is located on the south side of the river, so visitors and supplies must cross the river to reach Brooks Camp.

The floating bridge, which is 320 ft long, is periodically closed because of bear encounters and is shared between pedestrians and light utility vehicles. It provides direct access to Brooks Camp from the south, and an access trail then connects the north end of the floating bridge to Brooks Camp. The area of the trail known as the Corner is especially subject to disruptions from bear encounters, as it is close to the riverbank. Similarly, access to the barge landing is also periodically subject to disruptions from bear encounters. The no-action alternative would perpetuate temporary disruptions to

visitor access in these areas. Floatplane access would remain the same.

Bear viewers use the trail from the camp, through the Corner, and over the bridge as the access corridor the reach the Brooks Falls Viewing Platform upstream of the bridge. Anglers, however, have much different circulation patterns. A collection of social trails is used by anglers to reach the prime sport fishing locations on the northwest side of the bridge, such as the oxbow and the north bank of the river. Other popular fishing areas on the south bank of the river are near the west side bridge and the upper portion of the river above the falls. Anglers and bear viewers alike enjoy easy access to the riverbank.

Bridge, Boardwalk, and Viewing Platform Capacities

A recommended standard for pedestrian capacity on walkways, boardwalks, and viewing platforms was developed by Parks Victoria in Australia by adapting the U.S. Federal Highway Administration highway capacity manual to apply to a national park setting very similar to that of Brooks Camp. The results suggested 15–40 ft^2 of space per pedestrian for walkways and boardwalks, and 15–23 ft^2 per visitor for defined viewing areas (Itami 2002).

Data collected in September 2011 show that the maximum number of people recorded in the vicinity of the bridge at any one time is 72 people, which includes the number of people on the lower platform, the satellite platform, the corner, and the bridge, as well as the people in the river fishing, below the platforms and on the ground below the corner to the gravel bar (NPS 2011b). Based on this, it is unlikely that the number of people that would attempt to cross the bridge at any one time would be less than 72. The square footage of the bridge in alternative 1 (2,560 ft^2), when using the above standard, allows 64 to 171 pedestrians to travel comfortably across, even taking into account the likelihood that recreational users will stop briefly to take a photo or enjoy the view. This bridge capacity, therefore, does not detract from visitor experiences because even the highest potential visitation level at one time is within acceptable parameters.

The existing viewing platform, on the south side of the river, is 600 ft^2. When using the standard of 15–23 ft^2 per visitor, the ideal capacity for the viewing platform is 26–40 visitors. While up to 75 visitors may be able to physically stand on the platform, any number higher than 40 people would represent a diminished visitor experience. As this is the only viewing platform near the bridge and provides a wide view of the river, it is the main gathering point for visitors to watch bears and is subject to crowding. Based on the historic maximum of 72 people at one time throughout the entire area near the bridge, the current capacity of the platform would be likely not exceed acceptable standards.

Visitor Safety—Human-Bear Interaction and Pedestrian-Vehicle Conflicts

Currently, though there have historically been very few incidents reported, human-bear interactions pose a potential risk to visitor safety at Brooks Camp. An extensive education and monitoring program is in place to improve visitor safety. These programs notwithstanding, the floating bridge and its access trails continue to pose risks to visitor safety because human-bear interactions cannot easily be avoided. Furthermore, there are no emergency exits from the floating bridge that would allow for evacuation of the area in the event of unexpected bear encounters. Consequently, the bridge is closed as a precautionary measure when bears are present to prevent people from accessing it. Similarly, the Corner area continues to be a choke point of visitor access to the bridge, and bear encounters are especially common there. Overall, the no-action

alternative would have adverse impacts on visitor safety because of the potential risks associated with human-bear interactions that would likely continue to occur.

Additionally, though no incidents have been recorded, risk is inherent in allowing pedestrians and vehicles to use the same bridge, trail, and access points. This results in the potential risk of vehicle-pedestrian conflicts.

Crowding, access disruptions, and human-bear interactions are all caused or exacerbated by bears blocking access to facilities, which is experienced by 87 percent of visitors. This results in a localized, major, long-term, adverse impact on safety, yet creates localized, moderate, long-term beneficial impacts to visitor experience.

Cumulative Impacts

Past and present programs and projects in the Brooks Camp area have had an overall effect on the visitor experience. In particular, the visitor orientation program provides visitors with important information about recreational and other opportunities at Brooks Camp. This program also provides visitors with key information about bear and visitor safety. Similarly, projects related to facility and infrastructure developments and their continued maintenance, such as improvements to the picnic area, would be favorable to the visitor experience.

Reasonably foreseeable actions that might affect the visitor experience include the planned relocation of Brooks Camp south of the river. For instance, pedestrian-vehicle conflicts would be reduced because fewer vehicles would need to use the bridge and boardwalk since boats would dock on the same side of the river as the camp and their cargo would be transported over land to the south, rather than over the bridge to the north. Additionally, improvements to facilities, such as the picnic area, including food storage upgrades and the construction of a new trail from the campground to lodge area, would also have a positive effect on visitor safety by decreasing the likelihood of bear encounters.

Additional factors that might affect this project in the foreseeable future include changes to visitor use patterns. Use has risen at Brooks Camp as it has increasingly become renowned and popular for bear viewing. However, it is not expected that visitation would substantially change over the time frame being analyzed.

Under the no-action alternative, greater pedestrian-vehicle conflicts may occur during camp relocation activities because of the narrow floating bridge design. After the relocation activities have been completed, however, they would be reduced because the fewer vehicles would need to access the north side of the river.

Overall, localized, moderate, beneficial cumulative impacts on visitor experiences, and especially safety, would occur long-term when impacts of current conditions and operations are added to future proposed actions. Short-term impacts, however, may be localized, moderate, and adverse due to relocation and construction activities that create pedestrian-vehicle conflicts on the current bridge, as well as potential facility closures, increased noise levels, and a diminished natural experience. The contribution of impacts from alternative 1 are minimal to the overall scenario since the adverse impacts from the no-action alternative would be substantially mitigated by cumulative actions.

Conclusion

The no-action alternative would affect visitor experience and visitor safety differently. There would be localized, moderate, long-term beneficial impacts on visitor experience because the current

floating bridge and its closures provide a atmosphere of adventure by allowing close proximity to bears while still providing a sense of safety due to the presence of rangers.

Even though visitors perceive safety, and despite substantial efforts to educate visitors, monitor human-bear interactions and staff visitor areas with NPS rangers, the no-action alternative would have localized, major, long-term, adverse impacts on visitor safety because of the risk associated with continued frequent human-bear interactions.

ALTERNATIVE 2

Recreational Opportunities, Crowding, and Quality of Experience

Under alternative 2 visitors would continue to enjoy the range of activities they currently participate, including photography, camping, hiking, fishing, and bear viewing. Actions proposed would also not affect overall visitor use levels at the Brooks Camp (which may continue to gradually increase) but could disperse use to mitigate crowding.

Seven new platforms—two on either side of bridge at each end, two on the north boardwalk, and one on the south boardwalk—and wide boardwalks on both sides of the river would be added under alternative 2 to improve visitor movement, reduce vehicle-pedestrian conflicts, and potentially reduce crowding by distributing use. Crowding in the Corner area would be alleviated since the current trail would be removed and the elevated north boardwalk would begin adjacent to the lodge, about 535 ft from the riverbank. The mitigation of bridge closures caused by bear jams; however, may alter visitor behavior such that visitors would now have the ability to view bears for a longer period of time without being compelled to return to Brooks Camp earlier than needed to ensure compliance with travel itineraries. This may increase crowding and congestion. At present, visitors often spend several hours on the current platforms (NPS 2009f), which might be extended since the additional platforms would provide a greater diversity of viewing and photography perspectives.

The ability to view bears from certain locations will affect the popularity level of and length of stay at the platforms, and those with the best viewing opportunities at any given time are likely to be more crowded for longer periods of time than others.

Alternative 2 would enable visitors and staff to travel across the river unimpeded on raised boardwalks that still allow visitors to view bears without being inconvenienced by their proximity. The addition of viewing platforms would improve bear viewing options by providing more visitors with diverse opportunities to watch and photograph bears, the most popular visitor activities at Brooks Camp. Additionally, since bears are less sensitive to human presence on a raised bridge/boardwalk (NPS 2009f), visitors would be able to observe the bears' more natural behavior than if the people were at ground level. The quality of anglers' experience would also be enhanced by the unimpeded access provided by the raised travel corridor.

Short-term construction and restoration activities during project implementation would affect visitor experience because of noise and visual disruptions to the otherwise natural setting. These impacts would be partially mitigated by scheduling work during nonpeak visitor use hours and avoiding key access points.

