

National Park Service
U.S. Department of the Interior

Glacier National Park
Montana



Quartz Creek Fish Barrier Modification and Improvement Environmental Assessment and Statement of Findings- Floodplains

February, 2012



Existing Quartz Creek fish barrier, constructed in 2004. – NPS photo.

Quartz Creek Fish Barrier Modification and Improvement Environmental Assessment

Glacier National Park, Montana

Summary

Native fish populations in Glacier National Park have been severely compromised by the invasion and expansion of non-native fish species into the park's lakes and streams. Non-native fish can affect native fish populations through predation, hybridization, and competition and are imperiling populations of bull trout (*Salvelinus confluentus*), which are federally listed as threatened, and the native westslope cutthroat trout (*Oncorhynchus clarkii lewisi*), a state listed Species of Concern. Of the seventeen lakes on the west side of the park that support bull trout, nine have been compromised by non-native lake trout (*Salvelinus namaycush*) and a tenth has been compromised by the non-native brook trout (*Salvelinus fontinalis*).

Quartz Lake, located in the North Fork of the Flathead River drainage and the park's North Fork District, is one of the last remaining strongholds for bull trout in park waters west of the Continental Divide. Until recently, Quartz Lake was believed to be the largest lake on the west side of the park accessible to lake trout but not yet colonized by them. In 2005, lake trout were detected in Quartz Lake, threatening the long-term persistence of the Quartz Lake bull trout population. At that time, a fish passage barrier designed to protect the drainage from invasion by non-native fish was under construction on Quartz Creek, approximately 100 yards below Middle Quartz Lake, but completion of the barrier was suspended until options to control lake trout could be reviewed. The National Park Service (NPS) has since collaborated with the U.S. Geological Survey (USGS) and others in an ongoing experimental program to remove lake trout from Quartz Lake to suppress the population. Experimental suppression has so far been promising, with identification of lake trout spawning areas and annual removal of spawning lake trout. Data suggests that the project is successfully removing a high percentage of spawning adults annually, which is expected to eventually reduce the lake trout population over time.

The NPS is proposing to complete, modify, and improve the existing Quartz Creek fish barrier. The purpose of the project is to support lake trout suppression efforts in Quartz Lake, reduce the potential for additional lake trout to enter the lake, and reduce the likelihood of invasion from other non-native species such as rainbow trout and brook trout, thereby better protecting the integrity of native fish populations in the upper Quartz drainage.

This environmental assessment has been prepared in compliance with the National Environmental Policy Act (NEPA) to provide the decision-making framework that 1) analyzes a reasonable range of alternatives to meet the objectives of the proposal, 2) evaluates potential issues and impacts to Glacier National Park's resources, and 3) identifies mitigation measures to lessen the degree or extent of these impacts. Resource topics analyzed include fisheries/aquatic threatened species and species of concern, floodplains, recommended wilderness, and natural soundscapes. All other resource topics were dismissed because the project would result in negligible or minor effects to those resources or because the resource is not found in the analysis area, the issue is not applicable to the proposal, and the resource would not be affected by the project. No major effects are anticipated as a result of this project. Under Section 7 of the Endangered Species Act, the determination of effect for bull trout and grizzly bears would be "may affect, but not likely to adversely affect". Public scoping was conducted in accordance with the National Environmental Policy Act (NEPA), and the majority of the comments received were in support of the proposed project.

How to Comment

Comments on this environmental assessment can be provided directly through the park's planning website at **[http://parkplanning.nps.gov/QuartzFish Barrier](http://parkplanning.nps.gov/QuartzFishBarrier)**. Or write to: Superintendent, Glacier National Park, Attention: *Quartz Fish Barrier EA*, PO Box 128, West Glacier, Montana 59936. This environmental assessment will be on public review for 30 days. Before including your address, phone number, email address, or other personal identifying information in your comment, you should be aware that your entire comment – including your personal identifying information – may be made publicly available at any time. Although you can ask us in your comment to withhold your personal identifying information from public review, we cannot guarantee that we will be able to do so.

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Purpose and Need

The purpose of Glacier National Park is to:

- preserve and protect natural and cultural resources unimpaired for future generations (1916 Organic Act);
- provide opportunities to experience, understand, appreciate, and enjoy Glacier National Park consistent with the preservation of resources in a state of nature (1910 legislation establishing Glacier National Park); and
- celebrate the on-going peace, friendship, and goodwill among nations, recognizing the need for cooperation in a world of shared resources (1932 International Peace Park legislation).

The significance of Glacier National Park is explained relative to its natural and cultural heritage:

- Glacier's scenery dramatically illustrates an exceptionally long geological history and the many geological processes associated with mountain building and glaciation;
- Glacier offers relatively accessible, spectacular scenery and an increasingly rare primitive wilderness experience;
- Glacier is at the core of the "Crown of the Continent" ecosystem, one of the most ecologically intact areas remaining in the temperate regions of the world;
- Glacier's cultural resources chronicle the history of human activities (prehistoric people, Native Americans, early explorers, railroad development, and modern use and visitation) and show that people have long placed high value on the area's natural features; and
- Waterton-Glacier is the world's first international peace park.

Introduction

Glacier National Park is located in northwestern Montana along the Canadian border. The park is in the Northern Rockies, and straddles the rugged mountains of the Continental Divide. Together with Canada's Waterton Lakes National Park, it forms Waterton-Glacier International Peace Park, the world's first international peace park. The parks are listed together as a World Heritage Site and separately as International Biosphere Reserves. Outstanding natural and cultural resources are found in both parks.

Glacier National Park's primary mission is the preservation of natural and cultural resources, ensuring that current and future generations have the opportunity to experience, enjoy, and understand the legacy of Waterton-Glacier International Peace Park.

Native fish populations in Glacier National Park have been severely compromised by the introduction, invasion, and expansion of non-native fish species into the park's lakes and streams. In 2005, non-native lake trout (*Salvelinus namaycush*) were detected in Quartz Lake, located in the park's North Fork district. At that time, a fish passage barrier designed to protect the drainage from invasion by lake trout was under construction on Quartz Creek, but completion of the barrier was suspended until options to control lake trout, including an experimental lake trout population suppression program, could be reviewed. An environmental assessment (EA) for the fish barrier was prepared in 2004, and the Finding of No Significant Impact (FONSI) was signed on September 14, 2004.

The proposed action would modify and improve the existing fish barrier on Quartz Creek to support lake trout suppression efforts at Quartz Lake and reduce the potential for additional lake trout and other non-native fish to access the drainage. The modifications, improvements, and methods for this work were not analyzed under the original EA for the fish barrier, thus a new EA is required.

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

Background

Non-native lake trout began to appear in waters west of the Continental Divide in Glacier National Park in the late 1950s and early 1960s via the Flathead River system that forms the park's western and southern boundary. Other recent invaders into the park's western waters are rainbow trout (*Oncorhynchus mykiss*) and brook trout (*Salvelinus fontinalis*). Of the seventeen lakes on the west side of the park that support bull trout, nine have been compromised by lake trout and a tenth has been compromised by the non-native brook trout.

Non-native fish can affect native fish populations through predation, hybridization, and competition and are imperiling populations of bull trout (*Salvelinus confluentus*), which are federally listed as threatened, and the native westslope cutthroat trout (*Oncorhynchus clarkia lewisi*), a state listed Species of Concern. Lake trout are known to cause major adverse impacts to native fish populations, as has been documented in Kintla, Bowman, and Logging lakes in the North Fork of the Flathead River drainage, Lake McDonald, and numerous other lakes where lake trout have become established. Data show that lake trout are increasing in abundance and bull trout are in decline, and lake trout have largely replaced bull trout as the top level aquatic predator in lakes that have been monitored over time (Downs et al. 2011). Bull trout populations in some lakes appear to be at imminent risk of functional extinction, which means their populations would no longer be self-sustaining and would not play a significant role in the ecosystem. Fredenberg (2003) concludes that in lakes of the Rocky Mountains, conversion of unique bull trout ecosystems to lake-trout dominated systems appears to be a common result once lake trout are established. Further, he contends that this transition may be rapid (20-30 years) even when habitat conditions remain relatively unaltered from the natural state. The colonization of several of the park's lakes by lake trout and the subsequent decline of bull trout in the park make protecting remaining bull trout populations a high priority.

Furthermore, Glacier National Park is at high risk of critical habitat alteration from climate change induced glacier and snow loss. Changes in stream flow, warmer water, and the increasing frequency and intensity of other disturbances such as rain-on-snow events in the fall and winter, altered precipitation patterns, and wildfire are the most significant factors associated with climate warming likely to impact native trout populations in the western United States (Williams et al. 2009). These alterations to the park's ecological systems will compound existing stressors (e.g., invasive species) on already depressed bull trout populations. Bull trout require among the lowest water temperatures for optimal growth of any North American trout or salmon species (Selong et al. 2001), and many of the bull trout populations in the park are located in drainages where late season stream flow and cold water temperatures are supported by melting snowfields and glaciers. Changes in habitat conditions such as alterations of water temperature and flow patterns are expected to adversely impact bull trout populations and ultimately favor non-native species, such as lake trout and brook trout.

Quartz Lake, located in the North Fork of the Flathead River drainage, is a stronghold for native fish, including bull trout. From 1999 to 2001, the U.S. Fish and Wildlife Service's (USFWS) Creston Fish and Wildlife Center in Kalispell, Montana, completed a study entitled "Glacier National Park, Flathead Drainage Lake Survey, and Fish Passage Evaluation". Their report stated the following: "Clearly, the Quartz Lake chain is one of the remaining strongholds for bull trout in the Flathead drainage on the west side of Glacier National Park. It should be protected from lake trout or other non-native species introductions at all costs" (USFWS 2001).

Until recently, Quartz Lake was believed to be the largest lake on the west side of the park accessible to lake trout but not yet colonized by them. In 2004, the park prepared an EA and issued a FONSI for construction of a fish passage barrier on Quartz Creek. With assistance from the U.S. Fish and Wildlife Service, Glacier National Park began construction of the barrier on Quartz Creek between Middle and Lower Quartz Lakes to protect the area from invasion by

lake trout. But in 2005, before final construction of the barrier was complete, lake trout were detected in Quartz Lake and further work on the barrier was suspended until options to control lake trout could be reviewed. Since that time, the NPS has collaborated with the U.S. Geological Survey (USGS) and others in an ongoing experimental program to remove lake trout from Quartz Lake and suppress the population. Experimental suppression has so far been promising, with identification of lake trout spawning areas and annual removal of spawning lake trout. Overall, 91 percent of radio-tagged adult lake trout were removed from Quartz Lake during gill netting operations in 2009, and 44 percent were removed in 2010 (Muhlfeld and Fredenberg 2009 and D'Angelo et al. 2010). In 2011, five of six radio-tagged lake trout were caught and removed (V. D'Angelo, personal communication). This data suggests that the project is successfully removing a high percentage of spawning adults, which is expected to eventually reduce the lake trout population over time.

In addition to the threats they pose to bull trout, lake trout threaten other native fish in the Quartz Lake system, including the westslope cutthroat trout. While it is too late to keep lake trout out of Quartz Lake altogether, preventing additional lake trout from entering the lake and supporting the existing population remains a worthwhile endeavor. This is particularly the case given the success the NPS and its partners have had with the experimental lake trout suppression project in Quartz Lake. The NPS is therefore proposing to modify and improve the existing Quartz Creek fish barrier to support suppression efforts in Quartz Lake, reduce the potential for additional lake trout to enter the lake, and reduce the likelihood of invasion from other non-native species such as rainbow and brook trout.

Purpose and Need

Ten lakes on the west side of Glacier National Park have been compromised by non-native fish species, and populations of the federally threatened bull trout and other native fish are at risk. Quartz Lake is one of the last remaining strongholds for bull trout in park waters west of the divide. But non-native lake trout have invaded the lake, and the long-term persistence of the Quartz Lake bull trout fishery is threatened. The purpose of this project is to improve and modify the Quartz Creek fish passage barrier to better protect native fish populations in the upper Quartz drainage from invasion by non-native fish species. The following objectives would be met by this project:

- Protect the integrity of native fish populations in the upper Quartz drainage.
- Support lake trout suppression efforts on Quartz Lake by reducing the potential for additional lake trout to enter the lake.
- Reduce the potential for other non-native fish, including brook and rainbow trout, to access the upper Quartz drainage.

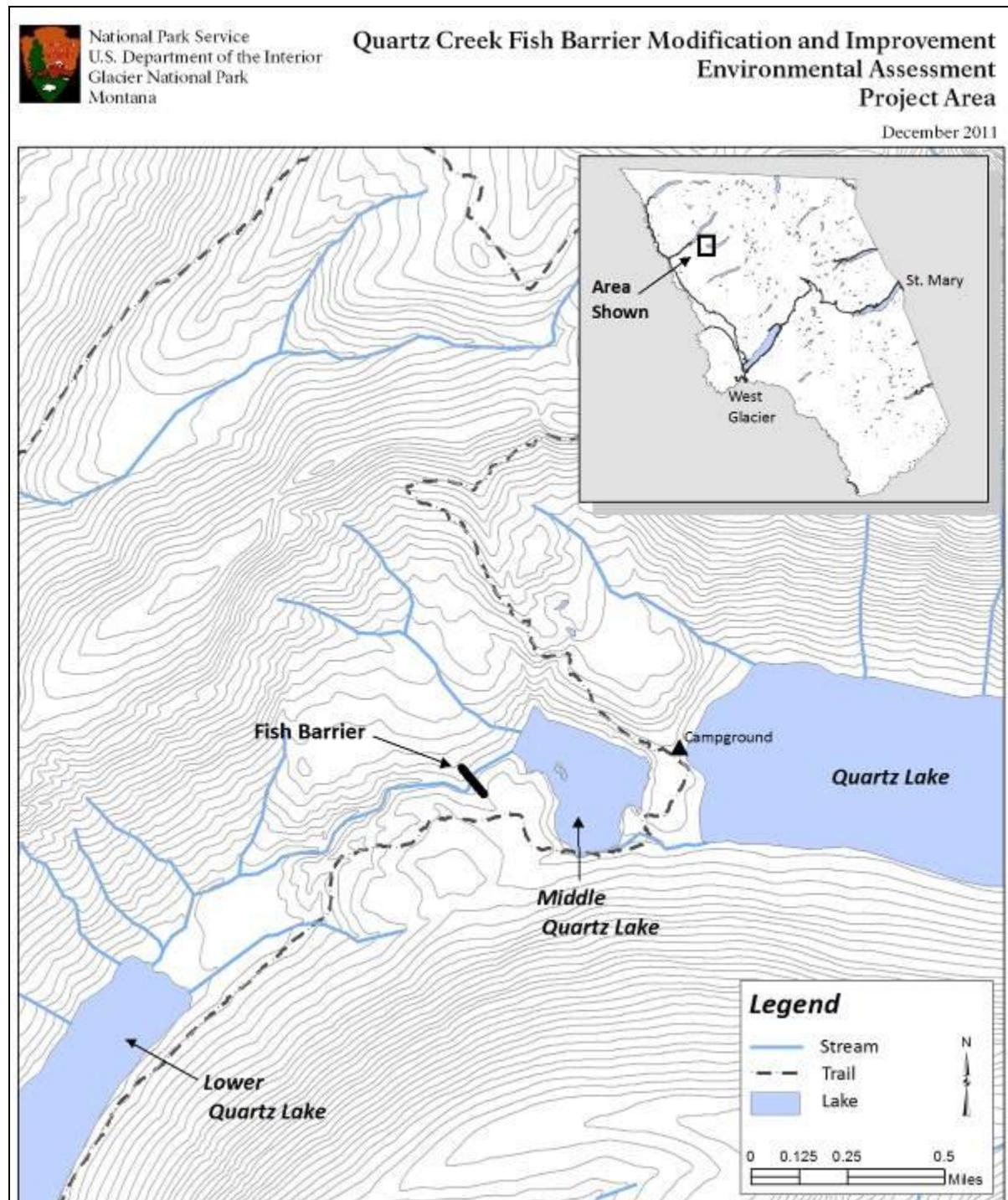


Figure 1: Quartz Creek fish barrier project area.

Relationship to Other Plans and Policies

Current plans and policies that pertain to this proposal include the 2006 NPS *Management Policies*, Glacier National Park's *Resources Management Plan* (NPS 1993), the park's *General Management Plan* (GMP) (NPS 1999), the park's *Bear Management Plan* (NPS 2010), the *Quartz Creek Fish Barrier Environmental Assessment* (NPS 2004) and *Finding of No Significant Impact* (NPS 2004), and the *Large-Scale Removal of Lake Trout in Quartz Lake Environmental Assessment* (NPS 2009). Following is more information on how this proposal meets the goals and objectives of these plans and policies:

- The proposal is consistent with the goals and objectives of the 2006 *NPS Management Policies* which hold the NPS responsible for maintaining all animals native to the natural ecosystems of parks, including fish, and for the reestablishment of “natural functions and processes”, including the control of exotic species. Section 4.4.2.3 of the *Management Policies* direct the NPS to meet its responsibilities under the Endangered Species Act, and includes the control of “detrimental nonnative species”.
- In keeping with Glacier National Park's 1993 *Resources Management Plan*, which gives the management and research of bull trout high priority, the completed fish barrier would protect one of the last remaining strongholds for bull trout in the park.
- The proposal would protect and maintain the integrity of native fish populations in the upper Quartz drainage and would therefore be compliant with the park's 1999 *General Management Plan*, which states that “management of natural resources in the backcountry zone would focus on protection and (when necessary) restoration of resources and natural processes”.
- The implementation plan for the proposed project contains mitigation measures to minimize temporary impacts to bears, including strict storage requirements for food and other attractants, and would not permanently affect bears or bear habitat. The project is consistent with the objectives of the park's 2010 *Bear Management Plan*, which provides guidelines for the management of bears in the park.
- The proposed action is consistent with the 2004 *Quartz Creek Fish Barrier Environmental Assessment* in that both projects call for the protection of native fish populations and the control non-native invasive fish.
- A completed, improved fish passage barrier is in keeping with the objectives of the 2009 *Large-Scale Removal of Lake Trout in Quartz Lake Environmental Assessment*, which was also designed to protect native fish and control non-native invasive fish species.

Identification of Impact Topics

The NPS takes a “hard look” at all potential impacts by considering the direct, indirect, and cumulative effects of the proposed action on the environment, along with connected and cumulative actions. In the environmental consequences section of this EA, impacts are described in terms of context and duration. The context or extent of the impact is described as localized or widespread. The duration of impacts is described as short-term, ranging from days to up to five years in duration, or long-term, extending beyond five years or longer. The intensity and type of impact is described as negligible, minor, moderate or major, and as beneficial or adverse. The NPS equates “major” effects as “significant” effects. The identification of “major” effects would trigger the need for an environmental impact statement (EIS). Where the intensity of an impact could be described quantitatively, numerical data is presented; however, most impact analyses are qualitative and use best professional judgment in making the assessment.

The NPS defines “measurable” impacts as moderate or greater effects. It equates “no measurable effects” as minor or less effects. “No measurable effect” is used by the NPS in determining if a categorical exclusion applies or if impact topics may be dismissed from further evaluation in an EA or EIS. The use of “no measurable effects” in this EA pertains to whether the NPS dismisses an impact topic from further detailed evaluation in the EA. The reason the NPS uses “no measurable effects” to determine whether impact topics are dismissed from further evaluation is to concentrate on the issues that are truly significant to the action in question, rather than amassing needless detail in accordance with CEQ regulations at 1500.1(b).

Impact Topics Retained for Further Analysis

Impact topics for this project were identified on the basis of federal laws, regulations, and orders; 2006 NPS *Management Policies*; and NPS knowledge of resources at Glacier National Park. Impact topics that are carried forward for further analysis in this EA include:

- **Fisheries/Aquatic Threatened, Endangered, and Candidate Species and Species of Concern**
 - **Bull Trout** (*Salvelinus confluentus*). Federally listed as threatened and state listed as a Species of Concern
 - **Westslope Cutthroat Trout** (*Oncorhynchus clarkii lewisi*). State listed Species of Concern
- **Floodplains**
- **Recommended Wilderness**
- **Natural Soundscapes**

Impact Topics Dismissed From Further Analysis

This section provides a limited evaluation and explanation as to why the following impact topics are not evaluated in more detail. Impact topics are dismissed from further evaluation if:

- they do not exist in the analysis area, or
- they would not be affected by the proposal or the likelihood of impacts are not reasonably expected, or
- through the application of mitigation measures, there would be minor or less effects (i.e. no measurable effects) from the proposal, and there is little controversy on the subject or reasons to otherwise include the topic.

Due to there being no effect or no measurable effects, there would either be no contribution towards cumulative effects or the contribution would not be measurable.

Wildlife

The NPS is charged with maintaining native wildlife as an integral component of natural ecosystems. Noise and human activity associated with the proposed action could temporarily disturb individuals of some wildlife species. But the work would be localized to the barrier site and undisturbed habitat would remain available, especially to highly mobile and far ranging species such as large mammals. Species with more constrained ranges would not be measurably impacted since the proposed project would result in few alterations to wildlife habitat and most disturbances would be short-term. The project could result in the permanent removal of some trees with cavities, broken tops, or other features favored by wildlife such as woodpeckers and cavity nesting birds. Efforts would be made to avoid cutting standing dead or live trees that could be used by wildlife, and downed timber would be collected before any standing live or dead trees are cut. Only about 5 to 10 trees in total are expected to supply

the necessary logs for the project, therefore the probability that critical wildlife habitat would be measurably affected is low. The work would also occur in the fall, when the critical nesting, denning, and young rearing periods are over for most species. Infrequent future maintenance (possibly every 7-10 years) of the barrier should not require helicopter support and would have only negligible to minor impacts on wildlife. Overall, impacts to wildlife would be negligible to minor, and are not further analyzed.