Transportation, Access and Circulation

The Brooks Camp area would continue to be accessed primarily by floatplane under this alternative. The barge landing would be improved, positively affecting a small number of visitors who access Brooks Camp by boat.

New elevated bridge and boardwalks would provide a safe travel corridor for visitors to cross Brooks River without interruption from bear interactions and other conflicts.

The north boardwalk would be approximately 535 ft long, 335 ft of which would be solely for pedestrian access and 200 ft would be shared with vehicles, which would have a separate access ramp to minimize pedestrian-vehicle conflicts. This would also eliminate the need for the access trail through the Corner, an area that has high potential for human-bear interaction. There would be two locations on the north boardwalk for visitors to step off the travel corridor into a defined viewing area overlooking the wetlands, one on the strictly pedestrian section and a second on the shared section which would serve a dual-purpose as a viewing area and as a place for visitors to let a vehicle pass. Two additional platforms, one facing east and one facing west of the bridge, would allow visitors to safely stop and overlook either side of the river without interfering with vehicles or other pedestrians who are crossing the bridge. These additions would improve visitor circulation.

On the south end, two more viewing areas would overlook the river, one on each side. There would also be another pedestrian boardwalk, extending a length of 715 ft, which would reach to the bus parking area and include one viewing area facing the wetland. A vehicle ramp would branch off at the terminus of the bridge and extend approximately 215 ft to meet up with the access road, again minimizing pedestrian-vehicle conflicts and improving circulation.

Bear activity at the boardwalk entry points and subsequent closures may continue to disrupt visitor opportunities for bear watching. This would be mitigated, however, by locating access points well away from the riverbank, although increasing the number of access points by separating pedestrian and vehicle access can create more potential for human-bear interactions (NPS 2009f). Visitors wishing to access the riverbank would be able to use the short vehicle ramp on the south side of the river, which is not only the safer side from the standpoint of human-bear interactions, but it also has better visibility and photography opportunities than the north side.

Angler access would continue to be provided without restriction. The unmaintained social trails to the oxbow area of the river and along the north bank would be unaffected. After the discontinued maintenance of the trail through the Corner, it would become an unmaintained social trail like the others. Anglers would also continue to cross the bridge frequently to gain access to the south bank and the upper portion of the river above the falls.

Overall, this alternative would improve visitor access and circulation because the bridge and boardwalk would allow free flow and safety of travel across Brooks River.

Bridge, Boardwalk, and Viewing Platform Capacities

The square footage of the bridge in alternative 2 (2,880 ft^2), when using the standard described in alternative 1 of 15–40 ft^2 of space per pedestrian, would allow 72 to 192 pedestrians to travel comfortably across unimpeded.

The three viewing platforms overlooking the wetlands would each have 150–225 ft^2 of space. Using the minimum standard of 15 ft^2 per visitor, as few as 10 (if the platform is 150 ft^2) or as many as 15 visitors (if the platform is 225 ft^2) could comfortably stand to take in the view. The additional four viewing platforms overlooking the river would each have areas of 225–300 ft^2. The capacity for these would range from 15 to 20 visitors.

In total, if each of the seven platforms were at maximum capacity, 90 to 125 visitors (depending on size of platforms) could comfortably occupy the designated viewing areas and be safely protected from both bear and vehicle interactions. Given that the greatest number of visitors currently documented to be in the area of the bridge at any one time is 72 (NPS 2011b), this capacity is sufficient for current use levels and also allows for a substantial increase in visitation. It must be taken into consideration, however, that the ability to view bears from certain locations will affect the popularity level of the platforms, and those with the best viewing opportunities at any given time are likely to be more crowded than other locations.

Overall, the visitor capacities of the bridge, boardwalks, and viewing platforms are enough to support high-quality visitor experiences.

Visitor Safety—Human-Bear Interaction and Pedestrian-Vehicle Conflicts

Alternative 2 includes numerous measures, addressing conflicts between visitors and both bears and vehicles, that improve the safety of visitors.

The elevation of the bridge would improve visitor safety by avoiding unwanted human-bear interactions in key areas such as the Corner and along the riverbanks. The 10-year average for human-bear interactions that may not have occurred if an elevated bridge and walkway were constructed between Brooks Camp and the south side of the river is 48, but the 5-year average is 77. This shows an increasing trend of potentially dangerous interactions. In 2007, a record 125 of such interactions were reported (NPS 2009h). The elevation of the primary pedestrian travel corridor, especially through the Corner, would considerably mitigate those potentially unsafe interactions.

Anglers would continue to have a greater chance to experience a human-bear interaction due to the nature of fishing taking place along the riverbanks, near areas that are frequented by bears. Bear orientations and safety instructions would remain important, especially for anglers.

Only a section of the north boardwalk and the entire bridge would have shared vehicle and pedestrian use. To the south, the boardwalk would be only for pedestrians and the current access road would be used for vehicles. These improvements would reduce the risk to visitor safety from potential pedestrian-vehicle conflicts.

The continued use of part of the north boardwalk and bridge by both user groups, however, would still pose some risk to visitor safety. Vehicles cross approximately six to fourteen times per day, the higher number of trips resulting from the arrival of floatplanes and the transportation of their cargo. The length of the boardwalk and reduced line of sight would affect the flow of vehicle traffic, but the viewing platforms would decrease the tendency of visitors to stop along the bridge or boardwalk, which, along with good etiquette among user groups, would further reduce pedestrian-vehicle safety conflicts.

Another safety precaution in alternative 2 would be the installation of an emergency ladder on the north side of the bridge that would provide increased opportunities for entry or exit from the bridge if there is an

unexpected bear encounter or other emergency.

This alternative also proposes moving the barge landing well south of its current location. This would have a negative effect on visitor safety because of potential delays in response time associated with having emergency boats located further away. Overall, alternative 2 would result in localized, moderate, long-term, beneficial impacts to visitor experience and safety. There would be, however, localized, moderate, short-term adverse impact due to effects of construction activities such as noise and visual disruptions.

Cumulative Impacts

The past, present and reasonably foreseeable actions that have an effect on the Brooks Camp area are outlined in alternative 1.

When the beneficial effects of the visitor orientation program, construction of the new inland trail from the campground to the lodge, and the eventual relocation of Brooks Camp are added to the moderate beneficial impacts of the new bridge and boardwalk in alternative 2, there would be the potential for a localized, major, long-term, beneficial cumulative impact on the visitor experience overall. The contribution of impacts from alternative 2 would considerably add to the cumulative impacts.

Conclusion

Alternative 2 would have localized, long-term, major, beneficial impacts on both visitor experience and safety in the Brooks River area associated with creating a safe travel corridor that would (1) avoid human/bear interactions; (2) avoid delays from bear conflicts; and (3) provide new bear viewing areas along the bridge and boardwalks. Temporary construction and potential vehicle-pedestrian conflicts on the shared access corridor, and boardwalk/bridge access restrictions due to bear encounters would have short- and long-term, respectively, minor, adverse impacts.

ALTERNATIVE 3

Recreational Opportunities, Crowding, and Quality of Experience

Under alternative 3, visitors would continue to enjoy the range of activities they currently participate, including photography, camping, hiking, fishing, and bear viewing. Actions proposed would not affect overall visitor use levels in the Brooks Camp area (which may continue to gradually increase) but could disperse use to mitigate crowding.

Four new platforms—two on each end of the bridge that face in opposite directions to provide a diversity of river views—and wide boardwalks would allow for improved visitor movement and would have the potential to reduce crowding by distributing use. Crowding in the Corner area would be alleviated since the current trail would be removed and the elevated north boardwalk would begin near the fish freezing station, about 330 ft from the riverbank. The mitigation of bridge closures caused by bear jams, however, may alter visitor behavior such that visitors would now have the ability to view bears for a longer period of time without being compelled to return to Brooks Camp earlier than needed. This may increase crowding and congestion. At present, visitors often spend several hours on the current platforms, which might be extended since the additional platforms would provide a greater diversity of viewing and photography perspectives.

The ability to view bears from certain locations will affect the popularity level of and length of stay at the platforms, and those with the best viewing opportunities at any given time are likely to be more

crowded for longer periods of time than others.

Alternative 3 would enable visitors and staff to travel across the river unimpeded on raised boardwalks that still allow visitors to view bears without being inconvenienced by their proximity. The addition of viewing platforms would create additional opportunities for bear watching and photography, the most popular visitor activities at Brooks Camp. Additionally, since bears are less sensitive to human presence on a raised bridge/boardwalk, visitors would be able to observe the bears' more natural behavior than if the people were at ground level. The quality of anglers' experience would also be enhanced by the unimpeded access provided by the raised travel corridor.

As mentioned in alternative 2, construction and restoration activities would negatively affects the visitor experience in the short term, but steps would be taken mitigate these effects.

Transportation, Access and Circulation

Overall, Brooks Camp would continue to be accessed primarily by floatplane. Developments at the barge landing would also improve access to Brooks Camp for a small number of private boaters who use the landing area.

The new elevated bridge and boardwalks would provide a safe travel corridor for visitors to cross Brooks River and access the camp area without interruption from bear interactions. The length of the bridge would increase to 415 ft due to the angle created by relocating the north end closer to the Corner.

The north boardwalk would be 300 ft long and would be completely shared between pedestrians and vehicles. No viewing platforms/pullouts would be located on this boardwalk. This would cause vehicle traffic to move slowly since there are no opportunities for visitors to completely step out of the path of traffic, although if visitors were to pause along the railing, the eight-foot width of the boardwalk would allow sufficient space for even the widest vehicle in use to pass. Once at the bridge, visitors would be able to step off of the travel corridor onto one of the two viewing platforms, located on either side of the bridge, to allow vehicles to pass.

On the south side, two more viewing platforms would allow visitors to move out of the flow of traffic before the 210-foot-long south boardwalk would begin. This short boardwalk would also be shared by pedestrians and vehicles, and connects to the access road.

Bear activity at the boardwalk entry points and subsequent closures may continue to disrupt visitor opportunities for bear watching. This would be mitigated on the north side, however, by locating the access point further away from the riverbank and by limiting the number of access points to one on each side of the river (NPS 2009f). Visitors wishing to access the riverbank would be able to do so easily using the short boardwalk on the south side of the river, which is not only the safer side from the standpoint of human-bear interactions, but it also has better visibility and photography opportunities than the north side.

Angler access would continue to be provided without restriction. The unmaintained social trails to the oxbow area of the river and along the north bank would be unaffected. After the discontinued maintenance of the trail through the Corner, it would become an unmaintained social trail like the others. Anglers would also continue to cross the bridge frequently to gain access to the south bank and the upper portion of the river above the falls.

Overall, this alternative would improve visitor transportation and access because

the bridge and boardwalk would allow free flow and safety of travel across Brooks River. The vicinity of the south boardwalk access point to the river, however, would maintain the potential for closures due to bear jams.

Bridge, Boardwalk, and Viewing Platform Capacities

The square footage of the bridge in alternative 3 (3,320 ft^2), when using the standard described in alternative 1, would allow 83 to 221 pedestrians to travel comfortably across unimpeded. That capacity is well above current visitation levels, given that the average of visitors per day in July, the peak month, is 188 people (NPS 2010g).

The four new viewing platforms on the bridge would each have an area of 225–300 ft^2. The capacity for these would range from 15 to 20 visitors per platform.

In total, if each of the four platforms was at maximum capacity, 60 to 80 visitors could comfortably occupy the designated viewing areas and be safely protected from both bear and vehicle interactions. This capacity is sufficient for current use levels and also allows for increasing visitation.

Overall, the visitor capacities of the bridge, boardwalks, and viewing platforms are enough to support high-quality visitor experiences.

Visitor Safety—Human-Bear Interaction and Pedestrian-Vehicle Conflicts

Alternative 3 includes numerous measures, addressing conflicts between visitors and both bears and vehicles, that improve the safety of visitors.

This alternative would improve visitor safety by elevating the bridge and boardwalks to avoid unwanted human-bear interactions in key areas such as the Corner and along the riverbanks. Evidence presented in the analysis of alternative 2 suggests that a substantial number of such interactions could be prevented with an elevated bridge and boardwalk. The nearness of the south boardwalk access point to the river, however, maintains the potential for frequent human-bear interactions (NPS 2009f).

The addition of an emergency ladder on the north side of the bridge would provide increased opportunities for entry or exit from the bridge if there is an unexpected bear encounter or other emergency.

Anglers would continue to have a greater chance to experience a human-bear interaction due to the nature of fishing taking place along the riverbanks, near areas, which are frequented by bears. Bear orientations and safety instructions would remain important, especially for anglers.

The movement of the barge landing approximately 200 ft to the south would not considerably delay the response times of emergency boats, and therefore would not cause a measurable change in visitor safety.

The continued use of the boardwalks and bridge by both pedestrians and vehicles would still pose some risk to visitor safety. The length of the boardwalk and reduced line of sight would affect the flow of vehicle traffic, but the viewing platforms would decrease the tendency of visitors to stop along the bridge, which, along with good pedestrian-vehicle etiquette, would somewhat reduce pedestrian-vehicle safety conflicts.

Overall, alternative 3 would result in localized, moderate, long-term, beneficial impacts to visitor experience and safety. There would also be localized, moderate, short-term adverse impact due to effects of construction activities such as noise and visual disruptions.

Cumulative Impacts

The past, present and reasonably foreseeable actions that have an effect on the Brooks Camp area are outlined in alternative 1.

When the beneficial effects of the visitor orientation program, construction of the new inland trail from the campground to the lodge, and the eventual relocation of Brooks Camp are added to the moderate beneficial impacts of the new bridge and boardwalk in alternative 3, there would be the potential for a major, long-term, beneficial cumulative impact on the visitor experience overall. The contribution of impacts from alternative 3 would considerably add to the cumulative impacts.

Conclusion

Alternative 3 would have localized, long-term, major, beneficial impacts on the visitor experience and safety in the Brooks River area associated with creating a safe travel corridor that would (1) avoid human/bear interactions; (2) avoid delays from bear conflicts; and (3) provide new bear viewing areas along the bridge and boardwalks. Temporary construction and potential vehicle-pedestrian conflicts on the shared access corridor, and boardwalk/bridge access restrictions due to bear encounters would have short- and long-term (respectively), minor, adverse impacts.

ALTERNATIVE 4

Recreational Opportunities, Crowding, and Quality of Experience

Under alternative 4 visitors would continue to enjoy the range of activities they currently participate, including photography, camping, hiking, fishing, and bear viewing. Actions proposed in this alternative would not affect overall visitor use levels at the Brooks Camp area (which may continue to gradually increase), but could disperse use to mitigate crowding.

Seven new platforms—two on either side of bridge at each end, two on the north boardwalk, and one on the south boardwalk—and wide boardwalks would allow for improved visitor movement and would have the potential to reduce crowding by distributing use. Crowding in the Corner area would be alleviated because the current trail would be removed and the elevated north boardwalk would begin adjacent to the lodge, about 560 ft from the riverbank. The mitigation of bridge closures caused by bear jams, however, may alter visitor behavior such that visitors would now have the ability to view bears for a longer period of time without being compelled to return to Brooks Camp earlier than needed. This may increase crowding and congestion. At present, visitors often spend several hours on the current platforms, which might be extended since the additional platforms would provide a greater diversity of viewing and photography perspectives.

The ability to view bears from certain locations will affect the popularity level of and length of stay at the platforms, and those with the best viewing opportunities at any given time are likely to be more crowded for longer periods of time than others.

Alternative 4 would provide an elevated travel corridor to permit unrestricted visitor movement without interruption from the presence of bears. The addition of viewing platforms would create additional opportunities for bear watching and photography, the most popular visitor activities at Brooks Camp. Additionally, since bears are less sensitive to human presence on a raised bridge/boardwalk, visitors would be able to observe the bears' more natural behavior than if the people were at ground level.

The quality of anglers' experience would also be enhanced by the unimpeded access provided by the raised travel corridor.

As mentioned in alternative 2, construction and restoration activities would negatively affects the visitor experience in the short term, but steps would be taken mitigate these effects.

Transportation, Access and Circulation

Overall, Brooks Camp would continue to be accessed primarily by floatplane. Developments at the barge landing would also improve access to Brooks Camp for a small number of private boaters who use the landing area.

As in the previous alternatives, the new elevated bridge and boardwalks would provide a safe travel corridor for visitors to cross Brooks River and access the camp area without interruption from bear interactions. The length of the bridge would be increased slightly over the current length, to 350 ft, based on the placement of the permanent structure.

The north boardwalk would be 560 ft long and would be completely shared between pedestrians and vehicles. The access point would be located adjacent to the lodge; therefore, the boardwalk would eliminate the need for the walking trail through the Corner. There would be two locations on the north boardwalk for visitors to step off the travel corridor into a defined viewing area overlooking the wetlands, which would improve the flow of vehicle traffic. Two additional platforms, one facing east and one facing west, would allow visitors to safely stop and overlook either side of the river without interfering with vehicles or other pedestrians who are crossing the bridge.

On the south side, two more viewing platforms would allow visitors to move out of the flow of traffic before the 630-foot-long south boardwalk would begin. This long boardwalk would also be shared by pedestrians and vehicles, and would include one viewing platform/pullout facing the wetland. The access point for the south boardwalk would be conveniently located about 100 ft from the bus parking area.