Threatened and Endangered Species, Candidate Species, and Species of Concern

The NPS analyzes impacts to federally listed species in accordance with NEPA and the Endangered Species Act (ESA). Section 7 of the Endangered Species Act requires all federal agencies to consult with the U.S. Fish and Wildlife Service (USFWS) to ensure that any action authorized, funded, or carried out by the agency does not jeopardize the continued existence of listed species or critical habitats. In addition, the 2006 *Management Policies* and Director's Order-77 *Natural Resources Management Guidelines* require the NPS to examine the impacts of projects on federal candidate species as well as state listed threatened, endangered, candidate, rare, declining, and sensitive species (NPS 2006); federal candidate species and species of concern are therefore treated as if they are ESA listed species. The NPS protects and attempts to recover all native species that are listed under the Endangered Species Act.

Water Howellia and Spalding's Catchfly Federally listed as Threatened. While present in Flathead County, there are no known locations of the threatened Spalding's catchfly (*Silene spaldingii*) or the threatened water howellia (*Howellia aquatilis*) within Glacier National Park; consequently, there would be no effect to Spalding's catchfly or water howellia from the proposed project. However, if locations of listed plant species become known within the vicinity of the project area, the plants would be avoided.

Grizzly Bear (*Ursus arctos horribilis*) Federally listed as Threatened. The Quartz Creek fish barrier is located within an area designated as Management Situation 1, where "management decisions will favor the needs of the grizzly bear when grizzly habitat and other land-use values compete and grizzly-human conflicts will be resolved in favor of grizzlies, unless the bear is determined to be a nuisance" (NPS 2010). Grizzly bears have been documented in the upper Quartz drainage. Grizzly bear habitat modeling by the Cumulative Effects Model (CEM) Working Group indicates that grizzly bear habitat values along Quartz Creek in the vicinity of Quartz Lake, Middle Quartz Lake, and Lower Quartz Lake are low during summer and autumn (CEM 2004, based on findings from Mace et al., 1999).

During modification of the fish barrier, individual bears travelling near the project area could be temporarily disturbed or displaced by noise and human activity. Helicopters can disturb grizzly bears and elicit responses that range from head raises without displacement to temporary displacement and increased physiological stress, depending in part on the duration of the helicopter activity (Anderson et al., 2009). Helicopters flying from the staging area on the Inside North Fork Road and delivering long-line sling loads to the fish barrier work site could disturb grizzly bears in the Quartz drainage. The duration of the disturbance would be short-term, however, and of low frequency, with only one or two flights occurring on one or two days, followed by a final flight on a subsequent day to haul out materials and equipment. Flights would not occur

during the grizzly bear denning season, and they would take place during the late summer or early fall when grizzly bear habitat values in the area are at their lowest and grizzly bears are more likely to be foraging at higher elevations.

Human activity would temporarily increase, especially at the project area and on the trail between Quartz Lake and Middle Quartz Lake when crews are hiking to and from the work site. But the work crew would be relatively small (estimated at 6), human activity would be very temporary (approximately ten days to two weeks) and primarily localized to the project area, and strict measures would be in place to prevent grizzly bears from obtaining food rewards, thereby reducing the chances of grizzly-human conflicts. Infrequent future maintenance (possibly every 7-10 years) of the barrier should not require helicopter support and would have only negligible to minor impacts on grizzly bears. Overall, due to the short duration and low intensity of the project, impacts to grizzly bears would be minor. Impacts to grizzly bears are therefore not further analyzed. Under Section 7, the determination for grizzly bears would be “may affect, not likely to adversely affect”, and a biological assessment has been prepared and submitted to the U.S. Fish and Wildlife Service (USFWS) along with a copy of this EA.

Canada Lynx (*Lynx canadensis*). Federally listed as Threatened. While potential lynx habitat exists in the Quartz drainage, there are no recent records of lynx activity in the area. If lynx are present, the proposed actions would not measurably affect them, given the project’s short duration and because the work would primarily be localized to the fish barrier. Impacts to lynx would be non-existent to negligible; under Section 7, the project would have “no effect” to lynx, and impacts to the species are not further analyzed.

Wolverine (*Gulo Gulo*). Candidate Species. The USFWS defines candidate species as species “for which the U.S. Fish and Wildlife Service has sufficient information on their biological status and threats to propose them as endangered or threatened under the Endangered Species Act (ESA), but for which development of a proposed listing regulation is precluded by other higher priority listing activities” (USFWS 2011). There are several records of wolverines in the Quartz drainage, including activity at Lower Quartz, Middle Quartz, and Quartz Lakes. Records include tracks, two sightings, and a hair sample collected from a hair-snare at the head of Quartz Lake in 2011. But because wolverines are highly mobile, wide ranging carnivores and since the project site is located in an area that would not normally be considered wolverine habitat, the species would not be measurably affected by the barrier modification project, which would be short-term and localized to the barrier site. Wolverines are therefore dismissed from further analysis.

Meltwater Stonefly (*Lednia tumana*). Candidate Species. Quartz Creek is very untypical habitat for the meltwater stonefly because the elevation is too low and the water temperatures are too warm. It is therefore extremely unlikely that the species would be present (J. Giersch, personal communication). The meltwater stonefly is not analyzed because it would not be impacted by the project.

Species of Concern. Common loons nest regularly on Middle and Lower Quartz Lake, and have also been observed on Quartz Lake. Loons have typically migrated from their nesting areas by mid- September, and would not likely be on any of the upper Quartz lakes during the work period for the fish barrier project. Any loons that are still on the lakes would be old enough to move away from disturbances; the helicopter would also avoid flying directly over Middle or Lower Quartz Lake, and would avoid the foot of Quartz Lake. Effects to loons would therefore be negligible and short-term.

A bald eagle (*Haliaeetus leucocephalus*) nest near the foot of Quartz Lake over 1000 meters (approximately 0.6 mile) from the project site could still be active during project implementation. For the last three years, the Quartz Lake nesting pair has initiated nesting in the spring, but successful nesting has not yet been documented. Quartz Lake is at a higher elevation than other bald eagle nests in the park, the lake ice takes longer to melt off, and the nesting pair typically initiates nesting later in the season. Therefore, if the nest is active and successful, it is likely that the juvenile eagle(s) would still be in the vicinity of the nest when work is underway. Human activity at the barrier is not likely to disturb bald eagles at Quartz Lake, given the distance between the lake and the project area and because the work site is not within sight of the nest. Helicopter flights would have the greatest potential to disturb bald eagles, but the helicopter would not be permitted to fly directly over Lower Quartz or Middle Quartz Lake and would not fly over the foot of Quartz Lake.

Disturbances to common loons and eagles from the proposed project would be very temporary and localized, and any adverse impacts would be negligible to minor. Future maintenance of the barrier would be infrequent, should not require helicopter support, and would have only negligible to minor impacts on loons and bald eagles. Over the long term, the fish barrier modification project would benefit both common loons and bald eagles by better protecting the native fish assemblage in the Quartz drainage. Native fish tend to forage nearer the surface than lake trout, making them more accessible to loons and bald eagles. Lake trout, by contrast, generally forage at greater depths and are less accessible. The beneficial impacts to loons and bald eagles would be minor, as they would likely extend only to individual birds using Quartz and Middle Quartz lakes, and would not measurably affect either species at the population level. Other state listed bird species of concern could occur within the project area, but none would be measurably impacted by the proposed project. The work would occur after the critical nesting period for most other species and only one localized geographic area would be affected. Species inhabiting the forested and riparian area near the fish barrier could be disturbed, but disturbances would be short-term with impacts that are minor or less. There are no known golden eagle nests in the area. Impacts to common loons, bald eagles, and other bird species of concern are therefore not further analyzed.

State listed mammalian species of concern that occur or may occur in Glacier National Park include the Townsend's big-eared bat (*Corynorhinus tonsendii*),

hoary bat (*Lasiurus cinereus*), northern bog lemming (*Synaptomys borealis*), and fisher (*Martes pennanti*) (MNHP 2011a). Townsend's big-eared bats have not been detected in the park; if they are present, they would be moving into subterranean hibernacula by the time the project is underway and would not likely be using habitat in the vicinity of the project area. The hoary bat is a migratory bat and could be found in the habitat type characterizing the project area (MNHP 2011b). Except when roosting, bats are highly mobile and would not likely be much affected if temporarily displaced, especially since the majority of the work would be localized to a very small area. While efforts would be made to avoid cutting standing dead or live trees that could be used by bats for roosting, the project could possibly result in the removal of some trees that provide bat roosting sites. Downed timber would be collected before any standing live or dead trees are cut, only about 5 to 10 trees in total are expected to supply the necessary logs for the project, and the probability that bat roosting habitat would be measurably affected is low. Adverse impacts to bats would therefore be negligible to minor, and the species is dismissed from further analysis. There are no records of the northern bog lemming in the Quartz drainage, and the fish barrier is not located in an area that is likely to provide preferred habitat for the species. Fishers have not been recently detected in the park and may not be present. If fishers do frequent the project area, they are not likely to be measurably affected by the project, which would occur outside the denning period and is of low intensity and short duration. Mammalian species of concern are therefore not further analyzed.

There are no known records of the northern leopard frog (*Rana pipiens*) in the park, and no records of the western toad (*Bufo boreas*) in the upper Quartz drainage, probably due to under-reporting. Transient use of the area by amphibians is likely. Any amphibians that are present are likely to be at very low abundance, and the proposed actions would not measurably impact any known local populations or their habitat. Any amphibians encountered would be moved out of the immediate work area to mitigate any potential impacts. Amphibian species of concern are dismissed from further analysis.

While distribution and abundance of invertebrate species of concern within the park are not well known, impacts are expected to be non-existent to negligible. Invertebrate species of concern are not further analyzed.

Vascular Plants. No rare plants or rare plant habitats are known to be located within the vicinity of this project. This topic is therefore dismissed.

Water Resources

NPS policies require protection of water quality in accordance with the Clean Water Act. The purpose of the Clean Water Act is to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters." The US Army Corps of Engineers (COE) has been charged with evaluating federal actions that result in potential degradation of waters of the United States and issuing permits for actions in accordance with section 404 of the Clean Water Act. The US Environmental Protection Agency (EPA) also has responsibility for oversight and review of State programs and permits which affect waters of the United States.

If the preferred alternative is implemented, all necessary federal, state and local permits would be obtained to ensure compliance with the Clean Water Act. These include a Section 404 permit from the Army Corps of Engineers, a

Montana Department of Environmental Quality (DEQ) 318 permit, a Nondegradation Review Permit from Montana DEQ, and a Montana Fish, Wildlife and Parks 124 Permit.

There would be no long-term impacts to water resources in Quartz Creek as a result of the fish barrier improvement project. Stream flow would remain similar to existing conditions and would not be altered enough to adversely affect the stream channel. There may be short-term pulses of sedimentation from in-stream disturbances during the work period, but no long-term effects. These small sediment releases would be minimal since construction would occur during the low water period in late summer and fall. Turbidity and water temperature would not be impacted over the long term. In addition, most of the stream bottom in the project area consists of very large cobble and boulders. A water diversion would be created by placing a temporary, inflatable bladder dam or other non-inflatable dam on top of the streambed and moving the water around the work area to minimize work in flowing, deeper water. Because the temporary diversion dam would be placed on top of the streambed, there would be little sediment generated by its installation. Heavy plastic would line the short diversion and little sediment is anticipated to be generated by the diversion itself. However, during construction, a park employee would be at the construction site to monitor sediment releases. If these releases are deemed excessive (highly unlikely given the large substrate material), the activity would be halted until the stream clears. At that time work activities would proceed. The proposed project would also not change water temperatures. Any adverse impacts to water resources would be localized, negligible, and short-term; water resources are therefore dismissed from further analysis.

Wetlands

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

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

According to a survey conducted in 2003, there are no wetlands located in the Quartz Creek fish barrier project area; these findings were reconfirmed in 2011. A statement of findings for wetlands will therefore not be prepared. Because there are no wetlands in the project area, this topic is dismissed from further analysis.

Soils and Vegetation

The NPS strives to maintain all components and processes of naturally evolving park ecosystems, including the natural abundance, diversity, and ecological integrity of plants (NPS 2006). The NPS also preserves the soil resources of parks and protects those resources by preventing unnatural erosion, physical removal, or contamination (NPS 2006). Impacts to soil and vegetation from this project would be minor or less. Planned work may result in very minor impacts to soil adjacent to the creek bank. These impacts would recover in short order. Ground cover and shrubby vegetation may be temporarily affected by trampling and moving logs into place. But several plant species would be nearing their dormancy stage by the time the project is underway in September, and would therefore be less vulnerable than in the spring. Affected vegetation would likely recover fully on its own without intervention from park staff. There are abundant trees in the project vicinity that would be suitable for use in the construction of the fish barrier. Targeted trees would include downed and dead first, then standing dead, and then live trees. The removal of this material would result in a very minor impact to vegetation as there are abundant seedlings/saplings and mature trees in the adjacent forests and the removal of the necessary trees would not affect the integrity of the stand as a whole. Because impacts would be minor or less, soils and vegetation have been dismissed from further analysis.

Air Quality

The Clean Air Act of 1963 (42 U.S.C. 7401 *et seq.*) was established to promote the public health and welfare by protecting and enhancing the nation's air quality. The act establishes specific programs that provide special protection for air resources and air quality related values associate with NPS units. Section 118 of the Clean Air Act requires a park unit to meet all federal, state, and local air pollution standards. Glacier National Park is classified as a mandatory Class I area under the Clean Air Act, where emissions of particulate matter and sulfur dioxide are to be restricted. Air quality is considered good in Glacier National Park. There are no metropolitan areas within 125 miles of the park, and no regional smog typical of highly populated areas with a high amount of vehicle traffic. Air quality would not be measurably affected by either of the alternatives, including low-level emissions from mechanized equipment during the construction period. Impacts to air quality are therefore not analyzed.

Climate

The Intergovernmental Panel on Climate Change (IPCC) predicts "impacts of climate change will vary regionally but, aggregated and discounted to the present, they are very likely to impose net annual costs which will increase over time as global temperatures increase" (IPCC 2007). The proposed project is of a small scale, would not change visitor use patterns, is not likely to result in increased or reduced greenhouse gas emissions, and therefore is not expected to measurably impact the global climate. Impacts to the climate have therefore been dismissed from further analysis.

Wild and Scenic Rivers

The project would occur on Quartz Creek, a tributary of the North Fork of the Flathead River, which is designated as a Wild and Scenic River. The project site is over 12 stream miles from North Fork and is outside the Wild and Scenic River Corridor; the corridor would therefore not be affected by any activities or sediment releases at the project site. There would be no short or long-term effects on the North Fork and no change in water quality, riparian areas,

floodplain conditions, or any of the outstanding, remarkable, values which led to its designation as a Wild and Scenic River. Therefore, Wild and Scenic Rivers was dismissed as an impact topic.

Night Skies

In accordance with 2006 *Management Policies*, the NPS strives to preserve natural night skies and will “minimize light that emanates from park facilities, and also seek the cooperation of park visitors, neighbors, and local government agencies to prevent or minimize the intrusion of artificial light into the night scene of the ecosystems of parks”. Glacier National Park considers the impacts to night skies in all projects within developed and backcountry areas. No night work would occur during implementation of the proposed project, and the completed barrier would not involve lighting of any kind. There would be no impacts to night skies, and the topic is dismissed.

Cultural Resources

For Section 106 purposes and unless additional information is raised during review of this EA, the park will document a “no historic properties affected” finding in its annual report to the State Historic Preservation Office in accordance with the *Programmatic Agreement among the National Park Service (U.S. Department of the Interior), the Advisory Council on Historic Preservation, and the National Conference of State Historic Preservation Officers for Compliance with Section 106 of the National Historic Preservation Act*. All cultural resource topics were dismissed from further analysis.

Historic Structures and Cultural Landscapes. The project is located in an undeveloped area of the park. No historic buildings and structures or cultural landscapes are in the project area. The area of potential effect has been surveyed; no identified and/or unevaluated historic properties exist, and the probability of discovering historic properties within the area of potential effect is highly unlikely.

Archeological Resources. The Area of Potential Effect for the proposed action was surveyed by the park’s archeologist in June 2011 and no archeological resources were identified. A previous archeological survey between Middle and Lower Quartz lakes in June of 2003 found that the creek runs in a relatively narrow channel with steep banks on either side; the steep topography bars access to the creek, and there is no evidence or possibility of a trail or travel route along the creek. If archeological resources are identified during the project, consultation with the State Historic Preservation Office and Tribal Historic Preservation Offices would occur in accordance with federal legislation and regulations and National Park Service policy. Archeological resources are therefore dismissed.

Ethnographic Resources. Ethnographic resources are defined by the NPS as “the cultural and natural features of a park that are of traditional significance to traditionally associated peoples” (NPS 2006). Neither the Blackfoot Tribe nor the Confederated Salish and Kootenai Tribes raised concerns about the proposed action during scoping for this or the earlier project. Therefore, the proposed action is not expected to impact ethnographic resources and ethnographic resources have been dismissed from further evaluation. However, Glacier National Park recognizes that the tribes hold a body of knowledge that may result in the identification of ethnographic resources in the area in the future. If

ethnographic resources are identified later, consultation will occur in accordance with federal legislation and regulations and National Park Service policy.

Museum Collections

According to the NPS *Management Policies* (2006) Director's Order 24 *Museum Collections*, the NPS requires consideration of impacts on museum collections (historic artifacts, natural specimens, and archival and manuscript materials). NPS policy defines museum collections management including policy, guidance, standards, and requirements for preservation, protection, documentation, access, and use. Museum collections would not be affected by this project.

Visitor Use and Experience

The upper Quartz drainage is a popular destination for both day hikers and visitors to the backcountry. Visitors access the area via the Quartz Creek Trail, the Quartz Lake Trail over Cerulean Ridge, or the West Lakes Trail over Quartz Ridge. The fish barrier modification project would occur in September after the peak visitor use period and would not permanently alter the way visitors use the area. Visitor use and experience would be temporarily affected if some visitors choose to avoid the area while work is underway, and because noise from helicopter flights and motorized tools and equipment would be audible during the project. Because project related noise would be temporary, intermittent, and largely localized to the immediate barrier site, and since the completed barrier would not be visible from the trail and would go unnoticed by most visitors, adverse impacts to visitor use and experience would be minor and very short-term. The project would benefit visitor use and experience by better protecting the species composition of fish caught by anglers. Conversely, taking no action to improve the fish barrier could cause a reduced abundance of westslope cutthroat trout, the primary species caught by anglers in the Quartz drainage. These impacts would be minor, since they would directly apply to a single segment of the visiting public. Visitor use and experience is therefore dismissed from further analysis.

Visual Resources

Visual resources in the upper Quartz drainage are characterized by scenic vistas of rugged mountain peaks, pristine lakes, and forested mountainsides. The existing fish barrier is located on Quartz Creek approximately 100 yards below Middle Quartz Lake and, as a human-made structure in the stream channel, the completed barrier would negatively affect visual resources in the immediate vicinity. The barrier would not be visible from the Quartz Creek Trail, however, and would affect the viewshed only for those who venture off the trail and bushwhack to the creek. One to three helicopter flights could temporarily disrupt the scenic values within the Quartz drainage, but such disruptions would be few and very short-term, and would not result in any lasting effects to the viewshed. Impacts to visual resources would be negligible to minor, and the topic is not further analyzed.

Environmental Justice

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

or low-income populations or communities as defined in the *Environmental Protection Agency's Environmental Justice Guidance* (1998) would not occur from actions proposed in the preferred alternative. Therefore, environmental justice was dismissed from further analysis.

Prime and Unique Farmlands

The Farmland Protection Policy Act of 1981, as amended, requires federal agencies to consider adverse effects to prime and unique farmlands that would result in the conversion of these lands to non-agriculture uses. There are no prime and unique farmlands located within Glacier National Park (NPS 1999).

Human Health and Safety

The NPS *Management Policies* (2006) states the safety and health of all people are core Service values. Public health is addressed in Director's Order 83 *Public Health and Vector-borne and Zoonotic Disease* and employee health is addressed in Director's Order 50 B *Occupational Health and Safety Program*. These policies call for risk recognition and early prevention for a safe work and recreational environment, and the NPS is committed to eliminating and reducing health and safety risks when they are identified. There would be no impacts to human health and safety from either alternative and the topic is dismissed from further analysis.

Socioeconomics

There would be no change to socioeconomic resources under either alternative. Visitor numbers would not change, and park concession operations and local businesses would not be impacted. The topic is therefore dismissed.

ALTERNATIVES CARRIED FORWARD

An interdisciplinary team of Glacier National Park staff originally identified four alternatives, including a no action alternative. Public scoping identified one alternative means of implementing the project. After further consideration, only the no action alternative and one action alternative have been carried forward for further evaluation. The other alternatives have been dismissed and are discussed under *Alternatives, Suggestions, and Concerns Considered but Eliminated from Detailed Study*.

No Action Alternative

The no action alternative describes the conditions that would continue to exist in the upper Quartz drainage if the fish barrier was not improved. The no action alternative provides a baseline for evaluating the changes and related environmental impacts that would occur under the action alternative.

Under the no action alternative, the National Park Service would not complete construction of the existing fish barrier on Quartz Creek. The structure would remain incomplete, and non-native lake trout would continue to move freely into the upper Quartz Lake system and augment the existing population of lake trout in Quartz Lake. Rainbow and brook trout also present a threat to the upper Quartz Lake system. A single hybridized westslope rainbow trout was detected out of a sample of 25 westslope cutthroat trout collected in Cerulean Lake in 2004, located upstream of the barrier site. Rainbow trout would likely continue to enter the drainage as they expand within the North Fork Flathead River drainage and would eventually threaten the remaining genetically pure populations of westslope cutthroat trout that exist in both Middle Quartz and Quartz lakes.

Preferred Alternative

Under this alternative, the NPS would modify, improve, and complete the existing fish passage barrier on Quartz Creek approximately 100 yards below Middle Quartz Lake. The modified barrier would be approximately 1 to 2 feet taller than the existing barrier; it would extend across the floodplain into the stream channel from both sides of the creek and would funnel flows through a narrow passage in the center of the channel at increased velocities. A heavy-duty screen would be added to the barrier and cantilevered over the channel in a downstream direction to block fish from swimming or jumping upstream while allowing debris or downstream migrating fish to pass. The modified barrier should eliminate upstream passage of fish during non-flood periods and greatly reduce the likelihood of upstream passage during flood flows. Downstream fish passage would not be impeded.