Bear activity at the boardwalk entry points and subsequent closures may continue to disrupt visitor opportunities for bear watching. This would be mitigated on the both sides of the river; however, by locating the access points a substantial distance from the riverbank and by limiting the number of access points to one on each side of the river (NPS 2009f). Visitors wishing to access the riverbank would be able to use the short access ramp on the south side of the river, which is not only the safer side from the standpoint of human-bear interactions, but it also has better visibility and photography opportunities than the north side. The provision of access ramp is an effective way to provide riverbank access to those relatively few visitors who desire it while still providing a long elevated boardwalk to facilitate unimpeded flow of pedestrian and vehicle traffic.

Angler access would continue to be provided without restriction. The unmaintained social trails to the oxbow area of the river and along the north bank would be unaffected. After the discontinued maintenance of the trail through the Corner, it would become an unmaintained social trail like the others. Anglers would also continue to cross the bridge frequently to gain access to the south bank and the upper portion of the river above the falls.

In general, this alternative would improve visitor transportation and access because the bridge and boardwalk would allow free flow and safety of travel across Brooks River.

Bridge, Boardwalk, and Viewing Platform Capacities

The square footage of the bridge in alternative 4 (2,800 ft^2), when using the standard described in alternative 1, would allow 70 to 187 pedestrians to travel comfortably across unimpeded.

The three viewing platforms overlooking the wetlands each would have 150–225 ft^2 of space. Using the prescribed standard for viewing areas, as few as 10 or as many as 15 visitors could comfortably stand to take in the view on each platform.

The new four viewing platforms on the bridge would each have an area of 225–300 ft^2. The capacity for these would range from 15 to 20 visitors per platform.

In total, if each of the seven platforms were at maximum capacity, 90 to 125 visitors could comfortably occupy the designated viewing areas and be safely protected from both bear and vehicle interactions. This capacity is sufficient for current use levels and allows for a substantial increase in visitation.

Overall, the visitor capacities of the bridge, boardwalks, and viewing platforms are enough to support high-quality visitor experiences.

Visitor Safety—Human-Bear Interaction and Pedestrian-Vehicle Conflicts

Alternative 4 includes numerous measures, addressing conflicts between visitors and both bears and vehicles, that improve the safety of visitors.

This alternative would improve visitor safety by elevating the bridge and boardwalks to avoid unwanted human-bear interactions in key areas such as the Corner and along the riverbanks. Evidence presented in the analysis of alternative 2 suggests that a considerable number of such interactions could be prevented with an elevated bridge and boardwalk.

The addition of an emergency ladder on the north side of the bridge would provide increased opportunities for entry or exit from the bridge if there is an unexpected bear encounter or other emergency.

Anglers would continue to have a greater chance to experience a human-bear interaction due to the nature of fishing taking place along the riverbanks, near areas, which are frequented by bears. Bear orientations and safety instructions would remain important, especially for anglers.

This alternative proposes moving the barge landing well south of its current location. This would have a negative effect on visitor safety because of potential delays in response time associated with having emergency boats located further away.

The continued use of the boardwalks and bridge by both user groups would still pose some risk to visitor safety. The length of the boardwalk and reduced line of sight would affect the flow of vehicle traffic, but the viewing platforms would decrease the tendency of visitors to stop along the bridge, which, along with good pedestrian-vehicle etiquette, would somewhat reduce pedestrian-vehicle safety conflicts.

Overall, alternative 4 would result in localized, major, long-term, beneficial impacts to visitor experience and safety. There would also be localized, moderate, short-term adverse impact due to effects of construction activities such as noise and visual disruptions.

Cumulative Impacts

The past, present and reasonably foreseeable actions that have an effect on the Brooks Camp area are outlined in alternative 1.

When the beneficial effects of the visitor orientation program, construction of the new inland trail from the campground to the lodge, and the eventual relocation of Brooks Camp are added to the major beneficial impacts of the new bridge and boardwalk in alternative 4, there would be the potential for a major, long-term, beneficial cumulative impact on the visitor experience overall. The contribution of impacts from alternative 4 would substantially add to the cumulative impacts.

Conclusion

Alternative 4 would have localized, long-term, major, beneficial impacts on the visitor experience and safety in the Brooks River area associated with creating a safe travel corridor that would (1) avoid human/bear interactions; (2) avoid delays from bear conflicts; and (3) provide new bear viewing areas along the bridge and boardwalks. Temporary construction and potential vehicle-pedestrian conflicts on the shared access corridor, and boardwalk and bridge access restrictions due to bear encounters would have short- and long-term (respectively), minor, adverse impacts.

ALTERNATIVE 5

Recreational Opportunities, Crowding, and Quality of Experience

Under alternative 5 visitors would continue to enjoy the range of activities they currently participate, including photography, camping, hiking, fishing, and bear viewing. Actions proposed in this alternative would not affect overall visitor use levels at the Brooks Camp area (which may continue to gradually increase) but could disperse use to mitigate crowding.

Six new platforms—two on either side of bridge at each end and two on the north boardwalk—and wide boardwalks would allow for improved visitor movement and would have the potential to reduce crowding by distributing use. Crowding in the Corner area would be alleviated since the current trail would be removed and the elevated north boardwalk would begin adjacent to the lodge, about 560 ft from the riverbank. The mitigation of bridge closures caused by bear jams, however, may alter visitor behavior such that visitors would now have the ability to view bears for a longer period of time without being compelled to return to Brooks Camp earlier than needed. This may increase crowding and congestion. At present, visitors often spend several hours on the current platforms, which might be extended since the additional platforms would provide a greater diversity of viewing and photography perspectives.

The ability to view bears from certain locations will affect the popularity level of and length of stay at the platforms, and those with the best viewing opportunities at any given time are likely to be more crowded for longer periods of time than others.

Alternative 5 would provide an elevated travel corridor on the north side of the river to permit unrestricted visitor movement without interruption from the presence of bears. The addition of viewing platforms would create additional opportunities for bear watching and photography, the most popular visitor activities at Brooks Camp. Additionally, since bears are less sensitive to human presence on a raised bridge/boardwalk, visitors would be able to observe the bears' more natural behavior than if the people were at ground level. The quality of anglers' experience would also be enhanced by the unimpeded access provided by the raised travel corridor. As mentioned in alternative 2, construction and restoration activities would negatively affects the visitor experience in the short

term, but steps would be taken mitigate these effects.

Transportation, Access and Circulation

Overall, Brooks Camp would continue to be accessed primarily by floatplane. Developments at the barge landing would also improve access to Brooks Camp for a small number of private boaters who use the landing area.

The new elevated bridge and boardwalks would provide a safe travel corridor for visitors to cross Brooks River and access the camp area without interruption from bear interactions. The length of the bridge would be increased slightly over the current length, to 350 ft.

The north boardwalk would be 560 ft long and would be completely shared between pedestrians and vehicles. The access point would be located adjacent to the lodge; therefore, the boardwalk would eliminate the need for the walking trail through the Corner. There would be two locations on the north boardwalk for visitors to step off the travel corridor into a defined viewing area overlooking the wetlands, which would improve the flow of vehicle traffic. Two additional platforms, one facing east and one facing west, would allow visitors to safely stop and overlook either side of the river without interfering with vehicles or other pedestrians who are crossing the bridge.

On the south side, two more viewing platforms would allow visitors to move out of the flow of traffic before the 215-foot-long south boardwalk would begin. This short boardwalk would also be shared by pedestrians and vehicles, and connects to the access road.

Bear activity at the boardwalk entry points and subsequent closures may continue to disrupt visitor opportunities for bear watching. This would be mitigated on the north side, however, by locating the access point further away from the riverbank and by limiting the number of access points to one on each side of the river (NPS 2009f). Visitors wishing to access the riverbank would be able to use the short boardwalk on the south side of the river, which is not only the safer side from the standpoint of human-bear interactions, but it also has better visibility and photography opportunities than the north side.

Angler access would continue to be provided without restriction. The unmaintained social trails to the oxbow area of the river and along the north bank would be unaffected. After the discontinued maintenance of the trail through the Corner, it would become an unmaintained social trail like the others. Anglers would also continue to cross the bridge frequently to gain access to the south bank and the upper portion of the river above the falls.

Overall, this alternative would improve visitor transportation and access because the bridge and boardwalk would allow free flow and safety of travel across Brooks River. The vicinity of the south boardwalk access point to the river, however, would maintain the potential for closures due to bear jams.

Bridge, Boardwalk, and Viewing Platform Capacities

The square footage of the bridge in alternative 5 (2,800 ft^2), when using standard described in Alternative 1, would allow 70 to 187 pedestrians to travel comfortably across unimpeded.

The two viewing platforms overlooking the wetlands on the north boardwalk would each have 150–225 ft^2 of space. Using the prescribed standard for viewing areas, as few as 10 or as many as 15 visitors could comfortably stand to take in the view on each platform.

The additional four viewing platforms on the bridge would each have an area of 200–250 ft^2. The capacity for these would range from 15 to 20 visitors per platform.

In total, if each of the seven platforms were at maximum capacity, 80 to 110 visitors could comfortably occupy the designated viewing areas and be safely protected from both bear and vehicle interactions. This capacity is sufficient for current use levels and allows for a substantial increase in visitation.

Visitor Safety — Human-Bear Interaction and Pedestrian-Vehicle Conflicts

Alternative 5 would improve visitor safety by elevating the bridge and boardwalks to avoid unwanted human-bear interactions in key areas such as the Corner and along the riverbanks. Evidence presented in the analysis of alternative 2 suggests that a considerable number of such interactions could be prevented with an elevated bridge and boardwalk. The nearness of the south boardwalk access point to the river, however, maintains the potential for frequent human-bear interactions (NPS 2009f).

The addition of an emergency ladder on the north side of the bridge would provide increased opportunities for entry or exit from the bridge if there is an unexpected bear encounter or other emergency.

Anglers would continue to have a greater chance to experience a human-bear interaction due to the nature of fishing taking place along the riverbanks, near areas, which are frequented by bears. Bear orientations and safety instructions would remain important, especially for anglers.

This alternative proposes moving the barge landing well south of its current location. This would have a negative effect on visitor safety because of potential delays in response time associated with having emergency boats located further away.

The continued use of the boardwalks and bridge by both user groups would still pose some risk to visitor safety. The length of the boardwalk and reduced line of sight would affect the flow of vehicle traffic, but the viewing platforms would decrease the tendency of visitors to stop along the bridge, which, along with good pedestrian-vehicle etiquette, would somewhat reduce pedestrian-vehicle safety conflicts.

Overall, alternative 5 would result in localized, moderate, long-term, beneficial impacts to visitor experience and safety. There would also be localized, moderate, short-term adverse impact due to effects of construction activities such as noise and visual disruptions.

Cumulative Impacts

The past, present and reasonably foreseeable actions that have an effect on the Brooks Camp area are outlined in alternative 1.

When the beneficial effects of the visitor orientation program, construction of the new inland trail from the campground to the lodge, and the eventual relocation of Brooks Camp are added to the moderate beneficial impacts of the new bridge and boardwalk in alternative 5, there would be the potential for a major, long-term, beneficial cumulative impact on the visitor experience overall. The contribution of impacts from alternative 5 would substantially add to the cumulative impacts.

Conclusion

In general, alternative 5 would have localized, long-term, major, beneficial impacts on the visitor experience and safety in the Brooks River area associated with creating a safe travel corridor that would (1) avoid human/bear interactions+

(2) avoid delays from bear conflicts+ and (3) provide new bear viewing areas along the bridge and boardwalks. Temporary construction and potential vehicle-pedestrian conflicts on the shared access corridor, and boardwalk and bridge access restrictions due to bear encounters would have short- and long-term, respectively+ minor+ adverse impacts.

VISUAL OR SCENIC RESOURCES

ALTERNATIVE 1

Analysis

Under alternative 1 the floating bridge would remain. Access to the bridge on the north side of Brooks River would be via a trail, well masked by vegetation. On the south side of the river, the bridge would continue to be accessed by the gravel road connecting to the barge landing site. The bridge itself is a temporary, low-profile structure that is easily identifiable against the surrounding landscape as it crosses the river. However, during winter the bridge is removed and no longer presents an intrusion to visual resources and scenery.

The barge landing site would remain in its current location at the mouth of Brooks River. A dirt access road runs to the site along the south shore of the river, and loading and unloading of boats by park and concessioner staff is in full view of visitors. Visually the site would continue to exhibit impacts on native vegetation and show some denuded areas that affect foreground views.

Overall, the no-action alternative would have a localized, moderate, long-term, adverse impact on visual resources and scenery because of the low-profile floating bridge and vegetation impacts at the barge landing site affecting foreground views in the largely natural landscape.

Cumulative Impacts

Past and present actions that have affected and affect visual resources include facility improvements to and ongoing maintenance of roads, trails, utilities, and housing. Together, these buildings, utilities, roads, and trails have created a large development footprint in the Brooks Camp area over time.

Future actions that would affect visual resources and scenery include the relocation of Brooks Camp to the south side of the river. The new location would shift visual resource impacts from the site of existing developments to a new, previously undisturbed area; however, that new location is even more well-screened from the river than the current camp.

These actions would have localized, long-term, major, beneficial impacts on scenic resources of the river because all development except the necessary bridge access would be relocated away from the river. Combined with alternative 1, localized, long-term, moderate, beneficial cumulative impacts would result since the retention of the floating bridge would detract somewhat from the beneficial impacts of cumulative actions.

Conclusion

Though easily identifiable from foreground views along the immediate shorelines of Brooks River, the floating bridge is low upon the overall landscape. Similarly, the barge landing, access roads, and trails would continue to be noticeable within the viewshed. The no-action alternative would continue to have localized, moderate, long-term, adverse impacts on visual resources and scenery.

ALTERNATIVE 2

Analysis

Alternative 2 proposes a high degree of new infrastructure with new elevated boardwalks extending well into the landscape on both the north and south sides of the bridge. Separate boardwalk and access roads south of the bridge would

also increase the amount of infrastructure and development intruding on the landscape from near and distant views. Additionally, both the bridge and boardwalks would be about 10 ft above grade, blending less into the low vegetation in the immediate river shoreline area than the floating bridge and therefore impacting foreground views. This alternative would include a permanent truss bridge, but having only two sets of pilings supporting the structure would help to minimize the visual profile of the bridge. Nevertheless, the structure would extend visual impacts year-round instead of being removed for the winter season.

The elevated bridge and boardwalk, on the other hand, would create longer visual profiles and the revegetation of the trail through the Corner would restore natural conditions in that area. In moving the barge landing site about 2,000 ft to the south, the access road along the south bank of the river would also be eliminated and reclaimed as part of the riparian environment, which would be visible by visitors on the bridge and boardwalks.

The barge landing's new location would be more wooded and farther from the main visitor corridor, mitigating its intrusion into the natural scenery of the Brooks River / Brooks Camp area by removing it from public view. However, the development of a new and longer access road would create a new cut in the tree line and vegetation along with the development of a new hardened beach landing ramp and parking in the area of the new barge landing site.

The elevated bridge and boardwalks would be highly visible developments (both from land and from floatplanes), but while on those structures visitors would enjoy improved visual resources due to the reclamation of the trail through the Corner and access road to the former barge landing. Therefore, alternative 2 would result in localized, moderate, long-term, adverse impacts on the visual resources from the perspective of a visitor looking at the bridge or new barge landing site, but would result in localized, moderate, long-term, beneficial visual impacts for visitors while on the bridge or boardwalks.

Cumulative Impacts

Past, present and future actions affecting visual resources at Brooks Camp are outlined in alternative 1.

These actions would have localized, long-term, major, beneficial impacts on scenic resources of the river because all development except the necessary bridge access would be relocated away from the river. The actions in alternative 2 would result in localized, moderate, long-term adverse impacts on the visual resources from the perspective of a visitor looking at the bridge or new barge landing site, but would result in localized, moderate, long-term, beneficial visual impacts for visitors while on the bridge or boardwalks. Overall, impacts to the visual and scenic resources would be localized, moderate, long term, and beneficial. The contribution of actions in alternative 2 would be marginal compared to the cumulative impacts.

Conclusion

Alternative 2 would result in localized, moderate, long-term, adverse impacts on the visual resources from the perspective of a visitor looking at the bridge or new barge landing site, but would result in localized, moderate, long-term, beneficial visual impacts for visitors while on the bridge or boardwalks.

ALTERNATIVE 3

Analysis

Alternative 3 includes minimal development of bridge and boardwalks, especially on the south bank. Both the

bridge and boardwalks would be about 10 ft above grade, and the bridge would be realigned and use a permanent, medium span design with six sets of pilings creating a longer, more noticeable profile against the landscape. This design would not blend as well into the low vegetation in the immediate river shoreline area as the current bridge, and foreground views would be impacted to a greater extent. The permanent nature of this structure would also extend visual impacts into the winter season. However, the removal of the trail through the Corner area would allow that area to be restored to natural and more visually appealing conditions.

In this alternative, the barge landing site would be moved from the largely open river mouth area slightly to the south to a wooded site and would use most of the current access road. This would increase the masking of the barge landing, mitigating its intrusion into the natural scenery. However, the continued use of the current access road along the shores of Brooks River and the development of a new hardened beach landing ramp and parking would cause visible signs of human activity and detract from the natural scenery.