The project's location would continue to be advantageous because of naturally occurring boulders that would form part of the structure. The improved barrier would also consist of gabions (metal cages) filled with available rocks and boulders found onsite; approximately 672 cubic feet of stone would be required to assemble the gabions. The porous gabions would allow some water to flow through at the creek edges without allowing fish to pass. Approximately 28 gabions (each about 2 ft. x 2ft. x 6 ft.) would be installed. A downstream splash pad would be created using large rock or additional gabions to prevent a jump pool from developing below the structure. Large logs (approximately 250 linear feet of 12-24 inch dbh log) would be used to increase the height of the barrier across the floodplain and across the center where the screen would be installed. The logs would be obtained from a combination of downed and standing dead timber and live trees. Approximately 5 to 10 trees should supply the necessary logs; downed timber would be collected first, followed by standing dead timber, and then live trees if necessary. The logs would be collected and/or cut onsite with chainsaws and dragged to the work area with a come-along. To minimize ground disturbance, smaller diameter "roller logs" would be placed across the path of the log that is being hauled, and the logs would be rolled

over the ground. The removal would occur well away (approximately 400 yards) from the Quartz Lake Trail. After the addition of the logs, the completed barrier would be approximately 75 ft. long x 6 ft. wide x 5 ft. high (Figure 2; construction drawings of the barrier modifications are also provided in Appendix B of this document.)



Figure 2: Conceptual rendition of what the Quartz Creek fish barrier would look like once completed. (modified NPS photograph)

A temporary, inflatable bladder dam approximately 4 ft. high x 10 ft. wide x 80 ft. long may be used to temporarily dewater the work area during construction, or a non-inflatable barrier may be used if available. Temporarily diverting water from the work site would reduce downstream turbidity and erosion during construction. It would also provide the driest possible working conditions, enabling workers to spend less time with their hands in very cold water and thus allowing them to do a better job building a structurally sound foundation. A small bypass channel would be constructed around the work site and lined with plastic, and one or two small water pumps would be used to divert the water around the work area and/or inflate the bladder dam with creek water. The bladder dam or non-inflatable barrier would be removed after the work is completed. Backpack electrofishing would be used as necessary to remove any fish from the small section of dewatered stream prior to diverting the water. Any disturbance to physical stream habitat would be repaired upon completion of the project.

In addition to chainsaws and one or two small water pumps, other motorized equipment that may be used onsite during the project include a rock drill, a small gas-powered portable

generator, and other mechanized hand tools as necessary. The rock drill would be required to anchor the screen to boulders and the log sill spanning the center of the barrier, and the generator would be needed to power the drill and the water pumps. Traditional hand tools would be used whenever possible.

Up to three helicopter flights would be required to haul the bladder dam, fish screen, generator, water pumps, rock drill, and other materials that cannot be packed into the work site and to remove equipment that cannot be packed out after the project is complete. Only small sized helicopters would be used, and equipment and materials would be transported and delivered to the work site as long-line sling loads. The helicopter would fly 2,000 feet above ground level from West Glacier to a staging area along the Inside North Fork Road, where it would pick up the equipment sling loads. The helicopter would then fly northeast along the Quartz drainage to the work site. The helicopter would fly between 500 feet and 2,000 feet above ground level during long line operations, except when landing or taking off. Emergency helispots for possible emergency evacuation of project personnel would be near the Middle Quartz Lake inlet. Flight times are not anticipated to exceed 30 minutes one way between West Glacier and the staging area, and 30 minutes round trip between the staging area and the work site. Other equipment, supplies, and materials would be packed in via livestock to a location along the trail near the outlet of Middle Quartz Lake and carried to the worksite by the work crews. If a non-inflatable water barrier is available, it could possibly be packed in on livestock, reducing the number of helicopter flights that are necessary.

The project would be completed by NPS crews with oversight from NPS engineers and fisheries specialists. The work crew (estimated at 6) would likely hike to the project area from Bowman Lake, following the route over Cerulean Ridge. Crews would likely stay at the Quartz Lake NPS backcountry cabin about 1.5 miles east of the work site. Some downed logs or brush may be cut or moved to facilitate off-trail access from the Quartz Lake Trail to the worksite. The project would take approximately ten days to two weeks to complete and would occur during September. Work would begin each day no earlier than one hour after sunrise and would stop no later than one hour before sunset. Prior to implementation, the park would continue to revise the barrier design and implementation logistics toward minimizing the use of helicopters and mechanical equipment.

The completed Quartz Creek fish barrier may require maintenance following the first spring runoff after construction. Future maintenance of the barrier would then be expected infrequently (approximately every 7-10 years), as the current structure has been in place since 2004 and has not required maintenance. Future maintenance is not anticipated to require helicopter use.

Mitigation Measures

The following mitigation measures would minimize the degree and/or severity of adverse effects and would be implemented during the project:

Fisheries

- Electrofishing would be conducted to remove fish in the project vicinity immediately prior to commencement of work.
- Work would occur during low water periods to minimize sediment generation and physical habitat disturbance.

Wildlife and Threatened and Endangered Species and Species of Concern

- Helicopters would avoid flying directly over Lower Quartz or Middle Quartz Lake, and would avoid the foot of Quartz Lake and other sensitive locations. Flight paths would be designated so as to avoid open alpine meadows where grizzly bears that are present would not have access to cover.
- The helicopter would fly at a minimum of 500 feet above ground level except when landing or taking off or when delivering supplies on a long-line.
- Helicopter flights would occur between one hour after sunrise and one hour before sunset to mitigate disturbance to wildlife.
- Work would begin no earlier than one hour after sunrise and would stop no later than one hour before sunset to minimize disturbances to foraging or migrating bald eagles, common loons, and other wildlife.
- Work crews would be trained on appropriate behavior in the presence of wildlife and on proper storage of food, garbage, and other attractants.
- The work would not occur until September, when the critical nesting, denning, and brood rearing periods are over.
- If standing dead and live trees are required for the project, they would first be assessed for wildlife use. Trees showing signs of foraging or that have cavities, sloughing bark, or broken tops would be avoided if possible.
- Any amphibians encountered would be moved out of the immediate work area.

Vegetation

- All equipment and materials used at the site would be cleaned and inspected prior to transport to prevent the spread of non-native invasive plants and aquatic invasive species.
- Glacier National Park's Best Management Practices would be implemented to minimize the extent of impacts.
 - Disturbance to vegetation would be avoided as much as possible and contained to as small a footprint as possible while meeting project objectives.

Soils

- Glacier National Park's Best Management Practices would be implemented to minimize the extent of impacts.
 - Disturbance to the ground would be avoided as much as possible and contained to as small a footprint as possible while meeting project objectives.
- Erosion control measures that provide for soil stability and prevent movement of soils into waterways would be implemented.

Recommended Wilderness

- Non-electric tools would be used as much as possible to reduce artificial noise.
- The backcountry patrol cabin at Quartz Lake would house workers during the installation phase to avoid construction of additional camping or food storage areas.
- Administrative helicopter flights would be coordinated with other projects in the area and hauling needs would be combined to minimize administrative flights over recommended wilderness. Construction debris, equipment, and garbage that could not be packed out would be flown out on back-hauls of incoming flights.
- The staging area for helicopter flights would be located outside the North Fork's Wild and Scenic River Corridor.
- Work would be conducted during the fall to minimize impacts to visitors, the sense of solitude, and the overall wilderness experience.
- Logs would be collected well away from the trail where evidence of their removal is not visible to hikers.
- Once the project is completed, brush, logs, and forest debris would be used to naturalize the immediate work site and the trail to the work site.

Natural Soundscapes

- Non-electric tools would be used as much as possible to reduce artificial noise.

Visitor Use and Experience

- Notifications of the proposed project would be posted at Quartz drainage trailheads on the Inside North Fork Road and at Bowman Lake for the duration of the project.
- All overnight visitors would be advised in advance about potential noise and activity in the area.

Alternatives Considered but Eliminated from Detailed Study

This section discusses three dismissed alternatives and two dismissed methods of implementing the project.

Complete the existing fish passage barrier as originally designed.

The park considered completing the existing fish barrier according to its original design, as described in the 2004 EA. This alternative was dismissed on the basis of construction limitations that would compromise the effectiveness of the barrier. The construction of the original barrier was halted when, in 2005, it was discovered that lake trout had already invaded Quartz Lake. This prompted a review of options to control lake trout and in 2009, the NPS, USGS, and others began a collaborative, experimental program to remove lake trout from Quartz Lake and suppress the population. The success of suppression efforts to date has underscored the need for an effective fish passage barrier to prevent additional lake trout from entering the system. The potential efficacy of a fish passage barrier was reevaluated, and the design of the original barrier was found to be insufficient and constructability questionable.

Initial construction of the existing barrier structure was limited because crews attempted to build the barrier in fast flowing, extremely cold, fairly deep water (without a diversion). This made construction very difficult, raised safety concerns and compromised the structure in the end. The original plans called for placing a large log set on top of rock filled gabion baskets across the middle of the channel to create a drop that would be impassable to fish. However, the proper support for the log could not be constructed in the cold flowing water. In addition, the drop created by placing a log across the middle of the existing structure was determined to not be sufficient to keep fish from jumping upstream over it. The original design did not include a

cantilevered aluminum or steel fish screen to block fish from swimming or jumping upstream. Given the relatively small drop over the structure, the screen would be a critical component. It would be needed to not only prevent lake trout from passing upstream, but also to prevent rainbow trout from accessing Quartz Lake. Rainbow trout are superior jumpers and very strong swimmers when compared against lake trout. The original design also did not include a downstream splash pad to prevent a jump pool from developing below the structure. Eliminating the potential for a jump pool to form would make it much more difficult for fish to jump over the structure. In combination, the revised plan includes increasing barrier height, installation of a fish screen, and installation of a splash pad downstream of the structure. Each of these components is a critical improvement over the original design.

Construct a new fish passage barrier below Lower Quartz Lake or outside recommended wilderness. An alternative location to construct the fish passage barrier, immediately below Lower Quartz Lake, was considered but rejected due to the size, depth, and topography of Quartz Creek below the lower lake. Additionally, since a barrier was already in place, less impact to resources would occur from improving the existing barrier than constructing a new one. Placing a barrier outside recommended wilderness was considered but rejected because it would require a larger lake trout suppression effort throughout the entire Quartz drainage. This would have greater and more extensive adverse impacts on recommended wilderness.

Construct a larger fish passage barrier than described in the Preferred Alternative at the current barrier site. The park also considered the construction of a much larger fish passage barrier at the location of the existing barrier. The concept was similar to the preferred alternative in that it would employ logs and rock filled gabions or log cribs, but the structure would have been considerably more massive (taller, wider, and longer). It would also have required considerably more raw materials (such as rocks and logs) to construct and would have required flying in a large amount of cobble and small boulder-sized rock, as well as several large culverts. The culverts would have been incorporated into the center of the structure. In concept, the larger barrier would have prevented fish passage up to a 25-year flood event and been more effective in keeping non-native fish out of the upper drainage. However, it is not certain that lake trout are able to reach the barrier site during peak runoff due to the nature of the channel downstream, where a confined, high gradient, boulder/cobble dominated stream system likely experiences high velocities and extreme turbulence during high water periods. Structural stability would also not be assured with a larger barrier design. Given that lake trout are already upstream of the barrier and the park is currently engaged in an experimental effort to suppress lake trout, it is more sensible to finish the initial investment in the existing barrier and greatly improve its existing condition and effectiveness.

Use only hand tools to modify and improve the fish barrier. Constructing the barrier modifications and improvements with hand tools alone was considered but dismissed because it would prolong the duration of the project and the amount of time work crews and livestock would be in the project area, therefore increasing the overall level of disturbance to other resources. There would also be an increased risk that the barrier would not be sufficient to prevent lake trout and other non-native fish from getting past it, because using hand tools would severely limit the crew's ability to construct a durable, structurally sound and effective barrier.

Transport the bladder dam, fish screen, generator, and other materials to the work site via livestock exclusively. Using livestock exclusively to transport equipment to the worksite was considered but dismissed because some of the materials and gear essential to the success of the project are too large, heavy, or awkward to pack on livestock and therefore could not be used. The success of the project and the efficacy of the barrier would be jeopardized and the risk of long-term adverse impacts to native fisheries would continue. Only using livestock would also require multiple trips into the backcountry over a prolonged period of time, including several off-trail trips between the Quartz Lake Trail and the worksite, increasing impacts to trails, soils, and vegetation. The use of livestock to transport some equipment and materials has been retained under the preferred alternative however, to reduce the number of helicopter trips.

Alternatives, Suggestions, and Concerns from Public Scoping

This section addresses comments and concerns that were raised during scoping.

Comment: *Please closely consider how the duration and timing of motorized equipment and helicopter flights could potentially impact wildlife and secure wildlife habitat; please discuss potential mitigation.* **Response:** This is discussed in the *Impact Topics Dismissed from Further Analysis* section of this document, under *Wildlife and Threatened and Endangered Species and Species of Concern*. Mitigation of impacts to wildlife and threatened and endangered species and species of concern is described in *Mitigation Measures*.

Comment: *How would the barrier construction and maintenance activities affect wildlife such as loons and eagles? What mitigation measures are planned for other species?* **Response:** Impacts to bald eagles and loons are addressed in the *Impact Topics Dismissed from Further Analysis* section of this document, under *Wildlife and Threatened and Endangered Species and Species of Concern*. Mitigation of impacts to wildlife is described in *Mitigation Measures*.

Comment: *How many trees will need to be cut for the barrier? How big are they? How will they be moved around?* **Response:** This is addressed in the *Alternatives Considered* section of this document, in the description of Alternative B.

Comment: *Please closely consider how the proposed action will affect the wilderness character of the area; please discuss potential mitigation and include a Minimum Requirements Analysis.* **Response:** This is addressed in the *Affected Environment and Environmental Consequences, Recommended Wilderness* section of this document, in the impacts analysis for Alternative B. Mitigation of impacts to recommended wilderness is described in *Mitigation Measures*. A *Minimum Requirements Analysis* is included in Appendix A of this document.

Comment: *Please address the unique characteristics of the Quartz Creek watershed and fish populations that justify the backcountry location of the proposed fish barrier.* **Response:** This is addressed in the *Purpose and Need* and the *Affected Environment and Environmental Consequences* sections for *Fisheries and Recommended Wilderness*.

Comment: *Why is a portable generator necessary in the backcountry? Hand tools should be used as they are in Forest Service wilderness areas. An alternative should be developed that does not use motorized equipment.* **Response:** Using hand tools and non-motorized equipment was considered but dismissed and is discussed at the beginning of this section. The necessity of a portable generator is addressed in the *Alternatives Considered* section of this document, in the description of Alternative B.

Comment: *What are the cumulative impacts from this project and the lake trout removal project on noise in the backcountry?* **Response:** Cumulative noise impacts from this project combined with the lake trout suppression effort on Quartz Lake, as well as other past, ongoing, and reasonably foreseeable actions, are addressed in the impacts analysis for Alternative B under *Natural Soundscapes and Recommended Wilderness*.

Comment: *How many helicopter flights is a small number? How many helicopter trips would be required and when? Would helicopter support be required for future maintenance? What mitigation measures would be required?* **Response:** These issues are addressed in *Alternatives Considered* in the description of Alternative B, the *Cumulative Impacts Scenario*, and under *Mitigation Measures* in this document.

Comment: *Why could not the barrier project be accomplished without helicopter use? Why can't pack animals be used to transport the tools and materials?* **Response:** Using pack animals to transport tools and materials to the worksite was considered and dismissed, and is discussed at the beginning of this section.

Comment: *The use of helicopters for administrative uses such as this proposed project appears directly at odds with the General Management Plan to ban helicopter use for commercial sight-seeing.* **Response:** The park recognizes that administrative flights can have impacts similar to those from scenic air tours. However, for some resources, the park is not able to carry out its mission without the support of helicopters and fixed wing aircraft. Page 65 of the *General Management Plan* briefly discusses the use of administrative flights. All administrative flights must go through a rigorous review to determine if there is no other way to accomplish the work, and require Superintendent approval in advance. The park has voluntarily set a limit of no more than approximately 50 administrative flights each year since 2003.

Comment: *How effective is the barrier likely to be and what is the effectiveness rating based upon?* **Response:** This is addressed in the *Affected Environment and Environmental Consequences, Fisheries/Aquatic Threatened Species and Species of Concern* section of this document, in the impacts analysis for Alternative B.

Comment: *How would the barrier affect other native fish species such as cutthroat trout?* **Response:** This is addressed in *Affected Environment and Environmental Consequences, Fisheries* in the impacts analysis for Alternative B.

Comment: *What would the impacts to the stream channel be from sediment production and changes to the stream flow?* **Response:** Effects to the stream channel are addressed in *Impact Topics Dismissed from Further Analysis, under Water Resources*.

Comment: *What kinds of onsite materials would be used during construction, and where would they be obtained from – the stream channel or upland? What impacts would result from using these materials?* **Response:** The types of onsite materials that would be used are addressed in the *Alternatives Considered* section of this document, in the description of Alternative B.

Comment: *What has been the success of the lake trout removal portion of the Quartz Lake project and how long can it be expected to continue with its use of motorized equipment?* **Response:** To date the program has been very successful at targeting and removing spawning adult lake trout using radio-telemetry and netting in combination, while minimizing by-catch of native species. Those data suggest we are catching and removing a large proportion of the spawning age adults each year. We know less about the success of catching and removing juvenile lake trout because population estimate and modeling work is ongoing. The lake trout suppression project was initially funded for four years and as such, four years was the initial planning and review timeframe. From a biological perspective, it will likely take several additional years to evaluate the program's effectiveness, and if long-term suppression appears feasible, the project could extend in some form into the foreseeable future, subject to additional environmental review.

Comment: *Was the barrier project abandoned in 2005 solely because lake trout were found in Quartz Lake or were there issues with the adequacy of the design? What design changes will be made to the barrier, and how will this improve its effectiveness?* **Response:** This is addressed in the *Purpose and Need* and *Alternatives Considered* sections of this EA.

Comment: *Since the barrier will only reduce the likelihood of upstream passage during flood flows, the EA must analyze whether the project is enough to protect the upper lakes from lake trout invasion.* **Response:** This is addressed in *Affected Environment and Environmental Consequences, Fisheries*, under the impacts analysis for Alternative B.

Comment: *Once the barrier is installed, will the ongoing lake trout removal project be halted?* **Response:** No. The fish passage barrier is being constructed in support of upstream lake trout control efforts. A reproducing lake trout population already exists upstream of the barrier site. The barrier is intended to keep additional lake trout from augmenting the existing lake trout population in Quartz Lake, but active lake trout population suppression in Quartz Lake is required for the program to be successful.

Comment: *Are there lake trout in Cerulean Lake? Will it be surveyed prior to this project?* **Response:** Cerulean Lake was surveyed for lake trout in 2005 and 2010. No lake trout were captured.

Comment: *What monitoring will be done to assess the effectiveness of the barrier?* **Response:** We would continue periodic (5-year) trend gill netting in Lower Quartz and Quartz lakes to assess any changes in species composition over time. In addition, we would use annual bull trout redd counts to monitor bull trout populations on an annual basis. Lake trout removal data from the suppression program would also be evaluated for trends in lake trout abundance.

Comment: *There is very little chance of successfully preventing lake trout from invading Quartz Lake.* **Response:** Lake trout have already invaded Upper Quartz Lake. We are trying to reduce the abundance of lake trout and keep it low enough that existing, still robust populations of native fish can persist in the system over time. Without such efforts, lake trout will eventually increase in abundance to the point that they threaten the bull trout population in Quartz Lake with extinction.

Comment: *Please provide examples of wildlife management programs that are successful and actually benefit Montana sportsmen and ranchers. What are the risks of the actions being proposed?* **Response:** Other wildlife management actions are outside the scope of this project. The benefits and impacts of the proposed project are addressed throughout this document, especially in the chapter on *Affected Environment and Environmental Consequences*.

Alternative Summaries

Table 1 summarizes the major components of Alternatives A and B and compares the ability of these alternatives to meet the project objectives as identified in the *Purpose and Need*. As shown, the no action alternative achieves none of the project objectives while the preferred alternative achieves all of the project objectives.

Table 1: **Summary of alternatives and how each alternative meets project objectives.**

Alternative Elements	Alternative A – No Action	Alternative B – Preferred
The existing fish barrier	The existing fish barrier on Quartz Creek would not be completed, modified, or improved.	The existing Quartz Creek fish barrier would be completed, modified, and improved. The modified barrier would consist of gabions (metal rock-filled cages) and would funnel flows through the center of the channel at increased velocities; a heavy-duty screen cantilevered over the channel would block fish from swimming upstream while allowing debris & downstream migrating fish to pass; naturally occurring boulders would also form part of the barrier; a downstream splash pad would be created from rocks or gabions to prevent a downstream jump pool from developing; large logs would be used to increase the height of the barrier.
Non-native lake trout	While the existing barrier may prevent some non-native lake trout from moving into the upper Quartz system during low flows, the potential for significant upstream migration of lake trout would remain.	The modified barrier should eliminate upstream passage of lake trout during non-flood periods and greatly reduce the likelihood of upstream passage during flood flows.
Other non-native fish species	Rainbow trout would likely continue to enter the upper Quartz drainage and would eventually threaten the remaining genetically pure populations of westslope cutthroat trout that exist in both Middle Quartz and Quartz lakes.	The barrier should also block upstream passage of other non-native fish during non-flood periods and greatly reduce the likelihood of upstream passage during flood flows.
Native fish	No action would be taken to better protect native fish habitat from being invaded by non-native fish.	Native fish would likely not be able to migrate upstream of the barrier, except possibly during flood flows; downstream passage of native fish would not be impeded.
Project Objectives	Meets Project Objectives?	Meets Project Objectives?
Protect the integrity of native fish populations in the upper Quartz drainage.	No. The upper Quartz drainage would remain accessible to non-native fish species, and the long-term integrity of native fish populations would be threatened.	Yes. An improved fish passage barrier would greatly reduce the potential for non-native fish to enter the upper Quartz drainage, thus protecting the integrity of native fish populations.
Support lake trout suppression efforts at Quartz Lake by reducing the potential for additional lake trout to enter the lake.	No. Without an effective fish passage barrier on Quartz Creek, non-native lake trout would continue to enter the upper Quartz system and potentially compromise suppression efforts.	Yes. A fish passage barrier that reduces the potential for additional lake trout to access the Quartz drainage would support lake trout suppression efforts at Quartz Lake.
Reduce the potential for other non-native fish, including brook and rainbow trout, to access the upper Quartz drainage.	No. Other non-native fish species such as rainbow trout would most-likely colonize the upper Quartz drainage and threaten the westslope cutthroat trout population.	Yes. The potential for non-native fish species to enter the Quartz drainage would be greatly reduced by an improved fish passage barrier.