The elevated bridge and boardwalks would be highly visible developments (both from land and from floatplanes), but while on those structures visitors would enjoy slightly improved visual resources due to the reclamation of the trail through the Corner.

Overall, alternative 3 would result in localized, moderate, long-term, adverse impact on the visual and scenic resources of the area.

Cumulative Impacts

Past, present and future actions affecting visual resources at Brooks Camp are outlined in alternative 1.

These actions would have localized, long-term, major, beneficial impacts on scenic resources of the river because all development except the necessary bridge access would be relocated away from the river. The actions in alternative 3 would result in localized, moderate, long-term, adverse impacts, making the cumulative impacts localized, minor, long term, and beneficial.

Conclusion

Alternative 3 would result in localized, moderate, long-term, adverse impact on the visual and scenic resources of the area.

ALTERNATIVE 4

Analysis

Alternative 4 proposes a high degree of new infrastructure with new elevated boardwalks extending well into the landscape on both the north and south sides of the bridge. Both the bridge and boardwalks would be about 10 ft above grade, blending less into the low vegetation in the immediate river shoreline area than the floating bridge and therefore impacting foreground views. The new bridge would use the current floating bridge alignment and consist of a permanent, wooden, short-span design with 14 sets of pilings giving the visual impression of a continuous boardwalk. This design would give the bridge a substantially more noticeable year-round profile against the landscape than the existing floating bridge.

The elevated bridge and boardwalk, on the other hand, would create longer visual profiles and the revegetation of the trail through the Corner would restore natural conditions in that area. In moving the barge landing site about 2,000 ft to the south, the access road along the south bank of the river would also be eliminated and reclaimed as part of the riparian

environment, which would be visible by visitors on the bridge and boardwalks.

The barge landing's new location would be more wooded and farther from the main visitor corridor, mitigating its intrusion into the natural scenery of the Brooks River / Brooks Camp area by removing it from public view. However, the development of a new and longer access road would create a new cut in the tree line and vegetation along with the development of a new hardened beach landing ramp and parking in the area of the new barge landing site.

The elevated bridge and boardwalks would be highly visible developments (both from land and from floatplanes), but while on those structures visitors would enjoy improved visual resources due to the reclamation of the trail through the Corner and access road to the former barge landing. Therefore, alternative 4 would result in localized, moderate, long-term, adverse impacts on the visual resources from the perspective of a visitor looking at the bridge or new barge landing site, but would result in localized, moderate, long-term, beneficial visual impacts for visitors while on the bridge or boardwalks.

Cumulative Impacts

Past, present and future actions affecting visual resources at Brooks Camp are outlined in alternative 1.

These actions would have localized, long-term, major, beneficial impacts on scenic resources of the river because all development except the necessary bridge access would be relocated away from the river. The actions in alternative 4 would result in localized, moderate, long-term adverse impacts on the visual resources from the perspective of a visitor looking at the bridge or new barge landing site, but would result in localized, moderate, long-term, beneficial visual impacts for visitors while on the bridge or boardwalks. Overall, impacts to the visual and scenic resources would be localized, moderate, long term, and beneficial. The contribution of actions in alternative 4 would be marginal compared to the cumulative impacts.

Conclusion

Alternative 4 would result in localized, moderate, long-term, adverse impacts on the visual resources from the perspective of a visitor looking at the bridge or new barge landing site, but would result in localized, moderate, long-term, beneficial visual impacts for visitors while on the bridge or boardwalks.

ALTERNATIVE 5

Analysis

Alternative 5 proposes a high degree of new infrastructure with new elevated boardwalks extending well into the landscape on the north side of the bridge. Both the bridge and boardwalks would be about 10 ft above grade, blending less into the low vegetation in the immediate river shoreline area than the floating bridge and therefore impacting foreground views. The new bridge would use the current floating bridge alignment and consist of a permanent, wooden, short-span design with 14 sets of pilings giving the visual impression of a continuous boardwalk. This design would give the bridge a substantially more noticeable year-round profile against the landscape than the existing floating bridge.

The elevated bridge and boardwalk, on the other hand, would create longer visual profiles and the revegetation of the trail through the Corner would restore natural conditions in that area. In moving the barge landing site about 2,000 ft to the south, the access road along the south bank of the river would also be eliminated and reclaimed as part of the riparian

environment, which would be visible by visitors on the bridge and boardwalks.

The barge landing's new location would be more wooded and farther from the main visitor corridor, mitigating its intrusion into the natural scenery of the Brooks River / Brooks Camp area by removing it from public view. However, the development of a new and longer access road would create a new cut in the tree line and vegetation along with the development of a new hardened beach landing ramp and parking in the area of the new barge landing site.

The elevated bridge and boardwalks would be highly visible developments (both from land and from floatplanes), but while on those structures visitors would enjoy improved visual resources due to the reclamation of the trail through the Corner and access road to the former barge landing. Therefore, alternative 5 would result in localized, moderate, long-term, adverse impacts on the visual resources from the perspective of a visitor looking at the bridge or new barge landing site, but would result in localized, moderate, long-term, beneficial visual impacts for visitors while on the bridge or boardwalks.

Cumulative Impacts

Past, present and future actions affecting visual resources at Brooks Camp are outlined in alternative 1.
These actions would have localized, long-term, major, beneficial impacts on scenic resources of the river because all development except the necessary bridge access would be relocated away from the river. The actions in alternative 5 would result in localized, moderate, long-term adverse impacts on the visual resources from the perspective of a visitor looking at the bridge or new barge landing site, but would result in localized, moderate, long-term, beneficial visual impacts for visitors while on the bridge or boardwalks. Overall, impacts to the visual and scenic resources would be localized, moderate, long term, and beneficial. The contribution of actions in alternative 5 would be marginal compared to the cumulative impacts.

Conclusion

Alternative 5 would result in localized, moderate, long-term, adverse impacts on the visual resources from the perspective of a visitor looking at the bridge or new barge landing site, but would result in localized, moderate, long-term, beneficial visual impacts for visitors while on the bridge or boardwalks.

SOCIOECONOMIC ENVIRONMENT

ALTERNATIVE 1

Analysis

Under alternative 1 spending, labor, and tax receipts to harden the barge landing site would minimally benefit the economy for a very short period of time. Most of the labor force working on this project would probably come from outside the local area, so only minimal spending would occur in the local area. Materials and supplies may need to be barged in, which would benefit shipping businesses and port laborers. Although the local economy would benefit, it would be barely detectable given the short time period and expected cost.

The provision of commercial services at Brooks Camp would continue to contribute to the economy by employing a seasonal work force and through spending related to transporting equipment, materials, and supplies. The continued provision of services by CUA holders would continue to benefit individual businesses and in turn benefit the economy by providing jobs, local spending, and tax receipts. Visitor spending and associated tax receipts would remain within the historical range and continue to benefit the economy, but remain subject to broader economic variables and conditions, including tourism demand for trips to and within Alaska. Benefits tied to visitor spending would continue to accrue almost exclusively during the summer season. Job creation would remain within the historical range.

All of the effects described would continue under alternative 1. Overall, economic activity would continue to be primarily tied to federal and visitor spending, as well as the provision of commercial and guide services in the park. Actions in alternative 1 would have long-term, minor, beneficial impacts to the regional economy. No change in the social character of the area would be expected.

Cumulative Impacts

Many past actions have had beneficial effects on the local and regional economy. The most economically beneficial past actions would be the creation of Brooks Camp and visitor and operational facilities. The construction of Brooks Camp itself required large purchases of materials and supplies and provided business revenue and employment. The availability of overnight accommodations and visitor services made it possible for tourists to experience the park in a developed setting, which increased visitation from levels when park visitors could only visit as part of day trips or primitive overnight trips. An increase in the number of people visiting the park resulted in an increased demand for visitor services and amenities, which resulted in new business and job creation and associated tax revenue locally and regionally. Once constructed, the facilities and infrastructure developments had to be maintained, which also benefited the economy over time. Economic activity tied directly or indirectly to park visitation and spending has benefited the local and regional economy since Brooks Camp was constructed.

Spending on materials, supplies, and labor to finish current improvements to Brooks Camp would benefit individual businesses and construction crews. Although some local construction labor might be used, most labor would come from outside the local area. Thus, most economic benefits associated with finishing improvements at Brooks Camp would be at the regional level. The benefits would only be a small contributor to the regional economy.