Table 2 summarizes the anticipated environmental impacts for Alternatives A and B. Only those impact topics that have been carried forward for further analysis are included. The *Affected*

Environment/Environmental Consequences chapter provides a more detailed explanation of these impacts.

Table 2: Impacts on resource topics under each alternative.

Impact Topic	No Action Alternative	Preferred Alternative
Fisheries/Aquatic Threatened Species and Species of Concern (including bull trout and westslope cutthroat trout)	Moderate to major adverse, long-term, and local and regional effects on native fish populations in the Quartz drainage and the Flathead Basin would occur from the diminished integrity of native fish populations.	Moderate, long-term, site-specific and local beneficial impacts on native fish populations in the Quartz drainage would occur due to a greatly reduced potential for non-native fish to enter the upper Quartz system. Negligible to minor, adverse, short-term and site-specific impacts to aquatic resources would occur from disturbances to the stream bed during project implementation. Under Section 7, the determination for bull trout would be “may affect, not likely to adversely affect”.
Floodplains	None.	Negligible to minor, adverse, site-specific, and long-term from the localized redirection of some water into the channel during high water events.
Recommended Wilderness	Moderate adverse, site-specific and local, and long-term impacts would occur to wilderness character from degradation of the natural condition, unique ecological value, and unique scientific value of recommended wilderness in the upper Quartz drainage from the continued presence of non-native fish and the unfinished fish barrier.	Moderate beneficial, site-specific and local, and long-term impacts to the natural condition and unique ecological and scientific value of recommended wilderness would occur from the protection of native fish populations. Minor adverse, site-specific and local, and short and long-term impacts to solitude and the undeveloped, natural character of recommended wilderness would occur from disturbances during the two-week work period and the semi-permanent presence of a manmade structure on the landscape.
Natural Soundscapes	None.	Minor to moderate, adverse, short-term, site-specific and local impacts would occur from noise produced by mechanized equipment and tools, and helicopter flights.

Environmentally Preferred Alternative

According to the CEQ regulations implementing NEPA (43 CFR 46.30), the environmentally preferable alternative is the alternative “that causes the least damage to the biological and physical environment and best protects, preserves, and enhances historical, cultural, and natural resources. The environmentally preferable alternative is identified after consideration and weighing by the Responsible Official of long-term environmental impacts against short-term impacts and in evaluating what is the best protection of these resources.

Alternative B (Modification and Improvement of the Quartz Creek Fish Barrier) is the environmentally preferable alternative for several reasons: 1) Native fish populations and native fish habitat in the upper Quartz drainage would be protected for the long-term; 2) one of the last remaining strongholds in the Flathead Basin for bull trout, a threatened species, would be protected for the long term; 3) a top aquatic predator, the bull trout, would continue to play a significant role in the predator-prey dynamics of the upper Quartz system; 4) the long-term persistence of native fish species would help reflect the overall ecological integrity of the upper Quartz drainage and the park; 5) valuable opportunities for scientific research of an ecologically sound aquatic system would be maintained; 6) outdoor educational opportunities inherent within a unique and increasingly rare aquatic ecosystem would endure for future generations; and 7) backcountry angling opportunities would remain undiminished by significant changes to fish species composition and abundance.

By contrast, Alternative A (No Action) is not the environmentally preferable alternative because, although there would be no activities that would disturb elements of the biological and physical environment, 1) the integrity and persistence of native fish populations in the upper Quartz system would be permanently compromised by non-native fish species accessing the drainage; 2) the effects to native fisheries would be adverse, major and long-term; 3) bull trout, a threatened species and top aquatic predator, would be significantly, adversely affected and at risk of functional extinction; 4) the overall ecological integrity of the Quartz drainage and the park as a whole would be diminished; 5) scientific research, outdoor education, and angling opportunities within the upper Quartz drainage would be permanently compromised.

Preferred Alternative

No new information came forward from public scoping or consultation with other agencies to necessitate the development of any new alternatives, other than those described and evaluated in this document. Alternative B is the environmentally preferable alternative and best meets the project objectives; therefore, it is also considered the NPS preferred alternative.

AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This chapter describes the affected environment (existing setting or baseline conditions) and analyzes the potential environmental consequences (impacts or effects) that would occur as a result of implementing the proposed project. Direct, indirect, and cumulative effects are analyzed for each resource topic carried forward. Potential impacts are described in terms of type, context, duration, and intensity. General definitions are defined as follows, while more specific impact thresholds are given for each resource in Table 3 and at the beginning of each resource section.

- **Type** describes the classification of the impact as either beneficial or adverse, direct or indirect:
 - *Beneficial*: A positive change in the condition or appearance of the resource or a change that moves the resource toward a desired condition.
 - *Adverse*: A change that moves the resource away from a desired condition or detracts from its appearance or condition.
 - *Direct*: An effect that is caused by an action and occurs in the same time and place.
 - *Indirect*: An effect that is caused by an action but is later in time or farther removed in distance, but is still reasonably foreseeable.
- **Spatial Context** describes the area or location in which the impact would occur. Effects may be 1) *site-specific* – at the location of the action, 2) *local* – on a drainage or district-wide level, 3) *widespread* – throughout the park, or 4) *regional* – outside of the park.
- **Duration** describes the length of time an effect would occur, either short-term or long-term. The definitions for these periods depend upon the impact topic and are described in Table 3.
- **Intensity** describes the degree, level, or strength of an impact. For this analysis, intensity has been categorized into negligible, minor, moderate, and major. Because definitions of intensity vary by resource topic, intensity definitions are provided separately for each impact topic analyzed in this EA and are also provided in Table 3.

Cumulative Impact Scenario

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

Cumulative impacts were determined by combining the impacts of the preferred alternative with other past, present, and reasonably foreseeable future actions. Therefore, it was necessary to identify other ongoing or reasonably foreseeable future projects at Glacier National Park and, if applicable, the surrounding region. Because the scope of this project is relatively small, the geographic and temporal scope of the cumulative analysis is similarly small. The geographic scope for this analysis includes actions within the park's boundaries, while the temporal scope includes projects within a range of approximately ten years. Given this, the following projects were identified for the purpose of conducting the cumulative effects analysis, listed from past to future:

Past Actions

- *Existing Quartz Creek fish barrier.* In 2004, with assistance from the U.S. Fish and Wildlife Service, Glacier National Park partially constructed a fish passage barrier on Quartz Creek between Middle and Lower Quartz Lakes to protect the area from invasion by lake trout. The barrier is approximately 100 yards below Middle Quartz Lake, consists of approximately 20 gabions (metal cages) filled with rocks and boulders, and is approximately 50 feet long, 3 feet wide, and 4 feet high. In 2005, before final construction of the barrier was complete, lake trout were detected in Quartz Lake and further work on the barrier was suspended until options to control lake trout could be reviewed.
- *Replaced boat docks at Kintla and Bowman Lakes.* In the spring of 2011, floating boat docks were installed at Kintla and Bowman Lakes to replace the old floating docks, which were disintegrating. The new, plastic-encased docks are removable and will be taken out each fall, stored on shore, and reinstalled in the spring.
- *Replaced bridge at Kintla outlet.* The bridge over Kintla Creek at the Kintla Lake outlet was replaced with a new bridge in the fall of 2011. The timbers for the old bridge were rotten and the bridge would not likely have sustained the next high water event. The bridge had not been replaced for approximately 20 years, and the project was part of cyclic maintenance.

On-going Actions

- *Experimental lake trout suppression effort at Quartz Lake.* A collaborative and experimental NPS and USGS project to remove and control lake trout at Quartz Lake began in 2009 and will continue through 2012. The project is intended to develop methods and approaches to remove or suppress lake trout in Quartz Lake. Radio-tagged lake trout are monitored to identify spawning locations. Spawning concentrations of adult lake trout and juveniles from rearing areas are removed using gill nets. Netting efforts occur in the fall for greatest efficiency in catching and removing lake trout while minimizing by-catch of non-target fish species. A motorboat equipped with an outboard motor is used to conduct the netting operation. Project staff members are housed at the Quartz Lake patrol cabin near Quartz Lake during September through early November. Peak netting activities occur during early morning hours and at dusk/night to take advantage of fish behavior. Fuel and other supplies are packed in by livestock and stored onsite. A report from the USGS detailing alternatives for managing the lake trout population in Quartz Lake is anticipated in 2013. Although the project is still ongoing, results to date have been positive. In the context of Cumulative Impacts, it is reasonable to expect the experimental suppression project to continue for at least the next several years. Continuation of the lake trout removal project is subject to additional NEPA documentation.
- *Trail clearing and maintenance.* Trails in the project vicinity include the Quartz Lake Trail

traversing Cerulean Ridge between the foot of Bowman Lake and the foot of Quartz Lake, the Quartz Creek Trail between Quartz Lake and the foot of Lower Quartz Lake, and the West Lakes Trail over Quartz Ridge between Lower Quartz Lake and Bowman Lake. These trails are cleared annually, usually in June, and clearing generally requires two days. Trail maintenance is performed as needed and is generally underway for approximately two weeks every summer. Maintenance is primarily focused on an ongoing project to construct multiple turnpikes across a wet area near Middle Quartz, where a raised boardwalk once existed. Turnpike construction has been ongoing for about ten years and is expected to continue for another five years. Intermittent maintenance of the campgrounds at Quartz Lake and Lower Quartz Lake generally occurs on a five year, cyclic basis. Emergency repair and maintenance projects occur as the need arises.

- *Administrative helicopter flights to Granite Park.* Untreated human waste is removed annually from the biological mediation system unit (toilet) that services the Granite Park Chalet. Waste is transferred to 55 gallon barrels approved for slinging under helicopters, flown to a helispot, and transported by vehicle to the park's sewage treatment facilities in West Glacier. Waste removal occurs in mid to late September and, depending on the amount of waste, requires approximately six round trip flights over a period of a few hours in a single day.
- *Commercial scenic air tours.* A number of commercial operators currently provide scenic air tours over the park. In the *Final General Management Plan* (1999), the park predicted that the number of commercial scenic over flights would increase, although a use ceiling was instituted in 2001 with the passage of the Air Tour Management Act. The Federal Aviation Administration (FAA) recommends that commercial air tour operators fly at least 2000 feet above ground level (AGL) over parks and wilderness areas. The NPS does not have jurisdiction over the airspace in the park, or over commercial air tour businesses that operate outside the park. .
- *Research efforts.* The NPS is cooperating with the USGS, USFWS, and Montana State University to evaluate translocation options for imperiled bull trout populations on the west side of the park. The project involves evaluating fish habitat suitability for translocating bull trout to other fish bearing waters located above natural fish passage barriers. The objective is to conserve local populations and their unique genetic material in the face of population loss from invasion of non-native lake trout. Additionally, a wolverine DNA study involving a hair snagging station at the head of Quartz Lake was underway during the winter of 2010-2011 and is planned for the winter of 2011-2012. Fixed-wing bald eagle nest monitoring in the Quartz drainage may also occur on an intermittent basis.

Future Actions

- *Akokala fish passage barrier.* The NPS is considering installing a fish passage barrier to protect bull and westslope cutthroat trout in Akokala Creek and Akokala Lake from invasive lake and rainbow trout. Such a barrier would likely be situated along the Inside North Fork Road at the Akokala Creek crossing, and would likely be outside of recommended wilderness.
- *Future suppression efforts.* The NPS may consider additional lake trout suppression efforts in other lakes in the park that support bull trout, depending on the outcome of the Quartz Lake project.
- *Additional administrative helicopter flights west of the Continental Divide.* Helicopters are

used administratively as necessary, and only after rigorous review, to deliver equipment and supplies necessary for backcountry projects and periodic maintenance and rehabilitation of backcountry structures, trails, lookouts, and campsites each year. Flights are not permitted if materials can be transported to the work sites by other methods. Additional helicopter flights west of the Continental Divide are anticipated to deliver supplies and materials to project sites in the backcountry in 2012, and to remove waste from Sperry and Granite Park Chalets. The park closely manages the use of administrative flights and has determined that approximately fifty flights per year will not result in measurable effects to park resources (NPS 2003). Glacier National Park conducts an aviation meeting each year with park staff to review and approve or deny flight requests for park projects. Information from this meeting is used to combine flights to reduce the total number of administrative flights. If more than approximately 50 flights are required in a given year, an environmental assessment or impact statement would be prepared.

- *Emergency response helicopter flights.* Helicopter flights in the backcountry could be required for emergencies.

Table 3: Definitions for intensity levels and duration.

Impact Topic	Negligible	Minor	Moderate	Major	Duration
Fisheries/Aquatic Threatened Species and Species of Concern	Impacts would be barely perceptible and impact a few individuals of a sensitive species or other native species, or their habitat.	Impacts would affect a relatively small proportion of the population of a sensitive species or other native species, or have very localized impacts upon their habitat. The change would require considerable scientific effort to measure and have minor consequences to the species or habitat function.	Impacts would cause measurable effects on: (1) a moderate number of individuals within the population of a sensitive native species, (2) the existing dynamics between multiple species (e.g., predator-prey, herbivore-forage), or (3) a moderately sized habitat area or important habitat attributes. A sensitive species or other native species population or their habitat might deviate from existing levels/conditions, but would remain viable indefinitely.	Impacts would have substantial and possibly permanent consequences for a sensitive native species population, the dynamics between multiple native species, or almost all available critical or unique habitats. A sensitive species or other native species population or its habitat would be permanently altered such that their continued survival would be threatened.	Short-term: After implementation, would be expected to recover in 1-5 years. Long-term: Effects would be expected to persist beyond 5 years.
Floodplains	Floodplains and floodplain values would not be affected, or changes would be either non-detectable or if detected, would have effects that would be slight and non-measurable. The change would have barely perceptible consequences to riparian habitat function.	Changes in floodplains and floodplain values would be measurable, although the changes would be small and the effects would be localized. The action would affect a few individual plants or wildlife species within an existing riparian area.	Changes in floodplains and floodplain values would be measurable, long term and on a localized scale. Plant and wildlife species within the existing riparian area would experience a measurable effect, but all species would remain indefinitely viable.	Changes in floodplains and floodplain values would be readily measurable and have substantial consequences to floodplain dynamics and would be noticed on a localized scale within the watershed.	Short-term – After implementation, recovery would last less than one year. Long-term – After implementation, recovery would last more than one year.

Impact Topic	Negligible	Minor	Moderate	Major	Duration
Recommended Wilderness	The effect on recommended wilderness character would not be detectable.	The effect would be detectable, but would not appreciably affect the character or defining attributes of wilderness as described by the Wilderness Act.	The effect would be readily apparent and/or would appreciably affect the character or defining attributes of wilderness as described by the Wilderness Act.	The effects would be highly apparent and would significantly affect the character or defining attributes of wilderness as described by the Wilderness Act.	Short-term: Occurs for one year or less. Long-term: Occurs for more than one year or is permanent.
Natural Soundscapes	Noise from the action would very rarely be audible or would be below the level of detection and would not result in any perceptible consequences.	The action would be less than 1 month or noise from the action would rarely be audible or would attenuate to 33 to 35 dBA in the backcountry and rustic zones and 23 to 25 dBA in day use and visitor service zones within a short distance (<100m for backcountry and rustic zones; <200m for day use and visitor service zones) from the source.	The action would be 1 to 3 months or noise from the action would occasionally be audible or would attenuate to 33 to 35 dBA in the backcountry and rustic zones and 23 to 25 dBA in day use and visitor service zones within an intermediate distance (100m - 500m for backcountry and rustic zones; 200m - 600m for day use and visitor service zones) from the source.	The action would be more than 3 months and noise from the action would be regularly audible and would attenuate to 33 to 35 dBA in the backcountry and rustic zones and 23 to 25 dBA in day use and visitor service zones within a large (>500m for backcountry and rustic zones; >600m day use and visitor service zones) distance from the source.	Short-term: Would be temporary during implementation. Long-term: Would be permanent or continual.

Fisheries/Aquatic Threatened Species and Species of Concern

AFFECTED ENVIRONMENT

According to the 2006 *Management Policies*, the NPS is responsible for maintaining all animals native to the natural ecosystems of parks, including fish. Additionally, the 2006 *Management Policies* and Director's Order 77 *Natural Resources Management Guidelines* require the NPS to examine the impacts of projects on federally listed species and state listed sensitive species. Section 7 of the Endangered Species Act requires all federal agencies to consult with the U.S. Fish and Wildlife Service (USFWS) to ensure that any action authorized, funded, or carried out by the agency does not jeopardize the continued existence of listed species or critical habitats.

The assemblage of fish species above the proposed barrier consists of native fish and what appears to be a low density and relatively newly established lake trout (*Salvelinus namaycush*) population (Table 4). Results of experimental lake trout suppression activities on Quartz Lake have been promising to date, with identification of lake trout spawning areas and 91 percent of radio-tagged adult lake trout removed during gill netting operations in 2009 and 44 percent removed in 2010 (Muhlfeld and Fredenberg 2009 and D'Angelo et al. 2010).

Table 4: Fish species present in the Quartz Creek drainage.

Species	Abundance	Native/ Non-native
Westslope cutthroat trout	common	native
Bull trout	common	native
Mountain whitefish	common	native
Sculpin	common	native
Longnose sucker	uncommon	native
Largescale sucker	common	native
Lake trout	uncommon	non-native

Bull trout: Bull trout (*Salvelinus confluentus*) are listed as threatened under the Endangered Species Act and are also a state listed Species of Concern. The upper Quartz drainage is Critical Habitat for bull trout (USFWS 2010), and Quartz Lake is an important remaining stronghold for bull trout within Glacier National Park. Bull trout are the apex predator of aquatic systems in the park. As such, along with other top, iconic predators such as the grizzly bear, bull trout are representative of the pristine, intact ecological systems for which Glacier National Park is renowned.

Bull trout require habitats offering cold summer water temperatures, complex large woody debris accumulations, and clean cobble and boulder substrates (Rieman and McIntyre 1993, Rich 1996). Water temperatures greater than 15° C (approximately 60° F) are believed to limit bull trout distribution (Fraley and Shepard 1989). As a general rule, the colder the summer water temperature, the better the habitat for bull trout, however, recent studies in the Klamath Basin, Oregon, found adult bull trout present at summer maximum temperatures of 20° C (J. Light and D. Buchanan, Weyerhaeuser and ODFW, Corvallis, OR, unpublished data). Other Montana studies found sub-adult bull trout in water temperatures of 4° to 19° C (C. Frissell, U of M, Missoula, pers. comm.). Clancy (1996) demonstrated a strong relationship between bull trout presence and cold summer water temperatures throughout the Bitterroot National Forest. Bull trout have three distinct life history forms: resident, migratory fluvial and migratory adfluvial (Goetz 1989). Resident populations usually spend their entire lives in small headwater streams, whereas migratory forms are born and reared in small tributary streams for several years before migrating into larger rivers (fluvial) or lakes (adfluvial).

Bull trout begin their spawning migration from Flathead Lake in April, arriving in the North Fork of the Flathead River in June and July. They remain at the mouths of the spawning tributaries for two to four weeks, entering the tributaries from July through September. Emigration of juveniles from tributaries into the river system occurs from June through August. They move rapidly downstream, arriving in the mainstem of the Flathead River below the confluence with the South Fork during August and September (Fraley and Shepard 1989).

Historically, bull trout were one of four native salmonid species distributed throughout the Flathead drainage. They co-existed with westslope cutthroat trout (*Oncorhynchus clarkii lewisi*), pygmy whitefish (*Prosopium coulteri*), and mountain whitefish (*P. williamsoni*) (Brown 1971). The Flathead Lake bull trout population colonized all three forks of the Flathead River, the Swan River, the Stillwater River, the Whitefish River, and the Lower Flathead River.

Bull trout populations directly associated with Flathead Lake have declined significantly since the early 1980's (Weaver et al. 2006). These recent declines in the spawning population of bull trout in virtually all monitored streams throughout the North and Middle Forks of the Flathead River indicate that recent changes in the foodweb and subsequent expansion of lake trout populations are the primary threat to bull trout at this time (Spencer et al. 1991, Fredenberg 2002, Ellis et al. 2010, Downs, et al. 2011).

On the west side of Glacier National Park, only 5 of 17 lakes remain secure from invasion of non-native lake trout due to geologic barriers (Fredenberg et al. 2007), making protection of remaining lakes with strong bull trout populations, such as Quartz Lake, a high priority.

Donald and Alger (1993) evaluated the interaction between introduced lake trout and bull trout in sympatric waters and concluded there was substantial niche overlap, and that lake trout eventually replace bull trout as the top-level aquatic predator in such systems. They concluded that lacustrine (lake dwelling) populations of bull trout usually cannot be maintained if lake trout are introduced. Because data indicate that bull trout populations in most of the large connected glacial lakes on the west side of the park are increasingly imperiled due to the presence of non-native lake trout, the highest priority for conservation of bull trout was assigned to the Quartz Creek drainage (Fredenberg 2002).