The eventual relocation of Brooks Camp to the south side of the river is a reasonably foreseeable future action that would benefit the economy. The economic benefit would be primarily felt during construction as a result of spending and tax receipts. The transportation of materials, supplies, and laborers would increase revenue to barge and floatplane businesses and operators and increase tax receipts, which would benefit the economy. However, because the labor force working on relocation would likely come from outside of the local area, the economic benefits from business purchases, personal employee spending, and associated tax receipts would benefit economies outside of the local area. For example, the purchase of supplies and labor for such projects are typically made in Anchorage and sometimes in the lower 48 states, which would increase business sales and tax revenue outside of the local area.

Collectively, the other past, present, and reasonably foreseeable future projects and actions would have long-term, moderate, beneficial impacts to the regional economy. When the likely effects of actions in Alternative 1 are added to the effects of other past, present, and reasonably foreseeable future actions, there would be a long-term, moderate, beneficial cumulative impact to the regional economy. Alternative 1 would contribute a very small increment to this cumulative impact.

Conclusion

Alternative 1 would have minor, long-term beneficial effects to the regional economy. These effects would be primarily tied to federal and visitor spending, as well as the provision of commercial and guide services in the park.

ALTERNATIVE 2

Analysis

Under alternative 2 spending and employment related to construction of the bridge, boardwalk, viewing platforms, vehicle ramps, and power connection and septic pump-out would provide some short-term benefits to the local economy.

Benefits would primarily accrue during construction, which would likely start in August of year one and be completed by June of year three; most construction activity would occur in winter and spring. The extent of the construction spending benefit would largely depend on where the labor force resides and where the materials and supplies are purchased. Based on past construction jobs in the park, most if not all of the approximately 12 person construction crew working on this project would be housed at Brooks Camp during staging and construction. The labor force would have minimal time to spend money locally, so this type of spending would likely be beneficial, but very small. Additional economic benefit would accrue locally as some food and personal supplies for the construction crew would be purchased locally and flown in. The contractor and subcontractors would benefit in the form of business revenue and continued employment. Few, if any new jobs would accrue to the local or regional economy. The resulting tax revenue would be generated outside of the local area.

Construction would require large material and supply purchases in the short term and smaller purchases to maintain the new infrastructure over the long term. Construction material and supply purchases would primarily be made in the region or outside of Alaska, benefitting nonlocal businesses and tax revenue. Transporting materials, supplies, and the construction crews to the site would benefit individual businesses, including barging businesses and fuel suppliers.

Barge shipment to Naknek would provide work to local port laborers and fuel suppliers, which would have a very small beneficial impact locally. Local and regional floatplane and barging businesses could be employed for temporary transport assignments to Brooks Camp at various stages of construction, which would benefit their revenues and benefit the local and regional economy in the form of tax revenue and indirect spending.

The development of a new barge landing/access road and removal of the old access road on the south side of the river would provide some economic benefit to the local economy before the construction of the bridge/boardwalk. This work would occur during one visitor season and would provide a small economic benefit locally because the labor force, as well as supplies and most materials would come from the larger regional market.

The area that includes King Salmon, Naknek, and South Naknek is a very small business market and is very isolated. As a result, the impact of spending in the local economy is not as great as it would be in larger business markets given that the business revenue and personal income associated with construction activity is for the most part likely to be transferred to business owners and laborers outside of the area. So although construction of the bridge/boardwalk and barge landing / access road would benefit the local economy, the effect is not as great as it would be in a larger market, such as Anchorage or Fairbanks. Alternative 2 would likely have the largest economic impact of all the alternatives due to the highest construction cost estimate; yet, the economic benefits of all construction under alternative 2 would still only constitute a very small amount of the overall regional economy; benefits accruing to the economy outside of Alaska would be essentially undetectable outside of the economic output of specific industries.

The provision of commercial services would continue during and after construction. No change in tourism and related tax receipts would be expected during the short term because staging, phasing, and timing of construction would ensure that the area remains easily accessible. In the long term, overnight visitation would not change because the number of rooms at the lodge and campground spaces would not change. Day trips, however, could possibly increase in the long term because some commercial services operators may choose to bring clients to Brooks Camp because of reduced delays in river crossings and the ability to get people onboard floatplanes in a timely manner. This would likely result in some additional concession sales at the Brooks Camp lodge and gift shop and additional business revenue and taxes generated from contracts and commercial use authorizations over the long term. Overall, commercial service operator revenue would likely remain unchanged during construction, but increase slightly over the long term.

All of the above effects would continue under alternative 2. Overall, the benefits of economic activity would be tied to construction of the bridge/boardwalk, barge landing/access road, and some additional commercial activity. No adverse impacts are expected. Overall, actions in alternative 2 would have minor, beneficial impacts to regional economic activity during the short and long term. No change in the social character of the area would be expected.

Cumulative Impacts

Past, present, and reasonably foreseeable projects and actions that would have an effect on economic activity in or near the park are described and summarized in the socioeconomic environment section of alternative 1.

Collectively, the other past, present, and reasonably foreseeable future projects and actions would have long-term, moderate, beneficial impacts to the regional economy. When the likely effects of actions in Alternative 2 are added to the effects of other past, present, and reasonably foreseeable future actions, there would be a long-term, moderate, beneficial cumulative impact to the regional economy. Alternative 2 would contribute a very small increment to this cumulative impact.

Conclusion

Alternative 2 would result in short and long-term, minor, beneficial impacts on the regional economy. These effects would primarily result from construction of the bridge/boardwalk, barge landing/access road, and some additional commercial activity.

ALTERNATIVE 3

Analysis

The impacts associated with alternative 3 are largely the same as the other action alternatives. Based on experience, the construction contractor would come from outside the local area. Thus, economic activity tied to employment, business, and employee expenditures, and associated tax receipts would benefit other areas in the region and to a very small degree, some businesses in the lower 48 states. Benefits from proposed barge landing site modifications would be slightly greater than those in alternative 1. The economic benefits from construction would likely be the smallest of all the action alternatives because this alternative has the lowest construction cost estimate. The effects of the continued provision of commercial services would be the same as those in alternative 2.

Overall, the benefits of economic activity would be tied to construction of the bridge/boardwalk, barge landing/access road, and some additional commercial activity. No adverse impacts are expected. Overall, actions in alternative 3 would have minor, beneficial impacts to regional economic activity during the short and long term. No change in the social character of the area would be expected.

Cumulative Impacts

Past, present, and reasonably foreseeable projects and actions that would have an effect on economic activity in or near the park are described and summarized in the socioeconomic environment section of alternative 1.

Collectively, the other past, present, and reasonably foreseeable future projects and actions would have long-term, moderate, beneficial impacts to the regional economy. When the likely effects of actions in Alternative 3 are added to the effects of other past, present, and reasonably foreseeable future actions, there would be a long-term, moderate, beneficial cumulative impact to the regional economy. Alternative 3 would contribute a very small increment to this cumulative impact.

Conclusion

Alternative 3 would result in short and long-term, minor, beneficial impacts on the regional economy. These effects would primarily result from construction of the bridge/boardwalk, barge landing/access road, and some additional commercial activity.

ALTERNATIVE 4

Analysis

The impacts associated with alternative 4 are largely the same as the other action alternatives. Based on experience, the construction contractor would come from outside the local area. Thus, economic activity tied to employment, business, and employee expenditures, and associated tax receipts would benefit other areas in the region and to a very small degree, some businesses in the lower 48 states. The economic benefits from construction would likely be slightly lower than those in alternative 2 based on construction cost estimates. The effects of the continued provision of commercial services would be the same as those in alternative 2.

Overall, the benefits of economic activity would be tied to construction of the bridge/boardwalk, barge landing/access road, and some additional commercial activity. No adverse impacts are expected. Overall, actions in alternative 4 would have minor, beneficial impacts to regional economic activity during the short and long term. No change in the social character of the area would be expected.

Cumulative Impacts

Past, present, and reasonably foreseeable projects and actions that would have an effect on economic activity in or near the park are described and summarized in the socioeconomic environment section of alternative 1.

Collectively, the other past, present, and reasonably foreseeable future projects and actions would have long-term, moderate, beneficial impacts to the regional economy. When the likely effects of actions in Alternative 4 are added to the effects of other past, present, and reasonably foreseeable future actions, there would be a long-term, moderate, beneficial cumulative impact to the regional economy. Alternative 4 would contribute a very small increment to this cumulative impact.

Conclusion

Alternative 4 would result in short and long-term, minor, beneficial impacts on the regional economy. These effects would primarily result from construction of the bridge/boardwalk, barge landing/access road, and some additional commercial activity.

ALTERNATIVE 5

Analysis

The impacts associated with alternative 5 are largely the same as the other action alternatives. Based on experience, the construction contractor would likely come from outside the local area. Thus, economic activity tied to employment, business, and employee expenditures, and associated tax receipts would benefit other areas in the region and to a very small degree, some businesses in the lower 48 states. The effects of the continued provision of commercial services would be the same as those in alternative 2.