The Quartz drainage subpopulation has the resilience to recover from short-term disturbances or subpopulation declines within one to two generations. Fish health surveys in 2000-2001 demonstrated existing healthy status. Genetic analyses of bull trout in Glacier National Park (Spruell et al. 2002, Meeuwig 2008) determined that bull trout populations inhabiting the various park drainages were generally genetically distinct from one another, meaning that movement of fish between these populations is infrequent. However, bull trout inhabiting the chain of lakes in the Quartz Creek drainage were not significantly different from one another, meaning that regular fish movement has historically occurred between the lakes in this system.

Implementation of this project would likely prohibit future upstream movement of bull trout from Lower Quartz Lake into the upper Quartz Lake system, but would not affect fish movement from the upper Quartz Lake system downstream into Lower Quartz Lake. Downstream movement of bull trout would maintain the genetic connection of these populations.

Westslope cutthroat trout. Westslope cutthroat trout (*Oncorhynchus clarkii lewisi*) are listed by the state of Montana as a Species of Concern. Westslope cutthroat trout in the Flathead drainage may be adfluvial, fluvial, or resident. Adfluvial fish occupy large lakes in the Upper Columbia drainage and spawn in tributaries. Fluvial fish reside in rivers instead of lakes and utilize tributaries for spawning. Most adults return to the river or lake after spawning. Resident fish complete their life history in tributary streams and all three life history forms may occur in a single basin.

Westslope cutthroat trout typically begin spawning between the ages of 3 and 5 (Brown 1971, Downs et al. 1997). Migratory adults typically move upstream to spawning tributaries coincident with increasing spring runoff, and spawn as peak spring flows begin to subside (generally in May and June) (Schmetterling 2001, Muhlfeld et al. 2009). Juveniles of the migratory life-history form generally spend 1-3 years in their natal streams before migrating to the lake habitats; migration of juvenile westslope cutthroat trout is usually associated with high spring flows and generally occurs between May and July (Downs and Jakubowski 2003). Migratory and resident forms may spawn in the same stream systems. Headwater areas are often dominated by resident fish.

Westslope cutthroat trout prefer cold, nutrient poor waters. Aquatic and terrestrial insects are the dominant food source (Brown 1971). Growth rates vary widely but are probably strongly influenced by overall aquatic habitat productivity. Spawning habitat has been characterized as gravel substrates with particle sizes ranging from 2 to 75 millimeters, mean depths ranging from 17 to 20 centimeters, and mean velocities between 0.3 and 0.4 meters per second (Shepard et al. 1984). Native westslope cutthroat trout are found throughout the Quartz Creek drainage.

INTENSITY LEVEL DEFINITIONS

Negligible: Impacts would be no more than negligible to any individuals of a sensitive species or other native species, or their habitat.

Minor: Impacts would affect a few individuals of sensitive species or other native species, or have very localized impacts upon their habitat. The change would require considerable scientific effort to measure and have barely perceptible consequences to the species or habitat function.

Moderate: Impacts would cause measurable effects on: (1) a relatively moderate number of individuals within a sensitive species or other native species population, (2) the existing dynamics between multiple species (e.g., predator-prey, herbivore-forage, vegetation structure-wildlife breeding habitat), or (3) a relatively large habitat area or important habitat attributes. A sensitive species or other native species population or their habitat might deviate from normal levels under existing conditions, but would remain indefinitely viable.

Major: Impacts would have drastic and permanent consequences for a sensitive species or other native species populations, the dynamics between multiple species, or almost all available critical or unique habitats. A sensitive species or other native species population or its habitat would be permanently altered from normal levels under existing conditions, and the population would be at risk of extirpation.

Short-term: After implementation, would recover in less than 1 year.

Long-term: Effects would persist beyond the project period or would be permanent.

IMPACTS OF ALTERNATIVE A – NO ACTION

A decision not to complete the fish barrier on Quartz Creek would allow the continued and likely expanded (i.e. new non-native species) passage of non-native fish species into the upper

Quartz Lake drainage. Despite the presence of non-native lake trout, Quartz Lake remains a native fish stronghold. Movement of additional lake trout into the upper lake system would undermine existing suppression activities and make the challenge of effective lake trout suppression in Quartz Lake considerably more difficult. Depending on the outcome of the suppression project as well as the movement of non-native fish species into the system, adverse impacts to native fish populations would be moderate to major. No action would perpetuate an open system, eliminating any chance of eradicating lake trout from Quartz Lake. Additional lake trout would be free to move upstream into upper Quartz Lake and further degrade critical habitat for bull trout. The movement of rainbow trout into the upper lake system could also occur, which would threaten the westslope cutthroat trout population.

Cumulative Impacts of Alternative A

The intent of the experimental lake trout suppression project at Quartz Lake is to protect native fish populations in the upper Quartz system, and results thus far have been promising. The proposed barrier modifications support this objective. If the no action alternative is implemented and the fish barrier is not improved and completed, the long-term effectiveness of the suppression effort would be continually undermined by movement of additional lake trout into the system. The lake trout suppression project is currently approved to continue through 2012 but could continue into the future, subject to additional environmental review. Failure to construct the barrier would preclude eradication of lake trout as a suppression project goal, as lake trout would be free to re-invade the lake. Under an ongoing suppression program, failure to construct a barrier would allow additional lake trout to augment the existing lake trout population in Quartz Lake, making effective suppression more difficult. In addition, non-native rainbow trout would be free to move upstream into Quartz Lake and threaten the persistence of westslope cutthroat trout in the system. Cumulative impacts would be moderate to major, adverse, local and regional, and short and long-term.

Conclusion

If no action to improve the Quartz Creek fish barrier is taken, the integrity of native fish populations in the upper Quartz drainage would be threatened by the movement of additional non-native lake trout into the system, and because of the potential for invasion by other non-native fish species. This alternative would risk the functional loss of bull trout and threaten the westslope cutthroat trout population in the upper Quartz system, causing impacts to native fish that are moderate to major, adverse, long-term, local and regional, as they would have implications not only for Glacier National Park, but for the larger Flathead River basin. Cumulatively, failure to improve and complete the barrier would undermine lake trout suppression efforts in Quartz Lake and, depending on the success of the suppression project, would have moderate to major adverse, local and regional, and short and long-term impacts to bull trout and native fisheries.

IMPACTS OF ALTERNATIVE B – PREFERRED

A modified, improved fish barrier would eliminate upstream passage of fish during non-flood conditions and reduce the likelihood of upstream passage during flood flows. The barrier would consist of a waterfall-type drop (approximately 4 feet), increased velocity in the center of the channel (estimated at approximately 11 feet per second (fps) for a two-year recurrence interval flow), and a “screen” across the center of structure (1 inch screen opening between bars). Modeling and a literature review (River Design Group 2009) indicated that neither the drop itself nor the increased water velocities would alone be sufficient to prevent “trout” from moving past the structure. However, based on professional judgment, the addition of a screen and the elimination of jump-pool formation downstream of the barrier would greatly improve its overall effectiveness. During low or high flows, it would not be possible for adult migratory “trout” to jump through the screen, which would be cantilevered downstream over the creek. It would be

more difficult for fish to jump over the screen during higher flows because this alternative would eliminate a jump pool below the structure. Any fish attempting to jump through the opening and over the screen would land on the screen and immediately encounter high sweeping water velocities and be washed back downstream. This alternative would substantially improve the current barrier situation, and have long-term benefits to native fish populations, including bull trout. Also, because this alternative would help maintain current levels of native fish in the upper Quartz drainage, it would protect opportunities for recreational anglers to fish in lakes inhabited by strong native fish populations.

In addition to restricting movement of non-native fish species upstream, the barrier would restrict upstream movement of native species. Any risks due to isolation are likely to be longer-term, while the negative impacts of non-native fish are considerably more urgent, near-term, and less theoretical. In addition, downstream connectivity would not be impacted and this is likely the key mechanism in maintaining gene flow and population support for bull trout in Lower Quartz Lake. The installation of the barrier is neither permanent nor irreversible if unanticipated consequences occur. Westslope cutthroat inhabiting Lower Quartz Lake would be prohibited from migrating as far upstream as the upper lakes following completion of the barrier. However, much of Quartz Creek upstream of Lower Quartz Lake would remain accessible to westslope cutthroat trout, nearly all the way upstream to Middle Quartz Lake (to the barrier site). In addition downstream movement and genetic exchange would not be impacted by the project. Upstream migration of westslope cutthroat trout through this reach likely occurs to some degree, but upstream movement rates are likely relatively low and it is also highly likely that Lower Quartz Lake functions as its own distinct population with adequate spawning and rearing habitat located downstream of the barrier site.

Sediment releases, which could harm fish, caused by in stream disturbances during the project would be minimal with construction occurring during the late-summer/fall low water period. In addition, most of the substrate in the project area consists of very large cobble and boulders. However, during construction a park employee would be at the construction site to monitor sediment releases. If these releases are deemed excessive (highly unlikely given the large substrate material), the activity would be halted until the stream clears. At that time, work activities would proceed. The proposed project would not change water temperatures.

A fisheries biological assessment was prepared for the initial barrier project and approved in April 2003. The USFWS has informed the park that the current proposal remains consistent with the action proposed in the original 2003 biological assessment and that the effects as analyzed would be the same. The 2003 concurrence therefore meets ESA compliance for bull trout, and a new biological assessment will not be prepared.

The matrix checklist and supporting documentation for the 2003 biological assessment indicate that the Quartz Creek fish barrier project may affect but would not likely adversely affect the listed bull trout. There is a negligible probability of "take" of ESA listed bull trout or native westslope cutthroat trout. Modification (in the form of a fish barrier) of proposed critical habitat would take place in order to protect bull trout and other native aquatic species in the upper Quartz drainage. Quartz Lake continues to represent a stronghold for native bull and westslope cutthroat trout, and the preferred alternative coupled with the ongoing experimental lake trout suppression project offers the best chance for preservation of this native aquatic ecosystem. The impact of minor temporary sediment pulses during construction has a negligible probability to impact bull trout and/or bull trout habitat in the Quartz drainage.

Cumulative Impacts of Alternative B

Results of experimental lake trout suppression efforts at Quartz Lake have so far been promising. Alternative B combined with ongoing and possible future lake trout suppression, as

well as other projects designed to protect bull trout populations, would benefit bull trout and other native fish species for the long term.

Conclusion

An improved fish barrier would greatly reduce the ability of non-native fish to enter the upper Quartz system, and would therefore have moderate, long-term, site-specific, local and regional beneficial impacts on native fish populations in the drainage. There would also be moderate beneficial, long-term impacts to recreational anglers from better protection of the upper Quartz native fish assemblage. Adverse impacts to aquatic resources from disturbances to the stream bed during implementation would be negligible to minor, short-term, and site-specific. Under Section 7 of the Endangered Species Act, the determination of effect for bull trout would be “may affect, but not likely to adversely affect”. Cumulatively, the action alternative would further the benefits of ongoing and possible future lake trout suppression efforts as well as other projects; the cumulative impacts to fisheries would be beneficial, moderate, long-term, local, and regional.

Floodplains

AFFECTED ENVIRONMENT

Executive Order 11988 Floodplain Management requires all federal agencies to “avoid to the extent possible the long and short term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct or indirect support of floodplain development wherever there is a practicable alternative”. The NPS is guided by the 2006 *Management Policies* and Director’s Order 77-2 *Floodplain Management*, which provides guidance on how to implement Executive Order 11988. The Service will strive to preserve floodplain values and minimize hazardous floodplain conditions. According to Director’s Order 77-2 *Floodplain Management*, certain construction within a 100-year floodplain requires preparation of a statement of findings for floodplains.

Floodplains are a very important component of a stream’s natural processes. They slow and disperse the energy of floodwaters, providing diverse habitat for wildlife and plants that thrive on flood disturbance. Large woody debris and fine river sediment collects in floodplains, increasing biodiversity in the area.

Quartz Creek drains a series of four glacially carved lakes, flowing approximately 8.8 miles from the outlet of Lower Quartz Lake before entering the North Fork of the Flathead River approximately five miles south of Polebridge. Middle Quartz, Quartz, and Cerulean lakes are found upstream of the fish passage barrier site, and Lower Quartz Lake is located approximately one mile downstream. Middle Quartz Lake is approximately 47 acres in size and has a maximum depth of approximately 41 feet. Quartz Lake has a surface area of approximately 869 acres and a maximum depth of approximately 273 feet. The upper-most lake, Cerulean Lake, is approximately 49 acres in size and has a maximum depth of approximately 118 feet. Hydrology in the Quartz Creek basin is snowmelt driven with peak flows typically occurring between April and June, although mid-winter rain-on-snow events can occur and produce floods of significant magnitude. The contributing drainage area for the Quartz Creek watershed has been estimated at 24.8 square miles, the mean watershed elevation at 6,151 feet, and the annual precipitation at 75.7 inches (River Design Group 2009). Based on methods outlined in the United States Geological Survey Water Resources Investigations Report 03-4308, a flood frequency analysis was conducted for the Quartz Creek watershed (Table 5) (River Design Group 2009).

Table 5: Flood frequency analysis results for the Upper Quartz Creek watershed (River Design Group 2009).

Recurrence interval (years)	Discharge (cubic feet per second)
2	770
10	1,232
50	2,250
100	3,150

Bankfull width ranges from 50-60 feet, the average channel slope is 4 to 5 percent, and half the particles in the channel bed are 300 millimeters or smaller (i.e. D50) (River Design Group 2009). The barrier site is located at the upper end of a confined valley type characterized by steep valley walls, a narrow valley bottom, and coarse bed sediments derived from glacial and fluvial processes (i.e. Rosgen B3 channel type).

NPS infrastructure in the drainage downstream of the project site is limited and consists of a footbridge and small backcountry campground near the outlet of Lower Quartz Lake, as well as the Quartz Creek Campground and the bridge along the Inside North Fork Road over Quartz Creek, both located approximately seven miles downstream of the Lower Quartz Lake outlet.

INTENSITY LEVEL DEFINITIONS

Negligible: Floodplains and floodplain values would not be affected, or changes would be either non-detectable or if detected, would have effects that would be slight and non-measurable. The change would have barely perceptible consequences to riparian habitat function.

Minor: Changes in floodplains and floodplain values would be measurable, although the changes would be small and the effects would be localized. The action would affect a few individual plants or wildlife species within an existing riparian area.

Moderate: Changes in floodplains and floodplain values would be measurable, long term and on a localized scale. Plant and wildlife species within the existing riparian area would experience a measurable effect, but all species would remain indefinitely viable.

Major: Changes in floodplains and floodplain values would be readily measurable and have substantial consequences to floodplain dynamics and would be noticed on a localized scale within the watershed.

Short-term: After implementation, recovery would last less than one year.

Long-term: After implementation, recovery would last more than one year.

IMPACTS OF ALTERNATIVE A – NO ACTION

There would be no action under this alternative that would change existing conditions; consequently, there would be no new impacts to floodplains under Alternative A.

Cumulative Impacts of Alternative A

There would be no action under this alternative, and no cumulative impacts.

Conclusion

Under no action, there would be no change to existing floodplain conditions along Quartz Creek, and no new impacts.

IMPACTS OF ALTERNATIVE B – PREFERRED

The completed fish barrier proposed under this alternative would not modify or occupy the Quartz Creek floodplain in such a way that it would measurably affect flood flows. The structure

would funnel water to the center of the channel over a screen that would prevent fish from passing upstream during most flows. During flows in excess of bankfull, some water that would normally be up on the floodplain would be directed back into the channel due to the presence of the 3 to 4-foot high gabion structure extending out onto the floodplain. However, immediately downstream of the barrier, the stream would have unimpeded access to the floodplain once again. The flood storage capacity and overall dynamics of the floodplain would not be affected. No floodplain dikes or similar water control structures would be involved in this project.

Hydraulic model results (Atkins 2011) indicate that for both the existing and proposed barriers, water would be anticipated to flow over the top of the structure every two years during peak runoff, which is similar to the typical bankfull flow for the stream. Hydraulic conditions on the floodplain may be slightly different due to the new height of the floodplain sill (an additional 1-2 feet), but access to the floodplain would essentially be similar under existing and proposed conditions. Under both conditions, the stream has access to its floodplain through the project area. In addition, a splash pad on the downstream side of the structure would reduce any erosion potential.

At most, the completed structure would impact floodplain function over perhaps 200 feet of an estimated 45,000 feet of stream channel extending from the project area downstream to the bottom of the drainage. Because the stream would continue to have access to its floodplain, and since the effects of the completed barrier would occur in a very localized area of Quartz Creek, adverse impacts to floodplains would be negligible to minor. Additionally, since the work would be completed during the fall at low water times, any impact to the floodplain during construction would be remediated by spring flows.

There are no site-specific flood risks, as the project is located in the backcountry and well away from any developed areas. Any flood risk associated with potential failure of the barrier would be attenuated immediately downstream of the structure in Lower Quartz Lake. The barrier would not necessarily be a permanent fixture on the landscape, and could be removed in the future if the NPS determined it is no longer needed.

Cumulative Impacts of Alternative B

The preferred alternative would result in improvements to the original barrier and would occur in the same location. The gabions for the improved barrier would extend further onto the floodplain than those for the existing barrier, causing only slight alterations to the displacement of high water flows. The two projects combined would therefore not result in any measurable increase in impacts to floodplains.

Conclusion

Under Alternative B, the completed fish barrier would not affect the overall dynamics of the Quartz Creek floodplain. During high-water events, the gabions extending onto the floodplain would redirect some water back into the channel, but the stream would have unimpeded access to its floodplain immediately downstream, and any effects would occur in a very localized area. Impacts to floodplains would therefore be adverse, negligible to minor, site-specific, and long-term. Cumulatively, the proposed project combined with the construction of the original barrier would not measurably increase impacts to floodplains; cumulative impacts would therefore be adverse, negligible to minor, site-specific, and long-term. A statement of findings for floodplains has been prepared and attached to this document.

Recommended Wilderness

AFFECTED ENVIRONMENT

In 1964, Congress passed the Wilderness Act to “assure that an increasing population, accompanied by expanding settlement and growing mechanization, does not occupy and modify

all areas within the United States and its possessions, leaving no lands designated for preservation and protection in their natural condition” [Section 2(a)]. The National Wilderness Preservation System was thus established, preserving millions of acres of undeveloped wild country across a diversity of landscapes in the nation’s wildlife refuges, forests, and national parks. The defining attributes of wilderness as described by the Wilderness Act in Section 2(c) include: “untrammelled”; “undeveloped Federal land retaining its primeval character and influence”; “without permanent improvements or human habitation”; “protected and managed so as to preserve its natural conditions”; “generally appears to have been affected primarily by the forces of nature, with the imprint of man’s work substantially unnoticeable”; “has outstanding opportunities for solitude or a primitive and unconfined type of recreation”; “has at least five thousand acres of land or is of sufficient size as to make practicable its preservation and use in an unimpaired condition”; and “may also contain ecological, geological, or other features of scientific, educational, scenic, or historical value”.

In 1974, Glacier National Park completed a study and environmental impact statement to comply with the Wilderness Act. That document resulted in the recommendation by the Secretary of the Interior that over 90% of the park be designated as wilderness. Amendments to the wilderness recommendation in 1984 and 1994 increased the amount of proposed wilderness in the park to 95%. Glacier National Park manages recommended wilderness as designated wilderness in accordance with NPS management policies. Wilderness management guidelines promote natural processes and allow humans only as temporary visitors. Park visitors are encouraged to comply with “leave no trace” practices that minimize human impacts, and motorized travel or tools are not permitted “except as necessary to meet minimum requirements for the administration of the area” for the purpose of the Wilderness Act [Section 4(c)]. *NPS Management Policies 2006*, Section 6.3.5, describe the minimum requirement concept as “a documented process used to determine if administrative actions, projects or programs undertaken by the Service or its agents and affecting wilderness character, resources, or the visitor experience are necessary, and if so how to minimize impacts”. The Minimum Requirement Decision Guide (MRDG) used for the minimum requirement-minimum tool analysis for this project is included in Appendix A. Required of federal land managers before implementing projects within wilderness, the MRDG enables managers to determine if a proposed project or activity in wilderness is appropriate and ensures that the minimum, least intrusive methods/tools are used during implementation.

Recommended wilderness in Glacier National Park begins 200 feet from the centerline of paved roads, 50 feet from unpaved roads, and 300 feet from developed areas (NPS 2004). The park’s recommended wilderness remains “untrammelled” and relatively unmanipulated. Human developments consist of trails (and associated constructions such as bridges and turnpikes), backcountry campsites, historic lookouts, and historic backcountry cabins. There are no permanently occupied structures, most of the park’s recommended wilderness is trail-less, and motorized use and access is prohibited except in the case of emergency or administrative purposes necessary for the management of wilderness. Administrative activity is generally limited to trail and campsite maintenance, preservation of historic structures, non-native invasive plant control, and wildlife management and research.

Glacier National Park’s recommended wilderness landscapes have retained their intrinsically wild character and persist in their essentially natural condition, without degradation from human interference. The native ecological systems within the park’s recommended wilderness provide valuable habitat for an abundance of plant and animal species, including the park’s iconic grizzly bear. The presence of other top predators such as wolves, Canada lynx, mountain lions, wolverines, and their prey make Glacier National Park’s recommended wilderness one of the most intact and functional ecosystems in the lower forty-eight states. The enduring natural state

of Glacier's recommended wilderness supports the park's biodiversity; maintains air, water, and soil quality; and influences local and widespread fire regimes.

Glacier National Park's recommended wilderness provides outstanding opportunities for solitude and primitive recreation, such as hiking, backcountry camping, canoeing/kayaking, and mountaineering. Roads and visitor facilities are absent, and human access is limited by the primitive and oftentimes demanding nature of the landscape. Remote, rugged, and vast, the park's recommended wilderness offers a refuge from the modern world, where visitors are free to enjoy and experience the quietude, peace, and unrestricted environs of wild country.

The Wilderness Act's definition of wilderness includes lands which may "contain ecological, geological, or other features of scientific, educational, scenic, or historical value [Section 2(c)(4)]. Much of Glacier National Park's recommended wilderness is characterized by features and attributes that possess these values, some of which are unique to the park. Areas of recommended wilderness serve as outdoor laboratories for students of all ages, and considerable knowledge has been gained from scientific research on natural resources within recommended wilderness. Glacier National Park's backcountry is renowned for its scenery, and much of the park's unique history is reflected by historic lookouts, backcountry cabins, and other cultural resources. These features represent the inextricable, historic link between wilderness and human endeavor, when people of earlier times encountered the park's wilder and more primitive landscapes in much the same way we do today.

West of the Continental Divide in the northwest part of the park, the recommended wilderness surrounding Quartz Creek is untrammeled, characterized by rugged, remote, and wild country, spectacular scenery, and a diverse assemblage of native plants and animals. The area is natural, except for the presence of non-native lake trout in the Quartz drainage. The project site is undeveloped except for the existing unfinished fish barrier. Many visitors to the area come to experience a sense of solitude and enjoy numerous recreational opportunities, including hiking and backcountry camping. Cultural resources within the area's wilderness setting include the Quartz Lake snow shoe cabin, which was built in the 1930s, and various archaeological sites found near the lakes. The wilderness resource in the Quartz drainage also offers unique opportunities for outdoor education, and the upper drainage provides especially valuable opportunities for scientific research on intact terrestrial and aquatic ecological systems, including those which support bull trout and other native fish species.

INTENSITY LEVEL DEFINITIONS

- Negligible:* The effect on recommended wilderness character (untrammeled, natural, undeveloped opportunities for solitude or primitive and unconfined recreation and other features, such as cultural) would not be detectable.
- Minor:* The effect would be detectable, but would not appreciably affect the defining attributes of wilderness character as described by the Wilderness Act.
- Moderate:* The effect would be readily apparent and/or would appreciably affect the defining attributes of wilderness character as described by the Wilderness Act.
- Major:* The effects would be highly apparent and would significantly affect the defining attributes of wilderness character as described by the Wilderness Act.
- Short-term:* Occurs for one year or less.
- Long-term:* Occurs for more than one year or is permanent.

IMPACTS OF ALTERNATIVE A – NO ACTION

Failure to improve the fish barrier under the no action alternative would increase the potential for native fish populations to become compromised or permanently lost as a result of colonization by non-native fish, and would adversely affect certain wilderness defining attributes of the upper Quartz drainage. The natural, historic state of the native fish community and the ecological condition of the drainage would become permanently altered as non-native fish species predominate over native fish. Such a profound alteration of the fishery would degrade the unique ecological value of the Quartz drainage, where the threatened bull trout still resides at the top of the food chain. The unique scientific value of the Quartz drainage would also be diminished, as opportunities to study and monitor one of the last ecologically intact strongholds for bull trout would be lost. Recreational opportunities would also be impacted, as changes to fish species composition and distribution would alter the dynamics of lake and stream fishing. Adverse impacts to the wilderness resource would extend throughout the upper Quartz drainage and be long-term and likely permanent.

Cumulative Impacts of Alternative A

Past, current and future actions such as trail maintenance, historic structure repairs, the unfinished existing fish barrier, research efforts, and backcountry helicopter or fixed-wing flights have had and continue to have some temporary effects on wilderness defining attributes, such as solitude. These actions combined with the long-term degradation of the natural condition, specifically the eventual loss of the native fisheries, of the upper Quartz drainage under no action would incrementally increase the overall level of adverse impacts to the wilderness resource. No action would undermine the overall benefit of efforts to suppress lake trout, and would also diminish the efficacy of other projects intended reduce access for non-native fish species elsewhere in the North Fork (such as Akokala Cr.), thereby degrading the natural condition of recommended wilderness on a wider scale.

Conclusion

Taking no action to improve the fish barrier on Quartz Creek would result in the permanent degradation of the natural condition, unique ecological value, and unique scientific value of recommended wilderness in the upper Quartz drainage. Impacts to recommended wilderness would be adverse, moderate, site-specific and local, and long-term. Cumulatively, no action combined with short-term disturbances from past, ongoing, and reasonably foreseeable actions would incrementally increase adverse effects to the overall quality of recommended wilderness, and would diminish the overall benefit of efforts to protect the native fish community elsewhere in the North Fork district. Cumulative impacts would be adverse, negligible to moderate, short and long-term, site-specific and local.

IMPACTS OF ALTERNATIVE B – PREFERRED

Improving the fish barrier on Quartz Creek under Alternative B would protect the native fish community in the upper Quartz drainage and thus benefit recommended wilderness. The unique ecological and scientific value of the wilderness resource within the Quartz drainage would be safeguarded for the long term, and recreational fishing opportunities would remain unaltered.

During implementation of the preferred alternative, the use of mechanized tools and equipment would temporarily disturb the solitude, natural and untrammelled, (unmanipulated) quality of recommended wilderness within and near the project area, and helicopters would briefly disrupt these attributes along the drainage. Noise would be intermittent and short-term, lasting only for the duration of the project (approximately two weeks). Noise from helicopters would be transient along the flight path, very short term, and would only occur one to three times, depending on the number of flight necessary. Given the few number of trees (approximately 5-10) that would be collected for the barrier, the removal of downed timber, standing dead timber, and possibly live

trees would only slightly affect the unmanipulated and natural quality of the area surrounding the work site. The use of “roller logs” to haul the logs over the ground would lessen these impacts considerably, as vegetation would not be destroyed but only temporarily compacted. The removal of the logs would also occur some distance from the trail, and would not be apparent to hikers. Clearing brush between the trail and the work site for work crew access would temporarily impact the unmanipulated quality of the immediate area, but evidence of clearing would likely not be apparent by the following spring.

Once completed, the barrier would constitute a semi-permanent human-made structure on a wilderness landscape, diminishing the pristine undeveloped, untrammeled and natural qualities of the immediate area for the long term. But because the barrier’s location is well away from the Quartz Creek Trail, is difficult to reach, and is not visible from the trail, it would be detected only by visitors who venture off the Quartz Creek trail and bushwhack to the creek. Adverse long term impacts to the wilderness resource would therefore be minor. Infrequent future maintenance (possibly every 7-10 years) of the barrier is not anticipated to require helicopter support and would have only negligible adverse impacts on recommended wilderness.

Cumulative Impacts of Alternative B

Disturbances during the project’s two-week work period combined with past, ongoing, and future actions (such as trail maintenance, structure replacements and repairs, lake trout suppression efforts, administrative flights and possible emergency flights to backcountry sites near the project area, as well as commercial scenic flights on the west side of the divide) would temporarily and incrementally increase the level of disturbance to recommended wilderness character. Any helicopter flights for this project would be included in the park’s 2012 administrative flight restrictions of approximately 50 park-wide flights. The presence of the barrier combined with other past, ongoing and future actions would have adverse long term impacts to the untrammeled and undeveloped wilderness qualities of the project site. However, combined with other efforts in the North Fork district to suppress lake trout and inhibit non-native fish from accessing park waterways, the preferred alternative would benefit the long-term natural character of the wilderness resource in the park.

Conclusion

By protecting native fish populations in the upper Quartz drainage, Alternative B would appreciably benefit the natural condition and unique ecological qualities of wilderness, resulting in long-term, moderate, beneficial, site-specific, and local impacts. Temporary disturbances during construction, impediment to upstream migration of native fish species and the semi-permanent presence of a human-made structure would have impacts to the wilderness qualities (untrammeled, undeveloped, natural and opportunities for solitude) that are adverse, site-specific, local, short and long-term, and minor since these effects would not appreciably affect the overall wilderness of the area, would remove a non-native fish species, would maintain the native fish population and because the barrier would remain undetected by most visitors. Future maintenance of the barrier would result in negligible adverse, short-term impacts. Cumulatively, disturbances from Alternative B would temporarily and incrementally increase disturbances from past, ongoing, and reasonably foreseeable actions and have minor adverse, short and long-term, site-specific and local impacts on wilderness. But the project would further the benefit of other efforts to protect native fisheries, resulting in beneficial cumulative impacts to recommended wilderness that are minor to moderate, long-term, and local.

Natural Soundscapes

AFFECTED ENVIRONMENT

An important part of the NPS mission is to preserve the natural soundscapes of national parks. Natural soundscapes are the sounds of nature, a diminishing resource in an ever modernizing world. Natural sounds have intrinsic value as part of the unique environment of Glacier National Park, and they predominate throughout most of the park. Glacier's natural soundscape includes the pervading quiet and stillness, low decibel background sounds, birdsong and animal calls, the buzz of insects, and the sound of wind, rain, and water, among many others. Natural soundscapes vary across the park, depending on elevation, proximity to water, vegetative cover, topography, time of year, and other influences.

In general, soundscapes in the park are managed according to the management objectives for the park's four different management zones (backcountry, rustic, day use, and visitor service). Existing ambient sound levels differ within each of these zones, and therefore soundscape management objectives for each zone are also different. Soundscapes for the park's backcountry and rustic zones differ markedly from the soundscapes within visitor service zones. Day use zones often overlap between rustic or backcountry zones, and soundscapes in these areas may be characteristic of both the backcountry and more developed areas.

According to the park's General Management Plan (NPS 1999), management in backcountry areas (which includes recommended wilderness) is focused on protection and, when necessary, restoration of resources and natural processes. Backcountry zones, where natural sounds predominate, are therefore managed for natural quiet. The rustic zone is managed to provide a staging area for use of the adjacent backcountry zone; facilities and campgrounds are primitive, and natural sounds also predominate. In contrast, visitor service and day use zones allow for heavier use and more congested conditions, and some level of artificial noise is expected. Soundscapes in day use zones are managed for a range of conditions that include some artificial noise as well as natural quiet, depending on their location in the park, while visitor service zones are managed for higher levels of human caused noise.

Artificial noise in Glacier National Park originates from human activities and varies depending on location, time of day, and time of year. Sources of artificial noise in the park include road traffic (including motorcycles); motorboats; aircraft; railroad traffic; human activity at visitor centers, campgrounds, picnic areas, and along trails; and park administrative activities that require power tools, heavy equipment, airplanes, helicopters, or emergency vehicles. Elevated noise levels are generally concentrated near campgrounds, roads, and developed areas. Existing and future development outside the park, including logging and construction, may also contribute to artificial noise within the park.

A short segment of lower Quartz Creek is within the rustic zone where it is crossed by the Inside North Fork Road. Otherwise, Quartz Creek is entirely within the park's backcountry management zone, within the conifer forest acoustic zone, which has natural ambient sound levels ranging between 19.4 and 30.5 dBA (U.S. DOT 2009). Natural ambient sound levels at Quartz Creek are likely midway within this range, at approximately 25 dBA, given predominating natural stream sounds and as suggested by specific sound level data obtained at similar measurement sites within the conifer forest acoustic zone (U.S. DOT 2009). The natural soundscape in the upper Quartz drainage is characterized almost exclusively by natural sounds and is interrupted only now and then by hiking parties, aircraft, or park administrative activities such as trail and backcountry campground maintenance. Since 2005, lake trout gill netting operations on Quartz Lake involving the use of a motorboat equipped with an outboard motor have produced some low-level artificial noise that is audible in the vicinity of the lake during the fall.

INTENSITY LEVEL DEFINITIONS

Note: The intensity level definitions for this resource topic vary according to the location of a proposed project, as natural ambient sound levels vary throughout the park and because different areas are managed for different levels of artificial noise. The definitions below therefore reflect natural ambient conditions within the Quartz drainage only, as well as management objectives for the park's backcountry zone.

Negligible: Noise from the action would very rarely be audible or would be below the level of detection and would not result in any perceptible consequences.

Minor: The action would be less than 1 month or noise from the action would rarely be audible or would attenuate (reduce in acoustic energy or amplitude) to 25 dBA within a short distance (<100 meters) from the source.

Moderate: The action would be 1 to 3 months or noise from the action would occasionally be audible or would attenuate to 25 dBA within an intermediate distance (100 meters to 500 meters).

Major: The action would be more than 3 months and noise from the action would be regularly audible and would attenuate to 25 dBA within a large distance (>500 meters) from the source.

Short-term: Would be temporary during implementation.

Long-term: Would be permanent or continual.

IMPACTS OF ALTERNATIVE A – NO ACTION

There would be no action under alternative A; therefore, there would be no new impacts to natural soundscapes.

Cumulative Impacts of Alternative A

There would be no cumulative impacts to natural soundscapes, since there would be no action under Alternative A.

Conclusion

No impacts would occur to natural soundscapes under this alternative because there would be no action.

IMPACTS OF ALTERNATIVE B – PREFERRED

The preferred alternative would cause temporary, intermittent disturbances to the natural soundscape from helicopter flights and the use of mechanized tools and equipment, including chainsaws, a rock drill, one or two water pumps, and a generator. Most of the noise would likely be localized to the work site, but helicopter noise would affect a greater area and tools with lower frequencies could produce noise that is audible beyond the project area. Mechanized tools and equipment would produce noise ranging between 68.5 and 112 dBA one meter from the source: the generator would produce noise at approximately 68.5 dBA 1 meter from the source, water pumps would produce noise at approximately 105 dBA 1 meter from the source, chainsaws would produce noise at approximately 110 dBA 1 meter from the source; and a pneumatic rock drill would produce noise at approximately 112 dBA 1 meter from the source.

Noise from the generator would be expected to attenuate (reduce in acoustic energy or amplitude) to 25 dBA within approximately 175 meters, and noise from the water pumps and chainsaws would likely attenuate to 25 dBA within approximately 3000 to 4000 meters, or 2.0 to 2.5 miles. The rock drill would produce noise at a lower frequency, which travels much farther than higher frequency sounds. Noise from the rock drill would attenuate to 25 dBA within approximately 11,000 meters, or nearly 7 miles. However, the audibility of noise beyond the project area would be dampened and minimized by topography, weather conditions, and fairly dense forest vegetation, including a very thick understory. There is also a higher natural ambient sound level in the project area due to natural stream sound, which would cause noise to attenuate over shorter distances. Additionally, the used of mechanized equipment would be minimized as much as possible and would only occur intermittently. The water pumps could be running intermittently every day for up to 7 days, depending on site conditions, how readily water is diverted from the immediate work area, and the overall progress of construction. The rock drill, which would have the greatest level of audibility, is expected to only be in use for approximately 15 minutes at a time over a 4 to 5 hour period. The attenuation distances therefore represent a worst case scenario, and do not reflect the anticipated or likely level of audibility.

Noise from the generator, chainsaws, water pumps, and rock drill would likely have some adverse effects to wildlife and visitors within and near the project area. Noise could mask biologically important sounds, degrade habitat, and cause behavioral and physiological changes in individual animals. However, these effects would diminish as the distance from the site increases, and impacts would be minor given the temporary, intermittent nature of the noise.

Because the helicopter would fly 2,000 feet above ground level from West Glacier to the staging area along the Inside North Fork Road, it would not measurably affect soundscapes within visitor service or day use zones along lower Lake McDonald and the Camas Road. The helicopter could be more audible within the rustic zone along the Inside North Fork Road, but again, the effects would be minimal given the elevation of the flights. Helicopter noise would be

audible and disruptive to the soundscape within the Quartz drainage and side tributaries as the helicopter flies from the staging area up to the work site. Helicopter noise could temporarily displace animals, cause behavioral and physiological changes, and mask important sounds. The noise would also disrupt opportunities for visitors to experience a sense of quiet and solitude in the backcountry. However, helicopter noise would be transient and very temporary, no more than three short (approximately 30 minute round trip) flights would likely occur on two different days, and adverse effects to the natural soundscape would be minor.

Overall, the introduction of artificial noise under the preferred alternative would be intermittent and very short-term. Modification of the fish barrier is estimated to require only ten days to two weeks. Work would be underway during daylight hours only. When onsite noise is produced, it would not occur continuously, but would be interrupted by periods of relative quiet when crews are doing work that does not require mechanized tools or equipment. Once the project is complete, there would be no impacts to the natural soundscape. While the preferred alternative would produce temporary noise that could be audible beyond the project area, the project would be of such a short duration that overall impacts to natural soundscapes in the affected area would be at a minor level.

Cumulative Impacts of Alternative B

Noise associated with the fish barrier modification combined with past, ongoing, and future actions (such as trail maintenance, structure replacements and repairs, lake trout suppression efforts at Quartz Lake, administrative flights and possible emergency flights to backcountry sites near the project area, as well as commercial scenic flights on the west side of the divide) would temporarily and incrementally increase impacts to the natural soundscape. Helicopter flights for this project would be included in the park's 2012 administrative flight restrictions of approximately 50 park-wide flights or less.

Conclusion

Noise from helicopter flights, chainsaws, a rock drill, water pumps, and a generator would have temporary adverse effects to natural soundscapes within and near the project area, and could disturb wildlife and visitors. However, artificial noise would be intermittent and short-term and would be interrupted by periods of quiet. Topography, forest vegetation, natural stream sounds, and weather conditions would minimize the audibility of the noise, and the effects would diminish as distance from the site increases. Helicopter noise would be transient and very temporary, and there would only be three flights of short duration (approximately 30 minutes round trip). Because the proposed action would be completed in only ten days to two weeks, adverse impacts to the natural soundscape would be minor, short-term, site-specific and local. Cumulatively, noise from the fish barrier modification combined with impacts from past, ongoing, and reasonably future actions would have minor to moderate, adverse, short and long-term, site-specific and local impacts to natural soundscapes.

COMPLIANCE WITH FEDERAL AND STATE REGULATIONS

National Environmental Policy Act (NEPA) and Regulations of the Council on Environmental Quality – The National Environmental Policy Act applies to major federal actions that may significantly affect the quality of the human environment. This generally includes major construction activities that involve the use of federal lands or facilities, federal funding, or federal authorizations. This EA meets the requirements of NEPA and of the Council on Environmental Quality in evaluating potential effects associated with activities on federal lands. If no significant effects are identified a finding of no significant impacts (FONSI) would be prepared. If significant effects are identified, a notice of intent (NOI) would be filed for preparation of an environmental impact statement (EIS).

Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.) – Section 7 of the Endangered Species Act is designed to ensure that any action authorized, funded, or carried out by a federal agency likely would not jeopardize the continued existence of any endangered or threatened plant or animal species. If a federal action may affect threatened or endangered species, then consultation with the U.S. Fish and Wildlife Service is required. The NPS has determined that the proposed action “**may affect, but not likely to adversely affect**” **bull trout** and **grizzly bears**; the NPS has determined “**no effect**” to **Canada lynx**. In accordance with Section 7, the NPS has initiated informal consultation with the USFWS. A fisheries biological assessment prepared for the initial barrier project was approved in April 2003. The USFWS has informed the park that the current proposal remains consistent with the action proposed in the original 2003 biological assessment and that the effects as analyzed would be the same. The 2003 concurrence therefore meets ESA compliance for bull trout. The park has submitted a separate biological assessment to the USFWS addressing the effects to grizzly bears.

Clean Water Act (CWA) and State and Local Water Quality and Floodplain Regulations – If the Preferred Alternative is implemented, all necessary federal, state and local permits would be obtained to ensure compliance with the Clean Water Act. These include a Section 404 permit from the Army Corps of Engineers, a Montana DEQ 318 permit, a Nondegradation Review Permit from Montana DEQ and a Montana Fish, Wildlife and Parks 124 Permit (Stream Preservation Act).

Executive Order 11990, Protection of Wetlands – E.O. 11990 was issued in 1977 “...to avoid to the extent possible the long and short term adverse impacts associated with the destruction or modification of wetlands and to avoid direct or indirect support of new construction in wetlands wherever there is a practicable alternative...”. A survey conducted in 2003 determined that there are no wetlands in the project area. Therefore wetlands would not be affected.

Executive Order 11988, Floodplain Management – E.O. 11988 requires all federal agencies to “avoid to the extent possible the long and short term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct or indirect support of floodplain development wherever there is a practicable alternative”. According with Director’s Order 77-2, the impacts of proposed actions within the 100-year floodplain must be addressed in a separate Statement of Findings (SOF). The structure would not modify or occupy the floodplain in such a way that it would affect flood flows. A statement of findings for floodplains has been prepared.

Wilderness Act – the Wilderness Act of 1964 (16 USC 1131 et seq.) established a wilderness preservation system. Public law 88-577 established a national wilderness preservation system and describes wilderness with the following language:

A wilderness...is...an area where the earth and its community of life are untrammled by man, where man himself is a visitor who does not remain. An area of wilderness is further defined to mean... an area of undeveloped Federal land retaining its primeval character and influence, without permanent improvements or human habitation, which is protected and managed so as to preserve its natural conditions and which: 1) generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable; 2) has outstanding opportunities for solitude or a primitive and unconfined type of recreation; 3) has at least 5,000 acres of land or is of sufficient size as to make practicable its preservation and use in an unimpaired condition; and 4) may also contain ecological, geological, or other features of scientific, educational, scenic or historical value.

The Minimum Requirement Decision Guide prepared for this project is included in Appendix A.

National Historic Preservation Act of 1966, as amended (16 U.S.C. 470, et seq.)— Section 106 of the National Historic Preservation Act of 1966 (as amended) requires all federal agencies to consider effects from any federal action on cultural resources eligible for or listed in the National Register of Historic Places (NHRP) prior to initiating such actions. During scoping, Glacier National Park notified the Montana State Historic Preservation Office (SHPO), the Confederated Salish and Kootenai Tribes, and the Blackfeet Tribal Business Council of the project in keeping with 36 CFR800. There are no historic buildings and structures or cultural landscapes in the project area, the Areas of Potential Effect have been surveyed for archeological resources and none were identified, neither the Blackfeet Tribe nor the Confederated Salish and Kootenai Tribes raised concerns about the proposed action, and no historic properties would be affected. The NPS will document a “no historic properties affected” finding in the EA transmittal letter to the Montana SHPO.

CONSULTATION AND COORDINATION

Internal and External Scoping

Scoping is an early and open process to determine the breadth of environmental issues and alternatives to be addressed in an EA. Glacier National Park conducted both internal scoping with park staff and external scoping with the public and interested and affected groups and agencies. The scoping process helped identify potential issues, alternatives, the possible effects of cumulative actions, and what resources would be affected.

Public scoping began on August 3, 2011 and the comment period closed on September 6, 2011. A press release was distributed to several media outlets and a scoping brochure was mailed to individuals and organizations on the park's EA mailing list, including members of Congress and various federal, state, and local agencies. An email announcement was sent to a number of interested parties with a link to the brochure on the NPS Planning, Environment, and Public Comment (PEPC) website.