Overall, the benefits of economic activity would be tied to construction of the bridge/boardwalk, barge landing/access road, and some additional commercial activity. No adverse impacts are expected. Overall, actions in alternative 5 would have minor, beneficial impacts to regional economic activity during the short and long term. No change in the social character of the area would be expected.

Cumulative Impacts

Past, present, and reasonably foreseeable projects and actions that would have an effect on economic activity in or near the park are described and summarized in the

socioeconomic environment section of alternative 1.

Collectively, the other past, present, and reasonably foreseeable future projects and actions would have long-term, moderate, beneficial impacts to the regional economy. When the likely effects of actions in Alternative 5 are added to the effects of other past, present, and reasonably foreseeable future actions, there would be a long-term, moderate, beneficial cumulative impact to the regional economy. Alternative 5 would contribute a very small increment to this cumulative impact.

Conclusion

Alternative 5 would result in short and long-term, minor, beneficial impacts on the regional economy. These effects would primarily result from construction of the bridge/boardwalk, barge landing/access road, and some additional commercial activity.

OTHER REQUIRED IMPACT ANALYSIS

UNAVOIDABLE ADVERSE IMPACTS

Unavoidable adverse impacts are defined as impacts that cannot be fully mitigated or avoided. All of the alternatives in this document would have unavoidable adverse impacts. In alternative 1, the no-action alternative, without a new elevated bridge and boardwalk there would continue to be ground level interactions between people and brown bears in high use areas, such as the mouth of the river and the Corner area, with continuing unsafe interactions and continual habituation of bears to humans. The floating bridge would continue to be an obstacle to fish migrations, and the annual installation and removal of the bridge would regularly disturb the riverbed. The floating bridge would also continue to alter river flow hydraulics and geomorphology (because of blocking upper levels of the water column), as well as contribute to bank erosion in areas near the bridge anchor points. Human activity in the Brooks Camp area would continue to have the potential to disturb nesting bald eagles. Some trampling of vegetation would continue from people in the Corner area on the north side of the river and between the floating bridge and the bus parking area on the south side of the river. Finally, the continuation of the floating bridge would have unavoidable adverse impacts on visitors, with visitors being subject to inconveniences when the bridge is closed.

In all of the action alternatives there would be unavoidable adverse impacts both from the construction of the bridge/boardwalk, barge landing site, and access road, and from the operation of these facilities, although the extent of the adverse impacts would differ. Even with the application of mitigation measures, the construction of the facilities would adversely affect the project area's natural resources. Some bear behavior probably would be altered during construction. After construction is completed, the presence and sounds of people and vehicles on the bridge and boardwalks could alter the behavior of some bears in the area. The close proximity of bears to people (primarily vertical separation) also could contribute to the habituation of bears to people, which in turn could result in unsafe conditions for both bears and people at ground level within the Brooks River area and beyond. The development of the new barge landing access road in alternatives 2, 4 and 5 would increase noise and human disturbance in a part of the park that has been relatively free of disturbance, which could also affect the behavior of some bears.

The construction and use of the new access road and barge landing area in alternatives 2, 4, and 5 could adversely affect bald eagles nesting and use of Beaver Pond, possibly deterring use of this area for nesting.

The bridge in all of the alternatives would likely have in varying degrees an unavoidable adverse impact on river hydrology, the floodplain, and salmon and other fish. The adverse impacts would result from the addition of pile systems in the river, which would act as permanent flow obstructions to the channel. Alternatives 4 and 5 would have the highest potential for adverse impacts because of the number of piles. The support piles and river debris that catches on the piles could partially obstruct fish passage and alter flow hydraulics, although none of the alternatives would block most fish from migrating and spawning.

The construction of the boardwalks, access road, and barge landing site in the action alternatives would result in the loss and alteration of vegetation and disturbance to wetlands along the proposed alignments.

Unavoidable adverse impacts would occur to the soundscape in the Brooks Camp area. Most of these impacts would be from construction activities, but there also would be increased noise impacts from subsequent use of the elevated bridge and boardwalks. Human and motorized vehicle noise from the elevated bridge and boardwalks also would carry farther. In alternatives 2, 4, and 5 there would be increased noise along the new access road and barge landing site in an area that in the past was relatively quiet.

The four action alternatives also could have unavoidable adverse impacts on cultural resources in the project area even with mitigation measures. Ground disturbance and construction of the pilings for the boardwalks could adversely affect archeological resources along the alignment, particularly where the pilings penetrate the ash layer in the soil. Likewise, construction of the new access road in alternatives 2, 4, and 5 could also adversely affect archeological resources. The construction of the new bridge and boardwalks also would have adverse effects on the cultural landscape that contributes to the significance of the Brooks Camp historic district, although the overall integrity of the cultural landscape would not be diminished to the point that its National Register eligibility would be jeopardized. Likewise, the ground-disturbing activities and the presence of an elevated bridge in the four alternatives could adversely affect ethnographic resources and the Brooks River ethnographic landscape.

The construction of the bridge and boardwalks in the four action alternatives would have an unavoidable adverse effect on the visual resources/scenery of the area. The new infrastructure would be easily visible in the natural viewshed. The permanent elevated bridge would extend visual impacts to be year-round instead of only in the summer-fall months.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

This question focuses on long-term, permanent effects on park resources. The bridge, boardwalks, access road, and utility connections all are seen as "permanent" facilities because they would remain for at least the next 20 years. As identified in the analysis of the action alternatives, all of the alternatives would have long-term effects on the area's natural, cultural, and visual resources. For the lifetime of the bridge there would be irreversible impacts to natural and visual resources, and the cultural landscape. Although impacts to archeological and ethnographic resources would not be expected with careful siting of the facilities and mitigation, there still could be irreversible impacts to these resources. The use of gravel in construction of the access roads in the action alternatives also would be an irreversible/irretrievable commitment of resources.

THE RELATIONSHIP BETWEEN SHORT-TERM USES OF THE ENVIRONMENT AND LONG-TERM PRODUCTIVITY

This question explores long-term effects of an alternative and whether the productivity of park resources is being traded for the immediate use of land. In all of the alternatives, the National Park Service would continue to manage the Brooks Camp area to maintain ecological processes and native biological communities and to provide appropriate recreational opportunities consistent with preservation of cultural and natural resources. Most of the project area would continue to be protected in its current state and would maintain its long-term productivity. The primary short-term uses of the Brooks Camp area would continue to be recreational use. Under the four action alternatives, there would be

expanded development to support recreational use and park operations, resulting in some localized loss of ecological productivity. Adverse impacts on the area's vegetation from construction of the bridge, boardwalks, access road, and barge landing site would reduce the productivity of natural resources in localized areas over time, although overall no measurable effect on the area's long-term productivity would be expected. On the other hand, efforts to restore native vegetation, such as the removal and revegetation of the barge landing access road and the existing trail from the camp to the north side of the river in alternatives 2, 4, and 5 would increase long-term productivity of the environment in localized areas.

CONSISTENCY OF THE ALTERNATIVES WITH THE PURPOSES OF THE NATIONAL ENVIRONMENTAL POLICY ACT

The National Environmental Policy Act in section 101(b) provides policy goals to improve and coordinate federal plans, functions, programs, and resources to the end that the nation may

- fulfill the responsibilities of each generation as trustee of the environment for succeeding generations
- assure for all Americans 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
- enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources.

The Council on Environmental Quality has promulgated regulations for federal agency implementation of the National Environmental Policy Act. Section 1500.2 states that federal agencies shall, to the fullest extent possible, interpret and administer the policies, regulations, and public laws of the United States in accordance with the policies set forth in the act (sections 101[b] and 102[1]); therefore, other acts and NPS policies are referenced, as appropriate, in the following discussion.

All alternatives considered in this draft environmental impact statement, including the no-action alternative, comply with NPS laws and policies (e.g., NPS Organic Act, NPS *Management Policies 2006*).

Management of park resources under the provisions of the NPS Organic Act and NPS policies would assure safe, healthful, and pleasing surroundings. Safety of visitors and staff would continue to be a high priority under all alternatives. The elevated bridge and boardwalk systems and elimination of barge landing operations at the river's mouth under each action alternative would reduce the risk of human-bear conflicts in areas where brown bears concentrate.

The action alternatives support diversity and variety of individual choice and opportunities to experience the Brooks River area of Katmai National Park and Preserve. The alternatives would improve the visitor experience when compared to the no-action alternative through improved access across Brooks River and elimination of barge landing operations at the mouth of the river that can detract from the visitor experience.

All alternatives meet the obligations of the National Park Service to protect the historic, cultural, and natural aspects of the Brooks River area. Each alternative meets this goal, although alternatives 2, 4, and 5 would enhance the natural environment through elimination of existing resources conflicts at the mouth of Brooks River.