Ten letters were received during scoping; seven letters were from private individuals and three were from organizations including the National Parks Conservation Association, the Flathead Audubon Society, and the Friends of the Wild Swan. Most of the letters were supportive of the proposal to modify and improve the Quartz Creek fish barrier. Five letters expressed full support for the project; two letters expressed support, but with concerns; one letter expressed general concerns about management actions; and one letter was in opposition to the project based on the belief that the effort would be unsuccessful and an imprudent use of federal dollars.

Comments have been addressed under the following sections in this EA: *Purpose and Need; Alternatives Considered; Alternatives, Suggestions, and Concerns Considered but Eliminated from Detailed Study; and Affected Environment and Environmental Consequences.*

Agency Consultation

In accordance with Section 7 of the Endangered Species Act (ESA), Glacier National Park initiated informal consultation with the U.S. Fish and Wildlife Service (USFWS) on August 3, 2011. In April of 2003, the park had submitted a biological assessment to the USFWS on impacts to bull trout from the original fish barrier construction project. In an email to the USFWS dated November 9, 2011, the park inquired as to whether the existing biological assessment would meet bull trout ESA compliance for the current proposal to complete and modify the barrier. On November 16, 2011, the USFWS replied that the current proposal remains consistent with the action proposed in the original 2003 biological assessment, the baseline would be unchanged, and effects as analyzed would be the same; the 2003 concurrence therefore meets ESA compliance for bull trout for the current proposal. The park has submitted a separate biological assessment to the USFWS addressing the effects to grizzly bears. On August 3, 2011, Glacier National Park also notified the Montana State Historic Preservation Office (SHPO) in keeping with 36 CFR800.

Native American Consultation

Glacier National Park also notified the Confederated Salish and Kootenai Tribes and the Blackfeet Tribal Business Council on August 3, 2011, in accordance with 36 CFR800. Neither the Blackfeet Tribe nor the Confederated Salish and Kootenai Tribes raised concerns about the proposed action during scoping for this or the earlier project.

Environmental Assessment Review and List of Recipients

This EA is subject to a 30-day public comment period. To notify the public of the availability of

the EA, NPS will send news releases to a number of state and local media outlets and a letter and/or the document to various agencies and tribes, as well as groups, business, and individuals on the mailing list. The document will be available for review on the park's planning website at <http://parkplanning.nps.gov/QuartzFishBarrier>. Copies of the EA will be provided to other interested individuals upon request.

During the 30-day public review period, the public is encouraged to submit their written comments to the NPS, as described in the instructions at the beginning of this document. Following the close of the comment period, all public comments will be reviewed and analyzed prior to the release of a decision document. The NPS will issue responses to substantive comments received during the public comment period.

List of Preparers

Chris Downs, Fisheries Biologist – Project Lead, Fisheries/Aquatic T & E sections, biological assessment; project description and alternatives

Dane Hanrahan, Computer Assistant – Computerized rendition of Figure 2

Kyle Johnson, Wilderness Manager – Recommended Wilderness section

Lon Johnson, Cultural Resource Specialist – Cultural resource sections, SHPO consultation

Joyce Lapp, Restoration Biologist – Vegetation and soils sections

Mary Riddle, Environmental Protection Specialist, Team Captain – Quality review, and editing; project description and alternatives; coordinates internal and regional reviews and agency consultation

Amy Secret, Compliance Biological Science Technician – Assisted with preparation of the EA, particularly the recommended wilderness, natural soundscape, wildlife, and T & E species sections; document compilation, technical writing, editing, and formatting

John Waller, Wildlife Biologist – Wildlife, Threatened and Endangered Species and Species of Concern sections; biological assessment

Consultants

Lisa Bate, Lead Wildlife Sciences Technician, Glacier National Park

Wade Fredenberg, Bull Trout Recovery Coordinator, U.S. Fish and Wildlife Service

Dan Jacobs, Park Trails Supervisor, Glacier National Park

Clint C. Muhlfeld, Aquatic Ecologist, U.S. Geological Survey

Wesley A. Reynolds, P.E., Park Engineer, Glacier National Park

Corey Shea, Westside Trails Foreman, Glacier National Park

Frank Turina, Ph.D., Outdoor Recreation Planner, NPS Natural Sounds Program Center

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As the nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering sound use of our land and water resources; protecting our fish, wildlife, and biological diversity; preserving the environmental and cultural values of our national parks and historical places; and providing for the enjoyment of life through outdoor recreation. The department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people by encouraging stewardship and citizen participation in their care. The department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

APPENDIX A MINIMUM REQUIREMENT DECISION GUIDE



GLACIER NATIONAL PARK

MINIMUM REQUIREMENTS DECISION GUIDE

“ . . . except as necessary to meet minimum requirements for the administration of the area for the purpose of this Act...”

– the Wilderness Act, 1964

Please refer to the accompanying MRDG [Instructions](#) for filling out this guide.

Project Title: **Quartz Creek Fish Barrier Modification and Improvement**

Step 1: Determine if any administrative action is necessary.

Briefly describe the situation that may prompt action.

Native fish populations in Glacier National Park have been severely compromised by the invasion and expansion of non-native fish species into the park’s lakes and streams. Non-native fish are imperiling populations of bull trout (*Salvelinus confluentus*), which are federally listed as threatened, and the native westslope cutthroat trout (*Oncorhynchus clarkii lewisi*), a state listed Species of Concern. Quartz Lake, located within recommended wilderness in the park’s North Fork District, is one of the last remaining strongholds for bull trout in park waters west of the Continental Divide. In 2005, lake trout were detected in Quartz Lake, threatening the long-term persistence of the Quartz Lake bull trout population. At that time, a fish passage barrier designed to protect the drainage from invasion by non-native fish was under construction on Quartz Creek, approximately 100 yards below Middle Quartz Lake, but completion of the barrier was suspended until options to control lake trout could be reviewed. The National Park Service (NPS) has since collaborated with the U.S. Geological Survey (USGS) and others in an ongoing experimental program to remove lake trout from Quartz Lake to suppress the population. Experimental suppression has so far been promising, with identification of lake trout spawning areas and annual removal of spawning lake trout. The NPS is proposing to complete, modify, and improve the existing

Quartz Creek fish barrier. The purpose of the project is to support lake trout suppression efforts in Quartz Lake, reduce the potential for additional lake trout to enter the lake, and reduce the likelihood of invasion from other non-native species such as rainbow trout and brook trout, thereby better protecting the integrity of native fish populations in the upper Quartz drainage.

A. Describe Options Outside of Wilderness

Is action necessary within wilderness?

Yes

Explain: The action is necessary for the protection of native fish populations in the upper Quartz drainage, which is within recommended wilderness. Placing a barrier outside recommended wilderness would require that active suppression efforts take place throughout the entire drainage. This would have greater and more widespread impacts on recommended wilderness and its characteristics of untrammelled, natural, undeveloped and opportunities for solitude.

B. Describe Valid Existing Rights or Special Provisions of Wilderness Legislation

Is action necessary to satisfy valid existing rights or a special provision in wilderness legislation (the Wilderness Act of 1964 or subsequent wilderness laws) that allows or requires consideration of the Section 4(c) prohibited uses? Cite law and section.

No

C. Describe Requirements of Other Legislation

Is action necessary to meet the requirements of other laws?

Yes

Explain:

The 1916 Organic Act that established the National Park Service, the park's enabling legislation, the 1978 Redwood Act, and the NPS Management Policies (2006) all direct the National Park Service to conserve and manage native populations of plants and animals within the parks in an unimpaired state for the enjoyment of future generations. The presence of invasive lake trout in waters on the west side of Glacier National Park clearly threatens the park's ability to accomplish this objective. Additionally, the 2006 Management Policies direct the NPS to "fully meet its obligations under the NPS Organic Act and the Endangered Species Act to both proactively conserve listed species and prevent detrimental effects on these species" (Section 4.4.2.3). The specific purpose of this project would be to reduce or eliminate negative inter-specific interactions between non-native lake trout and the threatened bull trout (as well as other native fish species), which generally lead to bull trout population loss over time. Successful implementation would also help in preventing the spread of non-native lake trout into Cerulean Lake, located upstream. Lake trout have not been detected in Cerulean Lake to date, but access from Quartz Lake appears possible. The Endangered Species Act (ESA) requires cooperation among Federal agencies in the restoration and conservation of listed species and their critical habitats, which this project endeavors to accomplish.

D. Describe Other Guidance

Is action necessary to conform to direction contained in agency policy, unit and wilderness management plans, species recovery plans, or agreements with tribal, state and local governments or other federal agencies?

Yes

Explain: In accordance with Section 4.1.5 of NPS 2006 Management Policies, the NPS is responsible for the reestablishment of “natural functions and processes”, including the control of exotic species. Section 4.4.2.3 of the Management Policies direct the NPS to meet its responsibilities under the Endangered Species Act, and includes the control of “detrimental nonnative species”. And in Section 4.4.4, the Policies state that “Exotic species will not be allowed to displace native species if displacement can be prevented.” Additionally, the park’s 1993 Resources Management Plan gives the management of bull trout high priority.

E. Wilderness Character

Is action necessary to preserve one or more of the qualities of wilderness character including: Untrammeled, Undeveloped, Natural, Outstanding opportunities for solitude or a primitive and unconfined type of recreation, or other unique components that reflect the character of this wilderness area?

Untrammeled: No

Undeveloped: No

Natural: Yes

Explain: Quartz Lake currently supports the most viable and un-impacted bull trout population remaining among the larger lakes in the park. It also supports a strong population of native westslope cutthroat trout. For the near term, it continues to provide a model of a fully functioning native aquatic ecosystem. The action would preserve the natural quality of the wilderness resource in the upper Quartz drainage by better protecting the integrity of native fish populations and, consequently, an aquatic ecological system on a local and regional scale.

Outstanding opportunities for solitude or a primitive and unconfined type of recreation:

No

Other unique components that reflect the character of this wilderness:

Yes:

Explain: The upper Quartz drainage is one of the last remaining strongholds for bull trout in the park and has significant value as an intact aquatic ecological system. Due to its ecological value, the area also possesses unique scientific and educational value. These components are currently threatened by the expansion of non-native fish species, and the action is necessary for their protection.

F. Describe Effects to the Public Purposes of Wilderness

Is action necessary to be consistent with one or more of the public purposes for wilderness (as stated in Section 4(b) of the Wilderness Act) of recreation, scenic, scientific, education, conservation, and historical use?

Recreation: Yes

Explain: The project will preserve recreational fishing opportunities in the Quartz drainage by protecting native fish species composition and westslope cutthroat trout, the primary species caught by anglers in the drainage.

Scenic: No

Scientific: Yes

Explain: The upper Quartz drainage provides especially valuable opportunities for scientific research on an intact aquatic ecological system that supports bull trout and other native fish species. Additionally, an experimental lake trout suppression project at Quartz Lake is contributing to a scientific body of knowledge pertaining to the control of non-native species.

Education: Yes

Explain: The upper Quartz drainage is a valuable place to study and learn about one of the last ecologically intact strongholds for bull trout in the park, and an experimental program to suppress non-native lake trout at Quartz Lake also possesses unique educational value pertaining to the control of non-native species.

Conservation: Yes

Explain: The fish barrier would greatly benefit the conservation of native fish species, including the threatened bull trout, in the upper Quartz drainage. This would in turn contribute to the overall conservation and protection of intact ecological systems within the park.

Historical use: Yes

Explain: Fishing is among the historical uses of the area, and has been documented since before the park's designation.

Step 1 Decision: Is any administrative action necessary in

Yes:

Explain: Without administrative action, significant populations of westslope cutthroat trout and bull trout will be at risk from the continued and likely expanded movement of non-native fish into the upper Quartz drainage. Movement of additional lake trout into the system would make the challenge of effective lake trout suppression in Quartz Lake considerably more difficult. Proposed critical habitat for bull trout would likely be degraded, and bull trout could become functionally extinct.

If action is necessary, proceed to Step 2 to determine the minimum activity.

Step 2: Determine the minimum activity.

Please refer to the accompanying MRDG [Instructions](#) for information on identifying alternatives and an explanation of the effects criteria displayed below.

Description of Alternatives

For each alternative, describe what methods and techniques will be used, when the activity will take place, where the activity will take place, what mitigation measures are necessary, and the general effects to the wilderness resource and character.

Alternative # <u> 1 </u>

Description: Helicopters would be used to fly materials and equipment to the barrier site, and motorized equipment would be used during the construction period. Up to three helicopter flights would be used to haul equipment and materials that cannot be packed into the work site, including a heavy duty screen and possibly an inflatable bladder dam, and to remove equipment that cannot be packed out after the project is complete. One or two small water pumps would be used to divert creek water around the work area and/or inflate the bladder dam with water; a non-inflatable water barrier that could be packed in on livestock instead of a helicopter would be used, if available. Chainsaws would be used to collect approximately 5 to 10 trees for logs needed to increase the height of the barrier; downed timber would be collected first, followed by standing dead and then live trees if necessary. A rock drill would be used to anchor a heavy-duty screen to the barrier structure, which would be cantilevered downstream over the channel to block fish from swimming or jumping upstream. A small gas-powered portable generator would be used to power the drill and the water pumps, and other mechanized hand tools would be used as necessary. Only small sized helicopters would be used, and equipment and materials would be transported and delivered to the work site as long-line sling loads. From a staging area along the Inside North Fork Road, the flights would proceed northeast along the Quartz drainage to the work site. Flight times are not anticipated to exceed 30 minutes round trip between the staging area and the work site. The helicopter would fly between 500 feet and 2,000 feet above ground level during long line operations, except when landing or taking off. The flights would be within the park's 2012 administrative flight restrictions of approximately 50 flights or less. Flights would be coordinated with other work projects in the area to minimize flight time over recommended wilderness. All flight times and routes, and camping and backcountry procedures would be coordinated through the natural resources and Park Ranger staffs. Emergency helispots for possible emergency evacuation of project personnel would be near the Middle Quartz Lake inlet. The project would take approximately ten days to two weeks to complete and would occur during September. An approximately 6-member NPS crew would perform the work. Some materials would be transported via livestock to reduce the number of helicopter trips.

Effects:

Wilderness Character

“Untrammled” Human activity and helicopters would temporarily diminish the unmanipulated quality of recommended wilderness in the immediate area near the barrier. The untrammled quality of wilderness would benefit from the mitigation of impacts caused by invasive species. There would be no long term effect to the untrammled character of the Quartz drainage, and the overall untrammled quality of the park's recommended wilderness would not be affected.

“Undeveloped” Human activity and up to three helicopter flights would temporarily diminish the undeveloped character of the upper Quartz area, and the presence of a semi-permanent human-made structure on the wilderness landscape could have long-term effects. But the existing barrier has been in

place for some time, and completing it would not result in much change to existing conditions. The barrier is also not visible from the Quartz Lake trail, and is only be detectable by visitors who venture off trail and bushwhack to the site. Effects to the undeveloped character of the area would therefore remain largely undetected.

“Natural” Helicopter and human activity could temporarily disturb or displace wildlife in the area, and the removal of downed timber, standing dead timber, and possibly live trees would slightly affect the natural quality of the area immediately surrounding the work site. But the protection of native fish populations would also appreciably benefit the natural condition of the upper Quartz drainage. Temporarily diverting water from the work site would minimize downstream turbidity and erosion during construction.

“Outstanding opportunities for solitude or a primitive and unconfined type of recreation” Helicopters and work crews would temporarily disrupt opportunities for solitude within a very small portion of the park’s recommended wilderness. Primitive and unconfined recreational opportunities would not be affected.

Other unique components that reflect the character of this wilderness

Because the fish barrier would better protect native fish populations, the unique ecological, scientific, and educational value of the upper Quartz drainage would benefit. The aquatic ecological system would benefit on a regional scale.

Heritage and Cultural Resources

There are no heritage or cultural resources that would be affected by this project.

Maintaining Traditional Skills

Some traditional skills such as hiking and backcountry camping would be necessary to complete the project. Hand tools would be used when possible, but traditional skills and tools would not be exclusively relied upon since helicopters and some motorized equipment would be used. Periodic maintenance of the structure would likely require future use of hand tools and backcountry skills.

Special Provisions

No special provisions would be affected.

Economics and Timing Constraints

The work window is fairly small due to the remote location and since the work can only be undertaken during periods of low water. Alternative 1 would enable the work to be completed in a timely manner, within a two week period in one summer season. Timely completion of the project in as short amount of time as possible would enable preservation of resources, keep soil and vegetation impacts at the job site at a minimum, and would be less intrusive to wildlife and visitors. The overall cost of the project would be minimized through the use of helicopters and power tools.

Additional Wilderness-specific Comparison Criteria

Alternative 1 would substantially improve the ability to construct a structurally sound, effective fish barrier, and would enable the project to occur.

Safety of Visitors, Personnel, and Contractors

Alternative 1 would not affect visitor safety. Motorized equipment would enable water to be more effectively diverted enabling workers to spend less time with their hands in very cold water and thus allowing them to do a better job building a structurally sound foundation.

Alternative # 2

Description: Only non-mechanized hand tools would be used to improve and complete the fish barrier and all equipment and materials would be transported to the work site via livestock and work crews. Multiple trips into the backcountry with pack animals would be necessary, including several off-trail trips between the Quartz Lake Trail and the worksite. The project would require several weeks to complete. The current design for the barrier and its construction includes large bulky materials, including a heavy duty screen and an inflatable water barrier. The screen could not be transported as designed, and could

not be securely bolted in place, threatening its long term effectiveness. The inflatable water barrier would be too heavy to pack on livestock, and would not be used. A non-inflatable barrier that could be packed on livestock and would not require water pumps for inflation would be used, if available. Attempts would be made to divert water around the work area without water pumps, but the work crews could still periodically be working within some stream flows during construction, since water would not be diverted as effectively. If a non-inflatable, packable water barrier is not available, diverting water would be nearly impossible. This alternative would severely inhibit the ability to construct a structurally sound, effective fish passage barrier.

Effects:

Wilderness Character

“Untrammled” Fewer noise impacts would occur from this alternative, compared to the temporary noise from helicopters and motorized equipment under Alternative 1. But the prolonged duration of human activity in the area and numerous supply trips with pack animals, including off-trail trips from the Quartz Creek Trail to the work site, would negatively affect the unmanipulated quality of the area, possibly for the long term. If this alternative results in the construction of an ineffective barrier, the untrammled quality of the wilderness resource would be adversely impacted by invasive species.

“Undeveloped” The existing condition of the undeveloped quality of the area would remain unchanged by this alternative.

“Natural” Because Alternative 2 would likely result in the construction of an ineffective barrier that is not structurally sound, it would increase the potential for native fish populations to become compromised or permanently lost as a result of colonization by non-native fish. This would permanently diminish the natural quality of recommended wilderness in the Quartz drainage. There would be a risk of downstream turbidity during construction because there would be no water pumps to more effectively divert water around the work area; impacts to water resources would increase if a non-inflatable water barrier is not available. The prolonged project time frame and multiple trips with livestock, including off trail trips between the Quartz Lake Trail and the worksite, would increase negative impacts to trails, soils, and vegetation.

“Outstanding opportunities for solitude or a primitive and unconfined type of recreation”
Under alternative 2 there would be no disruption to recreational opportunities, but solitude could be impacted by a prolonged project time frame.

Other unique components that reflect the character of this wilderness

The unique ecological, scientific, and educational value of the upper Quartz drainage would be permanently and negatively affected if a structurally sound, effective fish barrier could not be constructed. This would have implications to the aquatic ecological system on a regional scale.

Heritage and Cultural Resources

There are no heritage or cultural resource that would be affected by this alternative.

Maintaining Traditional Skills

Traditional skills would be maintained through the exclusive use of hand tools and livestock.

Special Provisions

No special provisions would be affected.

Economics and Timing Constraints

Under Alternative 2, several weeks would be required to improve and complete the fish barrier, and the overall cost of the project would increase.

Additional Wilderness-specific Comparison Criteria

Under Alternative 2, equipment and materials necessary to construct a structurally sound and effective fish barrier would be too large, heavy, or awkward to pack on livestock and therefore could not be used. This alternative would compromise the effectiveness of the structure, putting native fish populations at risk and diminishing the overall ecological integrity of the park's wilderness resource.

Safety of Visitors, Personnel, and Contractors

Crews would be forced to work with their hands in very cold water for long periods of time because water would not be able to be diverted from the work site. Under Alternative 2 visitor safety would not be affected.

Comparison of Alternatives

It may be useful to compare each alternative's benefits and adverse effects to each of the criteria in tabular form, keeping in mind the law's mandate to "preserve wilderness character."

(+) = beneficial; (-) = adverse; N/A = not applicable; N/E = no effect

	Alternative 1	Alternative 2	No Action
Untrammeled (unmanipulated by human activity)	+, -	+, -, -	-
Undeveloped	-	N/E	N/E
Natural	+, +, -,	-, -, -	-
Solitude or Primitive Recreation	-	-	+
Unique components	+, +, +	-, -, -	-, -, -
WILDERNESS CHARACTER	+++++ +/- - - -	+/- - - - - - - -	+/- - - - -

	Alternative 1	Alternative 2	No Action
Heritage & Cultural Resources	N/A	N/A	N/A
Maintaining Traditional Skills	-, +	+	N/E
Special Provisions	N/E	N/E	N/E
Economics & Timing	+, +	-, -	N/E
Additional Wilderness Criteria	+	-	-
OTHER CRITERIA SUMMARY	++++ +/-	+/- - -	-

	Alternative 1	Alternative 2	No Action
SAFETY (PUBLIC AND WORKERS)	N/E	N/E	N/E

Safety Criterion

Occasionally, safety concerns can legitimately dictate choosing one alternative which degrades wilderness character (or other criteria) more than an otherwise preferable alternative. In that case, describe the benefits and adverse effects in terms of risks to the public and workers for each alternative here but avoid pre-selecting an alternative based on the safety criteria in this section. Safety was addressed in the MRDG, however the selection has not been made on the basis of safety.

Step 2 Decision: What is the Minimum Activity?

Selected alternative: 1

Rationale for selecting this alternative (including safety criterion, if appropriate):

The wilderness character of the upper Quartz drainage would most benefit from the construction and improvement of the Quartz Creek fish barrier. The barrier would protect the integrity of native fish populations and reduce the potential for non-native fish species to negatively and permanently affect an intact ecological aquatic system. The NPS 2006 Management Policies direct the NPS to prevent exotic species from displacing native species, if possible. Under Alternative 1, helicopters would transport equipment and materials needed to construct an effective, structurally sound barrier, whereas Alternative 2 would not. Alternative 1 would cause only very short-term, minor disturbances to wilderness values, while Alternative 2 would have greater overall impacts to soils, vegetation, and water resources. The park would continue to revise the barrier design and implementation logistics to minimize the use of helicopters and mechanical equipment prior to implementation.

Mitigations:

The mitigation measures below were developed to mitigate impacts to recommended wilderness. The attached environmental assessment includes additional mitigation measures for wildlife and other resources.

- Non-electric tools would be used as much as possible to reduce artificial noise.
- The backcountry patrol cabin and campground at Quartz Lake would house workers during the installation phase to avoid construction of additional camping or food storage areas.
- Administrative helicopter flights would be coordinated with other projects in the area and hauling needs would be combined to minimize administrative flights over recommended wilderness. Construction debris, equipment, and garbage that could not be packed out would be flown out on back-hauls of incoming flights.
- The staging area for helicopter flights would be located outside the North Fork's Wild and Scenic River Corridor.
- Work would be conducted during the fall to minimize impacts to visitors, the sense of solitude, and the overall wilderness experience. All overnight visitors would be advised in advance about potential noise and activity in the area.
- Logs would be collected well away from the trail where evidence of their removal is not visible to hikers.
- Once the project is completed, brush, logs, and forest debris would be used to naturalize the immediate work site and the trail to the work site.

Monitoring and reporting requirements: see attached environmental assessment

Check any Wilderness Act Section 4(c) uses approved in this alternative:

- mechanical transport
- motorized equipment
- motor vehicles
- motorboats
- landing of aircraft (long line only)
- temporary road
- structure or installation

Record and report any authorizations of Wilderness Act Section 4(c) uses according to agency procedures.

Approvals	Signature	Name	Position	Date
Prepared by:		Kyle Johnson	Wilderness Specialist	
Recommended:		Kyle Johnson	Wilderness Specialist	
Recommended:		Phil Wilson	Chief, Science and Resources Management	
Recommended:		Mark Foust	Chief Visitor and Resources Protection	
Approved:		Chas Cartwright	Superintendent	

National Park Service
U.S. Department of the Interior

Glacier National Park
Waterton-Glacier International Peace Park
Montana



STATEMENT OF FINDINGS FOR FLOODPLAINS

Completion of Quartz Creek Fish Passage Barrier

Glacier National Park, Montana

Recommended: _____ Date _____
Chas Cartwright
Superintendent, Glacier National Park

Concurred: _____ Date _____
Bill Jackson
Chief, Water Resources Division

Approved: _____ Date _____
John Wessels
Intermountain Regional Director
National Park Service

INTRODUCTION

Glacier National Park (GNP) has prepared and made available an Environmental Assessment (EA) analyzing alternatives for improving and completing a fish passage barrier on Quartz Creek, approximately 100m downstream of Middle Quartz Lake. Construction on the structure was initiated in 2004 in order to prevent lake trout from colonizing the upper Quartz Lake system, a regional stronghold for both ESA listed bull trout as well as westslope cutthroat trout. However, lake trout were subsequently discovered upstream of the barrier construction site, and the project was not completed. In 2009, the NPS along with the US Geological Survey initiated a lake trout suppression program in Quartz Lake. The NPS is proposing to complete and improve the barrier in support of this effort. Completion of the barrier would make it more difficult for additional lake trout to enter the system and would reduce the likelihood of other non-native fish (i.e. rainbow and brook trout) to enter the system.

In addition, Executive Order 11988 ("Floodplain Management") requires the National Park Service and other agencies to evaluate the likely impacts of actions in floodplains. NPS Director's Order #77-2: Procedural Manual 77-2: Floodplain Management provides NPS policies and procedures for complying with EO 11988. This Statement of Findings (SOF) has been prepared in accordance with the NPS wetland and floodplain management procedures.

PROPOSED ACTION

Under the preferred alternative, the NPS would modify, improve, and complete the fish passage barrier in Quartz Creek approximately 100m below Middle Quartz Lake. The barrier would funnel flows through the center of the channel over a screen structure in order to prevent fish from swimming/jumping upstream through the area. This would generate peak estimated velocities in the center of the structure of approximately 12 feet per second for a 2-year recurrence interval flow event. The structure should eliminate upstream passage of fish during non-flood periods, and significantly reduce the likelihood of upstream passage during flood flows. Downstream passage of native fish would not be impeded. This project would entail the enhancement of an existing barrier structure extending across the floodplain and into the stream channel from both sides of the creek. This would direct more water through a narrow passage, increasing water velocities in the center of the channel. A heavy-duty steel or aluminum screen would be added to the structure and cantilevered over the channel in a downstream direction to block fish from swimming or jumping upstream through the center of the channel, while allowing debris or downstream migrating fish to pass over the screen. The barrier would consist of gabions (metal cages) filled with available rocks and boulders found on site (approximately 672 ft³ of stone required). These porous structures would still allow some water to flow through the creek edges without allowing the passage of fish. Approximately, 28 gabions (each 2' x 2' x 6') would be installed. The structure will be raised approximately 1 to 2' over the existing condition. In addition, the project's location would continue to be advantageous due to naturally occurring boulders that would form part of the barrier. A small amount of excavation along the creek bank may be necessary to ensure no openings are left that fish could fit through. Large logs would be used to increase the height of the barrier across the floodplain, and also to raise the elevation of the barrier across the center of the structure where the screen would be installed. The logs would be obtained from a combination of downed and standing dead timber and live trees. Approximately 5 to 10 trees (approximately 250 linear feet of 12-24 inch dbh log) should supply the necessary logs; downed timber would be collected first, followed by standing dead timber, and then live trees if necessary. The final barrier would be approximately 75'L x 6'W x 5'H. A

downstream splash pad would be created using large rock, wood, or additional gabions to prevent jump pool development below the structure.

A temporary, inflatable bladder dam approximately 4 ft. high x 10 ft. wide x 80 ft. long may be used to temporarily dewater the work area during construction or a non-inflatable barrier may be used. A small bypass channel would be constructed around the work site and lined with plastic, and one or two small water pumps would be used to divert the water around the work area and/or inflate the bladder dam with creek water. The bladder dam or non-inflatable barrier would be removed after the work is completed.

Up to three helicopter flights would be required to haul the bladder dam, fish screen, generator, water pumps, rock drill, and other materials that cannot be packed into the work site and to remove equipment that cannot be packed out after the project is complete. Only small sized helicopters would be used, and equipment and materials would be transported and delivered to the work site as long-line sling loads. The work crew (estimated at 6) would hike in and camp in/near the patrol cabin on Quartz Lake or at the campground. Other equipment, supplies, and materials would be packed in to a trail location near head of Middle Quartz Lake and carried to the worksite. Some logs or brush may be cut or moved from off-trail areas to facilitate access from the Quartz Lake Trail to the worksite. The project would take approximately ten days to two weeks in September to complete. Work would begin no earlier than one hour after sunrise and would stop no later than one hour before sunset.



Figure 1. Existing conditions at barrier site.

SITE DESCRIPTION

Physical Setting

The project area is located in the North Fork of the Flathead River drainage in Glacier National Park (Figure 3). Quartz Creek drains a series of four glacially carved lakes before entering the North Fork of the Flathead River approximately five miles south of Polebridge, Montana. Middle Quartz, Quartz, and Cerulean lakes are found upstream of the proposed barrier site. Lower Quartz Lake is located approximately one mile downstream of the barrier site. NPS infrastructure in the drainage downstream of the project site is limited and consists of a footbridge and small backcountry campground near the outlet of Lower Quartz Lake, as well as the Quartz Creek Campground and the bridge along the Inside North Fork Road over Quartz Creek, both located approximately seven miles downstream of the outlet of Lower Quartz Lake.

Middle Quartz Lake is 47 acres in size and has a maximum depth of 41 feet. Quartz Lake has a surface area of 869 acres and a maximum depth of 273 feet. The upper-most lake, Cerulean Lake, is 49 acres in size and has a maximum depth of 118 feet. Quartz Creek flows approximately 8.8 miles from the outlet of Lower Quartz Lake to the confluence with the North Fork Flathead River south of Polebridge. The existing fish exclusion barrier is located at the upper end of a confined valley type characterized by steep valley walls, a narrow valley bottom, and coarse bed sediments derived from glacial and fluvial processes. The site was chosen due to its physical setting as well as for its accessibility. The stream channel through the project area has been classified as a Rosgen B2 channel type. Bankfull width ranges from 50-60', the average channel slope is 4-5%, and the D50 of the channel bed is 300 mm (River Design Group 2009).

Fisheries

Native species in the Quartz Creek drainage include bull trout, a federally listed threatened species; westslope cutthroat trout, a Montana Species of Special Concern; mountain whitefish; longnose sucker; largescale sucker; sculpin; and redbreast shiner. The only known nonnative fish is lake trout, which were documented in Quartz Lake in 2005. A single westslope / rainbow trout hybrid was captured upstream of the project site in Cerulean Lake in 2004.

Hydrology

Hydrology in the Quartz Creek basin is snowmelt driven with peak flows typically occurring between April and June, although mid-winter rain-on-snow events can occur and produce floods of significant magnitude. For design and evaluation purposes, a flood frequency analysis was conducted for the Quartz Creek watershed (Table 1). The analysis was performed based on methods outlined in the United States Geological Survey Water Resources Investigations Report 03-4308. Contributing drainage area was estimated at 24.8 mi², mean (weighted) annual precipitation was estimated at 75.7 inches, and a mean watershed elevation of 6,151 ft. was used in the analysis (River Design Group 2009).

Table 1. Flood frequency analysis results for the Upper Quartz Creek watershed (River Design Group 2009).

Recurrence interval (years)	Discharge (cfs)
2	770
10	1,232
50	2,250
100	3,150

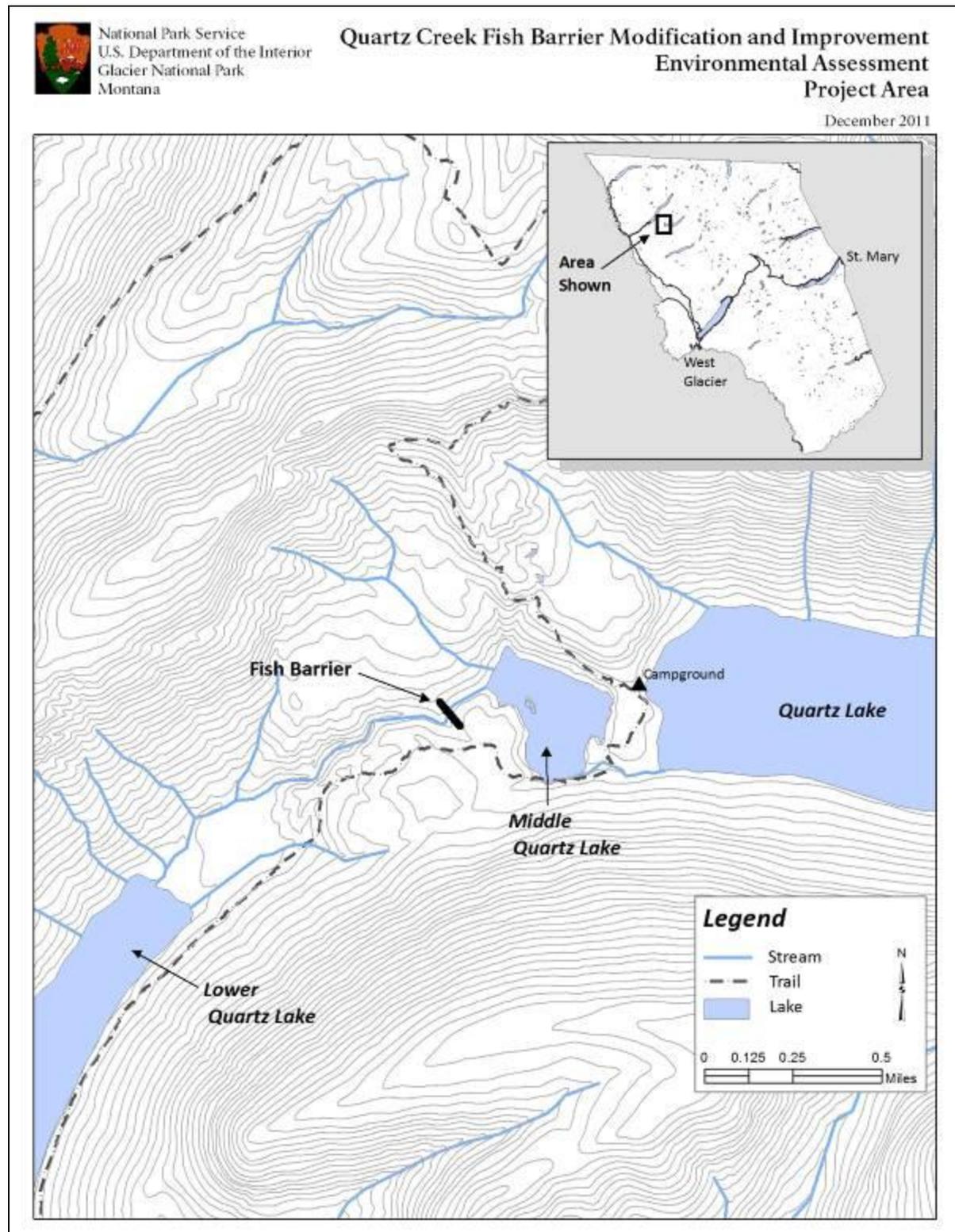


Figure 3. Map of Quartz Creek fish passage barrier location, Glacier National Park, Montana.

JUSTIFICATION FOR USE OF THE FLOODPLAIN

By nature of the intent of the project (fish passage barrier), the structure must be located in the floodplain. In addition, in order to construct a reasonably effective fish passage barrier, the structure must extend out onto the floodplain. The structure was designed to balance effectiveness, constructability, wilderness values, and resource impacts. As designed, it would have negligible to minor impacts to floodplains, in a very localized area of Quartz Creek. At most, the structure would impact floodplain function over perhaps 200' of stream channel out of an estimated 45,000 feet of stream channel, extending from the project area downstream to the bottom of the drainage.

In practice the structure would funnel water to the center of the channel over a screen that would prevent fish from passing upstream during most flows. During flows in excess of bankfull, some water that would normally be up on the floodplain would be directed back into the channel due to the presence of the 3-4' tall gabion structure extending out onto the floodplain. However, immediately downstream of the structure, the stream would have unimpeded access to the floodplain once again. No floodplain dikes or similar water control structures would be involved in this project. Hydraulic model results indicate that both the existing and proposed structures would be overtopped with a 2-year recurrence interval flow, which is similar to the typical bankfull flow for the stream (Tables 2 and 3, Figures 4 and 5). Hydraulic conditions on the floodplain may be slightly different due to the new height of the floodplain sill (an additional 1-2'), but access to the floodplain would essentially be similar under existing and proposed conditions. Under both conditions, the stream has access to its floodplain through the project area. In addition, a splash pad would be constructed on the downstream side of the structure to reduce any erosion potential.

Table 2. HEC-RAS model output for Quartz Creek barrier project site under existing conditions.

Flow Recurrence Interval	Discharge (cfs)	Water Surface Elevation (ft.)	Average Channel velocity (fps)	Maximum channel velocity (fps)
2-year	770	1003.0	5.3	6.5
50-year	2,250	1005.4	8.4	9.6
100-year	3,150	1006.4	9.7	10.9

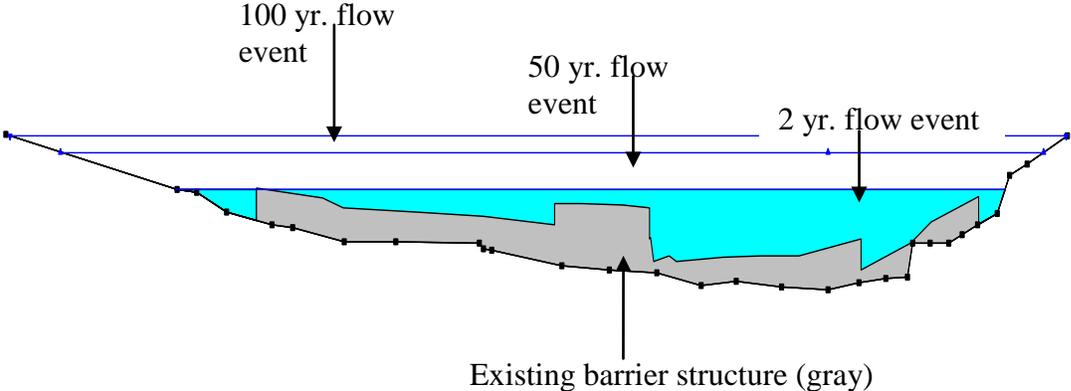


Figure 4. HEC-RAS modeled cross section of water surface elevations for existing barrier site conditions.

Table 3. HEC-RAS model output for Quartz Creek barrier project site under proposed conditions.

Flow Recurrence Interval	Discharge (cfs)	Water Surface Elevation (ft.)	Average Channel velocity (fps)	Maximum channel velocity (fps)
2-year	770	1004.9	8.5	11.9
50-year	2,250	1007.0	11.8	16.9
100-year	3,150	1007.9	13.2	18.6

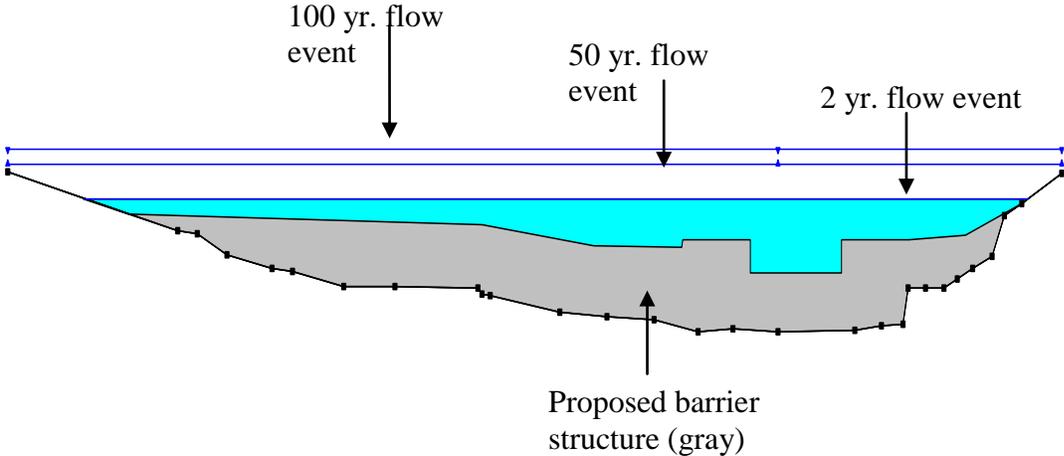


Figure 5. HEC-RAS modeled cross section water surface elevations for proposed barrier site conditions.

INVESTIGATION OF ALTERNATIVE SITES

Prior to initiation of construction of the existing barrier in 2004, an alternative location to construct the barrier was considered. Locating the barrier below Lower Quartz Lake was considered but rejected due to the size, depth, and topography of Quartz Creek below the lower lake. The existing barrier site was selected due to topography, as well as biological and logistical considerations. The site has already been substantially modified by the partial construction of a barrier, and the reasonable and prudent course of action is to proceed with completion of the barrier in its current location.

Such a barrier is not necessarily a permanent fixture on the landscape, and could be removed in the future if the NPS determined the barrier is no longer needed.

SITE-SPECIFIC FLOOD RISK

The November 2006 flood exceeded the 100-year flood levels, and the park must take into consideration all reasonable scenarios as weather patterns might become more sporadic and severe. During high-water events, water would access the floodplain and flow over or around the structure. There are no site-specific flood risks, as the project is located in the backcountry and well away from any developed areas. Any flood risk associated with potential structure failure would be attenuated immediately downstream of the structure in Lower Quartz Lake.

MITIGATION

Actions proposed in the floodplain would not affect the flood storage capacity of the floodplain. The natural floodplain value would not be reduced but slight alterations would be expected. Alterations would not influence the overall dynamics of the floodplain. The remote backcountry project location would further minimize potential hazards to human life and property.

- The project is located about one mile upstream of Lower Quartz Lake. Any risk associated with flooding would be attenuated in the lake. There are no structures or other developments between the project site and Lower Quartz Lake.
- Work would be completed during the fall at low water times such that any impact to the floodplain would be remediated by spring flows.

SUMMARY

The preferred alternative was designed to achieve project objectives, considering the wilderness and floodplain values of the area, as well as construction limitations. Despite occupying a small part of the stream's floodplain, it would largely allow normal floodplain function while reducing the ability of fish to pass upstream past the structure. Due to the nature of the project (fish passage barrier), placement of the structure in the floodplain is unavoidable.

Therefore the NPS finds this proposed action is consistent with the policies and procedures of NPS Director's Order #77-2: Procedural Manual 77-2: Floodplain Management, which provides NPS policies and procedures for complying with Executive Order 11988.

REFERENCES

Atkins. 2011. Final design plan set for modifications to the Quartz Creek fish passage structure. Report to the NPS from the Atkins engineering and design consulting firm, Bozeman, MT.

National Park Service (NPS). 2003. United States Department of Interior. 2003. Director's Order 77-2. Floodplain Management. Washington D.C.

River Design Group, Inc. 2009. Quartz Creek fish exclusion barrier project conceptual design alternatives report. Whitefish, Montana.